APPENDIX B: SEQUENCED EVALUATION OF LESS ENVIRONMENTALLY DAMAGING ALTERNATIVES

California High-Speed Rail Authority

San Francisco to San Jose Project Section

Checkpoint B Summary Report

July 2019

CALIFORNIA High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ACS	American Community Survey
Authority	California High-Speed Rail Authority
BART	Bay Area Rapid Transit
Bay Area	San Francisco Bay Area
BCDC	San Francisco Bay Conservation and Development Commission
BRT	bus rapid transit
C.F.R.	Code of Federal Regulations
CDFW	California Department of Fish and Wildlife
CP	control point
CRHR	California Register of Historical Resources
CWA	Clean Water Act
DTX	Downtown Extension Project
EIR	environmental impact report
EIS	environmental impact statement
FEMA	Federal Emergency Management Agency
FESA	federal Endangered Species Act
FIRM	Flood Insurance Rate Map
FRA	Federal Railroad Administration
GHG	greenhouse gas
GIS	geographic information system
HSR	high-speed rail
HUC	Hydrologic Unit Code
I-	Interstate
LEDPA	least environmentally damaging practicable alternative
LMF	light maintenance facility
MOU	Memorandum of Understanding
mph	miles per hour
MTC	Metropolitan Transportation Commission
MUNI	San Francisco Municipal Railway
NAIP	National Agriculture Imagery Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NOP	Notice of Preparation

NRHP	National Register of Historic Places
OHWM	ordinary high water mark
PCEP	Peninsula Corridor Electrification Project
PCJPB	Peninsula Corridor Joint Powers Board
PRIIA	Passenger Rail Investment and Improvement Act
Project Section, or project	San Francisco to San Jose Project Section
Prop 1A	Proposition 1A, The Safe, Reliable, High-Speed Passenger Train Bond Act for the 21st Century
PTC	positive train control
SamTrans	San Mateo County Transit District
San Francisco Bay RWQCB	San Francisco Bay Regional Water Quality Control Board
SB	Senate Bill
SFO	San Francisco International Airport
SFTC	Salesforce Transit Center
SHPO	State Historic Preservation Officer
SR	State Route
TM	technical memorandum
TOD	transit-oriented development
TPSS	traction power substation
U.S.C.	United States Code
US	U.S. Highway
USACE	U.S. Army Corps of Engineers
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
Valley to Valley	Silicon Valley to Central Valley
VMT	vehicle miles traveled
VTA	Santa Clara Valley Transportation Authority

1 INTRODUCTION

This report provides analysis and technical documentation for the San Francisco to San Jose Project Section (Project Section, or project) of the California High-Speed Rail (HSR) System. As provided by the National Environmental Policy Act (NEPA)/404/408 Integration Process Memorandum of Understanding (MOU), the purpose of this Checkpoint B Summary Report is to identify a reasonable range of project alternatives to be evaluated in the Draft San Francisco to San Jose Project Section Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) (Project Section EIR/EIS). The limits of analysis in this report are from the 4th and King Street Station in San Francisco to Scott Boulevard in Santa Clara, just north of the San Jose Diridon Station. The area from Scott Boulevard to the San Jose Diridon Station is covered in the *San Jose to Merced Project Section Checkpoint B Summary Report Addendum 4* (Authority and FRA 2018).

1.1 Checkpoint B Considerations

In 2005, the California High-Speed Rail Authority (Authority) and the Federal Railroad Administration (FRA) completed the Tier 1 *Final Program EIR/EIS for the Proposed California High-Speed Train System* (Statewide Program EIR/EIS) (Authority and FRA 2005) as the first phase of the environmental review process. The MOU recognizes that new information and changes in project decisions must be considered in selecting alternatives for the Project Section EIR/EIS and establishes a system of "checkpoints" (Checkpoints A, B, and C) to guide the process of selecting and analyzing alternatives. Pursuant to the MOU Checkpoint A provisions, the Authority and FRA submitted a Purpose and Need statement to the U.S. Environmental Protection Agency (USEPA) and U.S. Army Corps of Engineers (USACE) in April 2016. The USACE agreed with the Purpose and Need statement on May 3, 2016 and the USEPA agreed with the Purpose and Need statement on May 5, 2016.

The NEPA/404/408 integration MOU establishes that Checkpoint B consider information developed subsequent to the programmatic analyses of alternatives to inform selection of a reasonable range of alternatives to be included in the Project Section EIR/EIS. The purpose of this Checkpoint B Summary Report is therefore to analyze and document project alternatives so the Project Section EIR/EIS considers a reasonable range of alternatives. The MOU also indicates that this analysis and documentation should help the Authority and FRA comply with requirements of the Clean Water Act (CWA) Section 404(b)(1) Guidelines (40 Code of Federal Regulations [C.F.R.] Part 230) when preparing the Project Section EIR/EIS.

The CWA Section 404(b)(1) Guidelines state that, with limited exceptions, "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (40 C.F.R. § 230.10(a)). As such, the USACE may only issue a permit for the least environmentally damaging practicable alternative (LEDPA). The Checkpoint B Summary Report is intended to include the alternative that is likely to be the LEDPA. The LEDPA analysis occurs in Checkpoint C.

As provided by the MOU, this Checkpoint B Summary Report presents detailed descriptions of and environmental data for the project alternatives. Throughout the report two concepts are used. The *project footprint* consists of all right-of-way that would be used for construction in any manner, including temporary easements. The footprint represents the area within which ground disturbance is anticipated to occur. The report also refers to the *permanent right-of-way,* which refers to the Caltrain right-of-way that would be used as well as any additional real estate that would be permanently acquired.

1.2 Overview of San Francisco to San Jose Project Section

The Project Section is a component of the statewide HSR system, as illustrated on Figure 1-1, and would serve as the system's northern San Francisco Bay Area (Bay Area) terminus. It would provide HSR service from the Salesforce Transit Center (SFTC) in San Francisco to the Diridon Station in San Jose, where it connects to the San Jose to Merced Project Section. HSR stations

would be located at 4th and King Street[1] in San Francisco and at Millbrae. HSR service would share tracks with Caltrain along approximately 43 miles of blended system infrastructure primarily within the existing Caltrain right-of-way.

The Project Section parameters are constrained by a series of actions and legislative mandates from 2012 establishing the HSR project as a predominantly two-track blended system utilizing existing Caltrain track and remaining substantially within the existing Caltrain right-of-way. As described in more detail in Section 3.1.3.2, Tier 2 Planning for Two-Track Blended System, these legislative mandates, combined with the spatial constraints of integrating with existing passenger and freight rail in a constrained right-of-way, have limited the range of potential build alternatives.

What does "blended" mean?

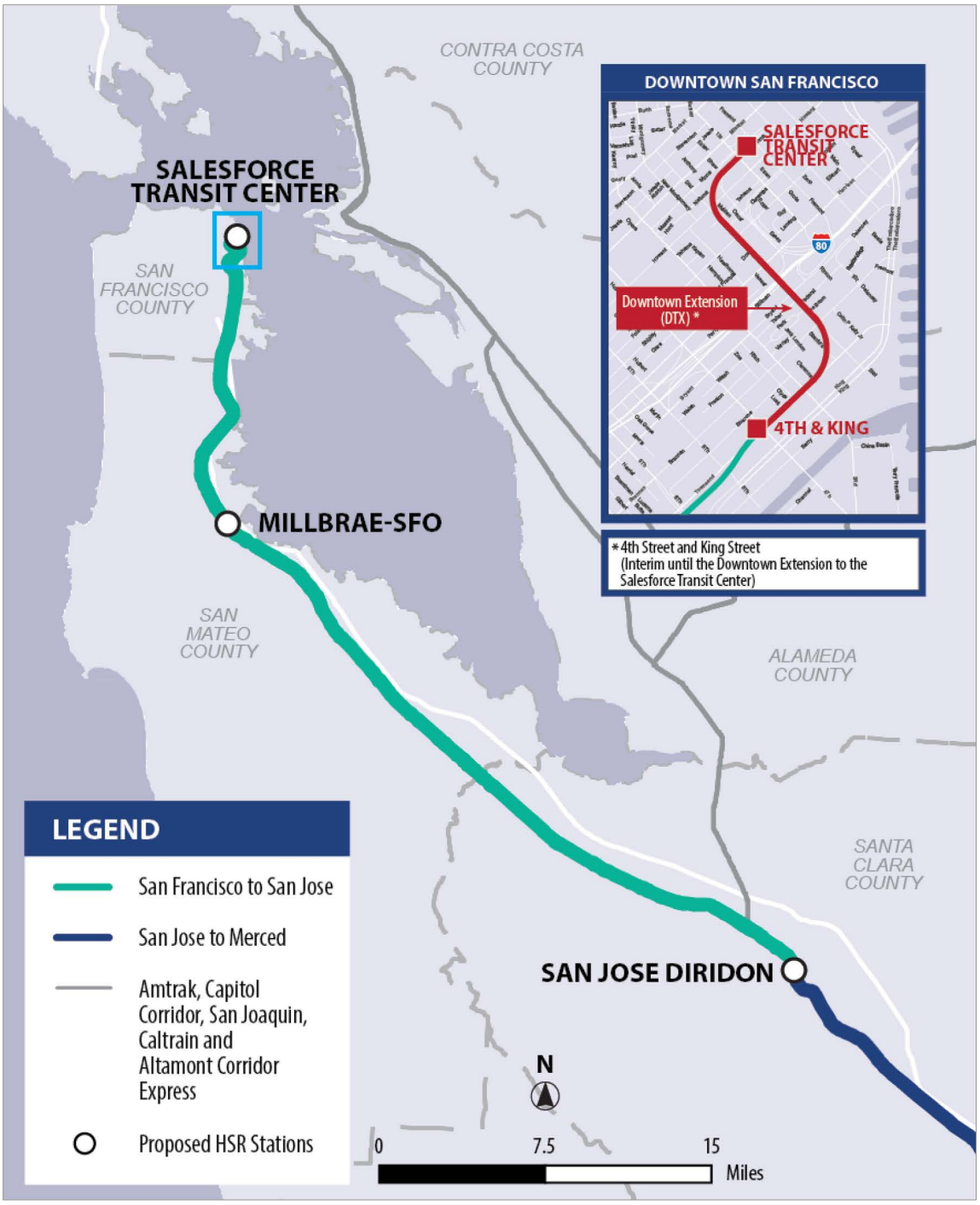
"Blended" refers to operating the HSR trains with existing intercity and commuter and regional rail trains on common infrastructure.

The Authority and FRA developed two end-to-end alternatives for the Project Section that are proposed for detailed analysis in the Project Section EIR/EIS—Alternative A and Alternative B. Project elements common to both alternatives include track modifications to support higher speeds while maintaining passenger comfort; station and platform modifications to accommodate HSR trains passing through or stopping at existing stations; safety and security improvements for at-grade roadway crossings and at existing Caltrain stations; a light maintenance facility (LMF) located in Brisbane; and communication radio towers located at approximately 2.5-mile intervals. Additional passing tracks would be provided under Alternative B. Both alternatives have similar design speeds and are capable of operating speeds of up to 110 miles per hour (mph) in blended operations. A detailed description of the project alternatives is provided in Section 3.2, Description of Alternatives.

1.3 Scope of Analysis

Consistent with the MOU, this Checkpoint B Summary Report identifies the alternatives that will be evaluated in the Project Section EIR/EIS. This report also describes alignment alternatives and passing track options that were withdrawn from further consideration. It provides detailed descriptions and illustrations for the blended system alternatives that will be carried forward into the Project Section EIR/EIS. This document relies on preliminary environmental data; estimates may change when more complete data is available. The updated information will be provided in the Project Section EIR/EIS.

[1] The 4th and King Street Station would serve as an interim station until completion of the proposed Downtown Extension Project (DTX). The DTX would extend the electrified peninsula rail corridor in San Francisco from the 4th and King Street Station to the SFTC. HSR would utilize the track constructed for the DTX to reach the SFTC.



Source: Authority 2018a

DRAFT SEPTEMBER 2018

Figure 1-1 San Francisco to San Jose Project Section

This report compares the two project alternatives based on environmental and engineering data. Each alternative's potential effects on environmental resources and community resources are summarized in Chapter 4, Aquatic Resources, through Chapter 8, Facilities Regulated under Section 14 of the Rivers and Harbors Act. The alternatives were evaluated for their impacts on aquatic resources; biological resources; and other environmental resources, including land uses; cultural resources; parks, recreation, and open-space resources; Federal Emergency Management Agency (FEMA) flood hazard zones and San Francisco Bay Conservation and Development Commission (BCDC) jurisdictional areas.[2] The alternatives were also evaluated for their impacts on community resources, including low-income and minority populations, as well as residential and business displacements. The alternatives were further evaluated for consistency with the requirements of Section 4(f) and Section 14 of the Rivers and Harbors Act ("Section 408"). Impacts were identified by overlaying the conceptual engineering project footprint[3] for each alternative with resource-specific data layers for each alternative in geographic information systems (GIS).

The resource-specific data layers used for this analysis include:

- Wetland delineation data based on the location of waters of the U.S. (not verified by USACE) from the Peninsula Corridor Joint Powers Board's (PCJPB) Peninsula Corridor Electrification Project (PCEP) (PCJPB 2015a). Data sources also include 2010 land cover data from the Authority for San Francisco to San Jose (Authority and FRA 2010a) and land cover data digitized by analysts using the National Agriculture Imagery Program (NAIP) (USDA 2014).
- Extent and quality of riparian corridors, as largely determined in consultation with the California Department of Fish and Wildlife (CDFW) and the San Francisco Bay Regional Water Quality Control Board (San Francisco Bay RWQCB) during authorization of the PCEP (PCJPB 2015a). These determinations helped support identification of wildlife movement corridors in the study area, which are generally limited to natural watercourses that support natural vegetation on both sides of tracks.
- Extent and quality of suitable habitat for special-status species[4] identified in the study area. In general, data collected from documents prepared in support of the federal Endangered Species Act (FESA) and consultations with the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) for PCEP (PCJPB 2015b, 2015c) were used to support habitat determinations for federally listed species. Information from the PCEP EIR (PCJPB 2015d) and land cover mapping data using aerial imagery supported habitat determinations for all other special-status species.
- Land uses based on a review of local and regional land uses, transportation, and subarea plans, and other relevant planning documents for the jurisdictions along the Project Section.
- Cultural resources, including known historic properties and archaeological resources identified through the National Register of Historic Places (NRHP), California Register of

[2] BCDC is a state agency that has been granted authority by the state, pursuant to the McAteer-Petris Act, to plan and regulate activities and development in and around San Francisco Bay, consistent with policies adopted in the San Francisco Bay Plan. BCDC also has federal consistency authority under the federal Coastal Zone Management Act for jurisdictional areas within San Francisco Bay.

[3] *Project footprint* is the area needed to construct, operate, and maintain all permanent HSR features (including tracks and guideway structures, train signaling and controls and communications facilities, traction power distribution facilities and substations, passenger platforms and stations, maintenance facilities, perimeter security controls, passenger station access, HSR facility operation or maintenance access, or other peripheral features owned and maintained by the Authority), roadway modifications, new or relocated utility features, access to new or relocated utility features, drainage facilities, any other physical changes within the area needed to construct and operate HSR, and HSR property rights or licenses to accommodate HSR construction, operation, and maintenance.

[4] Special-status species are defied as species that meet one or more of the following criteria: (1) species listed as threatened or endangered or proposed for listing under FESA; (2) species listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act; (3) Plants considered by CDFW to be "rare, threatened, or endangered in California" (California Rare Plant Rank 1B and 2); (4) Animal species of special concern to CDFW; (5) Animals fully protected in California.

Historical Resources (CRHR), and prior cultural resources reports prepared by various local and state agencies, historic resources inventories conducted by local governments and municipalities, and local historic registries and landmark lists of local governments and municipalities. Qualified specialists also reviewed California Department of Transportation Structure Maintenance and Investigations, including local and state historic bridge inventories (Caltrans 2016a, 2016b).

- Parks, recreation, and open-space resources identified through a review of city and county general plans for jurisdictions along the project corridor, consultation with officials with jurisdiction over resources, field reviews, public input, and the use of GIS data banks.
- Extent of the 100-year flood hazard areas based on the FEMA database (FEMA 2015, 2019a, 2019b).
- Prior consultations with BCDC regarding the extent of BCDC jurisdiction for preparation of the PCEP as well as land cover data and GIS data to identify the Bay and the 100 foot "Shoreline Band" (measured from the edge of the Bay) within BCDC jurisdiction.
- Low-income and minority populations[5] based on data from the 2010–2014 U.S. Census Bureau American Community Survey (ACS) 5-Year Estimates for census tracts located partially or fully within 0.5 mile of the alternatives' project footprints and for surrounding counties.
- Potential residential, commercial and business displacements based on a preliminary assessment of aerial imagery, parcel boundaries, and a conceptual engineering project footprint.
- Section 4(f) resources identified through an inventory of all public parks, recreation areas, NRHP-listed or potentially eligible historic properties, and wildlife/waterfowl refuges within the study area.
- Section 408 facilities identified using USACE's National Levee Database Interactive Map or through direct consultations with local flood control agencies along the project corridor including the San Francisco Public Utilities Commission, San Mateo County Flood Control District, and Santa Clara Valley Water District.

[5] Low-income within the Project Section is defined as a person whose median household income is at or below 200 percent of the Department of Health and Human Services poverty guidelines. Minority populations are readily identifiable group or groups of minority persons who live in geographic proximity and include persons who are American Indian and Alaska Native, Asian, Black or African American, Hispanic or Latino, and Native Hawaiian and other Pacific Islander.

2 PURPOSE AND NEED

2.1 Purpose of the HSR System

The Authority's statutory mandate under the High-Speed Rail Act is to develop an HSR system coordinated with California's existing transportation network, which includes intercity rail and bus lines, regional commuter rail lines, urban rail and bus transit lines, highways, and airports. The Authority has responded to this mandate by adopting the following objectives and policies for the proposed HSR system:

- Provide intercity travel capacity to supplement critically overused interstate highways and commercial airports
- Meet future intercity travel demand that will be unmet by current 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
- 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, and generate revenues in excess of operations and maintenance costs
- Provide intercity travel in a manner sensitive to and protective of the region's natural and agricultural resources and reduce emissions and vehicle miles traveled (VMT) for intercity trips

The Statewide Program EIR/EIS (Authority and FRA 2005) identified and evaluated alternative HSR corridor alignments and stations as part of a statewide HSR system, and established the purpose of the HSR system:

> *The purpose of the statewide HSR system is to provide a reliable high-speed electric-powered train system that links the major metropolitan areas of the state, and that delivers predictable and consistent travel times. A further objective is to provide an interface with commercial airports, mass transit and the highway network and relieve capacity constraints of the existing transportation system as increases in intercity travel demand in California occur, in a manner sensitive to and protective of California's unique natural resources.*

2.2 Purpose of the San Francisco to San Jose Project Section

The purpose of the Project Section is to contribute to completion of the statewide HSR system by providing the public with electric-powered HSR service that offers predictable and consistent travel times between San Francisco and San Jose, connects to the southern portion of the HSR system, and provides enhanced connections to the San Francisco and San Jose international airports, mass transit, and the Bay Area highway network, consistent with the Passenger Rail Vision in the California State Rail Plan Connecting California (Final) (Caltrans 2018), including the state's travel time objectives for the HSR system.

The Project Section would also fulfill the following purposes:

- Achieve HSR service that meets Prop 1A travel time requirements using blended train operations in the Caltrain corridor

- Provide blended system infrastructure that supports commercially feasible HSR, while also minimizing environmental impacts and maximizing compatibility with communities along the rail corridor
- Establish an HSR connection to the economic center of northern California
- Construct, maintain, and operate an electrified HSR system, which includes the construction, improvement, upgrade, operation, and maintenance of new and existing facilities and infrastructure necessary to support the system connecting the SFTC in San Francisco to Diridon Station in San Jose

Consistent with state law and the goal to minimize environmental impacts by providing a reduced HSR project footprint, the system would "blend" with the existing Caltrain system through the primary use of a two-track configuration, using existing transportation corridors and rights-of-way.

2.3 Related Projects Having Completed Project-Level Review

There are several related, but independent projects along the Project Section being implemented by others that have completed their project-level environmental review. These projects have independent utility and are thus included in the No Project Alternative.

2.3.1 Downtown Extension

The Downtown Extension Project (DTX) is a proposed 1.3-mile-long tunnel extending the electrified peninsula rail corridor in San Francisco from the existing 4th and King Street Station to the SFTC to connect with Caltrain, Bay Area Rapid Transit (BART), the San Francisco Municipal Railway (MUNI), and bus lines for Alameda–Contra Costa County Transit District, Golden Gate Transit, Greyhound, San Mateo County Transit District (SamTrans), Western Contra Costa County Transit Authority Lynx, and long-distance buses. Although the Authority would not construct the DTX, HSR would use this track to reach the SFTC. Construction of the SFTC Phase 1 project was completed in August 2018. It includes the transit center structure with an aboveground urban park, bus access facilities, an underground walkway to the BART system, and two below-grade levels: a concourse level and a structural shell for the HSR and Caltrain train station. Because the DTX project is not yet fully funded, the date of implementation is uncertain.

The DTX and SFTC projects were evaluated in the *Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final EIS/EIR* (USDOT et al. 2004). The Transbay Joint Powers Authority certified the Final EIS/EIR in 2004. The Federal Transit Administration and FRA issued the EIS Record of Decision in February 2005 to support FRA funding the HSR train box and securing HSR rights to use four tracks in the SFTC station in perpetuity. In 2012, a Supplemental EIS/EIR was initiated to address adjustments to the DTX tunnel design. The FRA is a cooperating agency for the preparation of the *Transbay Transit Center Program Final Supplemental EIS/EIR* (USDOT et al. 2018), published November 2018.

2.3.2 Peninsula Corridor Electrification Project

The Caltrain Modernization Program will electrify and upgrade the performance, operating efficiency, capacity, safety, and reliability of Caltrain's commuter rail service through the delivery of several key projects. These projects include the electrification of the existing Caltrain corridor from San Francisco to San Jose; upgrades to the signal system; and the replacement of most of Caltrain's diesel trains with high-performance electric trains or electric multiple units (Caltrain 2018a). The environmental process on the PCEP (electrification and new electric trains) was completed in January 2015 (PCJPB 2015d). Upgrades to the signal system have been completed and are now undergoing testing. The next steps involve community engagement and education and setting up project teams. The project is scheduled to be completed in 2022 (Caltrain 2018a).

2.3.3 25th Avenue Grade-Separation Project

Environmental clearance for the 25th Avenue Grade-Separation Project was completed by the City of San Mateo (sponsor agency) and PCJPB (implementing agency) in August 2016. The

project would construct a two-track elevated rail alignment between Hillsdale Boulevard and State Route (SR) 92, grade separating the existing at-grade crossings at 25th Avenue and adding new grade-separated crossings at 28th Avenue and 31st Avenue in San Mateo. The elevated rail alignment would relocate the Hillsdale Station to a new site north of its current location and provide station access and parking. The grade-separation project design, expected to be built in 2020, would accommodate the future development of a four-track passing track through San Mateo.

2.3.4 South San Francisco Caltrain Station Improvement Project

The South San Francisco Caltrain Station Improvement Project, which is currently under construction and anticipated to be completed in 2020, would replace the existing South San Francisco Station with a new center boarding platform connected to a pedestrian underpass (Caltrain 2018b). The project, which would also entail track work and signal work, would improve safety and eliminate the hold-out rule.[6]

[6] The hold-out rule is the rule enforced at Caltrain stations that have only one outboard platform which prevents a train from entering the station while another train at the station is boarding or alighting passengers.

3 SAN FRANCISCO TO SAN JOSE PROJECT SECTION

3.1 Background

3.1.1 The Decision to Prepare a Statewide High-Speed Rail System

The Authority and FRA have used a tiered environmental review process to support tiered decisions for the HSR system. Tiering of environmental documents means addressing a broad program in "Tier 1" environmental documents, then analyzing the details of individual projects within the larger program in subsequent project-specific or "Tier 2" environmental documents.

The Statewide Program EIR/EIS (Authority and FRA 2005) provided a programmatic analysis of implementing the HSR system across the state and compared it to the impacts of a No Project Alternative and a "modal alternative" that involved expanding airports, freeways, and conventional rail to meet the state's future transportation needs. The HSR alternative included consideration of different train technologies and vehicles types, as well as potential corridors and station locations. At the conclusion of that Statewide Program EIR/EIS, the Authority and FRA made the following decisions:

2005 Tier 1 Decisions	
Selection of transportation option	Selected the HSR alternative over the modal alternative (expanded airports and freeways) and the No Project Alternative (do nothing) to serve California's growing transportation needs.
Selection of train technology	Selected very high speed, electrified steel wheel on steel rail technology over magnetic levitation, lower speed, electrified steel wheel on steel rail; and lower speed diesel (non-electrified) steel wheel on steel rail.
Selection of preferred alignment corridors	Selected preferred corridors for most of the statewide system to be studied in more detail in Tier 2 EIR/EISs. Deferred selection of preferred corridors for Bay Area to Central Valley to a second Tier 1 EIR/EIS process.
Selection of preferred station locations	Selected station locations along the preferred corridors to be studied in more detail in Tier 2 EIR/EISs.
Adoption of mitigation strategies	Adopted broad mitigation strategies to be refined and applied at the second tier, as part of project planning and development and environmental review.

Source: Authority and FRA 2005
HSR = high-speed rail
EIR = environmental impact report
EIS = environmental impact statement

After completing the Statewide Program EIR/EIS, the Authority and FRA prepared a second program EIR/EIS to identify a corridor and station locations for the HSR connection between the Bay Area and the Central Valley, examining connections through the Pacheco Pass, the Altamont Pass, or both (Authority and FRA 2008). In 2008, the Authority and FRA selected a Pacheco Pass connection, with corridors and station locations for further examination in Tier 2 environmental reviews. As a result of litigation, the Authority prepared additional programmatic environmental review for the Bay Area and the Central Valley section, and again selected the Pacheco Pass connection (Authority 2012a).

2008/2012 Tier 1 Decisions	
Selection of preferred alignment corridors	Selected preferred corridors for connecting the Bay Area to the Central Valley north of Fresno to be studied in more detail in Tier 2 EIR/EIS.
Selection of preferred station locations	Selected station locations along the preferred corridors to be studied in more detail in Tier 2 EIR/EISs.
Adoption of mitigation strategies	Adopted broad mitigation strategies to be refined and applied at the second tier, as part of project planning and development and environmental review.

Source: Authority 2012a; Authority and FRA 2008
EIR = environmental impact report
EIS = environmental impact statement

These Tier 1 decisions established the broad framework for the HSR system that serves as the foundation for the Tier 2 environmental review of individual projects. Between San Francisco and San Jose, the corridor advanced for Tier 2 study was the existing Caltrain corridor. The station locations advanced for Tier 2 study included a station in downtown San Francisco, a potential mid-Peninsula station, a San Francisco International Airport (SFO) Station at Millbrae, and a station at the San Jose Diridon Station.

The Authority and FRA prepared these Tier 1 documents in coordination with the USEPA and the USACE. The USEPA and the USACE concurred that the corridors selected by the Authority and FRA in Tier 1 were most likely to yield the LEDPA under Section 404 of the CWA.

3.1.2 Implementation of the Statewide High-Speed Rail System

Since completion of the Tier 1 documents, the State of California has taken a series of steps to advance the implementation of a statewide HSR system. These efforts have resulted in securing dedicated funding for construction of the initial part of the system in the Central Valley and have further defined the State's vision for completing the system. The HSR system has also become a key component of the State's strategy for reducing greenhouse gas (GHG) emissions.

3.1.2.1 California State Legislation and Funding

In August 2008, the California Legislature adopted Assembly Bill (AB) 3034, finding "it imperative that the state proceed quickly to construct a high-speed passenger train system to serve the major metropolitan areas," and submitting Proposition 1A, The Safe, Reliable, High-Speed Passenger Train Bond Act for the 21st Century (Prop 1A) to the voters. In November 2008, California voters approved Prop 1A, making $9.95 billion in bond funds available to the Authority for initiating construction of the HSR system from San Francisco to the Los Angeles basin and linking the state's major population centers. Prop 1A includes provisions for continuing legislative oversight and requires the Authority to follow certain procedures to access bond funds. In 2012, the Legislature passed Senate Bill (SB) 1029, which appropriated $7.9 billion in federal funds and Prop 1A bond funds to begin construction of the HSR system.

The HSR system is identified as an integral GHG reduction measure in the Climate Change Scoping Plan prepared by the California Air Resources Board (CARB) pursuant to AB 32, the California Global Warming Solutions Act of 2006, which required a reduction in GHG emissions to 1990 levels by 2020 (CARB 2008, 2014). In 2014, the Legislature passed SB 862, which continuously appropriated 25 percent of specified Cap and Trade auction proceeds to Phase 1 (San Francisco to Anaheim) of the HSR system.[7] The Legislature found that the HSR system, once completed and operational, "will contribute significantly toward the goal of reducing emissions of greenhouse gases and other air pollutants" and provides "the foundation for a large-scale transformation of California's transportation infrastructure" by reducing millions of VMT by

[7] Cap and Trade refers to the market-based mechanism established by the California Air Resources Board for achieving the GHG reduction requirements in AB 32.

automobile and reducing the demand for air travel. In 2017, the Legislature extended the Cap and Trade program from 2020 to 2031.

3.1.2.2 Business Plans for the Statewide High-Speed Rail System

The High-Speed Rail Act requires the Authority to prepare, adopt, and submit a business plan to the State Legislature every 2 years describing its implementation approach for the statewide HSR system. Since 2008, the Authority has adopted business plans in accordance with this requirement. Most recently, on May 15, 2018, the Authority adopted its 2018 Business Plan, for submission to the Legislature by June 1, 2018 (Authority 2018b).

The 2018 Business Plan identifies major anticipated milestones for upcoming years, focusing on construction and program delivery. The key objectives and principles from prior business plans remain the same:

- Initiate HSR passenger service as soon as possible.
- Make strategic, concurrent investments throughout the system that will be linked together over time.
- Position the Authority to construct additional increments of the HSR system as funding becomes available.

Like the previous business plans, the 2018 Business Plan describes the phased implementation of the California HSR system. Phase 1 would connect the state's major metropolitan areas, extending from San Francisco and Merced to Los Angeles and Anaheim; the Bay Area and Los Angeles basin regions are considered the "bookends" of the HSR system. Phase 2 would complete extensions to Sacramento and San Diego. Phased implementation of the HSR system is consistent with the provisions of Prop 1A. The 2018 Business Plan also continues to incorporate the concept of "blended" service in certain shared corridors in Northern and Southern California, including between San Francisco and San Jose (as discussed in Section 3.1.3, History of the San Francisco to San Jose Project Section) and between Burbank and Anaheim.

With regard to the timing of implementation of Phase 1, the 2018 Business Plan continues the overall approach presented in 2016, which prioritizes connecting Silicon Valley to the Central Valley (Valley to Valley). To achieve that objective, the 2018 Business Plan calls for completing two lines initially—one in the Central Valley, from an interim station in Madera to Bakersfield, and one in the Bay Area/Silicon Valley, from San Francisco and San Jose to Gilroy—and then completing the Valley to Valley connection via the Pacheco Pass tunnels. Completion of this connection would provide continuous HSR service from San Francisco to Bakersfield. After that portion of the system is constructed, it is anticipated that the system would be extended to complete all of Phase 1 and ultimately Phase 2.

The 2018 Business Plan supports concurrent investments to deliver early benefits to Southern California in the Burbank–Los Angeles–Anaheim corridor and to Northern California in the San Francisco to Gilroy corridor and completion of the environmental review for all Phase 1 project sections statewide (Merced/San Francisco–Los Angeles/Anaheim) by 2022.

3.1.2.3 The California State Rail Plan

The federal Passenger Rail Investment and Improvement Act of 2008 (PRIIA) required states to develop state rail plans no less frequently than every 5 years, as a condition of eligibility for federal funding for HSR and intercity passenger rail programs. In accordance with PRIIA, the State of California adopted the *Final California State Rail Plan* in September 2018 (Caltrans 2018). The 2018 California State Rail Plan emphasizes HSR as a foundational component of statewide, integrated rail transportation network (Caltrans 2018).

3.1.2.4 The Federal Railroad Administration Grant Agreement

In 2009, the FRA announced a competitive grant program to fund HSR projects under the American Recovery and Reinvestment Act of 2009 through its High-Speed Intercity Passenger Rail Program. The State of California, acting through the Authority, successfully competed for

these grant funds and received awards totaling roughly $3.5 billion. In 2010, the Authority entered into cooperative agreements with the FRA under which the FRA committed to provide the grant funds to support initial construction of the first phase of the HSR system in the Central Valley, as well as related efforts for continued planning, engineering, and right-of-way preservation for the rest of the Phase 1 system between San Francisco and Anaheim.[8]

3.1.2.5 Project-Level Environmental Reviews

In accordance with the tiered approach to environmental review described in Section 3.1.1, The Decision to Prepare a Statewide High-Speed Rail System, the FRA and the Authority are preparing Tier 2 (project-level) EIR/EISs for individual sections of the California HSR System. Each Tier 2 EIR/EIS includes a section of the HSR system that serves a useful transportation purpose on its own and could function independently even if the adjacent sections were not completed. Each Tier 2 EIR/EIS evaluates proposed alignments and stations in site-specific detail to provide a complete assessment of the direct, indirect, and cumulative effects of the proposed action; considers public and agency participation in the screening process; and is developed in consultation with resource and regulatory agencies, including the USEPA and USACE. The Authority and FRA intend each Tier 2 EIR/EIS to be sufficient to support the USACE's permit decisions, where applicable.

To date, the Authority and FRA have completed Tier 2 EIR/EISs for the following project sections:

- Merced to Fresno
- Fresno to Bakersfield

Tier 2 EIR/EISs for the following Phase 1 project sections are all in progress:

- San Francisco to San Jose
- San Jose to Merced
- Bakersfield to Palmdale
- Palmdale to Burbank
- Burbank to Los Angeles
- Los Angeles to Anaheim

In addition, the Authority and FRA are at various stages of preparing supplemental EIR/EISs for the following sections:

- Merced to Fresno: Central Valley Wye
- Fresno to Bakersfield: Locally Generated Alternative

3.1.3 History of the San Francisco to San Jose Project Section

After completing the Tier 1 environmental process, the Authority and FRA initiated a Tier 2 environmental process for the San Francisco to San Jose Project Section in 2009. The Tier 2 planning process initially evaluated a fully grade-separated four-track system between San Francisco and San Jose. That analysis was paused in 2011 in response to concerns about the impacts of a fully grade-separated system. In 2016, the Authority and FRA reinitiated the Tier 2 planning process with a focus on a predominantly two-track blended system between San Francisco and San Jose. Section 3.1.3.1, Initial Tier 2 Planning for Four-Track System, and Section 3.1.3.2 describe these Tier 2 planning efforts that considered several alignments and passing track options, some of which were eliminated prior to this Checkpoint B analysis. Section 3.1.4, Alternatives Considered and Eliminated Prior to Checkpoint B Analysis, summarizes the eliminated alternatives and the reasons for eliminating them from further consideration.

[8] The grant agreements are available at: www.hsr.ca.gov/About/Funding_Finance/funding_agreements.html.

3.1.3.1 Initial Tier 2 Planning for Four-Track System

The Authority issued a Notice of Preparation (NOP) on January 8, 2009 (State Clearing House No. 2008122079) and the FRA published a Notice of Intent (NOI) in the *Federal Register* on December 29, 2008 to begin the Tier 2 project-level environmental review process. The proposed project was a fully grade-separated four-track system between San Francisco and San Jose with HSR sharing the corridor with Caltrain express commuter trains. Scoping meetings were held in 2009 and approximately 956 comment submissions were received during the scoping period. The Authority prepared and issued a Preliminary Alternatives Analysis in April 2010 and a Supplemental Alternatives Analysis in August 2010, and held community workshops and open houses to share information about the alternatives under consideration for the section at that time (Authority and FRA 2010b, 2010c).

The four-track system proposal generated concerns from communities along the highly urbanized Caltrain rail corridor. The cities and communities along the Project Section had developed around the historic rail corridor, resulting in the current blend of residential, commercial, mixed-use, and industrial development that tightly hugs the rail corridor. The community expressed concerns about the magnitude of potential impacts on environmental and community resources due to the proximity of the corridor to sensitive residential land uses and the need for additional rights-of-way acquisitions along the Project Section. In response to these concerns, the Authority suspended further work on the Project Section EIR/EIS in mid-2011 so that it could consider blended operations for the two services within a smaller project footprint, and determine the HSR service to be studied in the Tier 2 EIR/EIS (Authority 2011). In November 2011, the Authority proposed blended operations for the Project Section, which would provide HSR service between San Francisco and San Jose and a "one-seat ride"[9] to San Francisco by sharing Caltrain's existing predominantly two-track system, without requiring a dedicated four-track system.

3.1.3.2 Tier 2 Planning for Two-Track Blended System

Several important legislative actions and implementation decisions followed the Authority's proposal for blended operations for the Project Section in 2011. The framework for blended operations along the San Francisco Peninsula was memorialized in 2012 through four separate, but related actions: Authority adoption of the *California High-Speed Rail Program Revised 2012 Business Plan* (2012 Business Plan) (Authority 2012b), adoption of the *Metropolitan Transportation Commission Resolution No. 4056 Memorandum of Understanding*[10] (MTC 2012), and passage of SB 1029 and SB 557, which are described in more detail as follows:

- The 2012 Business Plan (Authority 2012b) proposed a blended system for the Peninsula described as primarily a two-track system that would be shared by Caltrain and HSR service, and other current passenger and freight rail tenants. The key improvements identified for the blended system included an upgraded signal system, electrification, and infrastructure upgrades which would be implemented by Caltrain. The 2012 Business Plan (Authority 2012b) further concluded that the HSR project to be studied in the Project Section EIR/EIS would be the blended system.
- Metropolitan Transportation Commission (MTC) Resolution No. 4056 (MTC 2012) is a nine-party agreement to establish a *Funding Framework for a High Speed Rail Early Investment Strategy for a Blended System in the Peninsula Corridor*. The early investment strategy identifies an interrelated program of projects to upgrade existing commuter rail service and prepare for a future HSR project with infrastructure that remains substantially within the existing Caltrain right-of-way. It would primarily utilize the existing track configuration on the Peninsula. The two interrelated projects funded by the early investment strategy are the

[9] A "one-seat ride" does not require a transfer between vehicles to complete the trip.

[10] The Authority and eight other Bay Area agencies (PCJPB, City and County of San Francisco, San Francisco County Transportation Authority, Transbay Joint Powers Authority, San Mateo County Transportation Authority, Santa Clara Valley Transportation Authority, City of San Jose, and MTC) approved MTC Resolution No. 4056 Memorandum of Understanding in March 2012.

installation of electric traction power infrastructure and purchase of electric passenger train equipment for commuter services, and upgrades to the signal system to provide positive train control (PTC).

- SB 1029 further defined the blended system by mandating that any funds appropriated for projects in the San Francisco to San Jose corridor, consistent with the blended system strategy identified in the 2012 Business Plan (Authority 2012b), shall not be used to expand the blended system to an independently dedicated four-track system (SB 1029 § 1 and § 2).
- SB 557 provides that any bond funds appropriated pursuant to SB 1029 will be used solely to implement a primarily two-track blended system substantially within the existing Caltrain right-of-way and that any track expansion beyond the blended system approach would require the approval of all nine parties to MTC Resolution No. 4056 (MTC 2012).

This framework for pursuing a blended system in the Project Section, along with other evolutions in statewide implementation of the HSR system as described above, provides the foundation for a new Tier 2 planning effort focusing on a predominantly two-track blended system utilizing existing Caltrain track and remaining substantially within the existing Caltrain right-of-way. The Tier 2 environmental process was reinitiated in April 2016, when the Authority and FRA submitted a Purpose and Need statement to USEPA and USACE, pursuant to the Memorandum of Agreement Checkpoint A provisions. The USACE agreed with the Purpose and Need statement on May 3, 2016, and the USEPA agreed with the Purpose and Need statement on May 5, 2016.

On May 9, 2016, the FRA and the Authority distributed an NOP and NOI, which reinitiated scoping for the Project Section EIR/EIS. The 2016 NOP/NOI rescinded the 2009 NOP and 2008 NOI and presented the blended system for the Project Section, which implements the strategy identified by the Authority's 2012 Business Plan and subsequent 2014 and 2016 business plans, and is further consistent with the Authority's 2018 Business Plan. Public scoping activities were conducted between May 9, 2016, and July 20, 2016 and included three scoping meetings and approximately 30 meetings with business and community groups, early agency coordination, and elected official briefings.

The Authority and FRA developed project alternatives for the Project Section consistent with the blended system framework and the overall project's Purpose and Need. Primary considerations when developing alternatives included avoiding and minimizing community and environmental resource impacts, and minimizing impacts on the existing passenger and freight rail systems operating within the Caltrain corridor. The Authority and FRA balanced these considerations with the objectives of predictable and consistent travel times. As a result of these considerations, the two alternatives proposed for detailed analysis in the Project Section EIR/EIS would predominantly utilize existing Caltrain track, remain substantially within the existing Caltrain right-of-way, and be designed to achieve operating speeds of up to 110 mph.

3.1.4 Alternatives Considered and Eliminated Prior to Checkpoint B Analysis

The Authority and FRA screened potential alternatives to eliminate alternatives that would not meet the project's Purpose and Need; would not be feasible or practicable, or would result in unacceptable adverse environmental or community impacts. This section provides a summary of the alternatives eliminated from further evaluation in the Project Section EIR/EIS as a result of this screening.

3.1.4.1 At-Grade Alignment Alternatives Eliminated from Consideration

Fully Grade-Separated Four-Track Alignment Alternative

The Authority and FRA originally proposed a shared, fully grade-separated four-track alignment alternative on the Caltrain corridor between San Francisco and San Jose. In the programmatic corridor planning process, the Project Section corridor advanced for Tier 2 study was the San Francisco and San Jose termini network alternative, which was described as a shared four-track, fully grade-separated system in the existing Caltrain corridor. This alternative is no longer being considered because it fails to comply with State legislative mandates per SB 1029 (2012) and SB

557 (2013) requiring the Project Section to be developed as a predominantly two-track blended system substantially within the existing Caltrain right-of-way; therefore, this alternative does not comply with the Purpose and Need for this Project Section.

Fully Grade-Separated Blended System Alignment Alternative

As described in detail in Chapter 10, Public Outreach and Community Input, several comments received from individuals, communities, and agencies during scoping requested an evaluation of fully grade-separated alternatives for completing the blended system.

A fully grade-separated blended system would require constructing 38 roadway overcrossings or undercrossings at the existing at-grade roadway crossings between the 4th and King Street Station and the project's southern limit of Scott Boulevard in Santa Clara. These existing at-grade crossings are located in highly urbanized areas with residential, commercial, mixed-use, and industrial development immediately adjacent to the rail corridor, as well as the downtown centers for cities and communities including Burlingame, San Mateo, San Carlos, Redwood, Menlo Park, Palo Alto, Mountain View, and Sunnyvale. Because of the number and close proximity of the at-grade crossings along the corridor, construction of grade separations would require partial or full acquisition of many private residential and commercial properties adjacent to the existing Caltrain right-of-way. Additionally, the integration of grade separations with the local roadway network would require the reconstruction and modification of adjacent streets and intersections. Construction activities associated with the construction of grade separations would require temporary road closures and detours and would temporarily restrict access to many properties. This alternative would be inconsistent with the project objective of minimizing impacts through a reduced project footprint predominantly within existing rights-of-way.

A fully grade-separated alignment alternative is not practicable from the standpoint of cost-effective project delivery. With an average cost of approximately $150 million per grade separation,[11] the additional costs associated with a fully grade-separated alignment alternative for the Project Section would be approximately $5.7 billion. This would more than double the projected capital cost estimates associated with construction of the Project Section (Authority 2018b). As a result, the fully grade-separated blended system alignment alternative was withdrawn due to additional community impacts and substantially higher costs.

3.1.4.2 Tunnel Alignment Alternative

The Authority and FRA also considered an approximately 6-mile-long tunnel alignment from Brisbane directly to the SFTC, comprised of two separate tunnels with a maximum depth of 80 feet that would return to grade near the intersection of Cesar Chavez Street and Interstate (I-280) to avoid the interstate's pile foundations. The tunnel alignment would have faster design speeds and thus faster operational service times than the at-grade alignments along the Caltrain corridor between Brisbane and the SFTC.

The tunnel alignment would be inconsistent with Tier 2 planning for the blended system described above and with SB 1029 and SB 557 which focus on a blended system substantially within the existing Caltrain right-of-way (see Section 3.1.3.2). Additionally, the tunnel alignment was estimated to cost approximately $3.5 billion more than alignment alternatives that utilize the existing Caltrain track.

The at-grade alignment alternatives using the existing Caltrain track would require minimal infrastructure improvements between Brisbane and the portal to the approved DTX tunnel to the SFTC. As a result, a tunnel alignment would not avoid any substantial environmental effects associated with construction of at-grade alignment alternatives. While the tunnel alignment from Brisbane to SFTC would decrease travel time, this alternative is not recommended for further

[11] Because the Project Section occurs in areas with dense residential development along an existing rail corridor that poses challenges for acquisition of rights-of-way required to build grade separations, estimates for grade-separation costs are based on the cost of the recently completed San Bruno Grade Separation Project (Caltrain 2014) and the $100–$200 million estimated costs identified in the Caltrain PCEP EIR (PCJPB 2015d).

analysis in the Project Section EIR/EIS due to the substantially greater capital costs, construction-related environmental effects, and inconsistency with prior blended system planning, commitments, and legislation.

3.1.4.3 Passing Track Alignment Options Eliminated as a Result of 2013 Analysis

> *Definitions*
>
> *Maximum non-stop service travel time*: As defined in Proposition 1A (2008), this is the travel time that the high-speed rail system is being designed to be able to achieve.
>
> *Operational service time*: This is the time of high-speed rail service in actual operation, including station stops and sharing of tracks with other services, like Caltrain.

Since the framework for blended system operations was established in 2012, the Authority and the PCJPB have studied the feasibility of blended system operations, including the utility of passing tracks. Passing tracks allow for faster-moving trains to bypass slower-moving trains, and have the potential to provide operational benefits associated with faster recovery times from incidents or perturbations (disruption events) on the railway.

The PCJPB conducted a study in 2013 that assessed the feasibility of blended system operations and passing track options (LTK Engineering Services 2013). Figure 3-1 illustrates the locations of the passing track options evaluated as part of the 2013 study. The results of the analysis on average HSR and Caltrain operational service times from the 4th and King Street Station to the San Jose Diridon Station, relative to the No Project Alternative (Baseline), are presented in Table 3-1. Based on this operational analysis, the Authority and FRA withdrew the North Four-Track and the South Four-Track Passing Track Options. The Short Middle Four-Track, Long Middle Four-Track, and Long Middle Three-Track Passing Track Options were retained as described in Section 3.2.1, Overview of System Design Performance and Common Project Features.

North Four-Track Passing Track Option

This option would build a 10.2-mile-long four-track segment from the Bayshore Station to just north of Broadway Avenue in Burlingame, requiring track expansion alongside the Brisbane Lagoon. Based on the LTK analysis, the average operational service time from San Jose to San Francisco would be approximately 61.8 minutes for Caltrain and 47.75 minutes for HSR (LTK Engineering Services 2013). Compared to the other passing track options, this option would result in the slowest average Caltrain and HSR operational service times (approximately 1.5–3 minutes slower). The LTK analysis further reported that this option would have difficulty supporting operational service time differences for overtakes, would result in long Caltrain operational service times, and would produce a high level of signal congestion. For these reasons, the Authority and FRA withdrew the North Four-Track Passing Track Option from further consideration.

Source: Authority 2017

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Figure 3-1 Passing Track Options Considered

Table 3-1 2013 Evaluation of Passing Track Options

Measure	Average Operational Service Times (minutes)[1]					
	No Project Alternative (Baseline)[2]	Short Middle Four Track (6 mi)	Long Middle Four Track (8 mi)	Long Middle Three Track (16 mi)	North Four Track (10 mi)	South Four Track (8 mi)
HSR operational service time	N/A	45.6	44.9	45.3	47.8	46.1
Caltrain operational service time	59.9	61.0	60.6	60.2	61.8	60.6
Determination	N/A	Carried forward	Carried forward	Carried forward	Withdrawn	Withdrawn

Sources: LTK Engineering Services 2013
HSR = high-speed rail
N/A = not applicable
mi = miles
mph = miles per hour
[1] Average operational service times are provided from 4th and King Street Station to San Jose Diridon Station, and assumes 5-minute headways/separation for the corridor and 4-minute headways/separation at diverging and merging at junctions.
[2] The No Project Alternative (Baseline) assumes a fully electrified Caltrain service operating up to six trains per hour per direction and speeds of up to 79 mph. Under the No Project Alternative, Caltrain would use existing areas of more than two tracks for passing operations. For blended conditions with the passing track options, Caltrain and HSR trains would be operating at 110 mph along the corridor.

South Four-Track Passing Track Option

This option would build a 7.8-mile-long four-track segment from just north of San Antonio Avenue in Palo Alto to south of the Lawrence Station in Santa Clara. Based on the LTK analysis, the average operational service time from San Jose to San Francisco would be approximately 60.6 minutes for Caltrain and 46.1 minutes for HSR (LTK Engineering Services 2013). Compared to other passing track options, this option would result in the second slowest average HSR operational service times (approximately 1.5 minutes slower than the fastest passing track option) and the third fastest Caltrain average operational service time (approximately 0.7 minute slower than the fastest passing track option), comparable to the Long Middle Four-Track Option. For these reasons, the Authority and FRA withdrew the South Four-Track Passing Track Option from further consideration.

3.1.4.4 Light Maintenance Facility Options

This section provides an overview of the function of and design criteria for an LMF, which would be located within this Project Section. The section also sets out the Authority's screening process to identify and evaluate potential LMF sites and summarizes the conclusions reached through the evaluation process.

Light Maintenance Facility Function and Design Criteria

The LMF is a critical component of the HSR system, which would operate 24 hours per day and provide for daily and scheduled maintenance of the HSR trainsets. Maintenance activities would include train washing, interior cleaning, wheel truing, testing, and inspections. These activities would occur between runs or as a pre-departure service at the start of the revenue day. The LMF must have the capacity to dispatch trains and crew to the terminal facility to begin revenue service throughout the day. The LMF would also be used as a service point for any trains in need of emergency repair.

The LMF functional criteria are presented in the Authority's Technical Memoranda (TM) 5.1 and 5.3.[12] These TMs have been informed by best practices and experience gained by other HSR system operators throughout the world. The LMF site design criteria include:

- **Site size**—The LMF sizing criterion is based on ridership projections and fleet size estimates to the year 2040, as identified in the Authority's 2018 Business Plan. The LMF for the San Francisco to San Jose Project Section would be one of three maintenance facilities for the statewide HSR system, so the capacity of the yard would need to be of sufficient size to accommodate approximately one third of the total fleet size. Based on this estimate, the LMF would require approximately 100 acres.

  TM 5.1 identifies the following primary features as minimum requirements for an LMF serving the San Francisco terminal station:

  – 18 yard tracks (10 layover/storage tracks and 8 service/shop tracks), each 1,700 feet long with 19.5-foot track centers and capacity to hold two complete trainsets per General Order 26-D Section 5 (California Public Utilities Commission). These tracks would support 16 double trainsets, each of which would be 200 meters long (approximately 700 feet). The lead tracks must be of adequate length to allow for HSR trains exiting the mainline track to slow to a stop, or for HSR trains entering the mainline tracks to accelerate to an appropriate speed. Yard tracks and lead tracks would require a combined minimum acreage of approximately 70 acres.

  – Maintenance building, incorporating shop areas and office space. A minimum of approximately 5 acres would be required to accommodate shop floor area and office space for maintenance crew and equipment.

  – 150 employee and visitor parking spaces would be required to accommodate train crew, engineers, office staff, and support staff across four overlapping shift patterns. Parking areas would require a minimum of approximately 5 acres.

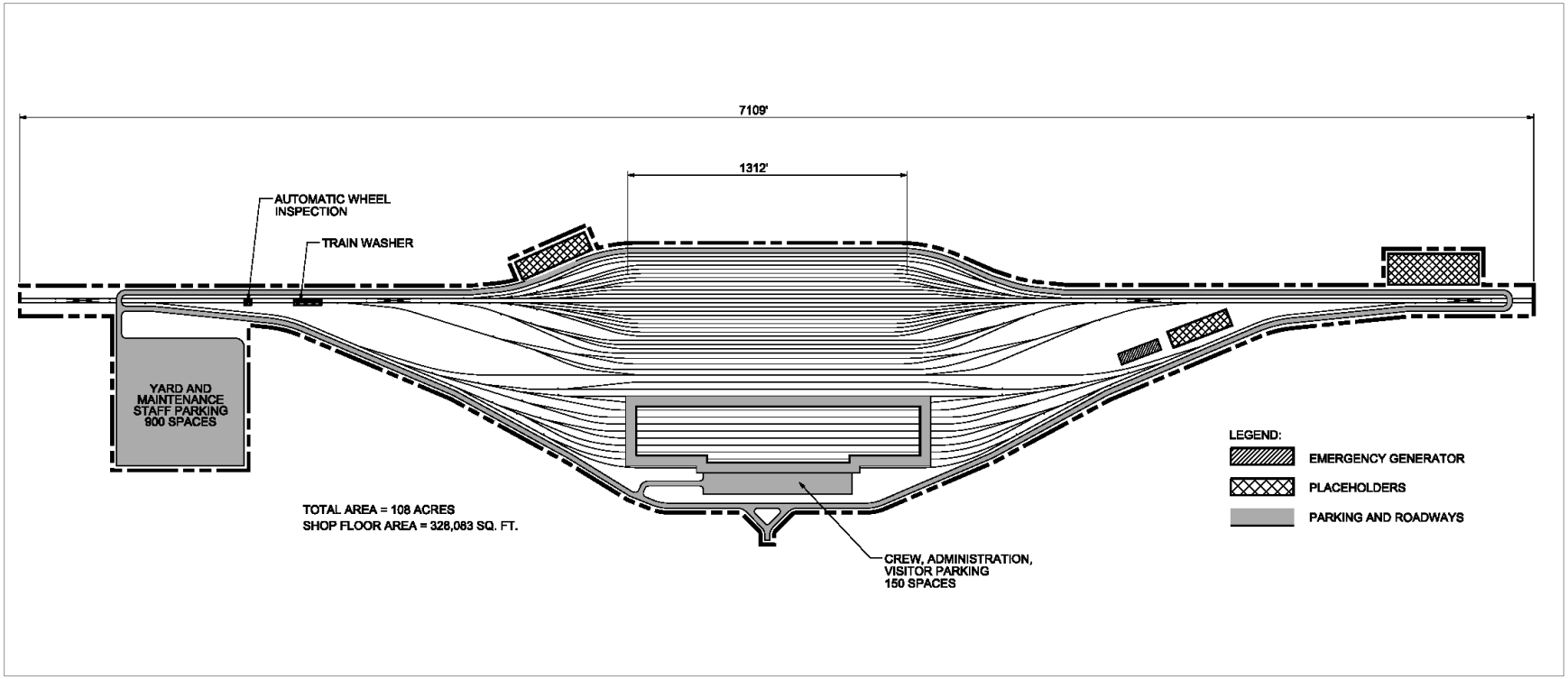
  – A 200-by-400-foot power substation, cistern, ballast storage, materials storage, hazardous materials storage, materials recycling, emergency generators, and other miscellaneous buildings. These facilities would require a minimum of approximately 5 acres.

  – A two-way circulation road, 24 feet wide along the interior perimeter of the facility. Roadways to provide access to specific locations in the buildings and yards would also be needed. These roadways would require approximately 15 acres.

Figure 3-2 shows a typical LMF (called a "Terminal Storage and Maintenance Facility") as depicted in TM 5.1. An LMF generally has a trapezoidal shape with minimum dimensions of 7,500 feet long and 1,100 feet wide. Each potential LMF site must meet the size criteria of 100 acres.

- **Double-ended lead tracks—**Double-ended lead tracks enable trains to enter and leave the LMF from both ends (north and south) of the facility. A single-ended track design (also known as a stub-ended track) provide access from mainline tracks from one direction only. As such, double-ended tracks would accommodate ingress and egress for trains traveling to and from the north terminal in San Francisco and for trains traveling to and from the southern end of the Project Section.

[12] In 2009, the Authority published TM 5.3, *Summary Description of Requirements and Guidelines for: Heavy Maintenance Facility (HMF), Terminal Layup/Storage & Maintenance Facilities & Right-of-Way Maintenance Facilities,* which described the facility size, design, and locational criteria to meet the functional requirements for an LMF serving a dedicated HSR corridor. After the release of the 2012 Business Plan, the Authority updated TM 5.3 with TM 5.1, *Summary of Requirements for O&M Facilities,* in 2013 to reflect the blended service concept; however, where not specifically superseded by criteria specified in TM 5.1, the LMF design criteria specified in TM 5.3 remained applicable.



Source: Authority 2013

Figure 3-2 Terminal Storage and Maintenance Facility

Double-ended lead tracks are necessary for efficiency and resiliency. This design allows for trains to move in and out of the LMF without delay or disruption. Double-ended tracks also eliminate the risks associated with system failures on a lead track. Such failures may entail a train breakdown on the lead track. If such a breakdown were to occur at a stub-ended facility, trains moving in or out of the LMF would be blocked. The impact of such a failure would likely be significant, causing an interruption of service, decreasing revenue, and compromising confidence in the reliability of the HSR system. Double-ended lead tracks would protect against this risk.

A single-ended track design would also impede operations by requiring trains from the opposite direction to either stop and reverse into the yard, thereby imposing capacity restraints, or to reverse in a more suitable location thereby resulting in additional deadhead (non-revenue) mileage. Deadhead mileage increases operations and maintenance costs without any off-setting revenue generation.

The optimal placement of the LMF is as close to the terminal station as feasible, preferably within 3 miles (TM 5.3). The LMF serves as the dispatch location at the start of the revenue day supplying fresh trainsets to the terminal station. The farther the distance of an LMF from the terminal station, the more time trains operate without generating revenue (these non-revenue operations are known as *deadhead movements*). Deadhead movements result in additional wear and tear on trainsets and tracks, increased maintenance, increased energy consumption, increased noise and vibration, and decreased reliability, without any positive revenue to offset the effects. Because the terminal station in the north would be in San Francisco (initially located at Caltrain's 4th and King Street Station and eventually transitioning to the SFTC upon completion of the DTX), the LMF must be sited in the San Francisco to San Jose Project Section, preferably as close to the terminal station as feasible.[13]

Potential Light Maintenance Facility Sites

Beginning in 2010, the Authority began identifying potential sites for the LMF within the Project Section and evaluating their suitability. The Authority evaluated potential sites within and in the vicinity of San Francisco, as well as in the mid-Peninsula and South Bay. The assessment of these sites first focused on their capacity to meet engineering guidelines established through the Authority's technical manuals (Authority 2009), including proximity to the terminal stations (i.e., San Francisco) and other operational needs. Identifying potentially suitable sites proved challenging due to the dense urban development and regionally important facilities and infrastructure located throughout the Project Section.

Sites throughout the Peninsula were also assessed for their potential practicability, including their availability for LMF development, the cost of acquisition and development of the site (which would include in most cases the cost of acquiring existing residential and commercial development), and the impact on public facilities and circulation elements of placing an LMF on the site, as well as for the potential effects on environmental resources associated with development of the LMF. On the basis of these considerations, a number of sites were determined to be unsuitable or infeasible for the LMF. Sites in San Francisco were rejected because they were not available and would be prohibitively expensive to develop due to the high cost of land in the city. Mid-Peninsula sites were eliminated based on the high cost of land acquisition and impacts on regional circulation elements. South Bay sites were not advanced for further consideration due to their

[13] For a brief period the Authority had an option to incorporate the LMF into the San Jose to Merced Project Section. In 2016, the Authority's Business Plan identified the San Jose Diridon Station as a temporary terminal station to serve the Valley-to-Valley initial start of service, linking Silicon Valley to the Central Valley. The Valley-to-Valley concept made it necessary to place an LMF in the San Jose to Merced Project Section, rather than the San Francisco to San Jose Project Section. In the 2018 Business Plan, the Authority changed the Valley-to-Valley approach, directing early operations be established first between San Francisco and Gilroy, followed by a Valley-to-Valley connection to the Central Valley. The 2018 Business Plan therefore established San Francisco as the terminal station city for the Northern California portion of the HSR system. As a result of this change, the location of the LMF was removed from the San Jose to Merced Project Section.

distance from the terminal station, the high costs associated with land acquisition and development and their lack of availability.

Four sites that were identified in the 2010 *Supplemental Alternatives Analysis Report for the San Francisco to San Jose Section* (Authority and FRA 2010b) and further assessed for potential practicability were advanced for consideration in this Checkpoint B analysis. Those sites are as follows:

- Port of San Francisco (Piers 90–94)
- SFO
- West Brisbane
- East Brisbane

Assessment of Potential Sites

As part of the Checkpoint B evaluation, an additional assessment of these four sites was conducted to determine the environmental impacts that would likely result from the development of each site and to identify practicability constraints associated with the sites. This section describes the potential environmental impacts of an LMF at each of the four sites, specifically with respect to aquatic and biological resources. This evaluation was based on the preliminary engineering designs evaluated in the 2010 Supplemental Alternatives Analysis, which were subsequently refined during the alternatives development process for the predominantly two-track blended system. In addition, the section provides an overview of the practicability considerations of developing an LMF at each of the sites drawing from the original 2010 Supplemental Alternatives Analysis and additional evaluation.

Aquatic and Biological Resources

- **Aquatic resources**—The four LMF sites were evaluated to determine the extent of potential impacts on wetlands and other waters of the U.S. Each of the four sites would have impacts on wetlands and other waters of the U.S., with the West Brisbane LMF site having the greatest impacts—10.2 acres of freshwater emergent wetland. The site with the second greatest impacts is the Port of San Francisco with impacts on 5.1 acres of open water and freshwater emergent wetlands. The SFO and East Brisbane LMF sites would affect 1.8 acres and 1.4 acres of wetland and constructed and natural watercourse, respectively. Table 3-2 shows the impacts on aquatic resources associated with each of the evaluated sites.

Table 3-2 Comparison of Impacts on Aquatic Resources (acres)

Aquatic Resource Type	Port of San	East Brisbane Site[1]	West Brisbane	SFO Site
Wetlands				
Freshwater emergent wetland	0.2	0.7	10.2	0.1
Saline emergent wetland	0.0	0.0	0.0	0.6
Scrub-shrub wetland	0.0	0.1	0.0	0.0
Nonwetland Waters				
Constructed watercourse	0.0	0.4	0.0	0.7
Constructed basin	0.0	0.2	0.0	0.0
Natural watercourse	0.0	0.0	0.0	0.4
Drainage ditch	0.0	0.0	0.0	0.0
Open water	4.9	0.0	0.0	0.0
Total waters of the U.S.	5.1	1.4	10.2	1.8

Source: Land cover generated using ESRI ArcGIS version 10.3 from aerial photo interpretation using NAIP aerial imagery dated 2010–2015
SFO = San Francisco International Airport
[1] This analysis was based on project footprints from the 2010 Supplemental Alternatives Analysis. The design of the East and West Brisbane LMFs has been refined since 2010, therefore the current project footprints reported in the Draft EIR/EIS have slightly different impacts on aquatic resources than shown in this table.

- **Biological resources**—The four LMF sites were evaluated for impacts on biological resources, specifically impacts on federally threatened and endangered and state threatened, endangered, and candidate plant and animal species (collectively, "listed species"). As shown in Table 3-3, SFO is the only site that supports listed species that may be affected by an LMF, with 0.6 acre of potential impacts on each of California seablite (*Suaeda californica;* federal endangered), Salt marsh harvest mouse (*Reithrodontomys raviventris;* federal and state endangered), California Ridgway's rail (*Rallus obsoletus obsoletus;* federal and state endangered), and California black rail (*Laterallus jamaicensis coturniculus*; state threatened). None of the four sites would affect riparian habitat or wildlife movement corridors.

Table 3-3 Comparison of Impacts on Biological Resources (acres)

Biological Resource	Port of San Francisco Site	East Brisbane Site[1]	West Brisbane Site[1]	SFO Site
Riparian Habitat (acres)	0.0	0.0	0.0	0.0
Wildlife Movement Corridors (acres)	0.0	0.0	0.0	0.0
Special-Status Plant Habitat (acres)				
California seablite (FE, 1B.2)	0.0	0.0	0.0	0.6
Special-Status Wildlife Habitat (acres)				
Salt marsh harvest mouse (FE, SE, FP)	0.0	0.0	0.0	0.6
California Ridgway's rail (FE, SE, FP)	0.0	0.0	0.0	0.6
California black rail (ST, FP)	0.0	0.0	0.0	0.6

Source: Land cover generated using ESRI ArcGIS version 10.3 from aerial photo interpretation using NAIP aerial imagery dated 2010–2015
SFO = San Francisco International Airport
Federal/State Status Codes:
FE = listed as endangered under the FESA
SE = Listed as endangered under the CESA
ST = Listed as threatened under the CESA
FP = California Fully Protected Species
1B.2 = California Rare Plant Rank (0.2 indicates a species that is moderately endangered in California)
[1] This analysis was based on project footprints from the 2010 Supplemental Alternatives Analysis. The design of the East and West Brisbane LMFs has been refined since 2010, therefore the current project footprints reported in the Draft EIR/EIS have slightly different impacts on biological resources than shown in this table.

Practicability

The four LMF options were evaluated to determine whether the sites would be potentially practicable. Specifically, the evaluation focused on the potential availability of each site and the potential practicability of building and operating an LMF in light of cost and logistics. The results of this assessment are as follows:

- **Availability**—Displacement of Regionally Important Public Facilities/Infrastructure: Sites currently occupied by public facilities or infrastructure that are of significant importance to the

region and cannot feasibly be relocated were considered to be unavailable to the Authority. The following sites were determined to be unavailable:

- San Francisco Port (Piers 90–94). After years of planning and coordination with the City of San Francisco, the Port of San Francisco established the Maritime Eco-Industrial Center (Center) at Piers 80–96 to help preserve maritime industrial uses in San Francisco (Port of San Francisco 2016). The Port defines the Center as an area to "co-locate maritime industrial uses to enable product exchange, optimize use of resources, incorporate green design and green technologies on-site, foster resource recovery and reuse, provide economic opportunities that employ local residents, minimize environmental impacts and incorporate public open space for enjoyment and habitat." The importance of the Center in the city's overall plan for the southeast part of San Francisco renders the site unavailable for use as an LMF.
- SFO. The use of the SFO site for the LMF would have the effect of reducing available space for airport-related operations at a currently constrained airport, as documented in the Airport Development Plan (SFO 2016) and the City and County Board of Supervisors' 2008 resolution.[14] The SFO Airport Development Plan acknowledges that SFO is significantly constrained in its ability to implement long-term expansion plans because of the lack of available vacant land. Adding to the challenges facing SFO, in 2008, the San Francisco Board of Supervisors passed a resolution restricting additional fill in San Francisco Bay for new or reconfigured runways at the airport. The importance of this site to support airport expansion and operations—a function critically important to the region—provided the basis for a determination that the site would be unavailable for use as an LMF.

- **Cost**—Each LMF option was evaluated to determine whether the site would be practicable from a cost standpoint. The evaluation considered the total capital cost of developing a site, including the cost of: (1) land acquisition of approximately 100 acres for LMF site placement and (2) infrastructure modifications or replacements needed to accommodate the LMF and lead tracks. Specifically, sites that would require unreasonable capital expenditures were not considered to be potentially practicable from a cost standpoint.

  Of the four LMF sites, two are potentially practicable from a cost standpoint—West Brisbane and East Brisbane. The Port and SFO sites would each require unreasonable expenditures of public funds to procure. With respect to the Port and SFO sites, development of an LMF would require the acquisition of residential, commercial, and industrial properties to meet the 100-acre size requirement for the LMF. Both sites are located in areas with exceedingly high real estate values. The cost of assembling these additional properties would greatly exceed the capital cost requirements for the Brisbane sites.

  As shown in Table 3-4, the cost of land acquisition for the West Brisbane and East Brisbane sites would be approximately $89.7M and $8.8M, respectively, while land acquisition costs would be approximately $762.3M for the Port and $566.3M for SFO. Land acquisition for the SFO site would be over 6 times the cost of the West Brisbane and 65 times the cost of East Brisbane, whereas land acquisition for the Port site would be over 8 times the cost of the West Brisbane and 87 times the cost of East Brisbane.

  The total capital costs for land acquisition and infrastructure at West Brisbane and East Brisbane would be approximately $402.7M and $321.7M, respectively, while capital costs would be approximately $1.9B for the Port and $1.3B for SFO (Table 3-4). At over three times the cost of West Brisbane and almost four times the cost of East Brisbane, the SFO site was determined to be not practicable from a cost standpoint. The more costly Port site would be almost five times the cost of West Brisbane and over six times the cost of East Brisbane, and therefore was also determined to be not practicable.

[14] Board of Supervisors Resolution No. 69-08. 2008. Policy Regarding Bay Infill at San Francisco International Airport. February 12.

Table 3-4 Capital Costs in 2018$ (Millions)

LMF Site	Infrastructure Costs	Land Acquisition Costs	Total Capital Cost
Port of San Francisco	1,163.0	762.3	1,925.3
SFO	705.5	566.3	1,271.8
East Brisbane	313	8.7	321.7
West Brisbane	313	89.7	402.7

LMF = light maintenance facility
SFO = San Francisco International Airport

- **Logistics**—Elimination of Major Circulation Elements: The placement of an LMF at a site that would require permanent closure of major roadways or otherwise cause permanent substantial disruption to existing circulation patterns was not considered to be practicable. The Port of San Francisco site was eliminated from further evaluation because of the severe and permanent effect on the City and County of San Francisco's roadway system:
  - Port of San Francisco (Piers 90–94). Placement of an LMF at the Port site would require the construction of a tunnel to connect the facility to the mainline track. The tunnel would intersect with Cesar Chavez Street at the junction with the existing Caltrain tracks, thereby permanently severing a major arterial in San Francisco. Cesar Chavez Street connects drivers moving to and from approximately 200 to 250 acres of existing medium to high density commercial and industrial development to the east to the U.S. Highway (US) 101 freeway. Traffic diverted from the existing access to US 101 to an alternative on/off ramp approximately 1.5 miles north would overload the capacity of those roadways.

Advancement of Potential Light Maintenance Facility Sites for Evaluation in the Draft EIR/EIS

The development of each of the four sites for an LMF would result in impacts on aquatic resources, with West Brisbane having the greatest impacts and East Brisbane the least. As a potentially practicable option with the least aquatic resource impacts and no impacts on listed species, the East Brisbane site will be evaluated in the Draft EIR/EIS. Similarly, the West Brisbane site will also be considered in the Draft EIR/EIS. Although development of an LMF at the Port or SFO site would result in less impacts on aquatic resources than at the West Brisbane site, neither site would serve as a practicable option from an availability or cost perspective, and the Port site would not be practicable because of the severity of impacts on San Francisco traffic circulation. Because the Port and SFO options would not be practicable for an LMF, they will not be advanced for consideration in the Draft EIR/EIS.

3.2 Description of Alternatives

The Tier 1 decisions, legislative mandates and other commitments to the blended system constrains the design options within the Project Section. Consequently, the two alternatives proposed to be carried forward for detailed analysis in the Project Section EIR/EIS would predominantly utilize existing Caltrain track, remain substantially within the existing Caltrain right-of-way, and be designed to accommodate operating speeds of up to 110 mph and to achieve maximum non-stop service travel times consistent with Prop 1A.

For this document, the term "operational service time" is used to refer to the typical time of HSR service in actual operation, including station stops and sharing of tracks with other services, like Caltrain. By contrast, the term "maximum non-stop service travel time," as used in Proposition 1A (2008), refers to the travel time that the HSR system is designed to be able to achieve under ideal operating conditions. The "maximum non-stop service travel time" is faster than the "operational

service travel time" because it does not include station stops and sharing of tracks with Caltrain.[15]

3.2.1 Overview of System Design Performance and Common Project Features

The portion of the Project Section studied in this Checkpoint B Report extends along the existing Caltrain right-of-way through urban cities and communities in San Francisco, San Mateo, and Santa Clara Counties, including San Francisco, Brisbane, South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Belmont, San Carlos, Redwood City, North Fair Oaks, Atherton, Menlo Park, Palo Alto, Mountain View, Sunnyvale, and Santa Clara. This portion of the Project Section comprises the following four geographic subsections: San Francisco to South San Francisco, San Bruno to San Mateo, San Mateo to Palo Alto, and Mountain View to Santa Clara (Figure 3-3).

San Francisco to San Jose Project Subsections

- San Francisco to South San Francisco — 10 miles from 4th and King Street Station in San Francisco to Linden Avenue in South San Francisco
- San Bruno to San Mateo—8 miles from Linden Avenue in South San Francisco to 9th Avenue in San Mateo
- San Mateo to Palo Alto—16 miles from 9th Avenue in San Mateo to San Antonio Road in Palo Alto
- Mountain View to Santa Clara—9 miles from San Antonio Road in Palo Alto to Scott Boulevard

Operating primarily on the two-track system within the existing Caltrain right-of-way, the project would use existing and in-progress infrastructure improvements developed by Caltrain for its Caltrain Modernization Program, including electrification of the Caltrain corridor between San Francisco and San Jose and upgrading the existing system to meet PTC requirements. These improvements would provide consistent and predictable travel between San Francisco and San Jose. The blended system would accommodate operating speeds of up to 110 mph for up to four HSR trains and six Caltrain trains per hour per direction in the peak period.

Operation of the blended system would require additional infrastructure improvements and project elements beyond the Caltrain Modernization Program to accommodate HSR service. Two project alternatives are proposed for detailed analysis in the Project Section EIR/EIS—Alternative A and Alternative B. This chapter describes the common design features of the two project alternatives, followed by descriptions of each alternative. Project elements required for both project alternatives include track modifications to support higher speeds while maintaining passenger comfort; station and platform modifications to accommodate HSR trains passing through or stopping at existing stations; safety and security improvements for at-grade roadway crossings and at existing Caltrain stations; an LMF located east or west of the mainline Caltrain tracks; and communication radio towers located at approximately 2.5-mile intervals. A 6-mile passing track section between San Mateo and Redwood City (the Short Middle Four-Track) would be provided under Alternative B.

[15] Prop 1A, enacted in 2008, calls for the HSR system to be designed to be capable of achieving a 30-minute "maximum nonstop service travel time" between San Francisco and San Jose (California Streets and Highways Code § 2704.09(b)(3)) on an alignment that follows existing transportation and utility corridors to the extent feasible (California Streets and Highways Code § 2704.09(g)).

Source: Authority 2018c

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Figure 3-3 San Francisco to San Jose Project Section Subsections

3.2.1.1 Track and Station Modifications

Depending on the alternative selected, between 7 and 10 of the existing 23 Caltrain stations between 4th and King Street in San Francisco and Scott Boulevard in Santa Clara[16] would require varying degrees of modifications to accommodate HSR trains passing through or stopping at the stations. HSR trains would stop at the 4th and King Street and Millbrae Stations, requiring dedicated HSR platforms and associated passenger services be provided at these stations. Other stations would also be modified to accommodate track adjustments, remove the hold-out rule, and construct project features such as the Brisbane LMF and passing track.

Definition of Hold-out Rule

Hold-Out Rule is the rule enforced at Caltrain stations that requires passengers to board and alight the train from between the active tracks. An oncoming train is detained outside of the station zone until the passengers are safely clear.

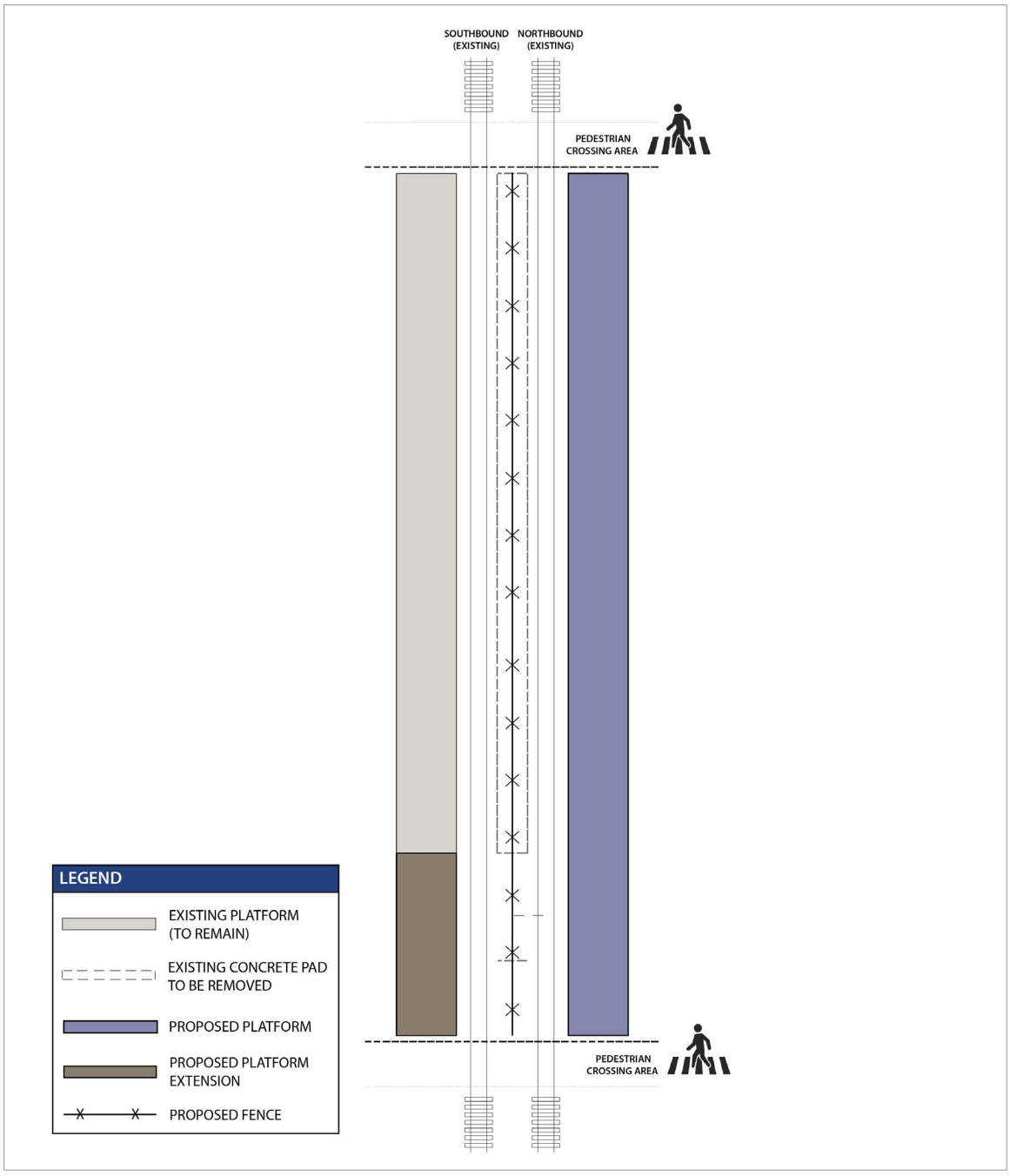
The blended system would require curve straightening, track center modifications, and superelevation[17] of existing Caltrain tracks along approximately 33 percent of the project corridor to support higher speeds of up to 110 mph. Where track modifications would occur at existing Caltrain stations, adjustments to existing platforms would be required. Track modifications at San Bruno Station under Alternatives A and B and Hayward Park Station under Alternative B would require modifying or realigning the existing station platforms.

Two existing Caltrain stations—Broadway and Atherton Stations—would be modified as part of the blended system improvements to remove the existing hold-out rule. Under both alternatives, new northbound outboard platforms would be constructed at these stations to eliminate the need for passengers to cross between the tracks. Figure 3-4 depicts the required modifications to eliminate the hold-out rule at these existing stations.

Project components such as the Brisbane LMF under both alternatives and the passing tracks under Alternative B would require station modifications or relocations. The Brisbane LMF would require modifying the station platforms and pedestrian overpass at the Bayshore Station in Brisbane. The passing tracks under Alternative B would require modifying the Hayward Park, Hillsdale, Belmont, and San Carlos Caltrain Stations.

[16] The 23 existing Caltrain stations between 4th and King Street in San Francisco and Scott Boulevard in Santa Clara are 4th and King Street, 22nd Street, Bayshore, South San Francisco, San Bruno, Millbrae, Broadway, Burlingame, San Mateo, Haywood Park, Hillsdale, Belmont, San Carlos, Redwood City, Atherton, Menlo Park, Palo Alto, Stanford, California, San Antonio, Mountain View, Sunnyvale, and Lawrence. Stations that would require modification are illustrated on Figures 3-10, 3-15, 3-19, 3-20, 3-21, 3-22, and 3-24.

[17] *Superelevation* is the vertical distance between the height of the inner and outer rails at a curve. Superelevation is used to partially or fully counteract the centrifugal force acting radially outward on a train when it is traveling along the curve.



Source: Authority 2018d

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Figure 3-4 Illustration of Hold-Out Rule Stations

3.2.1.2 Safety and Security Modifications to the Right-of-Way

Consistent with FRA safety guidelines for HSR systems with operating speeds of up to 110 mph, the blended system would implement safety improvements at the at-grade crossings to create a "sealed corridor" that would reduce conflicts with automobiles and pedestrians. Safety improvements would include installing four-quadrant gates extending across all lanes of travel and median separators to channelize and regulate paths of travel at all at-grade crossings. These gates would prevent drivers from traveling in opposing lanes to avoid the lowered gate arms. Pedestrian crossing gates also would be constructed parallel to the tracks, and aligned with the vehicular gates on either side of the roadway.

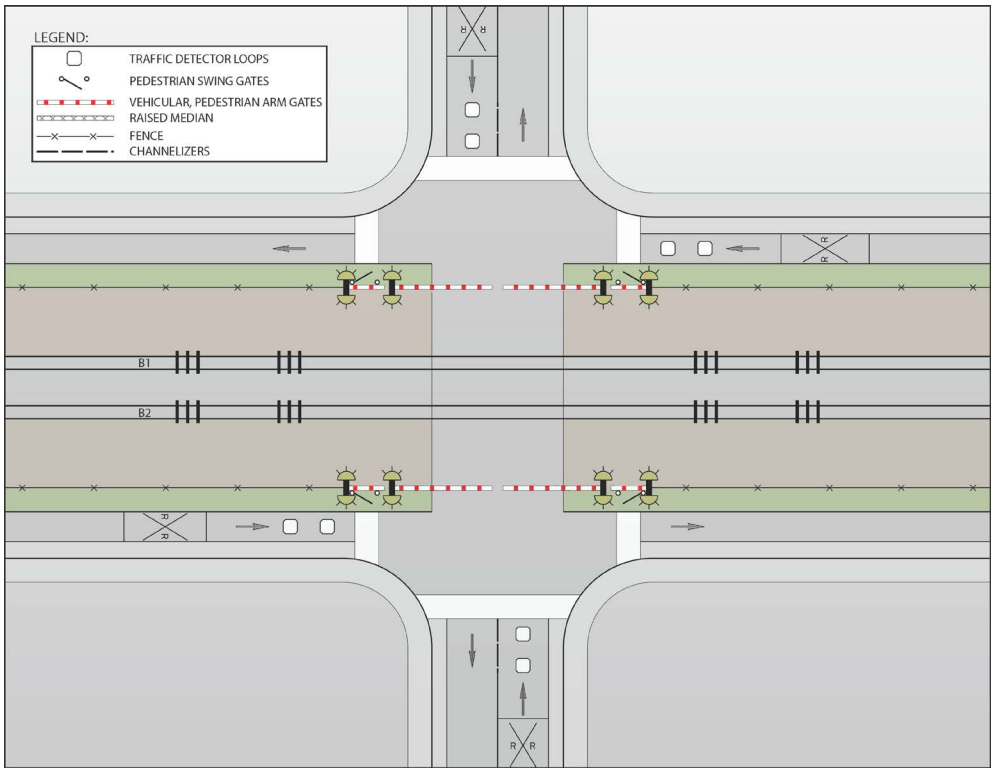
Depending on the configuration of the existing at-grade crossing, one of six different four-quadrant gate applications (illustrated on Figures 3-5, 3-6, and 3-7) would be installed at each of the 38 at-grade crossings along the Project Section. Table 3-5 identifies the number and locations of four-quadrant gate applications. These applications would specify the improvements at each at-grade crossing, including the number of vehicle and pedestrian gates, and the need for channelization or raised medians.

Table 3-5 Number and Locations of Four-Quadrant Gate Applications within the Project Section

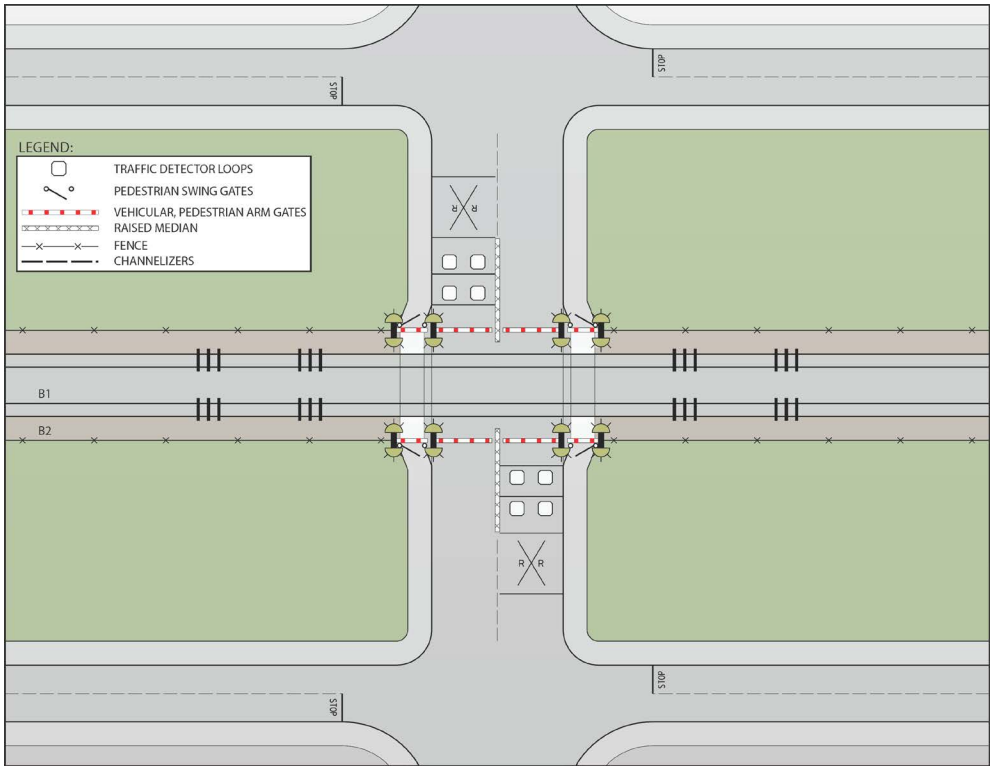
Application	Number of At Grade Crossings	Location of At Grade Crossings
A	7	Mission Bay Drive and 16th Street (San Francisco); 4th Avenue and 5th Avenue (San Mateo); Oak Grove Avenue and Ravenswood Avenue (Menlo Park); and Mary Avenue (Sunnyvale)
B	11	Center Street (Millbrae); Oak Grove Avenue, North Lane, Howard Avenue, Bayswater Avenue, and Peninsula Avenue (Burlingame); Villa Terrace and Bellevue Avenue (San Mateo); Chestnut Street (Redwood City); Encinal Avenue (Menlo Park); Alma Street (Palo Alto)
B1	2	Scott Street (San Bruno); Watkins Avenue (Atherton)
C	4	Broadway (Burlingame); Whipple Avenue (Redwood City); Rengstorff and Castro Street (Mountain View)
D	7	Linden Avenue (South San Francisco); Brewster Avenue and Broadway (Redwood City); Churchill Avenue, Meadow Drive and Charleston Road (Palo Alto); Sunnyvale Avenue (Sunnyvale)
E	7	1st Avenue, 2nd Avenue, 3rd Avenue, and 9th Avenue (San Mateo); Maple Street, Main Street (Redwood City); and Glenwood Avenue (Menlo Park)
Total	38	

Source: Authority 2018c

Application A



Application B



Source: Authority 2018e

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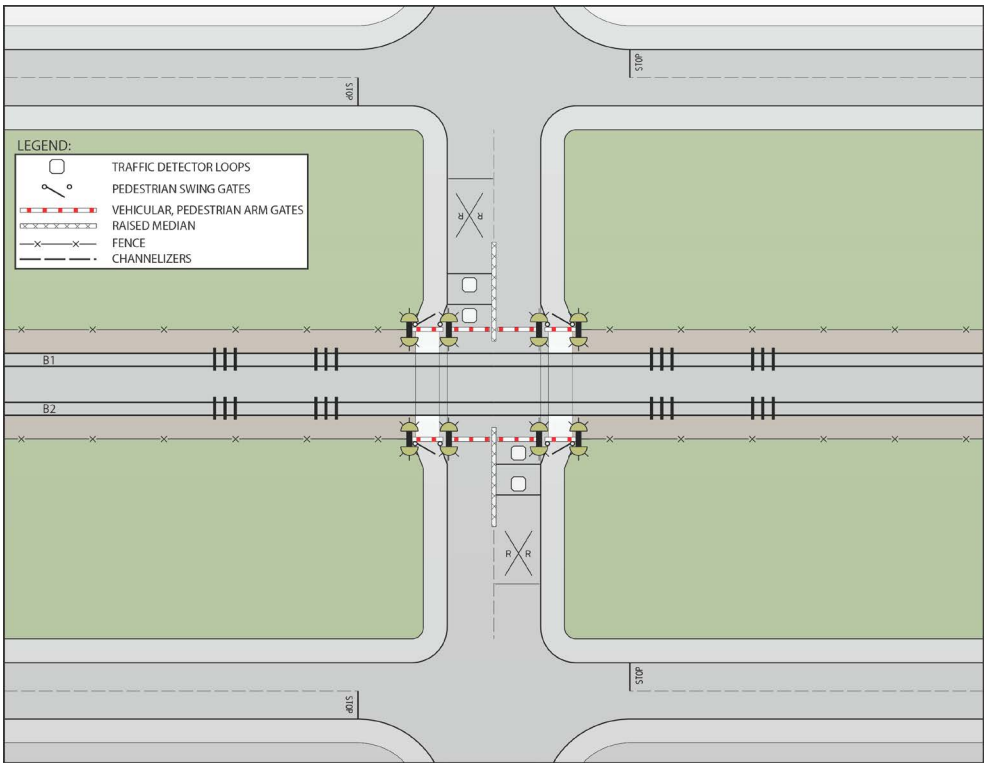
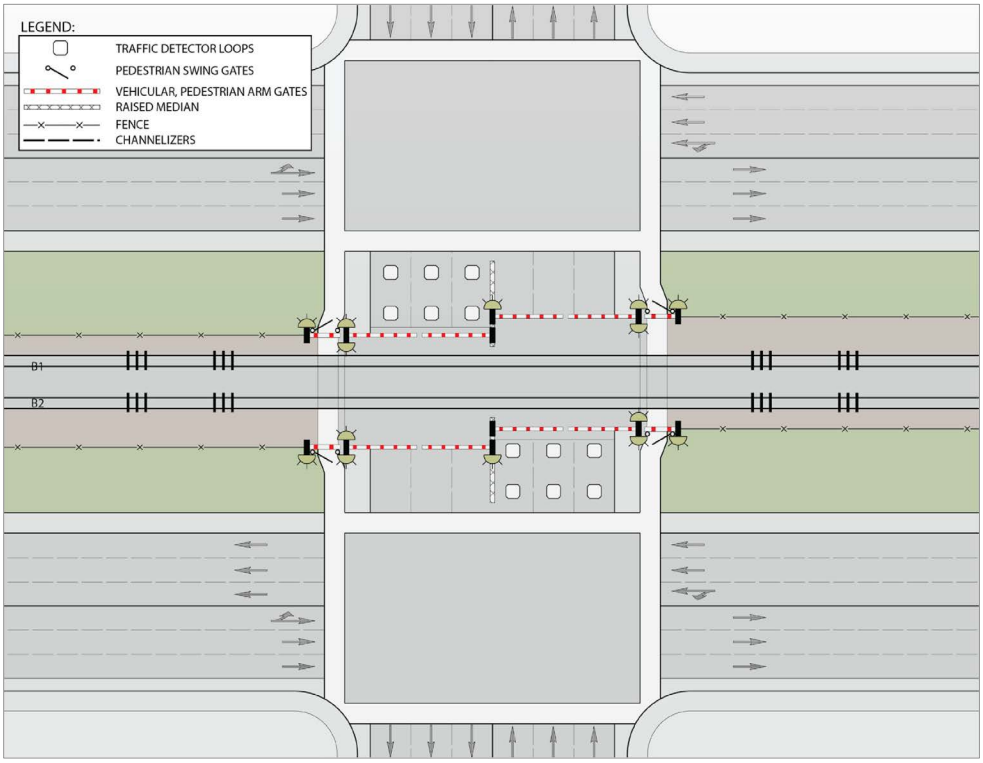
Figure 3-5 Applications of Four-Quadrant Gates (A and B)

Application B1



Application C



Source: Authority 2018e

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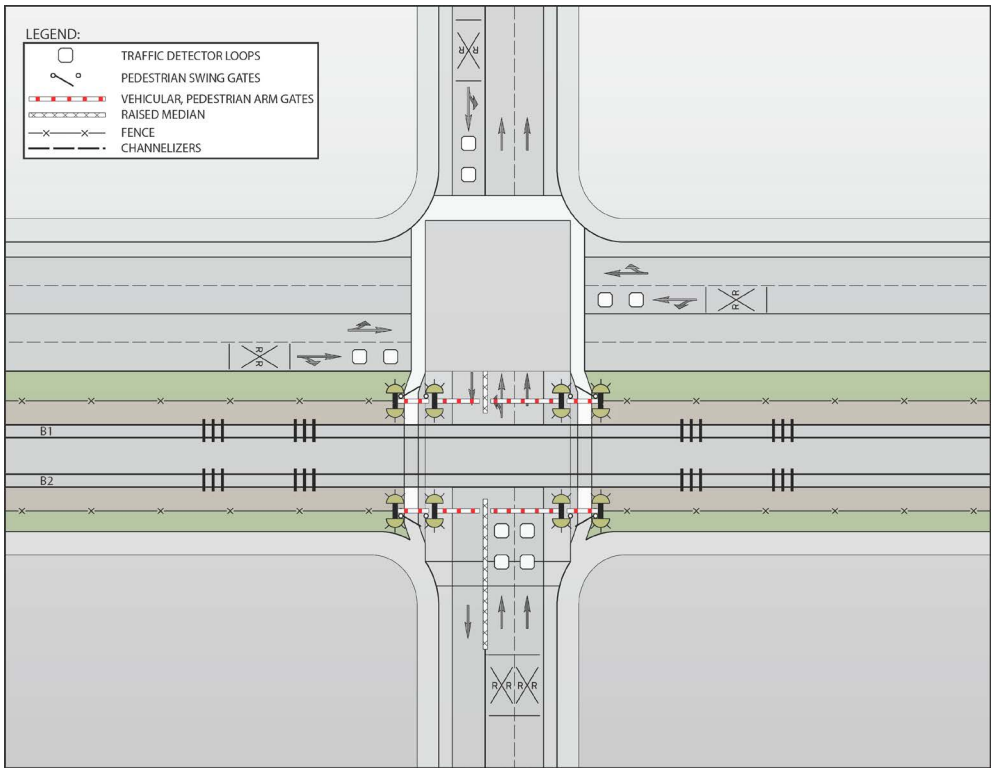
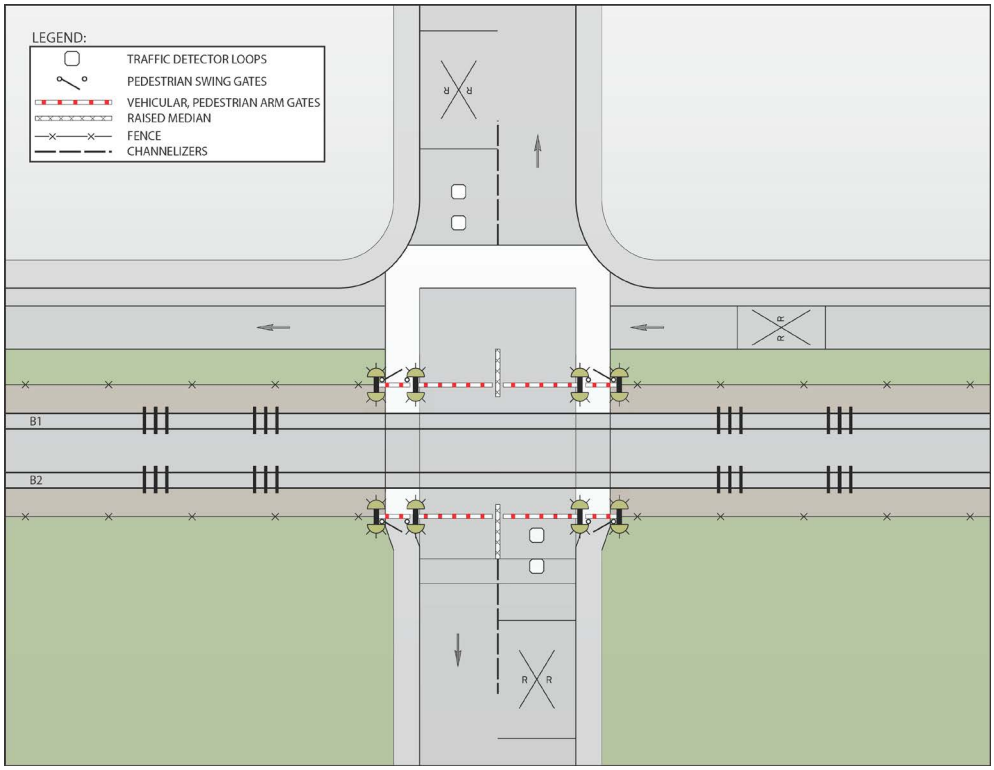
Figure 3-6 Applications of Four-Quadrant Gates (B1 and C)

Application D



Application E



Source: Authority 2018e

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Figure 3-7 Applications of Four-Quadrant Gates (D and E)

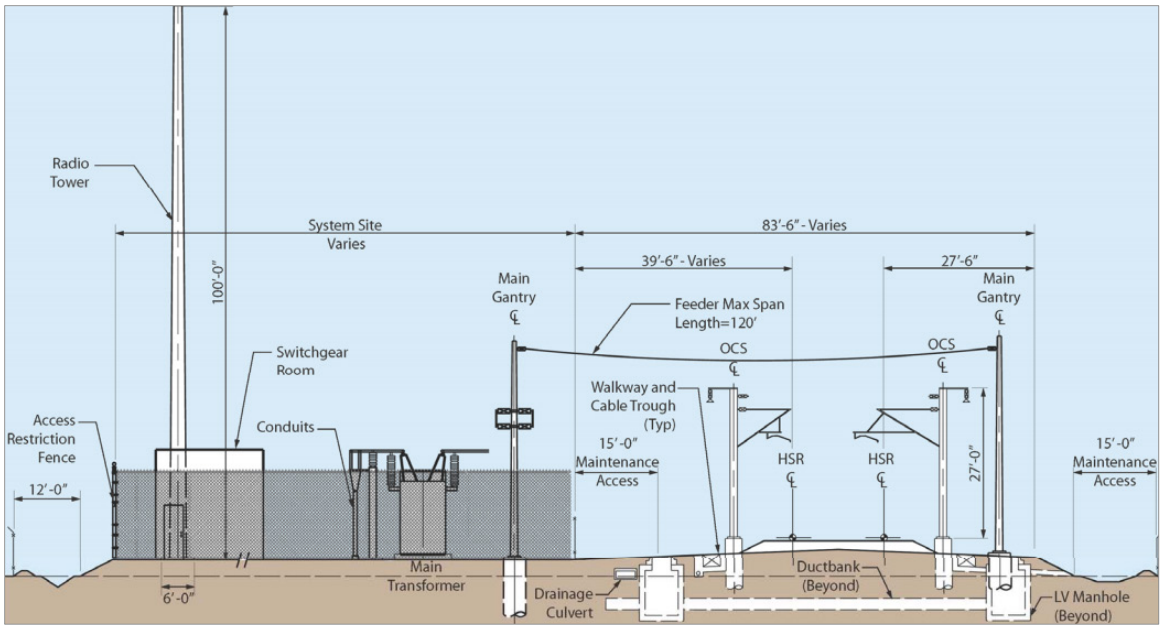
The Authority would install fencing at the at-grade crossings and along the perimeter of the Caltrain corridor. Consistent with Caltrain's design standards, existing fencing would be extended to adjacent structures to close any gaps. Figure 3-8 depicts photographs of existing perimeter fencing of railroad rights-of-way.

Source: Authority 2017 DRAFT APRIL 2017

Figure 3-8 Photographs of Perimeter Fencing of Right-of-Way

3.2.1.3 Train Control and Communication Facilities

Caltrain is upgrading the signal system along the Caltrain corridor to increase operational safety and meet the requirements of PTC regulations. Beyond these upgrades, which are being implemented by Caltrain, HSR would require the installation of a radio-based communications network to maintain communications and share data between the trains and the operations control center. Communications radio towers would consist of an 8-foot by 10-foot communications equipment shelter and a 6- to 8-foot-diameter communications tower extending 100 feet above top-of-rail located at intervals of approximately 2.5 miles. Where possible, these facilities are co-located at an existing Caltrain traction power substation (TPSS), switching station, paralleling station, or Caltrain station. Where communications towers cannot be co-located with other Caltrain facilities, the communications facilities would be sited near the HSR corridor in a fenced area approximately 20 by 15 feet. Some but not all of the stand-alone locations have two options for environmental clearance. Figure 3-9 illustrates a radio tower site co-located with a Caltrain TPSS.



Source: Authority 2018c

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Figure 3-9 Typical Cross Section of At-Grade Profile with an Adjacent Communications Radio Tower Co-Located with Caltrain Traction Power Substation

3.2.1.4 Light Maintenance Facility Options

The Project Section would include an approximately 100-acre LMF in the City of Brisbane. Designed to accommodate projected system growth to the year 2040, the LMF would provide storage capacity for trains and accommodate light maintenance activities, including daily inspections, pre-departure cleaning, testing, and servicing between runs; monthly inspections; quarterly inspections; train washing; and wheel truing. Two site options for the Brisbane LMF, located east and west of the mainline Caltrain tracks, are evaluated in this document as part of the two project alternatives and described in more detail in Section 3.2.2, Alternative A, and Section 3.2.3, Alternative B. These site options were developed by the Authority because each has tradeoffs in terms of construction requirements, planned land uses, and aquatic resources. Functionally, both of the LMF options could be integrated into either of the alternatives.

3.2.1.5 Passing Track Options

To assess the capacity and operational flexibility of the Caltrain corridor between San Francisco and San Jose on HSR and Caltrain, the Authority conducted an evaluation of a No Passing Track option and further evaluation of the three passing track options not eliminated as a result of 2013 operational analysis—Short Middle Four-Track, Long Middle Four-Track, and the Long Middle Three-Track (illustrated on Figure 3-1). While the 2016 operational analysis is a useful tool for comparison between passing track options, the average operational service times are not directly comparable to the previous 2013 analysis due to changes in assumptions with regards to headways. The operational analysis was accompanied by a preliminary evaluation of community impacts, to determine the level of community disruption generated by each option. As shown in Table 3-6, the different options provide different operational service times for HSR and Caltrain, with varying levels of disruption to the local communities.

Table 3-6 2016 Evaluation of Passing Track Options

Measure	Passing Track Option				
	No Project Alternative (Baseline)[2]	No Passing Track	Short Middle Four Track (6 mi)	Long Middle Four Track (8 mi)	Long Middle Three Track (16 mi)
Operational Analysis					
HSR average operational service time (minutes)[1]	N/A	47.1	44.7	44.2	42.7
Caltrain average operational service time (minutes)[1]	62.2	62.5	65.0	60.9	58.6
Community Considerations					
Communities affected	N/A	None	San Mateo Belmont San Carlos Redwood City	San Mateo Belmont San Carlos Redwood City	San Mateo Belmont San Carlos Redwood City North Fair Oaks Atherton Menlo Park Palo Alto
Length of passing track adjacent to residential land uses (mi)	N/A	0	1.8	2.3	8.3
Potential number of affected at-grade crossings	N/A	0	0	6	16
Determination	N/A	Carried forward (Alternative A)	Carried forward (Alternative B)	Withdrawn	Withdrawn

Sources: SMA Rail Consulting 2016; Authority 2018c; City of Belmont 2016; City of Menlo Park 2015; City of Palo Alto 2011; City of Redwood City 2010; City of San Carlos 2009; City of San Mateo 2010
HSR = high-speed rail
N/A = not applicable
mi = miles
[1] Average service travel times are provided from 4th and King Street Station to San Jose Diridon, and assumes 3 minute headways/separation along the corridor and 2 minute headways/separation at junctions.
[2] The No Project Alternative (Baseline) assumes a fully electrified Caltrain service operating up to six trains per hour per direction and speeds of up to 79 miles per hour. Under the No Project Alternative, Caltrain would use existing areas of more than two tracks for passing operations.

The following provides a more detailed discussion of the factors affecting the determination of passing track options recommended for further consideration in the Project Section EIR/EIS. Primary considerations included avoiding and minimizing community and environmental resource impacts, and minimizing impacts on the existing passenger and freight rail systems operating within the Caltrain corridor. The Authority and FRA balanced these considerations with the objectives of predictable and consistent travel times. Based on this balancing approach, the Authority and FRA are not carrying forward the long Middle Four-Track Passing Track and Long Middle Three-Track Passing Track options because of their substantially greater level of community disruption and right-of-way acquisition. The Authority and FRA are carrying forward the No Passing Track and Short Middle Four-Track Passing Track options as part of the two blended system alternatives because these options are consistent with operational service time objectives for HSR and Caltrain, and would minimize impacts on adjacent communities.

No Passing Track Option

Under the No Passing Track Option new passing tracks would not be built. Rather, HSR and Caltrain would use existing areas along the Caltrain corridor that have more than two tracks (South Terminal, Lawrence, North Fair Oaks, and Brisbane) to allow faster-moving trains to bypass slower-moving trains. The Millbrae Station would be expanded to a four-track station with dedicated HSR tracks, which would allow for new passing opportunities.

The average Caltrain operational service time from San Jose to San Francisco (4th and King Street Station) with the No Passing Track Option would be approximately 62.5 minutes, approximately 0.3 minute (18 seconds) slower than under the baseline conditions associated with the No Project Alternative (SMA Rail Consulting 2016). The No Passing Track Option would avoid right-of-way acquisition, temporary construction disruption, and aesthetic impacts associated with new areas of passing track, and environmental and community impacts associated with construction of passing tracks. For these reasons the No Passing Track Option is recommended for further analysis.

Short Middle Four-Track Passing Track Option

The Short Middle Four-Track Passing Track Option (see Figure 3-1) would construct an approximately 6-mile-long passing track section between Ninth Avenue in San Mateo to just north of Whipple Avenue in Redwood City. This section is already grade separated, with the exception of 25th Street in San Mateo, which will be grade separated prior to construction of the passing track as part of the 25th Avenue Grade-Separation Project described in Section 2.3, Related Projects Having Completed Project-Level Review. This passing track option would reconstruct the aerial San Carlos and Belmont Caltrain stations and the at-grade Hillsdale and Hayward Park Stations.

As shown in Table 3-6, the average Caltrain operational service time for the Short Middle Four-Track Passing Track Option would be approximately 65.0 minutes compared to 62.2 minutes under baseline conditions and 62.5 minutes with the No Passing Track Option (SMA Rail Consulting 2016). Caltrain operational service times would be longer for the Short Middle Four-Track Passing Track Option than the No Passing Track Option because the passing track section is not long enough to avoid Caltrain trains needing to stop at stations to allow adequate time for the HSR trains to pass Caltrain trains. Average HSR operational service times for the Short Middle Four-Track Passing Track Option would be 44.7 minutes compared to 47.1 minutes with the No Passing Track Option. HSR operational service times would be worse with the Short Middle Four-Track Passing Track Option because HSR trains would not be able to pass Caltrain trains between northern Redwood City and southern San Mateo.

The Short Middle Four-Track Passing Track Option would provide for more track capacity between southern San Mateo and northern Redwood City, which would provide greater operational flexibility than the No Passing Track Option. This additional track capacity would allow the system to recover faster due to delays and incidents. For example, if a train were delayed or a track were out of service along the segment between southern San Mateo and northern Redwood City there would be greater ability to route trains around the incident and faster recovery of operational service times accordingly.

The Short Middle Four-Track Passing Track Option is the shortest of the four passing track options and would have the least impact on adjacent residential land uses. Because this 6-mile-long passing track section would be grade separated prior to construction of the passing track, this option would cause the least amount of temporary construction disturbance within adjacent communities associated with track construction and roadway modifications. Further, the temporary and permanent aesthetic impacts associated with construction and operation of this passing track option would be substantially less than the other passing track options considered.

The Short Middle Four-Track Passing Track Option is recommended for further analysis because it would allow for shorter HSR operational service times (although at the expense of slower Caltrain operational service times) and because it has the potential to provide operational benefits associated with faster recovery times from perturbations to railway operations. Additionally, this

option would be built within an already grade-separated track section, thereby minimizing community disruption and displacements associated with expanding the existing right-of-way.

Long Middle Four-Track Passing Track Option

The Long Middle Four-Track Passing Track Option (see Figure 3-1) would build an approximately 8-mile passing track section from south of Ninth Avenue in San Mateo to south of SR 84 (Woodside Road) in Redwood City (an additional 2 miles of passing track south of the Short Middle Four-Track Passing Track). This option would require reconstruction of the aerial Caltrain San Carlos and Belmont Stations, the at-grade Hillsdale and Hayward Park Stations, and the Caltrain Redwood City Station, as well as additional right-of-way through downtown Redwood City.

Average operational service time from San Jose to San Francisco (4th and King Street Station) would be approximately 60.9 minutes for Caltrain and 44.2 minutes for HSR with the Long Middle Four-Track Passing Track Option. This option would improve Caltrain service by 1.3 minutes compared to baseline conditions and by 1.6 minutes compared to the No Passing Track Option, and would improve HSR operational service times by 2.9 minutes compared to the No Passing Track Option (SMA Rail Consulting 2016). Construction of the Long Middle Four-Track Passing Track Option would disrupt several cities and require right-of-way acquisition in San Mateo, Belmont, San Carlos and northern and downtown Redwood City. Downtown Redwood City currently has five at-grade crossings, which would need to be reconstructed or modified to accommodate this passing track option. Temporary road closures, detours, and reduced access to property during construction at the at-grade crossings would substantially disrupt downtown Redwood City. This passing track option would have greater aesthetic impacts relative to the Short Middle Four-Track Passing Track Option due to additional elevated segments passing through adjacent communities.

The Long Middle Four-Track Passing Track Option is not recommended for further analysis. Although it would have average operational service times for HSR similar to the Short Middle Four-Track Passing Track Option and would improve Caltrain service compared to both the baseline conditions and the No Passing Track Option, it would require more construction along a longer extent of track, resulting in greater community impacts. The limited gain to HSR and Caltrain operational service times in light of the additional environmental and community impacts of the Long Middle Four-Track Passing Track Option is the primary reason for recommending withdrawal from future consideration.

Long Middle Three-Track Passing Track Option

The Long Middle Three-Track Passing Track Option (see Figure 3-1) would build a 16-mile section from San Mateo (south of Ninth Avenue) to north of San Antonio Avenue in Palo Alto (an additional 10 miles of passing track south of the Short Middle Four-Track Passing Track). This option includes one additional track in existing two-track areas, and utilizes the existing four-track area at Redwood Junction in Redwood City. The third track would be used bidirectionally for both northbound and southbound trains, requiring precise coordination of HSR and Caltrain operations to provide for safe use of the passing track.

The Long Middle Three-Track Passing Track Option is the longest passing track option, and would extend adjacent to residential land uses for approximately half of its length (8 miles). Construction of this passing track option could require reconstructing some or all of the existing 16 at-grade crossings, resulting in construction disruption in San Mateo, Belmont, San Carlos, Redwood City, Atherton, Menlo Park, and Palo Alto. The width of new right-of-way acquisition in San Mateo, Belmont and San Carlos and Redwood City would, however, be less than the Short Middle Four-Track and Long Middle Four-Track Passing Track Options due to the three-track rather than four-track configuration.

Average operational service time from San Jose to San Francisco would be approximately 58.6 minutes for Caltrain and 42.7 minutes for HSR, assuming bidirectional use of the Long Middle Three-Track Passing Track Option. This option has the shortest average operational service times for both Caltrain and HSR of the options studied. Operation of this option would, however,

be more challenging than the four-track passing track options, due to the need for precision dispatching, and it is possible that this option could result in slower recovery times from delays or disruption events.

Although the Long Middle Three-Track Passing Track Option would result in the best Caltrain and HSR average operational service times of the options evaluated, it would require construction along the longest extent of track, resulting in a greater extent of community impacts. Further, the operational challenges associated with the bidirectional use of this option could be considerable. For these reasons, the Long Middle Three-Track Passing Track Option is recommended for withdrawal from further consideration.

3.2.2 Alternative A

Alternative A (illustrated on Figure 3-3 and described as the No Passing Track Option) would modify approximately 14.5 miles of existing Caltrain track, predominantly within the existing Caltrain right-of-way, construct the East Brisbane LMF, modify seven existing stations or platforms to accommodate HSR, and install safety improvements and communication radio towers. Caltrain has several locations of four-track segments where trains can pass; no additional passing tracks would be constructed under Alternative A. Table 3-7 presents a summary of the alternative's design features, followed by a more detailed description by subsection.

Table 3-7 Summary of Design Features for Alternative A

Feature	Alternative A
Length of existing Caltrain track (miles)[1]	42.9
Length of modified track (miles)[1]	14.5
Length of track modification <1 ft (miles)[1]	5.1
Length of track modification >1 ft and <3 ft (miles)[1]	2.2
Length of track modification > 3 ft (miles)[1]	7.2
Length of OCS pole relocation (miles)[1, 2]	9.4
LMF	East Brisbane
Modified stations	
Modifications to HSR stations	4th and King Street; Millbrae
Modifications to Caltrain stations due to the LMF	Bayshore
Modifications to Caltrain stations due to track shifts	San Bruno; Hayward Park
Modifications to Caltrain stations to remove hold-out rule	Broadway; Atherton
Number of modified or new structures[3]	14
New structures	2
Modified structures	7
Replaced structures	2
Affected retaining walls	3
Number of at-grade crossings with safety modifications (e.g., four-quadrant gates, median barriers)	38
Length of new perimeter fencing (miles)[1]	7.3
Communication radio towers	20

Source: Authority 2018c
LMF = light maintenance facility
OCS = overhead contact system
[1] Lengths shown are guideway mileages, rather than the length of the northbound and southbound track.
[2] OCS pole relocations are assumed for areas with track shifts greater than 1 foot.
[3] Structures include bridges, grade separations such as pedestrian underpasses and overpasses, tunnels, retaining walls, and culverts.

3.2.2.1 San Francisco to South San Francisco Subsection

The San Francisco to South San Francisco Subsection would extend approximately 10 miles from the 4th and King Street Station in downtown San Francisco to Linden Avenue in South San Francisco, through the cities of San Francisco, Brisbane, and South San Francisco. The existing Caltrain track within this subsection is predominantly two-track at grade, with four two-track tunnel segments in San Francisco, and a four-track at-grade section through Brisbane. As illustrated on Figure 3-10, this alternative would modify the existing 4th and King Street and Bayshore Stations, construct the East Brisbane LMF and associated track modifications, reconfigure Tunnel Avenue, install four-quadrant gates at three existing at-grade crossings, and install five communication radio towers. Additional right-of-way would be required in San Francisco and in Brisbane to accommodate track modification, the East Brisbane LMF, Tunnel Avenue reconfiguration, four-quadrant gates, and communication radio towers.

Source: Authority 2018c

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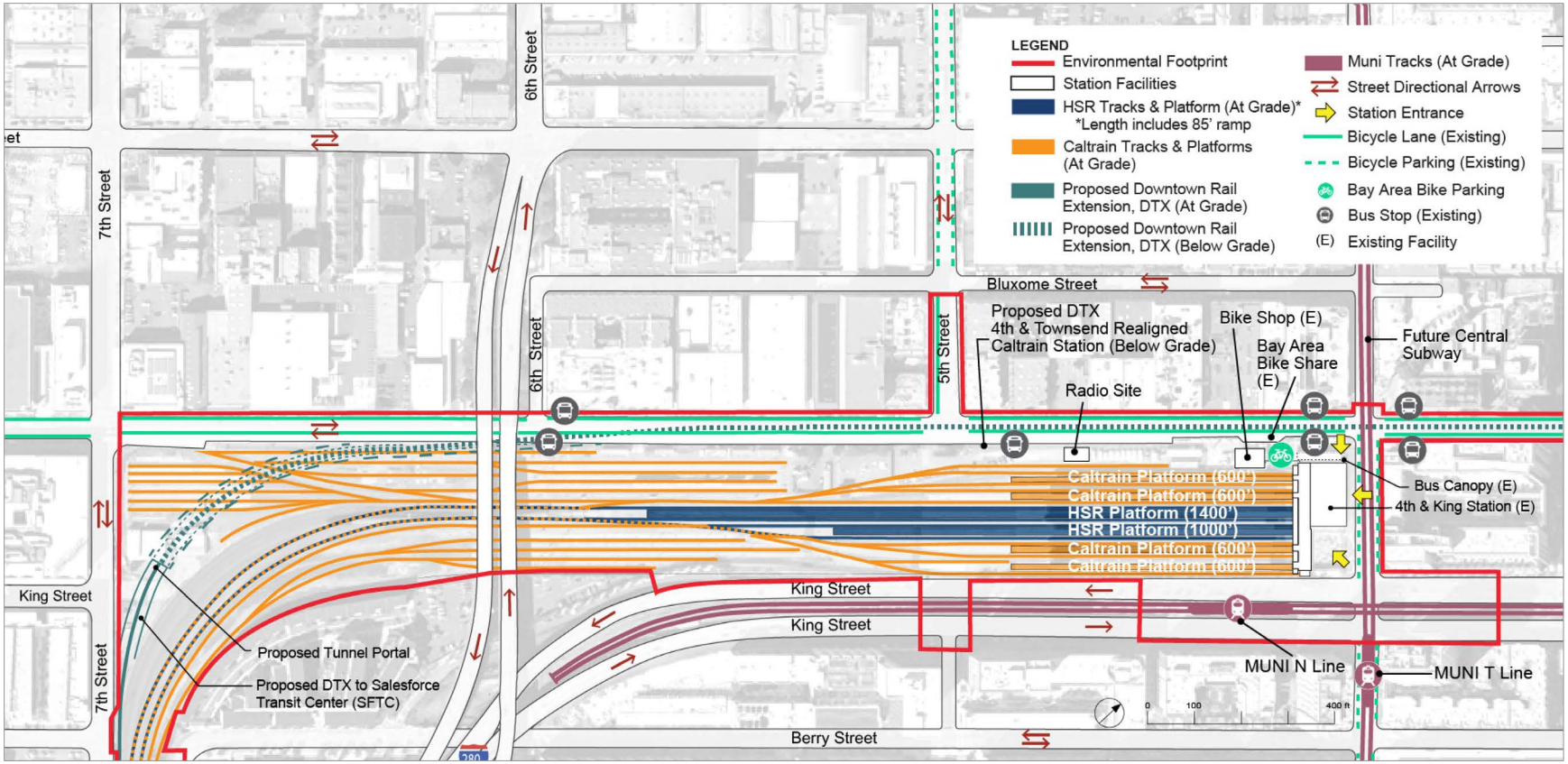
Figure 3-10 San Francisco to South San Francisco Subsection—Alternative A

4th and King Street Station

The existing 4th and King Street Station would serve as the interim terminal station for the Project Section until the DTX provides HSR access to the SFTC. Figure 3-11 depicts the site plan for the interim station. Station improvements would include installing a booth for HSR ticketing and support services, adding HSR fare gates, and modifying existing tracks and platforms. Until the DTX provides service to the SFTC, passengers would use alternative methods of transportation between the 4th and King Street Station and SFTC (e.g., MUNI, ride-share program, or walk). Figures 3-12 and 3-13 present a cross-section view of the HSR tracks and platforms at 4th and King Street Station looking northeast.

To support HSR operations, two existing Caltrain platforms in the center of the station yard would be raised and lengthened to serve four northbound and southbound HSR tracks. The HSR platforms would be approximately 4.25 feet high, with lengths of 1,000 feet and 1,400 feet for the southbound platform. Ramps would be installed to provide pedestrian access from the station building to the raised platforms. Four existing Caltrain platforms, 600 feet or 800 feet in length, would remain on either side of the HSR platforms to serve eight Caltrain tracks.



Source: Authority 2018c

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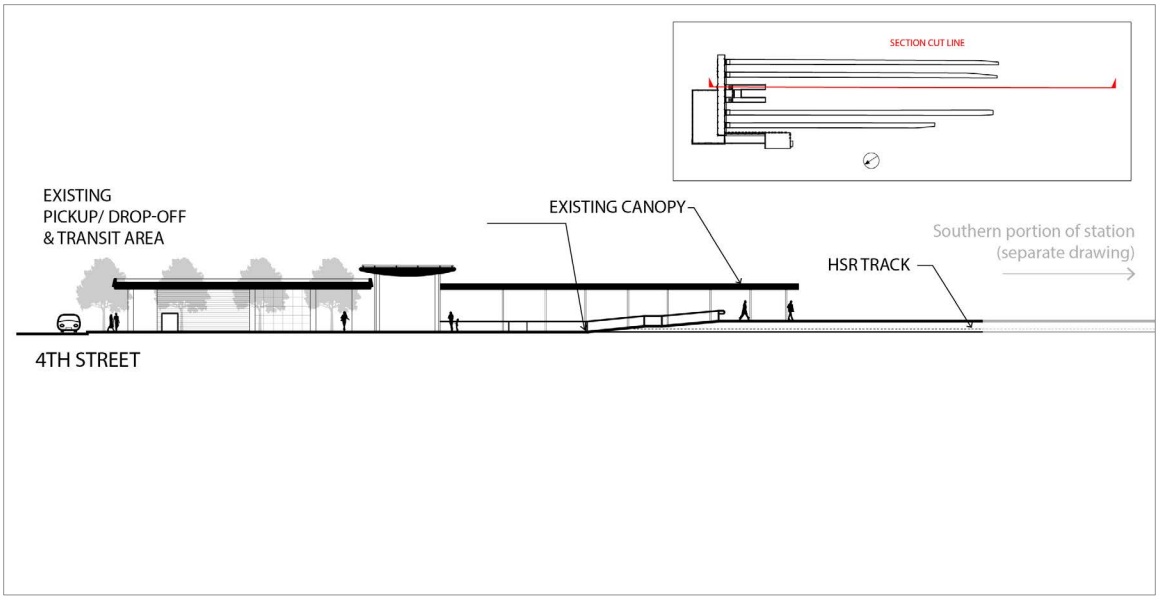
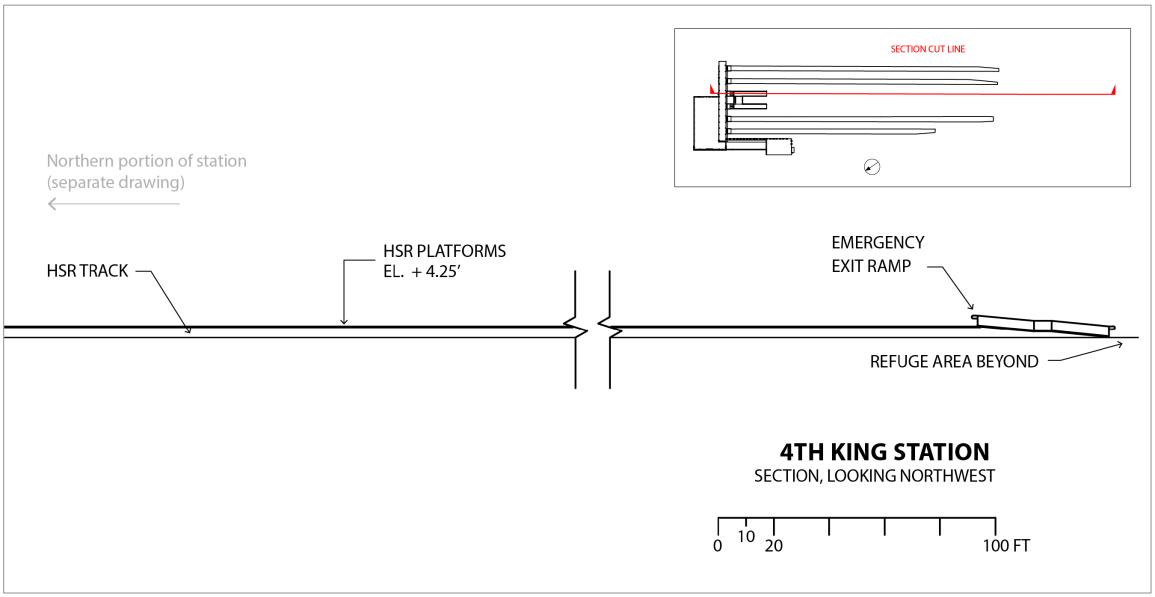
Figure 3-11 4th and King Street Station Site Plan—Alternative A and B



Source: Authority 2018c DRAFT JUNE 2018

Figure 3-12 4th and King Street Station Cross Section (Northern Portion)—Alternative A and B



Source: Authority 2018c DRAFT JUNE 2018

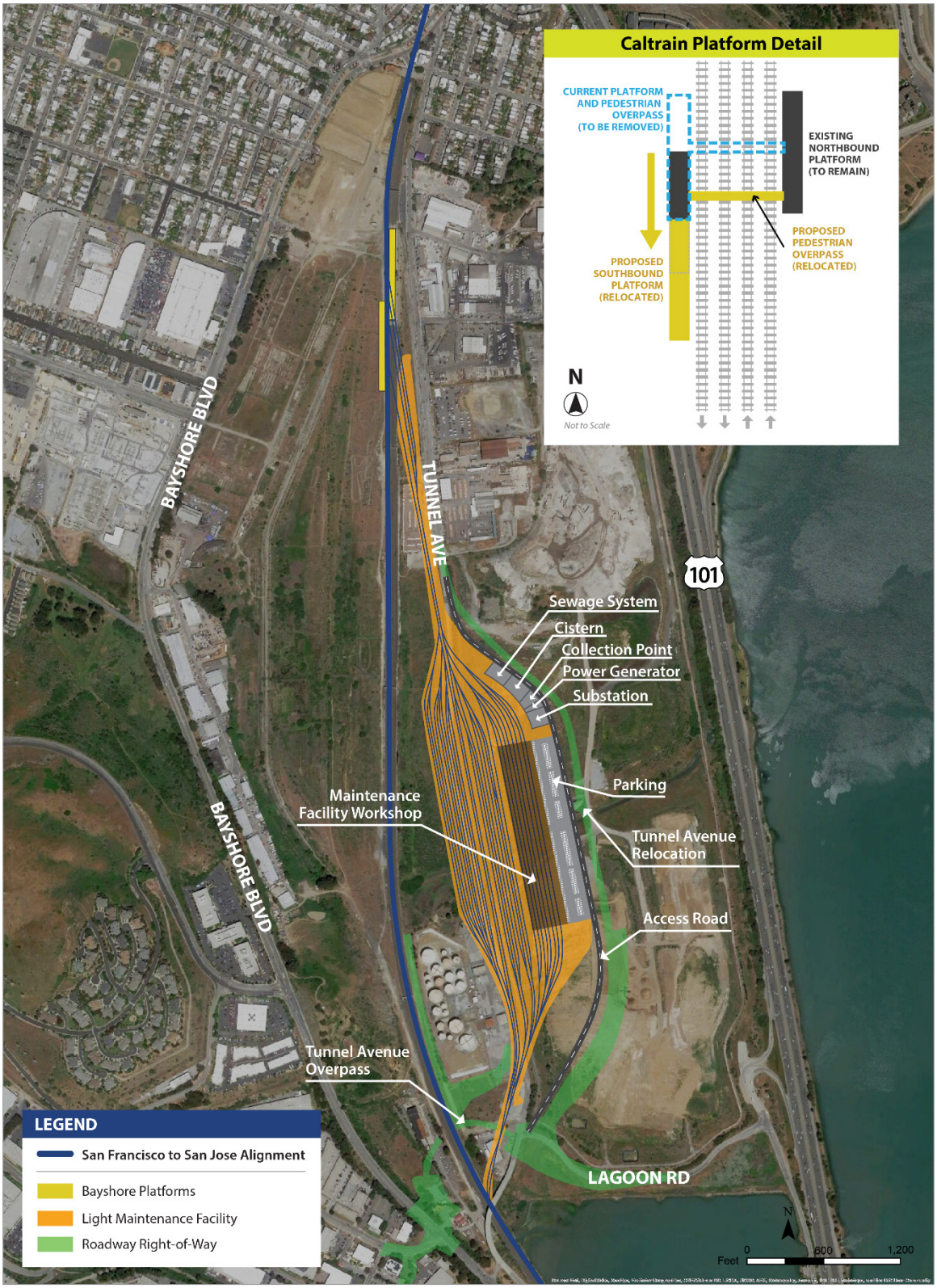
Figure 3-13 4th and King Street Station Cross Section (Southern Portion)—Alternative A and B

East Brisbane Light Maintenance Facility

The East Brisbane LMF would be built south of the San Francisco tunnels on approximately 100 acres east of the Caltrain corridor. Direct HSR mainline track access would be along double-ended yard leads that enable north and south movements. The mainline track would be shifted up to 48 feet, and new yard leads connecting to the East Brisbane LMF would be constructed west of the existing tracks then cross over the realigned four-track mainline on an aerial flyover to avoid blended train operations on the mainline track. Approximately 1,700-foot-long transition tracks would allow trains to reduce or increase speed when entering or exiting the East Brisbane LMF.

The East Brisbane LMF (illustrated on Figure 3-14) would include a maintenance yard with 17 yard tracks adjacent and parallel to a maintenance building containing eight shop tracks with interior access and inspection pits for underside and truck inspections. The maintenance building would provide storage areas for reserve equipment, workshops, and office space. A power generator, sewage system, cistern, collection point, and electrical substation would be located north of the maintenance building with a 400-space surface parking lot for automobiles and trucks located east of the maintenance building. An access road would connect the facility to the realigned Tunnel Avenue.

The track modifications associated with the East Brisbane LMF would require relocating the Caltrain Bayshore Station (described in Track and Station Modifications), relocating the Tunnel Avenue Overpass, widening the bridge crossing Guadalupe Valley Creek in Brisbane, and relocating control point (CP) Geneva. The reconstructed Tunnel Avenue Overpass would connect to Bayshore Boulevard north of its existing connection, at its intersection with Valley Drive, and would provide a roadway extension connecting Valley Drive to Old Country Road. The widened Guadalupe Valley Creek Bridge would support the East Brisbane LMF lead tracks as they cross the creek. Track modification near CP Geneva could require relocating the overhead signal pole.



Source: Authority 2018c

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Figure 3-14 East Brisbane Light Maintenance Facility Layout—Alternative A

Track and Station Modifications

Track and station modifications within the San Francisco to South San Francisco Subsection (shown on Figure 3-10) are predominantly associated with the 4th and King Street Station modifications and the East Brisbane LMF. To accommodate the realignment of the mainline tracks for the East Brisbane LMF, the Caltrain Bayshore Station and associated surface parking lot, southbound platform, and a new pedestrian overpass would be reconstructed approximately 0.2 mile south of the existing station (illustrated in the inset on Figure 3-14). A new pedestrian overpass would access the reconstructed station by connecting to Tunnel Avenue on the east and the planned local roadway network envisioned in the Brisbane Baylands Specific Plan on the west (City of Brisbane 2011). The relocated Caltrain Bayshore Station would be closer to the planned future Geneva Avenue extension, which would extend from Bayshore Boulevard to US 101.

Track modifications not associated with the 4th and King Street Station and East Brisbane LMF would be limited to minor track shifts of less than 1 foot within the existing right-of-way in San Francisco and South San Francisco, and track modifications in South San Francisco to accommodate the planned South San Francisco Caltrain Station Improvement Project being implemented by Caltrain in coordination with the City of South San Francisco. Expected to be constructed by 2019, the improvement project would replace the existing South San Francisco Station platforms (which are subject to the hold-out rule) with a standard center boarding platform connected to a pedestrian underpass, to improve safety and eliminate the hold-out rule. The project would shift tracks up to 27 feet, install crash barriers at the Grand Avenue Overpass, and replace columns that support the US 101 overpass with a pair of solid pier walls.

Safety and Security Modifications to the Right-of-Way

To improve safety, four-quadrant gates would be installed at three at-grade crossings in the subsection—Mission Bay Drive, 16th Street, and Linden Avenue (see Figure 3-10). Table 3-5 specifies the four-quadrant gate application that would be applicable to each at-grade crossing, and Figures 3-5, 3-6, and 3-7 illustrate the configurations for these applications. Perimeter fencing (examples of which are shown on Figure 3-8) would be installed along the right-of-way where it does not already exist.

Train Control and Communication Facilities

Within the San Francisco to South San Francisco Subsection under Alternative A, there would be five communication radio towers, described in more detail under Section 3.2.1.3, Train Control and Communication Facilities. The typical configuration is illustrated on Figure 3-9:

- Standalone radio tower at the 4th and King Street Station in San Francisco
- Co-located radio tower at Caltrain's Paralleling Station 1 in the Potrero Hill neighborhood of San Francisco
- Stand-alone radio tower in the Bayview neighborhood of San Francisco
- Co-located radio tower at Caltrain's Paralleling Station 2 near the Bayshore Station in Brisbane
- Stand-alone radio tower in Brisbane adjacent to Bayshore Boulevard
- Co-located radio tower at TPSS 1 in South San Francisco

These locations are depicted on Figure 3-10. Two site options are evaluated for each stand-alone communications radio tower; however, only one site would be selected for construction.

3.2.2.2 San Bruno to San Mateo Subsection

The San Bruno to San Mateo Subsection extends approximately 8 miles from Linden Avenue in South San Francisco to Ninth Avenue in San Mateo through South San Francisco, San Bruno, Millbrae, Burlingame, and San Mateo. The existing Caltrain track within this subsection is predominantly two-track at grade on retained fill with a three-track at-grade section south of the Millbrae Caltrain Station. As illustrated on Figure 3-15, this alternative would modify the existing San Bruno, Millbrae, and Broadway Stations, modify track, install four-quadrant gates at 16 existing at-grade crossings, and install three communication radio towers. Additional right-of-way would be required in Millbrae, Burlingame, and San Mateo associated with communication radio towers, the Millbrae Station modifications to accommodate HSR service, track modifications, roadway relocations, and four-quadrant gates.

Millbrae Station

New HSR infrastructure within the San Bruno to San Mateo Subsection would be constructed at the existing Millbrae BART/Caltrain Intermodal Station. As illustrated on Figure 3-16, new HSR station facilities, located on the west side of the existing Caltrain corridor, would include a station house area for ticketing and support services and an indoor station room for passengers. The station area design would provide intermodal connectivity with Caltrain and BART via an overhead crossing that would extend the existing station concourse to the new HSR tracks and platforms located on the west side of the station. Circulation linkages between the station house and the station platforms may include an access bridge to cross over railroad tracks, stairs, escalators, and elevators.

The primary access to the Millbrae HSR Station would be by transit (Caltrain, BART, SamTrans), bicycles, walking, and shared vehicles, as opposed to single-occupancy vehicles parked at the station. Consequently, while the station design includes enhanced vehicle access (along with improvements for transit, bicycle, and pedestrian access), a modest increase in vehicle parking supports the transit emphasis at this station. Additional vehicle parking would be provided at several surface parking lots on the west side of the alignment, resulting in a net increase of approximately 34 parking spots.

Enhanced automobile access would be provided on the west side of the station through the extension of California Drive to Victoria Avenue. Curbside passenger pick-up and drop-off facilities west of the station would be located along the new extension of California Drive and El Camino Real and east of the station would be located in the first level of the BART parking structure. SamTrans bus stops would be located along El Camino Real at the new signalized intersection and pedestrian crossings at Chadbourne Avenue, with direct access to the station. A new dedicated cycle track provides west side bicycle access to the station. Figures 3-17 and 3-18 present cross-section views of the Millbrae Station looking south.

Track modifications extending approximately 1 mile north and south of the station would require additional right-of-way along the west side of the Caltrain corridor and modifying existing Caltrain tracks, station platforms, and structures. Constructing two new HSR tracks would require widening the Hillcrest Boulevard Underpass north of the Millbrae Station. At the station, the existing BART tracks and platforms and the easternmost Caltrain track (MT1) and platform would remain unchanged. The westernmost Caltrain track (MT2) would be shifted west by up to 40 feet for construction of two new HSR tracks, an 800-foot-long center HSR platform, and a new Caltrain MT2 outboard platform. The historic Southern Pacific Depot/Millbrae Station (previously relocated to accommodate station improvements) and associated surface parking along California Drive would be relocated to accommodate these track modifications.

Source: Authority 2018c

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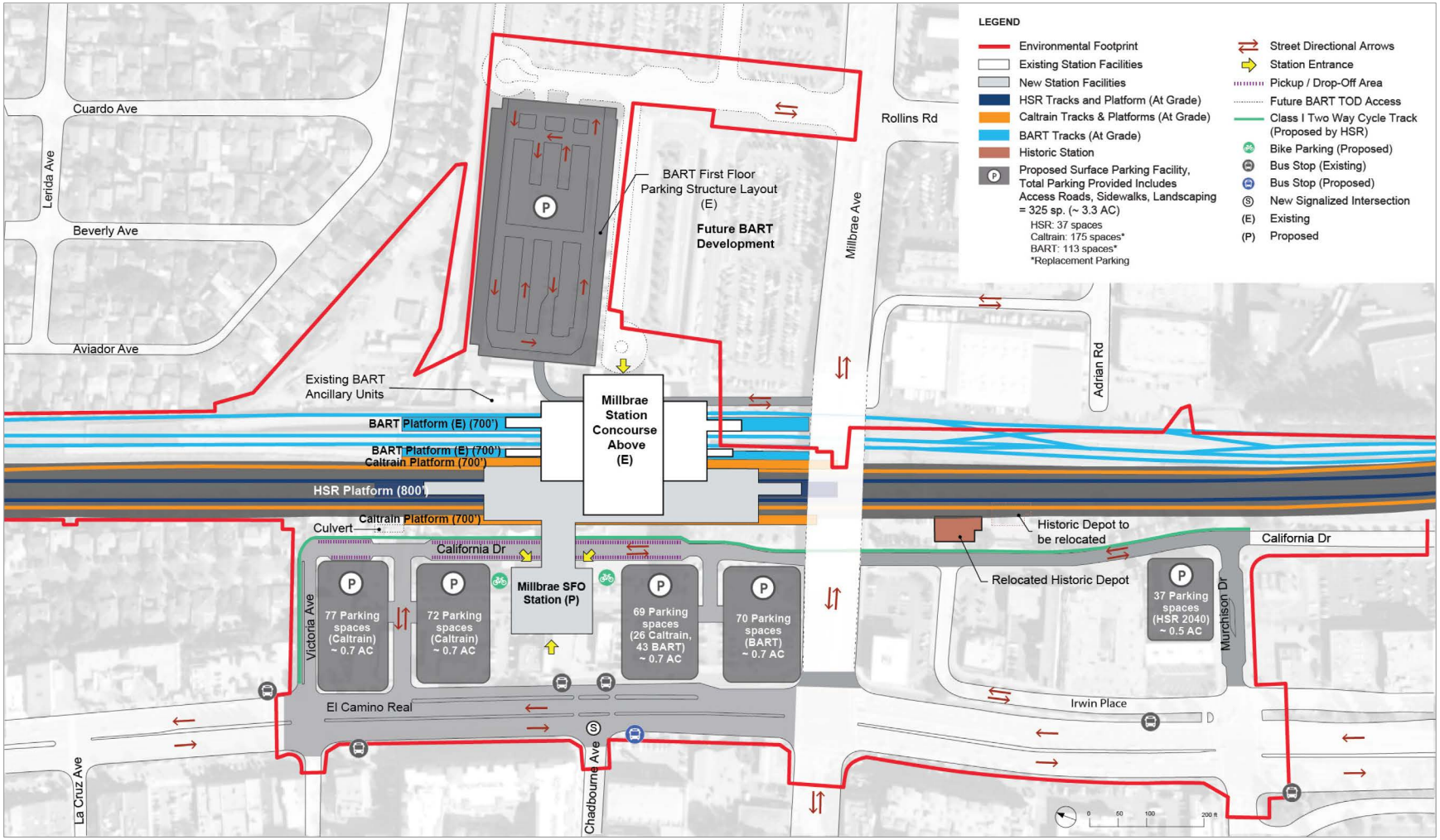
Figure 3-15 San Bruno to San Mateo Subsection—Alternative A and B



Source: Authority 2018c

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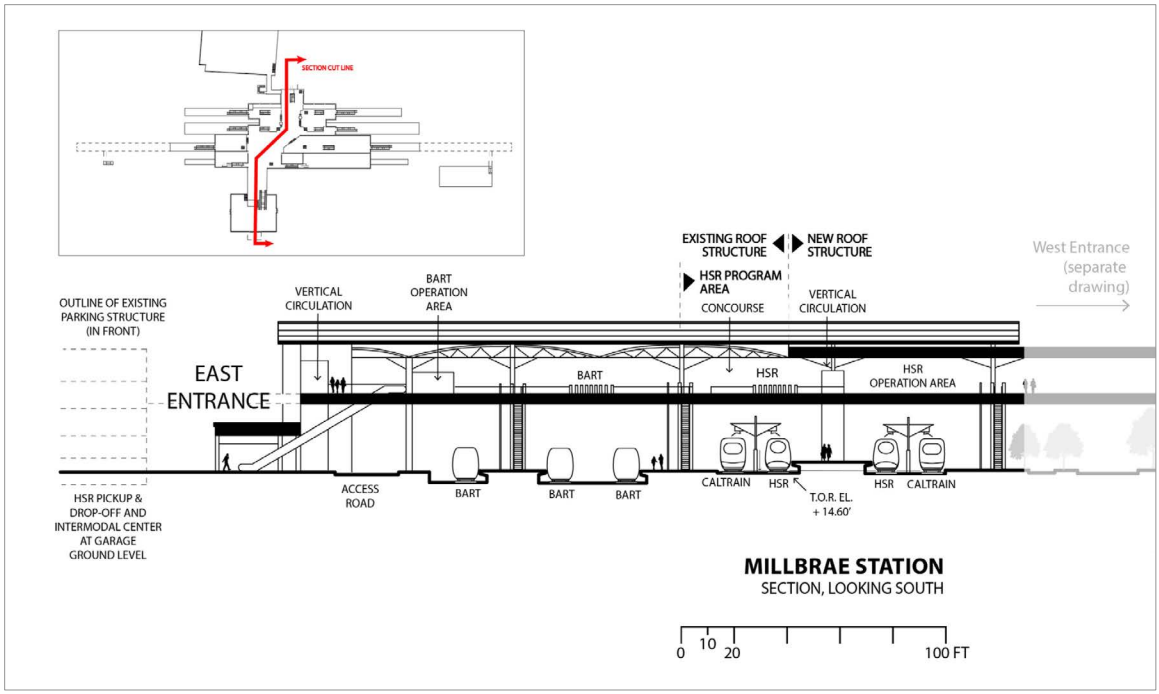
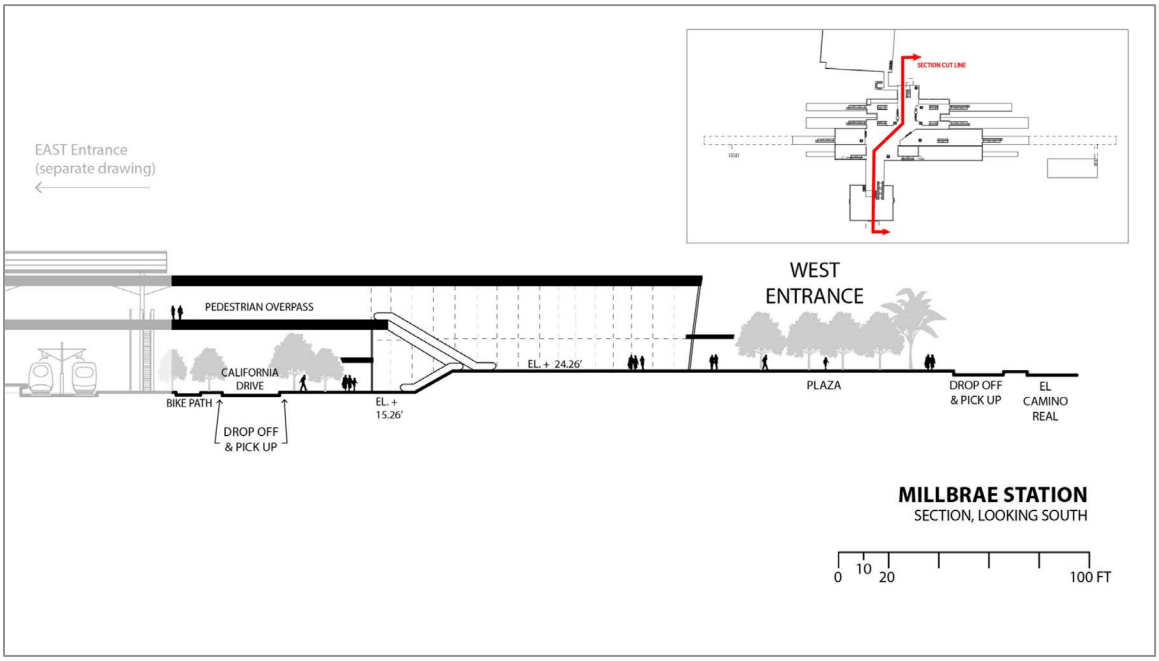
Figure 3-16 Millbrae Station Site Plan—Alternative A and B



Source: *Authority 2018c* DRAFT JUNE 2018

Figure 3-17 Millbrae Station Cross Section (East Entrance)—Alternative A and B



Source: Authority 2018c DRAFT JUNE 2018

Figure 3-18 Millbrae Station Cross Section (West Entrance)—Alternative A and B

Track and Station Modifications

Track and station modifications in this subsection include curve straightening near the San Bruno Station, platform modifications at the Broadway Station to eliminate the hold-out rule, and several other minor track shifts in San Bruno and San Mateo. The curve straightening at the San Bruno Station would require an extension of the existing platforms approximately 145 feet south, and relocation of the existing stairs/ramps from the northern to southern side of the northbound platform. The Euclid Avenue pedestrian underpass, located just north of the San Bruno Station, would be widened to support the realigned tracks, and the concrete retaining wall along the east side would be modified to accommodate the realigned tracks. Safety-related modifications would be made to the Broadway Station, including platform upgrades that would eliminate the hold-out rule by adding a second outboard platform to serve the northbound track and extending the southbound platform (see Figure 3-4). The southbound platform extension would affect the station's surface parking along California Drive, and minor track shifts south of the Broadway Station would require widening of the Sanchez Creek and Mills Creek Culverts.

Safety and Security Modifications to the Right-of-Way

To improve safety four-quadrant gates and channelizers would be installed at 16 at-grade crossings: Scott Street, Center Street, Broadway Street, Oak Grove Avenue, Burlingame Avenue, Howard Avenue, Bayswater Avenue, Peninsula Avenue, Villa Terrace, Bellevue Avenue, First Avenue, Second Avenue, Third Avenue, Fourth Avenue, Fifth Avenue, and Ninth Avenue. As illustrated on Figure 3-15, most of these crossings are located in Burlingame and San Mateo. Table 3-5 specifies the four-quadrant gate application that would be applicable to each at-grade crossing, and Figures 3-5, 3-6, and 3-7 illustrate the configurations for these applications. Perimeter fencing (examples of which are shown on Figure 3-8) would be installed along the right-of-way where it does not already exist.

Train Control and Communication Facilities

There would be three communication radio towers (see Figure 3-9 for an illustration of the typical configuration) located within the San Bruno to San Mateo Subsection. These facilities—including a new stand-alone radio tower near SFO, a co-located radio tower located at Paralleling Station 3 Option 4 in Burlingame, and a new stand-alone radio tower in San Mateo near 1st Avenue—are illustrated on Figure 3-15. Two site options are evaluated for each stand-alone communications radio tower; however, only one site would be selected for construction.

3.2.2.3 San Mateo to Palo Alto Subsection

The San Mateo to Palo Alto Subsection extends approximately 16 miles from Ninth Avenue in San Mateo to San Antonio Road in Palo Alto through the cities of San Mateo, Belmont, San Carlos, Redwood City, Atherton, Menlo Park, and the northern portion of Palo Alto. The existing Caltrain track within this subsection is predominantly two-track at grade on retained fill. As illustrated on Figures 3-19 and 3-20, this alternative would modify platforms at the existing Atherton Station, modify tracks, install four-quadrant gates at 15 existing at-grade crossings, and install 7 communication radio towers. Minor amounts of additional right-of-way would be required in San Mateo, Belmont, San Carlos, Redwood City, Menlo Park, and Palo Alto for the siting of four-quadrant gates and communication radio towers.

Source: Authority 2018c

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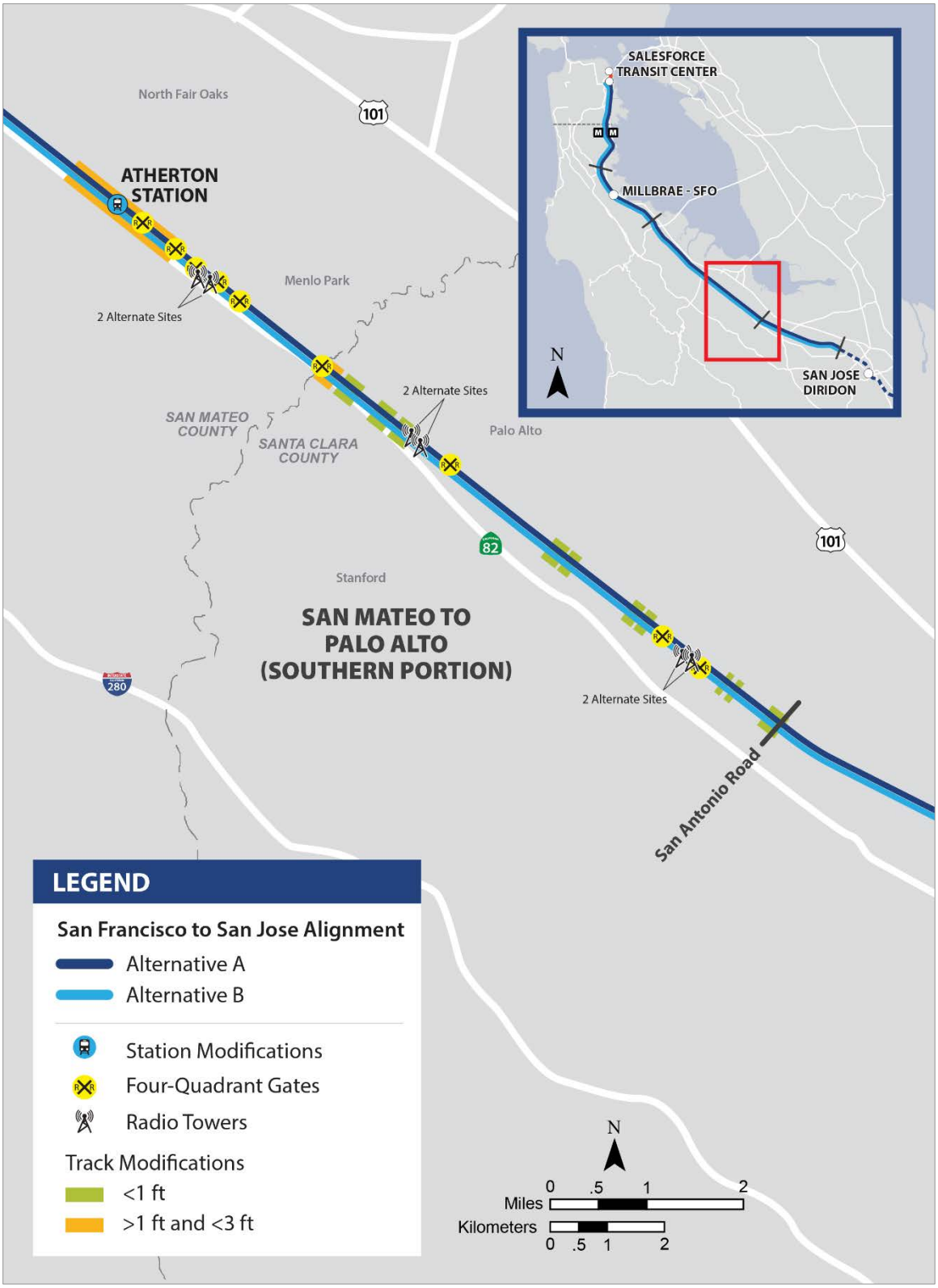
Figure 3-19 San Mateo to Palo Alto Subsection (Northern Portion)—Alternative A



Source: Authority 2018c

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Figure 3-20 San Mateo to Palo Alto Subsection (Southern Portion)—Alternative A and B

Track and Station Modifications

Track and station modifications in this subsection (illustrated on Figures 3-19 and 3-20) consist of curve straightening predominantly located in San Mateo, Belmont, San Carlos, and Palo Alto, and station platform modifications at the existing Atherton Station to remove the hold-out rule. In several locations, these track modifications would result in modifications to existing Caltrain structures; track shifts south of Ralston Street in Belmont and north of Holly Street in San Carlos would require the modifying the existing retaining walls along the west side of the Caltrain corridor to accommodate the shifted track. The HSR project would be compatible with Caltrain and the City of San Mateo's planned 25th Avenue Grade-Separation Project. This grade-separation project, expected to be constructed by 2020, would elevate the existing at-grade track between SR 92 and Hillsdale Boulevard to provide a grade-separated undercrossing of 25th Avenue, construct new east-west crossings under the track corridor at 28th and 31st Avenues, and relocate Hillsdale Station. No design changes to the 25th Avenue Grade-Separation Project are expected to result from the blended system.

Safety-related modifications would be made to the Atherton Station, including platform upgrades that would eliminate the hold-out rule by extending the southbound platform and adding a second outboard platform to serve the northbound track (see Figure 3-4). Track shifts would occur north and south of the station.

Safety and Security Modifications to the Right-of-Way

To improve safety four-quadrant gates and median barriers would be installed at 15 at-grade crossings: Whipple Avenue, Brewster Avenue, Broadway Street, Maple Street, Main Street, Chestnut Street, Watkins Avenue, Encinal Avenue, Glenwood Avenue, Oak Grove Avenue, Ravenswood Avenue, Alma Street, Churchill Avenue, Meadow Drive, and West Charleston Road. As illustrated on Figures 3-19 and 3-20, most of these crossings are located in Redwood City, Menlo Park, and Palo Alto. Table 3-5 specifies the four-quadrant gate application that would be applicable to each at-grade crossing, and Figures 3-5, 3-6, and 3-7 illustrate the configurations for these applications. Perimeter fencing (examples of which are illustrated on Figure 3-8) would be installed along the right-of-way where it does not already exist.

Train Control and Communication Facilities

Within this subsection under Alternative A, there would be seven communication radio towers (see Figure 3-9 for an illustration of the typical configuration):

- Co-located radio tower at Caltrain's Paralleling Station 4 south in San Mateo
- Stand-alone radio tower near the Belmont Station
- Stand-alone radio tower in San Carlos
- Co-located radio tower at Caltrain's Switching Station 1, Option 2 in Redwood City
- Stand-alone radio tower in Menlo Park
- Stand-alone radio tower in Palo Alto north of Embarcadero Road
- Stand-alone radio tower in Palo Alto north of West Charleston Road

These locations are illustrated on Figures 3-19 and 3-20. Two site options are evaluated for each stand-alone communications radio tower; however, only one site would be selected for construction.

3.2.2.4 Mountain View to Santa Clara Subsection

The Mountain View to Santa Clara Subsection extends approximately 9 miles from San Antonio Road in Palo Alto to Scott Boulevard in Santa Clara through the cities of Palo Alto (the southern portion), Mountain View, Sunnyvale, and Santa Clara. The existing Caltrain track within this subsection is predominantly two-track at grade and there are no major project features within this subsection. As illustrated on Figure 3-21, this alternative would make minor track modifications, install four-quadrant gates at four at-grade crossings, and install four communication radio towers. Minor amounts of additional right-of-way would be required in Palo Alto, Mountain View, Sunnyvale, and Santa Clara for communication radio towers.

Track and Station Modifications

Minor track shifts of less than 1 foot would be required in several locations in Mountain View, Sunnyvale, and Santa Clara. The largest track shift within this subsection would be a shift of 2.5 feet that occurs near Bowers Avenue in Santa Clara. None of these track shifts would require modifying existing Caltrain structures or stations.

Safety and Security Modifications to the Right-of-Way

To improve safety, four-quadrant gates and median barriers would be installed at four at-grade crossings in Mountain View and Sunnyvale. These crossings include Rengstorff Avenue, Castro Street, Mary Avenue, and Sunnyvale Avenue (shown on Figure 3-19). Table 3-5 specifies the four-quadrant gate application that would be applicable to each at-grade crossing, and Figures 3-5, 3-6, and 3-7 illustrate the configurations for these applications. Perimeter fencing (examples of which are shown on Figure 3-8) would be installed along the right-of-way where it does not already exist.

Train Control and Communication Facilities

Within this subsection, there would be four communication radio towers (see Figure 3-9 for an illustration of the typical configuration):

- Stand-alone radio tower in Mountain View
- Stand-alone radio tower in Sunnyvale east of SR 237
- Co-located radio tower at Caltrain's Paralleling Station 6 near the Sunnyvale Station
- Stand-alone radio tower in Sunnyvale east of County Road G2

These locations are illustrated on Figure 3-21. Two site options are evaluated for each stand-alone communications radio tower; however, only one site would be selected for construction.

Source: Authority 2018c

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Figure 3-21 Mountain View to Santa Clara Subsection—Alternative A and B

3.2.3 Alternative B

Alternative B (see Figure 3-3) would modify approximately 17.4 miles of existing Caltrain track, predominantly within the existing Caltrain right-of-way, build the West Brisbane LMF and the Short Middle Four-Track Passing Track (described in Section 3.2.1), modify 10 existing stations or platforms to accommodate HSR, and install safety improvements and communication radio towers. Table 3-8 summarizes the alternative's design features, followed by a more detailed description by subsection.

Table 3-8 Summary of Design Features for Alternative B

Feature	Alternative B
Length of existing Caltrain track (miles)[1]	42.9
Length of modified track (miles)[1]	17.4
Length of track modification <1 ft (miles)[1]	4.3
Length of track modification >1 ft and <3 ft (miles)[1]	1.9
Length of track modification > 3 ft (miles)[1]	11.2
Length of OCS pole relocation (miles)[1, 2]	13.1
LMF	West Brisbane
Modified stations	
Modifications to HSR stations	4th and King Street; Millbrae
Modifications to Caltrain stations due to the LMF	Bayshore
Modifications to Caltrain stations due to the passing tracks	Hayward Park; Hillsdale; Belmont; San Carlos
Modifications to Caltrain stations due to track shifts	San Bruno
Modifications to Caltrain stations to remove hold-out rule	Broadway; Atherton
Number of modified or new structures[3]	35
New structures	3
Modified structures	18
Replaced structures	7
Affected retaining walls	7
Number of at-grade crossings with safety modifications (e.g., four-quadrant gates, median barriers)	38
Length of new perimeter fencing	8.7
Communication radio towers	20

Source: Authority 2018c
HSR = high-speed rail
LMF = light maintenance facility
OCS = overhead contact system
[1] Lengths shown are guideway mileages.
[2] OCS pole relocations are assumed for areas with track shifts greater than 1 foot.
[3] Structures include bridges, grade separations such as pedestrian underpasses and overpasses, tunnels, retaining walls, and culverts.

3.2.3.1 San Francisco to South San Francisco Subsection

The Alternative B characteristics in this subsection would be predominantly the same as those described for Alternative A in San Francisco to South San Francisco Subsection. Locating the LMF on the west side of the Caltrain corridor (West Brisbane LMF) would, however, require different track, roadway, and Bayshore Station modifications than described for Alternative A. Locations for the track modifications, safety and security improvements, and communication radio towers within this subsection are depicted on Figure 3-22.

Source: Authority 2018c

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Figure 3-22 San Francisco to South San Francisco Subsection—Alternative B

West Brisbane Light Maintenance Facility

The West Brisbane LMF would be constructed south of the San Francisco Caltrain tunnels on approximately 110 acres west of the Caltrain corridor. Direct mainline track access would be along double-ended yard leads to enable north and south movements. The four existing mainline tracks would be shifted west by up to 16.5 feet, and new yard leads connecting to the West Brisbane LMF would be constructed east and west of the existing tracks. The yard leads east of the existing tracks would cross over the realigned four-track alignment on an aerial flyover to avoid train operations on the mainline track, converging with the yard leads on the west side of the track alignment. Approximately 1,700-foot-long transition tracks would allow trains to reduce or increase speed when entering or exiting the LMF.

As illustrated on Figure 3-23, the West Brisbane LMF would include a maintenance yard with 17 yard tracks parallel to a runaround track and a maintenance building with 8 shop tracks. A power generator, sewage system, cistern, collection point, and an electrical substation would be located north of the maintenance building. A 400-space surface parking lot would be provided west of the maintenance building with truck and vehicle access to Industrial Way, which parallels and connects to Bayshore Boulevard.

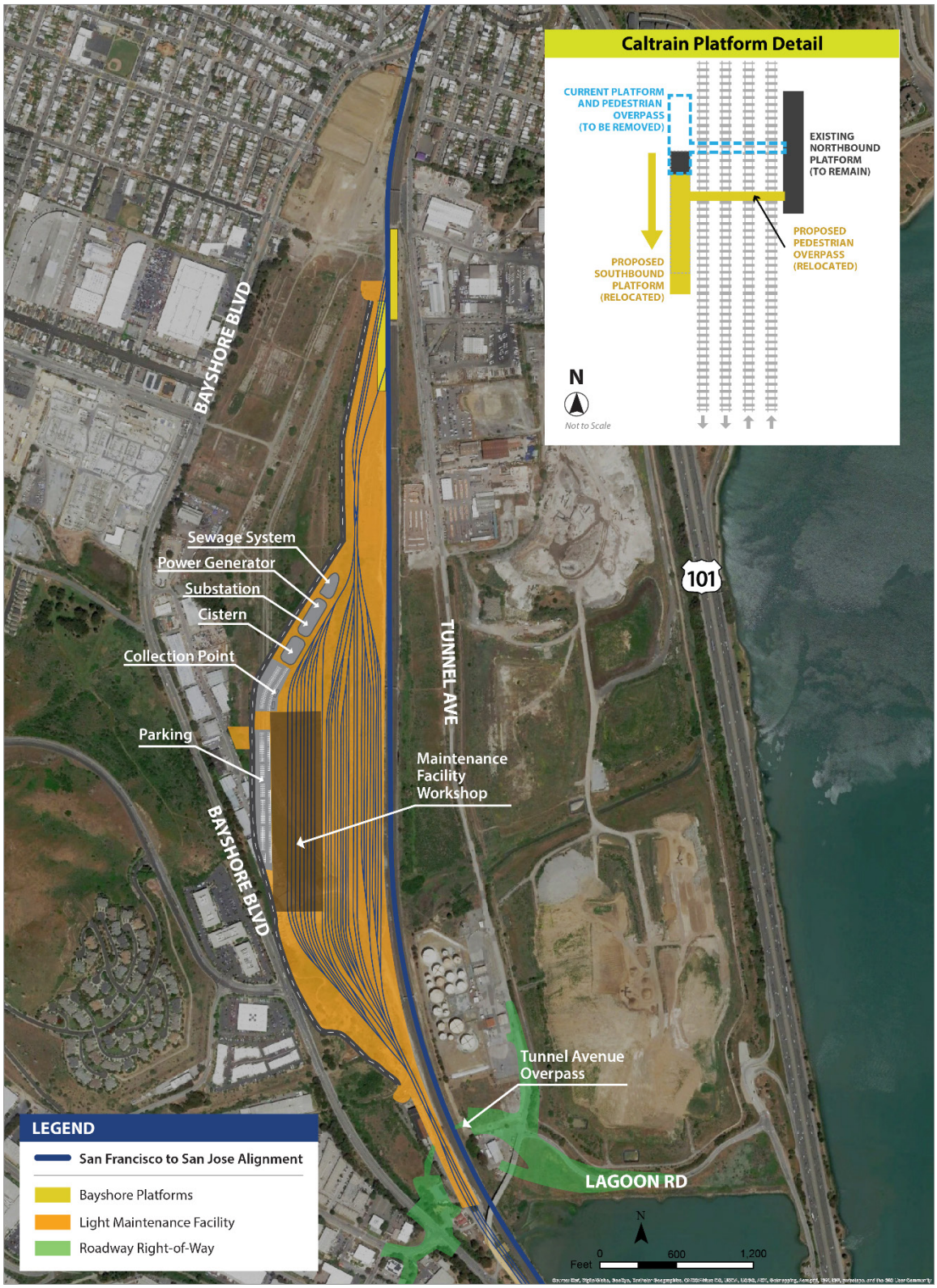
Track modifications associated with the West Brisbane LMF would require relocating the Tunnel Avenue overpass, widening the bridge crossing Guadalupe Valley Creek in Brisbane, and relocating CP Geneva, at its intersection with Valley Drive, and providing a roadway extension connecting Valley Drive to Old Country Road. The widened Guadalupe Valley Creek Bridge would support the West Brisbane LMF lead tracks as they cross the creek. Track modification near CP Geneva could require relocating the overhead signal pole.

Track and Station Modifications

Track and station modifications within the San Francisco to South San Francisco Subsection for Alternative B (illustrated on Figure 3-22) are predominantly associated with the West Brisbane LMF. The realignment of the mainline tracks for the West Brisbane LMF would require relocation of the Caltrain Bayshore Station and removal of the existing Bayshore Station pedestrian overpass. The Caltrain Bayshore Station and associated surface parking lot, southbound platform, and a new pedestrian overpass would be reconstructed approximately 0.2 mile south of the existing station (illustrated in the inset on Figure 3-23). The new pedestrian overpass would provide access to the reconstructed station by connecting to Tunnel Avenue on the east and the planned local roadway network envisioned in the Brisbane Baylands Specific Plan on the west (City of Brisbane 2011). Caltrain Bayshore Station would be closer to the planned future Geneva Avenue extension, which would extend from Bayshore Boulevard to US 101.

3.2.3.2 San Bruno to San Mateo Subsection

The characteristics of the Alternative B San Bruno to San Mateo Subsection would be the same as those described for Alternative A. The track and station modifications, safety and security improvements, Millbrae Station, and communication radio towers within this subsection are depicted on Figure 3-15.



Source: Authority 2018c

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Figure 3-23 West Brisbane Light Maintenance Facility Layout

3.2.3.3 San Mateo to Palo Alto Subsection

Under Alternative B the San Mateo to Palo Alto Subsection would construct passing tracks through San Mateo and San Carlos and modify the Hayward Park, Hillsdale, Belmont and San Carlos Stations to accommodate the additional passing tracks. As illustrated on Figures 3-20 and 3-24, this alternative also would modify existing track, install four-quadrant gates at 15 existing at-grade crossings, and install 7 communication radio towers. The platforms at the existing Atherton Station would be modified to eliminate the hold-out rule. While the northern portion of this subsection (illustrated on Figure 3-24) differs from Alternative A because of the passing tracks and associated track and station modifications, the characteristics of the southern portion of the San Mateo to Palo Alto Subsection would be the same as those described for Alternative A (illustrated on Figure 3-20). The locations for the safety and security improvements and communication radio towers within this subsection are depicted on Figure 3-24 (northern portion) and Figure 3-20 (southern portion). Additional right-of-way would be required in San Mateo, Belmont, San Carlos, Redwood City, Menlo Park, and Palo Alto associated with four-quadrant gates, communication radio towers, passing tracks, and the reconfiguration or relocation of existing Caltrain stations.

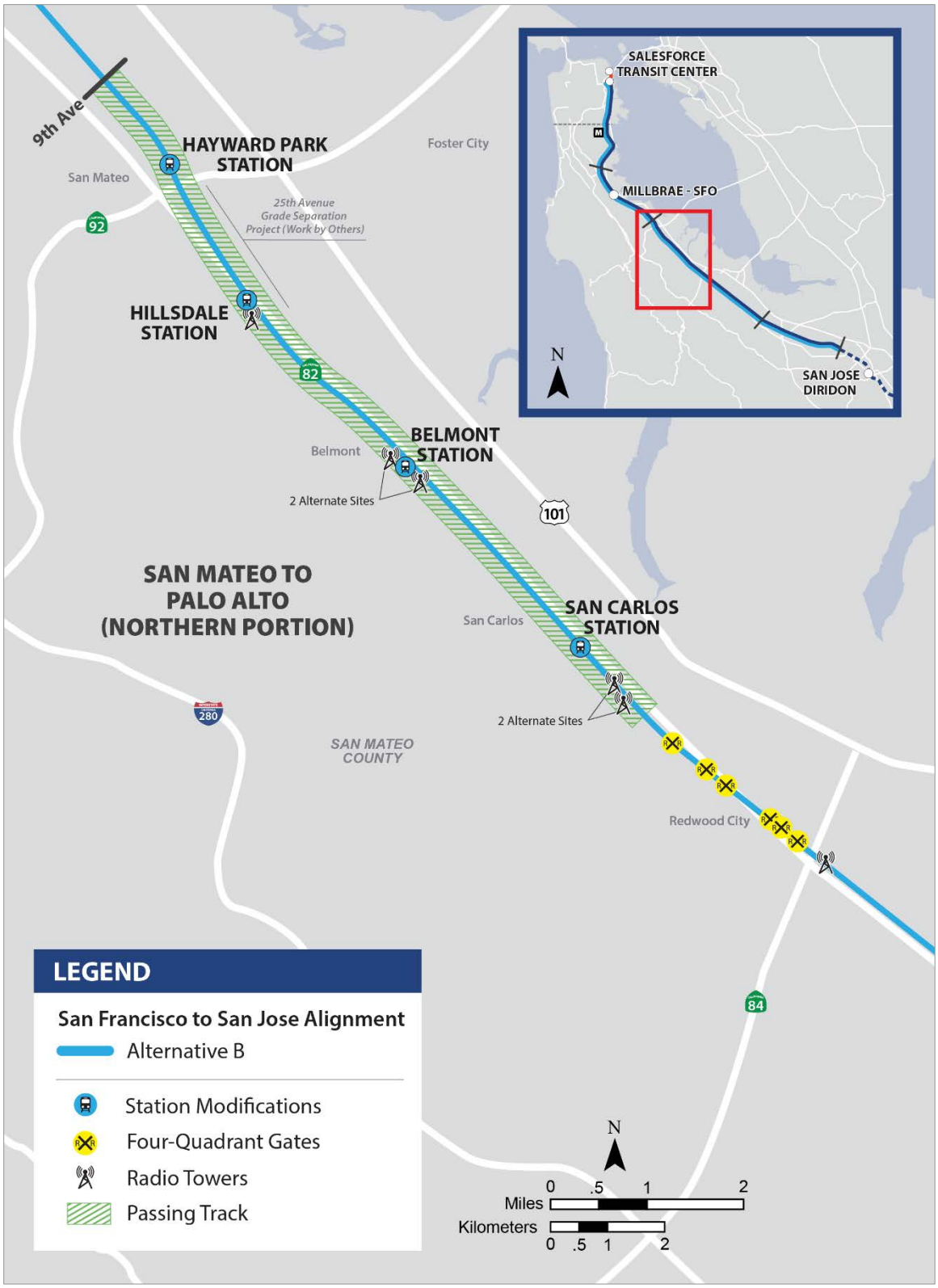
Passing Tracks

The approximately 6-mile-long four-track passing track would extend through San Mateo, San Carlos and into the northern portion of Redwood City (illustrated on Figure 3-24). South of 9th Avenue in San Mateo, the two-track alignment would diverge to four tracks continuing at grade and on retained fill. The existing tracks would be realigned predominantly within the existing right-of-way to accommodate the new four-track configuration. Additional right-of-way would be required in some areas with particularly narrow existing rights-of-way or where curve straightening would be necessary to achieve higher speeds.

25th Avenue Grade-Separation Project

This grade-separation project, which is being undertaken by Caltrain in coordination with the City of San Mateo, would elevate the existing at-grade track between State Route 92 and Hillsdale Boulevard to provide a grade-separated undercrossing of 25th Avenue, construct new east-west crossings under the track corridor at 28th and 31st Avenues, and relocate the Hillsdale Station. Construction is expected to be completed in 2020.

The tracks in Hayward Park north of the SR 92 crossing, which are located on retained fill, would be shifted up to 46 feet, requiring additional right-of-way acquisition. New outboard platforms and a pedestrian underpass at the Caltrain Hayward Park Station, and a new structure south of the SR 92 overpass to carry the reconfigured four-tracks over the Borel Creek Culvert also would be constructed. South of the Hayward Park Station, the passing tracks would use the infrastructure installed by the planned 25th Avenue Grade-Separation Project (described in the inset box). A new retaining wall would be installed between SR 92 and Hillsdale Boulevard to match the elevation of the 25th Avenue Grade-Separation Project, along with new bridge structures for the two new tracks at Borel Creek and 25th, 28th, and 31st Avenues. Additionally, a northbound Hillsdale Station platform would be constructed, eliminating some existing parking at the Hillsdale Station. At Hillsdale Boulevard, the existing underpass structure would be widened to accommodate the realigned tracks, along with widening of the existing Laurel Creek underpass to the south.



Source: Authority 2018c

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Figure 3-24 San Mateo to Palo Alto Subsection (Northern Portion)—Alternative B

South of Hillsdale Boulevard, the passing tracks would ascend to a four-track aerial viaduct. Between Hillsdale Boulevard and Whipple Avenue, the following structures or facilities would be replaced or reconstructed: CP Ralston tie-in points, Belmont Station platforms, and San Carlos Station and platforms. The Belmont Station and platforms would be reconstructed to accommodate the new four-track configuration. The San Carlos Station platforms would be relocated approximately 2,260 feet south of their currently location to Arroyo Avenue and a pedestrian underpass would be constructed. The following structures would be removed and replaced or modified: 42nd Avenue underpass, Caltrain Belmont Station pedestrian underpass, Ralston Avenue underpass, Harbor Boulevard underpass, F Street pedestrian underpass, Holly Street and San Carlos Station pedestrian underpass, Arroyo Avenue pedestrian underpass, Brittan Avenue, and Howard Avenue. South of Howard Avenue, Alternative B would descend to grade and converge back to a two-track configuration.

Track and Station Modifications

The track and station modification characteristics of the Alternative B San Mateo to Palo Alto Subsection would vary from those described for Alternative A in the northern portion of the subsection between Ninth Avenue in San Mateo and Whipple Avenue in Redwood City. In this portion of the subsection, the passing track would result in modifications to the existing Hayward Park, Hillsdale, Belmont, and San Carlos Stations that include modifying and realigning station platforms at Hayward Park, constructing new platforms at the Hillsdale and Belmont Stations, and relocating the San Carlos Station platforms approximately 2,260 feet south of its existing location. Figure 3-25 illustrates the proposed relocation of the San Carlos Station platforms.

South of Whipple Avenue, the track and station modifications in the southern portion of this subsection would be the same as described for Alternative A. Safety-related modifications would be made to the Atherton Station, including platform upgrades that would eliminate the hold-out rule by extending the southbound platform and adding a second outboard platform to serve the northbound track (see Figure 3-4). Station parking on the west side of the corridor would be affected by the platform reconstruction and track shifts would occur north and south of the station.

3.2.3.4 Mountain View to Santa Clara Subsection

The characteristics of the Alternative B Mountain View to Santa Clara Subsection would be the same as those described for Alternative A. The locations for track modifications, safety and security improvements, and communication radio towers within this subsection are depicted on Figure 3-21.

Source: Authority 2018c

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Figure 3-25 San Carlos Station Relocation—Alternative B

4 AQUATIC RESOURCES

This chapter compares the effect of each project alternative on aquatic resources. *Aquatic resources* is defined as all water features that may be subject to the jurisdiction of the USACE as waters of the U.S. and subject to the jurisdiction of the State Water Resources Control Board as waters of the state.

The study area contains freshwater emergent wetland, saline emergent wetlands, scrub-shrub wetlands, constructed watercourses (including culverts), constructed basins, natural watercourses, drainage ditches, and open water. Of these aquatic resources, freshwater emergent wetlands, saline emergent wetlands, seasonal wetlands, and scrub-shrub wetlands are considered wetlands, whereas constructed watercourses, constructed basins, natural watercourses, ponds, open water, and drainage ditches are considered nonwetland waters. All aquatic resources identified have the potential to be regulated under federal or state law, but not all of these aquatic resources would be directly affected by the project.

4.1 Scope of Analysis

4.1.1 Study Area

For the purposes of this analysis, the study area for aquatic resources is the combined footprint for both alternatives. The project footprint is the area needed to accommodate construction, operations, and maintenance of all permanent HSR features, roadway modifications, new or relocated utility features, access to new or relocated utility features, drainage facilities, any other physical changes within the area needed to construct and operate HSR, and HSR property rights or licenses to accommodate HSR construction, operation, and maintenance. The project footprint represents the area within which ground disturbance is anticipated to occur for each alternative. The footprints of the two alternatives are identical throughout much of the Project Section; the primary difference is the location of the LMF—East Brisbane LMF (Alternative A) or West Brisbane LMF (Alternative B). Alternative B involves building 6 miles of additional passing track between San Mateo and Redwood City.

4.1.2 Methods

The Preliminary Delineation of Wetlands and Other Waters of the United States for the PCEP (PCJPB 2015a) provided data on waters inside the Caltrain right-of-way (approximately 2 percent of the study area). Aquatic resources mapping outside of the Caltrain right-of-way, the majority of which occurs at the LMF sites in Brisbane, was completed using HSR's Preliminary Jurisdictional Waters and Wetlands Delineation Report for San Francisco to San Jose (PBS&J 2011) (approximately 57 percent of the study area), the wetland dataset developed for the San Jose to Merced Project Section of the California HSR System[18] (collected in 2011) (less than 1 percent of the study area), and the NAIP dataset (USDA 2014) (approximately 40 percent of the study area). Aerial photo interpretation was also conducted to verify the accuracy of the data throughout the study area and update any resources that had been altered since the time of the prior field surveys. With the exception of three constructed watercourses totaling approximately 0.06 acre, delineation of aquatic resources in the study area have not been previously verified by the USACE.

This document identifies aquatic resources within the project footprint and assumes, for the purpose of the Checkpoint B analysis, that all of those features would be permanently affected. The impact acreage calculation likely represents an overestimation of the actual permanent loss of waters, because the preliminary design (currently at a 15 percent level of design) does not include the exact locations of project features such as piers and abutments, nor does it distinguish between temporary and permanent impacts. For instance, impacts on waters within the project footprint may be avoided through the use of clear-span bridges and other engineering approaches. Consequently, the total impacts on waters of the U.S. and/or state associated with

[18] This wetland dataset, developed by ICF International in 2011 for the adjacent San Jose to Merced Project Section, extends into the southernmost portion of the study area for the San Francisco to San Jose Project Section.

each alternative analyzed in this report would likely be less than indicated in the report. The methodology set out in the report is intended to allow for a comparison of impacts on aquatic resources between alternatives.

The analysis in this report is limited to a comparison between the alternatives of the quantity of impacts on aquatic resources. The analysis does not include a comparison of the qualitative differences between the resources that would be affected by each of the alternatives. Prior evaluations (such as the EIR, wetland delineation, and biological assessment prepared for the Caltrain PCEP) and desktop analysis, however, demonstrate that, generally, wetlands and natural watercourses in the study area maintain higher functions and services than constructed watercourses, given that they are often constructed in areas that would otherwise have been uplands (i.e., lack sufficient hydrology and connectivity), can consist of impervious surfaces, and often support sparser vegetation, nonnative vegetation, or both.

The evaluation of the project alternatives' impacts on aquatic resources presented in this chapter is based on a 15 percent level of engineering design. The designs for the East and West Brisbane LMF sites have been refined since the 2010 Supplemental Alternatives Analysis, which evaluated four potential LMF sites and recommended the advancement of the East and West Brisbane LMF sites. As a result, the analysis based on the current 15 percent level of design results in different levels of impacts on aquatic resources for East and West Brisbane LMF than the levels of impacts using the 2010 project footprints for the these LMF sites.[19]

4.2 Aquatic Resources in the Study Area

4.2.1 Watershed Conditions

The study area is located in the San Francisco Bay Hydrologic Region. The northern portion of the study area is in the San Francisco Bay watershed (Hydrologic Unit Code [HUC] 18050004) and the southern portion is in the Coyote watershed (HUC 18050003). The watershed divide between the San Francisco Bay watershed and the Coyote watershed is in the Palo Alto area. Watercourses in the study area flow to San Francisco Bay. Watersheds in the study area are summarized in Table 4-1 and depicted on Figure 4-1.

Table 4-1 Watersheds in the Study Area

Watershed (HUC)	Large Watercourses in the Study Area	Watershed Area in the Study Area (acres)
San Francisco Bay (18050004)	Colma Creek, San Mateo Creek, Cordilleras Creek	660
Coyote (18050003)	San Francisquito Creek, Matadero Creek, Permanente Creek, Stevens Creek, Calabazas Creek	170

Source: USGS 2016a
HUC = Hydrologic Unit Code

The extensive development within the Bay Area has altered natural hydrology and drainage patterns. Historically, small watercourses near the study area flowed primarily from west to east to the San Francisco Bay. However, as the region urbanized, most of the watercourses in the study area were channelized and covered over and now function as underground drains. As a result, there are few remaining freshwater bodies or streams within the study area that retain remnant natural conditions (see Section 4.2.1.2, Nonwetland Waters, Subsection Natural Watercourse) (San Francisco Planning Department 2008; Hermstad et al. 2009; Beller et al. 2012). Additionally, development has obscured and modified the historic drainage basin boundaries.

[19] Refer to Section 3.1.4.4, Light Maintenance Facility Options, for a discussion of the rationale for withdrawal of the Port of San Francisco and SFO sites for a potential LMF.

Most watercourses in the study area are perennial, flowing year-round except in times of drought. Outside the study area, mid-to-upper reaches of tributary streams are intermittent or perennial, depending on the characteristics of local aquifers. However, historically (i.e., before urbanization), most watercourses in the study area were dry during the summer (Beller et al. 2012). As patterns of water use and water importation have evolved, many watercourses have experienced increased summer flow (Santa Clara Basin Watershed Management Initiative 2000). Today, some watercourses are perennial in their lower reaches due to urban runoff or high groundwater, while others flow due to artesian wells, springs, and water releases. Reservoir operators and water managers release some flows in the summer to promote groundwater recharge, contributing to the perennial nature of streams in the study area.

Surface runoff in the vicinity discharges into a network of underground and surface drainage pathways (including the combined sewer system in San Francisco). Generally, these pathways converge into larger underground storm drains, drainage culverts, streams, and creeks, which become progressively larger as the runoff moves downstream, eventually reaching a common discharge location, often near the San Francisco Bay.

Sources: Authority 2018c; ESRI/National Geographic 2018; USGS 2016b DRAFT SEPTEMBER 2018

Figure 4-1 Watersheds in the Study Area

4.2.1.1 Wetlands

Wetlands in the study area occur throughout the corridor, though a vast majority of the total acreage occurs in the northern portion of the corridor, particularly at the proposed LMF sites in Brisbane (see Section 4.3, Impacts of Project Alternatives on Aquatic Resources). In the Brisbane Baylands, the area associated with the East Brisbane LMF under Alternative A is more developed with industrial uses, including a soil processing center, recycling center, lumber yard, and former landfill, development of which has previously removed habitat in the study area. The area associated with the West Brisbane LMF under Alternative B is less developed.

Freshwater Emergent Wetland

A total of 34 freshwater emergent wetland features covering approximately 13.7 acres occur in the study area. Over 90 percent of the freshwater emergent wetlands in the study area occur at the two LMF sites (combined) in Brisbane. The remaining features are relatively small and occur throughout the northern portion of the corridor between Brisbane and Belmont.

Some of the freshwater emergent wetlands consist of traditional, depressional wetlands because they occur either in closed depressional topography or shallow gradient swales that do not show any ordinary high water mark (OHWM) indicators. Broad-leaved cattail (*Typha latifolia*) is typically the dominant plant, but other hydrophytic plants such as salt grass (*Distichlis spicata*) and tall flat sedge (*Cyperus eragrostis*) also are present. Other freshwater emergent wetlands occur in segments of streams or ditches that exhibit OHWM characteristics such as shelving, bed and banks, presence of litter and debris, and scour. Broad-leaved cattail is the dominant species in these wetlands.

Saline Emergent Wetland

The study area contains a total of five saline emergent wetlands encompassing approximately 1.3 acres. These saline emergent wetlands occur within a 1.7-mile stretch of the northern portion of the alignment along Guadalupe Valley Creek (near where it flows into Brisbane Lagoon), along the northeastern margin of Brisbane Lagoon, and along the edge of the Caltrain right-of-way near Oyster Point. More extensive saline emergent wetlands occur at the northern and southern ends of Brisbane Lagoon, just east of the study area. The dominant plant in the saline emergent wetlands at the time of the delineation (PCJPB 2015a) was Pacific pickleweed (*Sarcocornia pacifica*) and associated species include strict gumplant (*Grindelia stricta*), alkali sea heath (*Frankenia salina*), and alkali Russian thistle (*Salsola soda*).

Scrub-Shrub Wetland

Five small scrub-shrub wetlands encompassing 0.74 acre were identified in the study area at the LMF sites in Brisbane. The dominant species in this wetland was arroyo willow (*Salix lasiolepis*) at the time of the delineation (PCJPB 2015a).

4.2.1.2 Nonwetland Waters

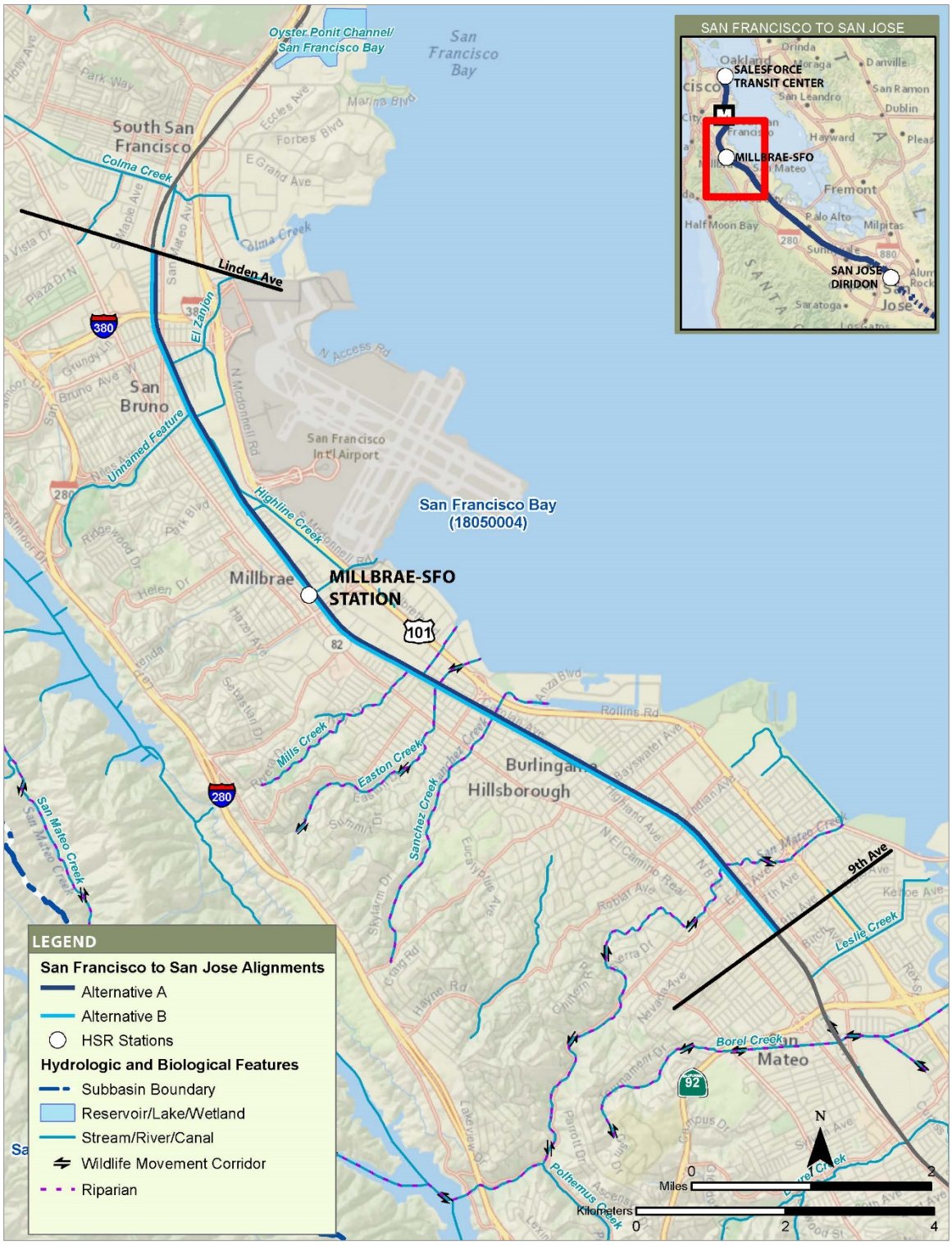
Constructed Watercourse and Constructed Basin

Constructed watercourses are distributed relatively evenly throughout the corridor.[20] Constructed watercourses consist of excavated channels, channelized or engineered watercourses with concrete or sackcrete-lined channels that lack natural beds and banks on one or both sides, and channelized watercourses that have earthen beds and banks on one or both sides. Only 4 of the 22 constructed watercourses (Visitacion Creek, Easton Creek, Sanchez Creek, and Permanente Creek), contain earthen beds or banks that allow for vegetation. All but three of the constructed watercourses are named creeks. These watercourses are depicted on Figure 4-2 through Figure 4-5.

[20] Culverted portions of natural and constructed watercourses that connect these features under the tracks were included in the total acreage of constructed watercourses. Culverts connecting watercourses total approximately 1.6 acres.

Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; ESRI/National Geographic 2018; USGS 2016b, 2016c DRAFT DECEMBER 2018

Figure 4-2 Hydrological Features—Part 1 of 4



Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; ESRI/National Geographic 2018; USGS 2016b, 2016c DRAFT SEPTEMBER 2018

Figure 4-3 Hydrological Features—Part 2 of 4

Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; ESRI/National Geographic 2018; USGS 2016b, 2016c DRAFT SEPTEMBER 2018

Figure 4-4 Hydrological Features—Part 3 of 4

Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; ESRI/National Geographic 2018; USGS 2016b, 2016c DRAFT SEPTEMBER 2018

Figure 4-5 Hydrological Features—Part 4 of 4

The study area contains four constructed basins totaling approximately 0.44 acre. All of the constructed basins that overlap the footprint are associated with Alternative A and the East Brisbane LMF site. There are no constructed basins in the study area for Alternative B.

Natural Watercourse

Natural watercourses are distributed relatively evenly throughout the corridor and are comprised of named creeks—Guadalupe Valley Creek, Mills Creek, San Mateo Creek, Borel Creek, Belmont Creek, Cordilleras Creek, San Francisquito Creek, and Stevens Creek. All eight natural watercourses support riparian vegetation (discussed in Section 5.2.1, Riparian Habitat) and seven of the eight natural watercourses serve as wildlife movement corridors (discussed in Section 5.2.2, Wildlife Movement Corridors). These watercourses are depicted on Figure 4-2 through Figure 4-5.

Open Water

A total of 0.94 acre of open water is contained within the study area. Open water (i.e., the San Francisco Bay) habitat is unvegetated tidal areas located above mean high water elevation. Brisbane Lagoon, which is an estuary that receives tidal action from the bay, parallels the study area south of the LMF site, and it is the largest area of open water in the study area. China Basin and the Islais Creek channel in San Francisco are the only other locations where the San Francisco Bay is in the study area.

4.3 Impacts of Project Alternatives on Aquatic Resources

The USACE definition of waters of the U.S. defines the amount of aquatic resources in the study area. Alternative A would affect a total of 9.86 acres of aquatic resources, while Alternative B would affect approximately 16.36 acres (Table 4-2). For the purposes of this analysis, all aquatic resources within the footprint are assumed to be affected. As such, these numbers likely represent an overestimation of the total impacts on these resources; however, the estimates demonstrate a relatively greater impact on waters of the U.S. for Alternative B.

Tidal Jurisdiction

U.S. Army Corps of Engineers

Mean high tide line under Section 404 of the Clean Water Act.

High tide line under Section 10 of the River and Harbors Act.

San Francisco Bay Conservation and Development Commission

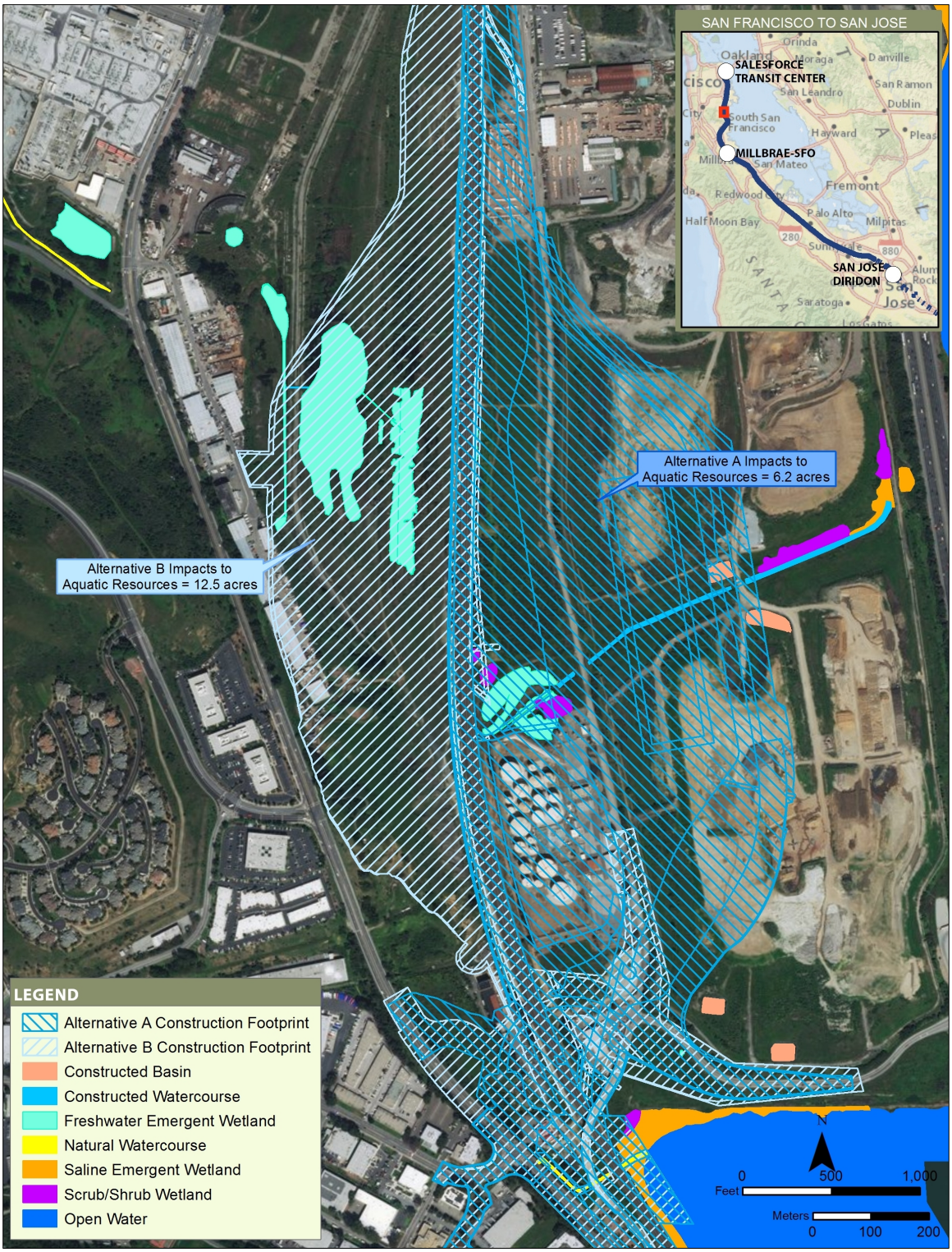
Mean high tide line in areas without tidal vegetation and 5 feet above the mean high tide line in areas with tidal vegetation.

The West Brisbane LMF under Alternative B would affect approximately 12.46 acres of aquatic resources; while the East Brisbane LMF under Alternative A would affect 6.16 acres of aquatic resources (Figure 4-6). Table 4-2 quantifies and describes the relative number of aquatic resources within the footprint for each alternative and indicates differences in impacts between the alternatives. The impact estimate under this section and Section 6.1.2.5, San Francisco Bay and Shoreline Band (BCDC Jurisdictional Areas), diverge because USACE and BCDC have different jurisdictional limits. The USACE regulates impacts on freshwater and tidal waters and wetlands in the study area under Section 404 of the CWA, and regulates tidal waters up to the high tide line under Section 10 of the Rivers and Harbors Act. BCDC regulates the San Francisco Bay, tidal channels, managed wetlands, and salt ponds and a 100-foot Shoreline Band around the Bay and tidal waters. BCDC jurisdiction over tidal waters extends up to the mean high tide line where tidal vegetation is not present and up to 5 feet above the mean high tide line where tidal vegetation is present. Both Visitacion Creek and Brisbane Lagoon contain tidal vegetation.

Table 4-2 Impacts on Aquatic Resources

Aquatic Resource Type	Alternative A Impacts (acres)	Alternative B Impacts (acres)	Notes on Differences in Impacts
Wetlands			
Freshwater emergent wetland	3.75	11.56	The LMF footprint under Alternative B contains a total of 10.14 acres of freshwater emergent wetland, whereas the Alternative A footprint only has 2.35 acres of freshwater emergent wetland. Differences in quantities of freshwater emergent wetlands at other locations are negligible (0.05 acre) in light of the differences in impacts at the LMF sites.
Saline emergent wetland	1.28	1.28	No difference.
Scrub-shrub wetland	0.74	0.19	The West Brisbane LMF footprint under Alternative B overlaps three scrub-shrub wetlands, whereas the East Brisbane LMF under Alternative A contains five small scrub-shrub wetlands.
Nonwetland Waters			
Constructed watercourse	2.27	1.91	The Alternative A footprint contains 2.27 acres of constructed watercourses while Alternative B contains 1.91 acres of constructed watercourses. Alternative A contains 0.52 acre of Visitacion Creek while Alternative B does not contain Visitacion Creek. Other constructed watercourses (named) that overlap both alternative footprints significantly (over 0.1 acre) include Burlingame Creek, Easton Creek, Matadero Creek, and San Tomas Aquinas Creek.
Constructed basin	0.44	0	The Alternative A footprint contains four constructed basins in the East Brisbane LMF footprint, whereas the West Brisbane LMF footprint under Alternative B does not contain any constructed basins.
Natural watercourse	0.44	0.48	Due to very small alignment differences, Alternative B contains a greater acreage of three natural watercourses (Belmont Creek, Borel Creek, and Cordilleras Creek).
Open water	0.94	0.94	No difference.
Total aquatic resources	9.86	16.36	

Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015a
LMF = light maintenance facility



Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015a

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Figure 4-6 Impacts on Aquatic Resources Associated with Light Maintenance Facility Alternatives

5 BIOLOGICAL RESOURCES

This chapter describes estimated impacts on biological resources, including riparian habitats, wildlife movement corridorsand special-status species habitat . There are no biological reserves or preserves in the study area.

5.1 Scope of Analysis

5.1.1 Study Area

For the purposes of this analysis, the study area for biological resources is the combined footprint for both alternatives. The footprints of the two alternatives are identical throughout much of the Project Section. The primary differences between the alternatives is the location of the LMF site and the 6 miles of passing track between San Mateo and Redwood City under Alternative B.

5.1.2 Methods

This section describes the methods used to determine the types and general locations of biological resources within the study area, including riparian habitat, wildlife movement corridors, and special-status species habitat. This report does not identify the exact locations where temporary or permanent impacts to habitat special-status species would occur; instead, this report includes t the total acreage of potential impacts on the different habitat types that occur within each footprint as a measure of the relative impact on biological resources associated with each alternative. As a result, the estimates of potential impacts on biological resources set out in this report are greater than the impacts that would likely occur as a result of project implementation.

5.1.2.1 Riparian Habitat

This report identifies riparian habitat in the study area by utilizing information gathered during the regulatory permitting effort for the PCEP. This report includes all areas CDFW and the San Francisco Bay RWQCB considered as riparian habitat for the PCEP (San Francisco Bay RWQCB 2016; CDFW 2016). Biologists mapped riparian habitat by using aerial imagery at proposed PCEP activity locations (i.e., overhead contact system pole foundations) in Google Earth. Riparian habitat above the OHWM of aquatic features has been identified and quantified. Areas below the OHWM are mapped and reported as waters of the U.S.

5.1.2.2 Wildlife Movement Corridors

The term *corridor* is used by ecologists and conservation biologists in a variety of ways. For the purposes of this document, a *wildlife corridor* is defined as “any space, usually linear in shape, that improves the ability of organisms to move among their habitat” (Hilty et al. 2006). Wildlife corridors analyzed in this report are generally small in scale and facilitate regional wildlife movement among habitat patches and through human-dominated landscapes. Preliminary information on known wildlife movement corridors in the Project Section was obtained by reviewing California Essential Habitat Connectivity project data (Spencer et al. 2010) in the CDFW’s Biogeographic and Information System Habitat Connectivity Viewer[21] and the PCEP (PCJPB 2015d). This information was reviewed and the results are summarized in Section 5.2.2.

Wildlife movement corridors in the study area may also include watercourses that cross under the tracks. This report only identifies natural watercourses as wildlife movement corridors (as described in Section 4.2.1.2). If a watercourse only surfaced on one side of the alignment (i.e., watercourse is underground on the opposite side), it was not considered to serve as a wildlife movement corridor. Areas other than watercourses were generally excluded as movement corridors due to the intensity of surrounding development, the presence of right-of-way fencing, and the existing operations in the corridor that preclude wildlife movement.

[21] Viewed online at www.dfg.ca.gov/biogeodata/bios/

5.1.2.3 Special-Status Species Habitat

Special-status species are defined as species that meet one or more of the following criteria: (1) species listed as threatened or endangered or proposed for listing under FESA; (2) species listed or designated as a candidate for listing by the State of California as threatened or endangered under the California Endangered Species Act; (3) plants considered by CDFW to be "rare, threatened, or endangered in California" (California Rare Plant Rank 1B and 2); (4) animal species of special concern to CDFW; (5) animals fully protected in California.

Habitat for special-status species was identified in two ways. Biologists identified potential habitat for federally listed species by reviewing habitat maps prepared for the PCEP Biological Assessment (PCJPB 2015b) and the informal consultation letter to the NMFS (PCJPB 2015c). All other special-status species habitat was identified through desktop land cover mapping based on aerial imagery, some of which was prepared in support of PCEP (e.g., western pond turtle [*Emys marmorata*]). No reconnaissance-level field visits to verify the presence or absence of these resources have been conducted. Because field visits have not been conducted and because design is preliminary the study area is assumed to provide habitat for each non-federally listed special-status species, which represents a conservative (i.e., high) estimate.

5.2 Biological Resources in the Study Area

5.2.1 Riparian Habitat

A total of 1.93 acres of riparian habitat occurs in the study area. Riparian communities occur relatively evenly throughout the study area and are found in discrete areas along the banks of all eight of the natural watercourses as well as at three constructed watercourses. Riparian corridors in the study area are generally constricted by surrounding development. Riparian vegetation also occurs along one freshwater emergent wetland functioning as a small drainage tributary to Sanchez Creek. Riparian habitats in the study area typically contain an overstory dominated by woody arborescent vegetation. Willows (*Salix* spp.) often dominate these communities, forming scrubby streamside thickets, ranging from open to extremely dense. Other species present include Fremont's cottonwood (*Populus fremontii*), redwood (*Sequoia sempervirens*), coast live oak (*Quercus agrifolia*), and various upland grasses and forbs.

Riparian habitats provide food, water, dispersal, wildlife movement corridors, escape, nesting, and thermal cover for a variety of wildlife taxa. Numerous species of amphibians and reptiles occur in lowland riparian systems. Many are permanent residents; others are transient or temporal visitors. Riparian habitat also provides nesting and foraging habitat for resident and winter bird species. Watercourses with riparian habitat are depicted in Figure 4-2 through Figure 4-5 and summarized in Table 5-1.

Table 5-1 Riparian Habitat in the Study Area

Watercourse	Type	Movement Corridor
Guadalupe Valley Creek	Natural	Yes
Mills Creek	Natural	No
Easton Creek	Constructed	Yes
Sanchez Creek	Constructed	No
Freshwater emergent wetland/drainage	Natural	N/A
San Mateo Creek	Natural	Yes
Borel (Fiesta) Creek	Natural	Yes
Belmont Creek	Natural	Yes
Cordilleras Creek	Natural	Yes
San Francisquito Creek	Natural	Yes
Permanente Creek	Constructed	No
Stevens Creek	Natural	Yes

Sources: Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015
N/A = not applicable
[1] Some watercourses categorized as constructed are natural in part of the study area and concrete-lined in other parts (i.e., on one side of the tracks). Only portions of constructed watercourses that are natural were determined to support riparian vegetation.

5.2.2 Wildlife Movement Corridors

The California Essential Habitat Connectivity Project (Spencer et al. 2010) identifies two Natural Landscape Blocks in the vicinity of the Project Section: (1) San Bruno Mountain north of South San Francisco, and (2) an uninterrupted block of high-quality northern coastal salt marsh that fringes the southern end of San Francisco Bay. Neither of these blocks intersect the study area. No other modeled corridors published in statewide reports are present.

Wildlife movement corridors in the study area are exclusively associated with watercourses that daylight (i.e., are not culverted) and support natural habitats on both sides of the alignment. These corridors are distributed relatively evenly throughout the study area and occur at seven natural watercourses (all but Mills Creek). All of these movement corridors either pass through a culvert under the tracks or under a small bridge. Of the seven wildlife movement corridors, San Francisquito Creek, Stevens Creek, and Cordilleras Creek provide the best connectivity (i.e., "the extent to which a species or population can move among landscape elements in a mosaic of habitat types" [Hilty et al. 2006]) for wildlife due to the presence of riparian vegetation. All three of these creeks support relatively uninterrupted riparian corridors that span from the San Francisco Bay to undeveloped areas in the creeks' headwaters, located 2 to 5 miles east of the project alignment. Guadalupe Valley Creek also provides opportunities for wildlife to move between Brisbane Lagoon and the limited riparian habitat that extends approximately 500 feet upstream of the lagoon before the creek is culverted. The remaining three movement corridors are relatively constricted by development and lack of neighboring riparian communities upstream or downstream of the study area. Figure 4-2 through Figure 4-5 and Table 5-1 identify watercourses supporting wildlife movement corridors. Common, urban-adapted wildlife that likely use these corridors include northern raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), and mule deer (*Odocoileus hemionus*).

5.2.3 Special-Status Plants

Although certain limited areas within the study area may potentially support special-status plants, such as freshwater emergent and saline emergent wetlands, the vast majority of the study area is

disturbed or developed and is unlikely to contain special-status plants. Analysts identified four special-status plant species as potentially occurring in the study area based on the presence of potential habitat (Table 5-2). Freshwater emergent wetlands were assumed to provide habitat for bristly sedge (*Carex comosal*), although the likelihood of its occurrence is low due to its rarity—only one occurrence has been recorded within 10 miles of the study area and it may be extirpated (Occurrence No. 10; CDFW 2018). Saline emergent wetlands were assumed to provide habitat for California seablite (*Sueda californica*), Point Reyes salty bird's-beak (*Chloropyron maritimum* ssp. *palustre*), and saline clover (*Trifolium hydrophilum*), although the occurrence of these species is also unlikely due to their rarity and the disturbed condition of the saline emergent wetlands (i.e., tidal marsh) at the northern end of Brisbane Lagoon.

Table 5-2 Special-Status Plants Potentially Occurring in the Study Area

Species	Status[1] Federal/State/CRPR	Habitat Requirements	Extent of Potential Habitat in Study Area	Potential Habitat in Study Area (acres)
California seablite *(Sueda californica)*	FE / - / 1B.1	Margins of tidal salt marsh, below 49 feet AMSL	Habitat limited to saline emergent wetlands at Brisbane Lagoon.	1.3
Point Reyes salty bird's-beak *(Chloropyron maritimum* ssp. *palustre)*	- / - / 1B.2	Coastal salt marsh; below 33 feet AMSL	Habitat limited to saline emergent wetlands at Brisbane Lagoon.	1.3
Bristly sedge (*Carex comosal)*	- / - / 2.1	Wetlands and lake margins.	Habitat limited to freshwater emergent wetlands in the study area.	13.7
Saline clover (*Trifolium hydrophilum)*	- / - / 1B.2	Salt marsh, mesic alkaline areas in grasslands, vernal pools.	Habitat limited to saline emergent wetlands at Brisbane Lagoon.	1.3

Sources: PCJPB 2015b, 2015d
AMSL = above mean sea level
[1] Status explanations:
FE = listed as endangered under the FESA
California Rare Plant Rank (CRPR)
1B = List 1B species: rare, threatened, or endangered in California and elsewhere
2 = List 2 species: rare, threatened, or endangered in California but more common elsewhere
CRPR Code Extensions:
0.1 = seriously endangered in California
0.2 = fairly endangered in California

5.2.4 Special-Status Fish and Wildlife

The majority of the study area is highly disturbed and adjacent to dense urban development that provides little to no habitat for special-status fish or wildlife. Exceptions include the following:

- The small area of saline emergent wetland at northern end of Brisbane Lagoon in South San Francisco provides limited habitat for the following special-status wildlife species: California Ridgway's rail (*Rallus obsoletus obsoletus*), California black rail (*Laterallus jamaicensis coturniculus*), Alameda song sparrow (*Melospiza melodia pusillula*), salt marsh common yellowthroat (*Geothlypis trichas sinuosa*), salt marsh harvest mouse (*Reithrodontomys raviventris*), and salt marsh wandering shrew (*Sorex vagrans halicoetes*). With the exception of Alameda song sparrow and salt marsh common yellowthroat, the occurrence of these species is unlikely due to the small size of the wetland and adjacent disturbance.

- The SFO West-of-Bayshore property, located east of the project footprint between Angus Avenue in San Bruno and the Millbrae BART station, supports one of nine remaining populations of the federally and state-endangered San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) as well as the federally threatened California red-legged frog (*Rana draytonii*).
- Riparian habitat and ornamental landscaping provide nesting habitat for white-tailed kite (*Elanus leucurus*), a California fully protected species, and roosting habitat for three special-status bat species: pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and western red bat (*Lasiurus blossevillii*). The high acreages for these species are for *potential* habitat only and should not be interpreted as occupied habitat.
- Several streams that cross the habitat study area are seasonally used by central California coast steelhead (*Oncorhynchus mykiss*), but habitat conditions are severely degraded and do not provide spawning habitat.

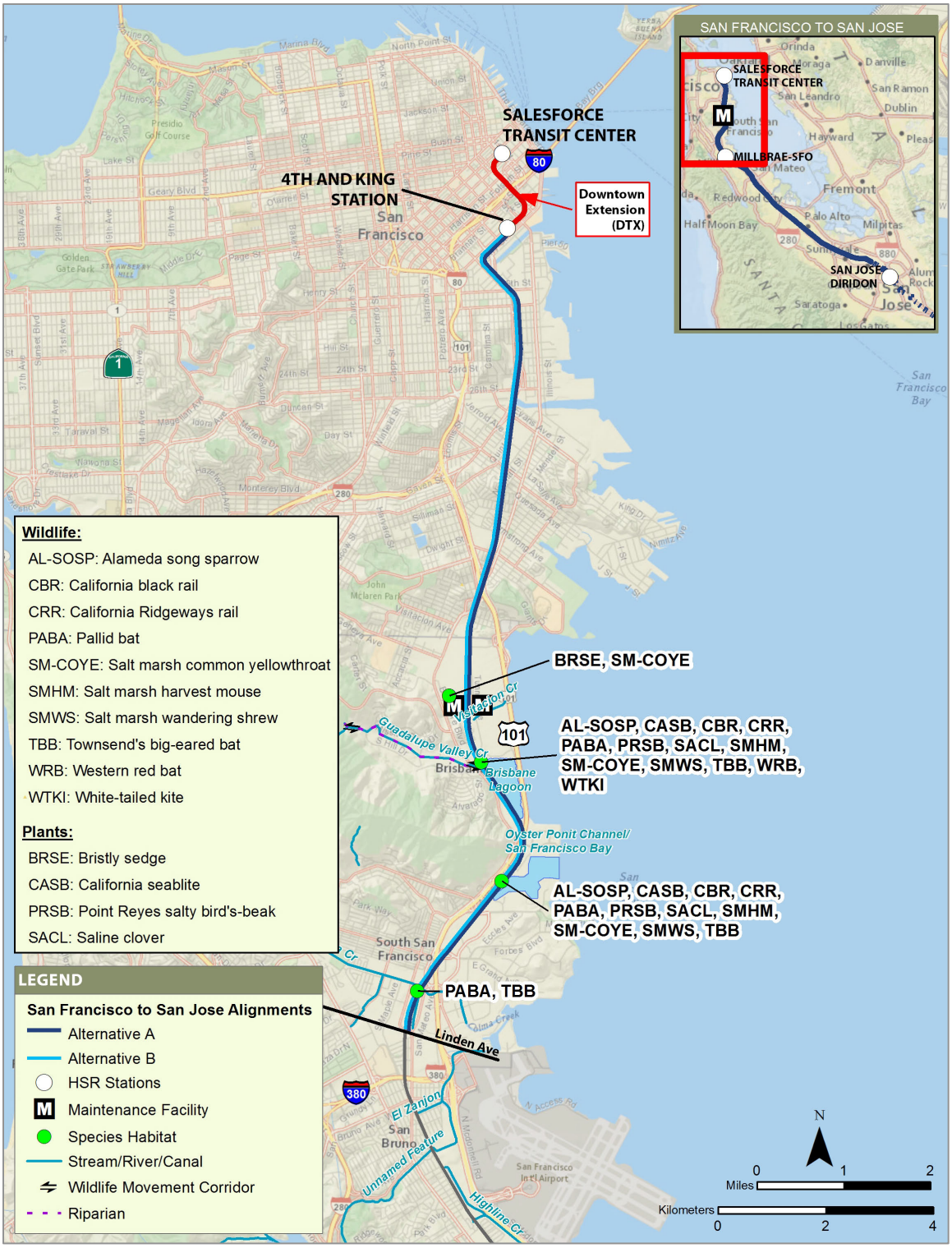
Table 5-3 describes special-status species habitats that may occur in the study area that are depicted on Figure 5-2 through Figure 5-5.

Table 5-3 Special-Status Fish and Wildlife Potentially Occurring in the Study Area

Species	Status[1] Federal/ State	Habitat Requirements	Extent of Potential Habitat in Study Area	Potential Habitat in Study Area (acres)
Central California coast steelhead *(Oncorhynchus mykiss)*	FT / -	Cold, clear water with clean gravel of appropriate size for spawning. Most spawning occurs in headwater streams. Steelhead migrate to the ocean to feed and grow until sexually mature.	Watercourses with habitat in the study area include Mills Creek, San Mateo Creek, San Francisquito Creek, and Stevens Creek. Of these, only San Mateo, Stevens, and San Francisquito Creeks are known to currently support a "definite" steelhead run or population (Leidy et al. 2005).	0.20
California red-legged frog *(Rana draytonii)*	FT / SSC	Permanent and semi-permanent aquatic habitats, such as creeks and cold-water ponds, with emergent and submerged vegetation; may aestivate in rodent burrows or cracks during dry periods.	Habitat occurs in 22 of the 30 watercourses (tidally influenced creeks and those with bed and banks comprised entirely of concrete not included), including adjacent wetlands and tributaries/channels.	1.79
San Francisco garter snake *(Thamnophis sitralis tetrataenia)*	FE / SE / FP	Favors ponds, lakes, slow-moving streams and marshy areas containing abundant vegetation for cover.	Habitat occurs in aquatic habitats with direct connectivity to known occupied habitat in the open space east of the right-of-way adjacent to San Francisco International Airport (i.e., West-of-Bayshore property), approximately 0.8 mile north of the Millbrae Station.	0.09
Salt-marsh harvest mouse (*Reithrodontomys raviventris)*	FE / SE / FP	Saline to brackish salt marsh habitat.	Habitat limited to saline emergent wetlands in the study area.	1.3
California Ridgway's rail *(Rallus obsoletus obsoletus)*	FE / SE / FP	From tidal mudflats to tidal sloughs.	Habitat limited to saline emergent wetlands in the study area.	1.3

Species	Status[1] Federal/ State	Habitat Requirements	Extent of Potential Habitat in Study Area	Potential Habitat in Study Area (acres)
California black rail *(Laterallus jamaicensis conturniculus)*	- / ST / FP	Tidal salt marshes associated with heavy growth of pickleweed; also brackish marshes or freshwater marshes at low elevations.	Habitat limited to saline emergent wetlands in the study area.	1.3
Western pond turtle *(Emys marmorata)*	- / - / SSC	Ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies or other aquatic vegetation in woodlands, grasslands, and open forests.	Habitat in the study area occurs in 22 of the 30 watercourses (tidally-influenced creeks and those with bed and banks comprised entirely of concrete not included), including adjacent wetlands and tributaries/channels.	1.79
Townsend's big-eared bat *(Corynorhinus townsendii)*	- / - / SSC	Roosts in caves, tunnels, mines, and dark attics of abandoned buildings. Very sensitive to disturbances and may abandon a roost after one on-site visit.	Habitat limited to bridges over streams.	1.05
Pallid bat *(Antrozous pallidus)*	- / - / SSC	Roosts in fissures in caves, tunnels, mines, hollow trees, and locations with stable temperatures.	Habitat limited to bridges over streams.	1.05
Western red bat *(Lasiurus blossevil)*	- / - / SSC	Roosts in trees, primarily riparian and wooded habitats. Occurs at least seasonally in urban areas. Day roosts in trees within the foliage.	Habitat includes urban landscaped environments and riparian areas.	72.4
Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa)*	- / - / SSC	Freshwater marshes in summer and salt or brackish marshes in fall and winter; requires tall grasses, tules, and willow thickets for nesting and cover.	Habitat limited to saline emergent wetlands and freshwater emergent wetlands (i.e., only at the maintenance facility site) in the study area.	12.95
Alameda song sparrow *(Melospiza melodia pusillula)*	- / - / SSC	Brackish marshes associated with pickleweed; may nest in tall vegetation or among the pickleweed.	Habitat limited to saline emergent wetlands in the study area.	1.3
White-tailed kite *(Elanus leucurus)*	- / - / FP	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging.	Habitat includes urban landscaped environments and riparian areas	72.4
Salt-marsh wandering shrew (*Sorex vagrans halicoetes)*	- / - / SSC	Salt marshes from 6 to 9 feet above mean sea level.	Habitat limited to saline emergent wetlands in the study area.	0.29

Sources: PCJPB 2015b, 2015d
FESA = federal Endangered Species Act
CESA = California Endangered Species Act
CDFW = California Department of Fish and Wildlife
[1] Status explanations:
FE = listed as endangered under the FESA
FT = listed as threatened under the FESA
SE = Listed as endangered under the CESA
ST = Listed as threatened under the CESA
SSC = Animal species of special concern to CDFW
FP = Animals fully protected in California



Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015b, 2015c

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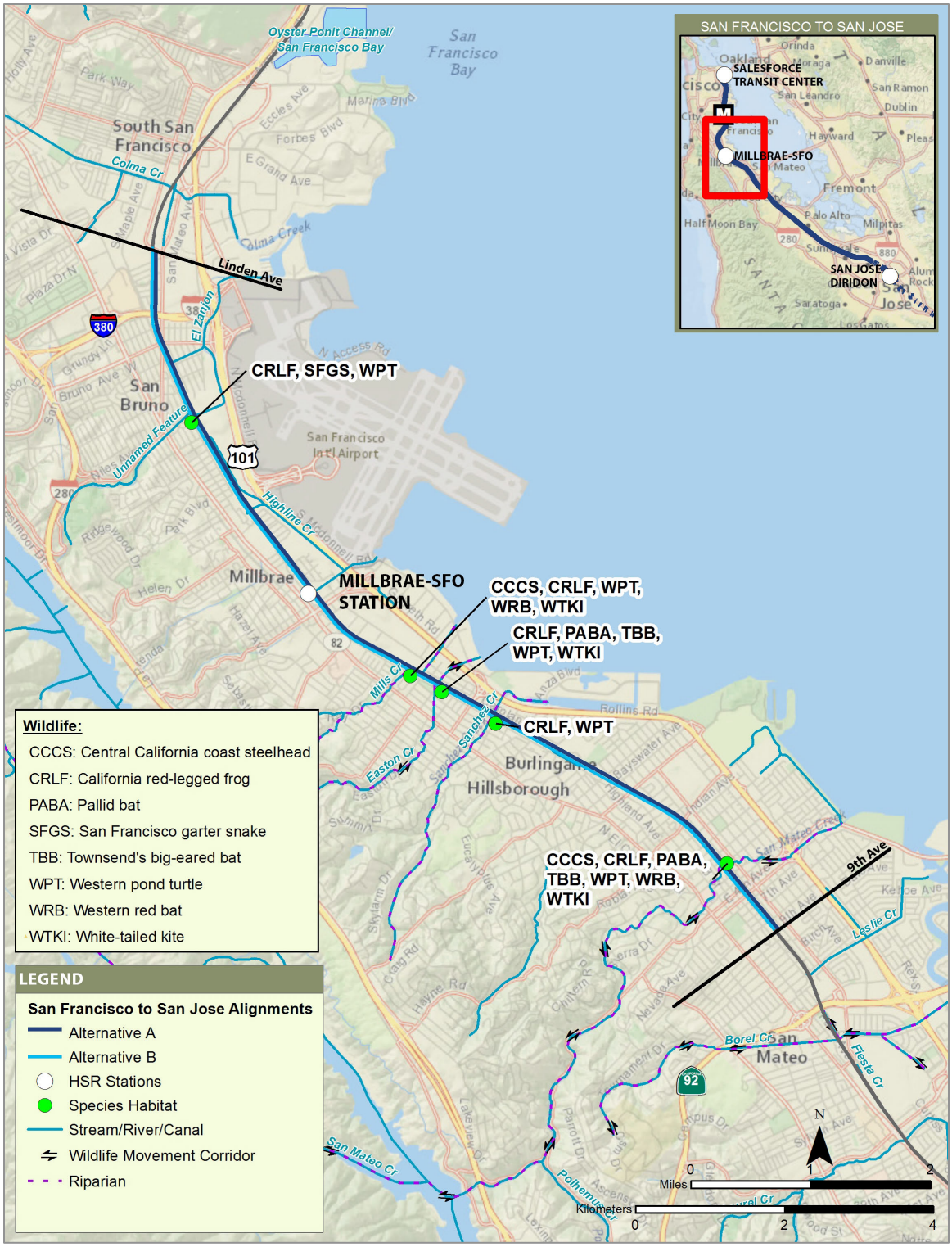
Figure 5-1 Special-Status Species Habitat in Study Area—Part 1 of 4



Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015b, 2015c

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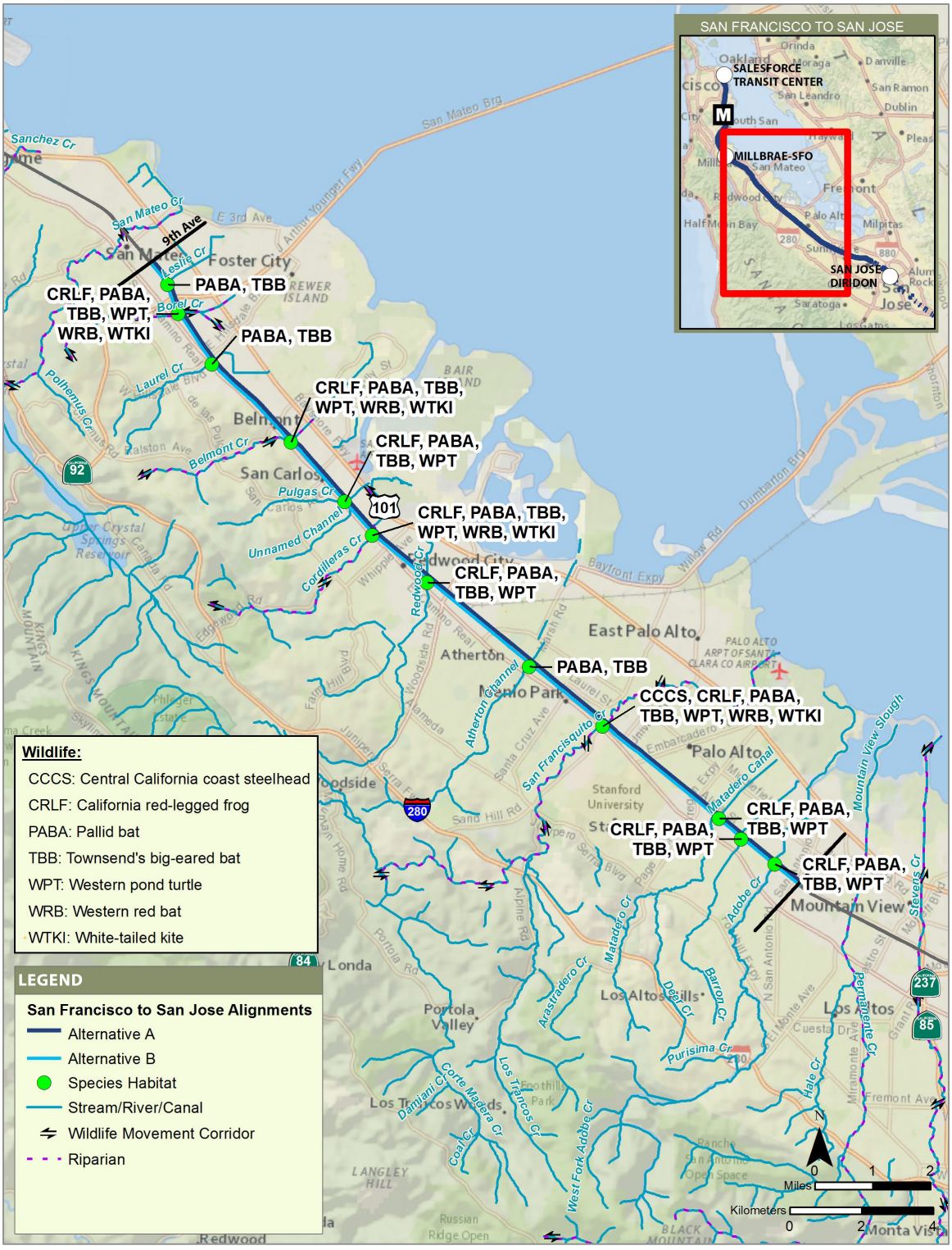
Figure 5-2 Special-Status Species Habitat in Study Area—Part 2 of 4



Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015b, 2015c

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Figure 5-3 Special-Status Species Habitat in Study Area—Part 3 of 4

Sources: Authority 2018c; Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015b, 2015c

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Figure 5-4 Special-Status Species Habitat in Study Area—Part 4 of 4

5.3 Impacts of Project Alternatives on Biological Resources

Due to the density of surrounding development, the most sensitive biological resources in the study area occur at four locations: (1) the West Brisbane LMF site (Alternative B), (2) Brisbane Lagoon, (3) San Francisquito Creek, and (4) Stevens Creek. These locations contain vegetation communities and/or aquatic resources that potentially support special-status species and/or serve as wildlife corridors on the San Francisco Peninsula. However, the difference in potential impacts on biological resources (i.e., riparian areas, wildlife movement corridors, special-status species habitat, and special-status plant species) between the alternatives is minimal and largely limited to the two LMF sites. Both alternatives may potentially affect eight riparian corridors, with Alternative B resulting in approximately 0.05 acre more impacts. Furthermore, there are no distinguishable differences in impacts on wildlife movement corridors across alternatives. Lastly, the impacts on the majority of special-status species habitats are also similar across alternatives, particularly for state and federally listed species. Table 5-4 summarizes impacts on riparian habitat, wildlife movement corridors, and special-status species.

While impacts on special-status species are largely similar, the following differences exist between the alternatives:

- **Bristly sedge**—The West Brisbane LMF would affect an additional 7.81 acres of bristly sedge habitat under Alternative B because of the greater acreage of freshwater emergent wetlands west of Tunnel Avenue. These wetlands were originally delineated in 2003 (Authority and FRA 2010a). Project biologists plan to revisit this parcel to inform the upcoming Aquatic Resources Delineation Report and Biological and Aquatic Resources Technical Report.
- **Salt marsh common yellowthroat**—The West Brisbane LMF would affect an additional 7.81 acres of salt marsh common yellowthroat habitat under Alternative B because of the greater acreage of freshwater emergent wetlands west of Tunnel Avenue. This estimate may be reduced if future field visits to the West Brisbane LMF footprint reveal that the wetlands are smaller than originally delineated and/or provide little habitat value for salt marsh common yellowthroat (i.e., limited vegetation cover for nesting).
- **White-tailed kite**—The additional 3.89 acres of impacts on white-tailed kite habitat under Alternative B are associated with the Short Middle Four-Track Passing Track, which would affect more riparian habitat and urban landscaping than Alternative A. Actual impacts would only occur if construction activities removed or caused abandonment of an active nest. The likelihood of this is slightly higher under Alternative B because it would affect a larger area of potential nest trees within riparian habitat and urban landscaping.

Table 5-4 Impacts on Biological Resources

Biological Resource	Alternative A	Alternative B
Riparian habitat (acres)	0.76	0.81
Wildlife movement corridors (number/acres)	8/0.86	8/0.93
Conservation areas (acre)	None	None
Special-Status Plant Habitat (acres)		
California seablite (FE, 1B.2)	1.3	1.3
Point Reyes salty birds-beak (1B.2)	1.3	1.3
Bristly sedge (2.1)	3.75	11.56
Saline clover (1B.2)	1.3	1.3
Special-Status Wildlife Habitat (acres per species/habitat)		
Central California Coast steelhead (FT)	0.20	0.20
California red-legged frog (FT, SSC)	1.71	1.79
San Francisco garter snake (FE, SE)	0.09	0.09
Salt marsh harvest mouse (FE, SE, FP)	1.3	1.3
California Ridgway's rail (FE, SE, FP)	1.3	1.3
California black rail (ST, FP)	1.3	1.3
Western pond turtle (SSC)	1.71	1.79
Townsend's big-eared bat (CFT, SSC)	1.00	1.05
Pallid bat (SSC)	1.00	1.05
Western red bat (SSC)	66.90	70.79
Salt marsh common yellowthroat (SSC)	2.94	11.22
Alameda song sparrow (SSC)	1.3	1.3
White-tailed kite (FP)	66.90	70.79
Salt marsh wandering shrew (SSC)	1.3	1.3

Sources: Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015a, 2015b

6 OTHER ENVIRONMENTAL AND COMMUNITY RESOURCES

This chapter evaluates each alternative's potential impacts on other environmental resources and communities. This evaluation includes an assessment of land use considerations; cultural resources; parks, recreation, and open-space resources; FEMA flood hazard zones; and BCDC jurisdictional areas, as well as the presence and proximity of low-income and minority populations and residential and business displacements.[22] This analysis was based on preliminary environmental information available at this conceptual stage of engineering design.

6.1 Other Environmental Resources

6.1.1 Scope of Analysis

6.1.1.1 Study Area

For the purposes of this analysis, the *study area* is the combined project footprint of both alternatives. The project footprint is the area needed to construct, operate, and maintain all permanent HSR features, roadway modifications, new or relocated utility features, access to new or relocated utility features, drainage facilities, any other physical changes within the area needed to construct and operate HSR, and HSR property rights or licenses to accommodate HSR construction, operation, and maintenance. The project footprint therefore reflects the area of direct disturbance for each alternative. For land uses, analysts considered resources within a 0.5-mile radius of the edge of the footprint for stations and the LMF.

6.1.1.2 Methods

Land Uses

Data collection for land use consisted of acquiring GIS data from local jurisdictions or digitizing land uses based on a review of local and regional land use plans, transportation, and subarea plans, and other relevant planning documents.[23] Analysts used this GIS data to characterize land uses for the counties and cities in the direct track alignment and station study areas.

Cultural Resources

Research was conducted to identify historic properties and previously recorded archaeological resources, or previous studies that could inform identification efforts. Information was obtained through the NRHP, CRHR, and prior cultural resources studies. A background records search was conducted in May 2016 by the Northwest Information Center, based on a preliminary project footprint. These resources were then mapped in GIS in relation to the project footprint to determine potential for effects on cultural resources. The cultural resource information presented in Section 6.1.2.2, Cultural Resources, represents an estimate of the relative effect of each alternative on cultural resources. Not every resource that is identified would be affected.

Parks, Recreation, and Open-Space Resources

The parks, recreation, and open-space resources that exist in the study area were identified by taking an inventory of all public parks, recreation areas, and open spaces, including greenbelts, wildlife/waterfowl refuges, pedestrian and bicycle trails, playfields, and school district play areas available for public use during non-school hours within the study area. Data collection for parks, recreation, and open space consisted of a review of regional and local plans and policies, interviews with local planning organizations, and the use of GIS data banks.[24] The cities and counties provided the boundaries for parks and recreation resources in the study area in GIS data format and in adopted plans, which were used to assess impacts. The parks, recreation, and open-space resources information presented in Section 6.1.2.3, Parks, Recreation, and Open-

[22] Important Farmland is identified as an evaluation criteria in the MOU; however, there is no Important Farmland along the Project Section. As a result, this criteria is not discussed further.

[23] See sources for Table 6-3 for representative plans reviewed for this analysis.

[24] See sources for Table 6-10 for representative plans and GIS databases reviewed for this analysis.

Space Resources, represents an estimate of the relative effect of each alternative on these resources. Not every resource that is identified would be affected.

Federal Emergency Management Agency Flood Hazard Zones

FEMA issues Flood Insurance Rate Maps (FIRM) for communities participating in the National Flood Insurance Program, which delineate flood hazard zones in the community. A FIRM is the official map of a community prepared by FEMA to delineate both the special flood hazard areas and the flood risk premium zones applicable to the community. Analysts collected FIRMs prepared by FEMA for San Francisco, San Mateo, and Santa Clara Counties. These maps were reviewed in relation to the project footprint to identify the locations of current 100-year floodplains in the study area.

San Francisco Bay and Shoreline Band (BCDC Jurisdictional Areas)

The BCDC is a state agency that has been granted authority by the state, pursuant to the McAteer-Petris Act,[25] to plan and regulate activities and development in and around San Francisco Bay, consistent with policies adopted in the San Francisco Bay Plan.[26] BCDC requires permits to fill areas within the Bay or bay/tidal waterways or to undertake development activities that occur within 100 feet of the Bay ("Shoreline Band").

Analysts digitized the Shoreline Band using a 100-foot buffer from the high tide line; the associated open water was identified as the Bay(tidal) under BCDC jurisdiction. Analysts then intersected these areas with the combined footprints using GIS to identify the potential acreage of impacts on BCDC jurisdictional areas. BCDC jurisdictional areas were only identified in areas directly affected or immediately adjacent to the combined footprint for this analysis.

6.1.1.3 Existing Conditions

Land Uses

The Project Section is located in San Francisco, San Mateo, and Santa Clara Counties. These counties are an urban, highly developed area. Existing land uses adjacent to the east and west side of the alignment are presented in Table 6-1.

Table 6-1 Existing Land Uses Adjacent to the San Francisco to San Jose Project Section

City/Subsection	East/ West of Alignment	Predominant Land Uses[1,2]
San Francisco to South San Francisco Subsection		
San Francisco 4th and King Street to 22nd Street	East	Mixed use, residential, commercial, parks/open space, education/public/semi-public, industrial, commercial
	West	Mixed use, industrial, residential
22nd Street to Bayshore area	East	Industrial, residential, education/public/semi-public
	West	Industrial, residential
Brisbane	East	Commercial, vacant/undeveloped, industrial
	West	Commercial, vacant/undeveloped, industrial, residential

[25] California Government Code §§ 66000–66694 (2015). BCDC also derives its authority from the Suisun Marsh Preservation Act. See California Public Resources Code §§ 29000–29612 (2015).

[26] California Government Code § 66610(a)–(d) (2015). BCDC has permit jurisdiction over San Francisco Bay proper, a strip of land extending inland for 100 feet from the upland edge of the Bay, salt ponds, managed wetlands, and certain named tributaries that flow into the Bay. In addition, BCDC's jurisdiction also extends to Suisun Marsh.

City/Subsection	East/ West of Alignment	Predominant Land Uses[1,2]
South San Francisco	East	Commercial/industrial
	West	Residential, commercial, industrial, mixed use
San Bruno to San Mateo Subsection		
San Bruno	East	Industrial, residential, commercial
	West	Residential, commercial
Millbrae	East	Parks/open space, industrial, residential, mixed use
	West	Residential, commercial, mixed-use
North Burlingame border to Broadway	East	Mixed use (commercial/industrial)
	West	Commercial, residential, parks/open space, education
Broadway to south Burlingame border	East	Commercial, residential, mixed use
	West	Commercial, residential
San Mateo to Palo Alto Subsection		
North San Mateo border to 1st Street	East	Residential, education
	West	Residential, commercial, mixed use
1st Street to Hayward Park (Concar Drive)	East	Commercial, residential, industrial, education
	West	Commercial, residential, mixed use, parks/open space
Hayward Park (Concar Drive) to Hillsdale Boulevard	East	Mixed use, commercial, residential, public space
	West	Commercial, residential, mixed use
Hillsdale Boulevard to South San Mateo border	East	Residential, commercial, education
	West	Commercial, mixed use, residential
Belmont	East	Residential, commercial, education
	West	Residential, commercial, mixed use, education
San Carlos	East	Industrial, residential, commercial
	West	Residential, commercial
Redwood City	East	Residential, education/public/semi-public, mixed use, industrial, commercial
	West	Residential, education, commercial
North Fair Oaks (unincorporated)	East	Industrial, residential, commercial
	West	Residential, commercial
Atherton	East	Residential, parks/open space
	West	Residential, public/semi-public space
Menlo Park	East	Residential, commercial, public/semi-public space, parks/open space
	West	Commercial, residential
Palo Alto	East	Residential, mixed use, commercial
	West	Residential, education/public/semi-public spaces, commercial

City/Subsection	East/ West of Alignment	Predominant Land Uses[1,2]
Mountain View to Santa Clara Subsection		
San Antonio Road to Castro Street	East	Residential, office industrial, mixed use
	West	Residential, office, commercial, parks/open space, industrial
Castro Street to South Mountain View border	East	Residential, industrial/office
	West	Residential, Commercial, industrial/office, residential commercial
North Sunnyvale border to Sunnyvale Avenue	East	Residential, industrial
	West	Residential, education/public/semi-public space, commercial, industrial
Sunnyvale Avenue to Lawrence Expressway	East	Mixed use (residential/industrial), residential, industrial
	West	Commercial, residential, mixed use (residential/ industrial)

Sources: City of Belmont 2016; City of Brisbane 1994; City of Burlingame 2015; City of Menlo Park 2015; City of Millbrae 2009; City of Mountain View 2012; City of Palo Alto 2011; City of Redwood City 2010; City of San Bruno 2009; City of San Carlos 2009; City and County of San Francisco 2015; City of San Mateo 2010; City of Santa Clara 2010; City of South San Francisco 1999; City of Sunnyvale 2011; County of San Mateo 2011

[1] Includes prominent, large-scale land uses. Most segments include small parks/open spaces, commercial blocks, and small educational facilities.

[2] Unless otherwise specified, "mixed use" refers to residential/commercial mixed use.

All of the proposed HSR station sites have existing rail and bus transportation facilities with linkages to a variety of local and regional transit services, such as Caltrain, Santa Clara Valley Transportation Authority (VTA) bus and light rail service, SamTrans bus routes, Altamont Corridor Express and Capitol Corridor commuter rail services, BART, airports, and highways. Although fully developed, each station area has been targeted for infill development and/or transit-oriented development (TOD). Since the HSR stations are located at existing rail stations or bus transit centers, communities in the study area have typically recognized and incorporated mixed use or TOD in their general plans and other land use plans. Although some of the regulatory plans were developed prior to the HSR and do not address the HSR project specifically, several plans have been recently adopted, such as the Transit Center District Plan in San Francisco and the Millbrae Station Area Specific Plan in Millbrae, which address HSR and anticipate HSR station facilities and complementary land uses.

The Schlage Lock redevelopment plan, located west of the alignment northwest of the Caltrain Bayshore Station, plans to transform previously vacant land into a livable, mixed-use urban community; a place designed to encourage walking, biking, and the use of mass transit; and a network of well-designed open spaces and public amenities. The Schlage Lock development is approved and currently under construction.

The City of Brisbane and the voters in the city approved a General Plan amendment in 2018 related to the Brisbane Baylands. The Brisbane Baylands extend from Schlage Lock in the north to Brisbane Lagoon in the south, on both the west and east sides of the rail alignment. The site is currently vacant and has been historically used for manufacturing and industrial activity along with a landfill. The approved General Plan amendment allows for residential uses only west of the Caltrain alignment in the area north of the extended line of Main Street. Nonresidential uses are allowed west and east of the Caltrain alignment. The approved General Plan amendment allows up to 2,200 dwelling units, 6.5 million square feet of new commercial development, and up to 500,000 square feet of hotel development. City of Brisbane policies also require that 15 percent of the housing be affordable and that 25 percent of the site be open space. The owner of the property (Universal Paragon Corporation) has developed extensive plans and has been seeking to develop the site for many years. With the General Plan amendment approval in November 2018, the developer is required to prepare a Specific Plan and development agreement consistent with the amendment and the City of Brisbane will prepare an EIR. The two LMF options would be on land allowed for development under the approved General Plan amendment

with the East Brisbane LMF (Alternative A) located east of the Caltrain corridor and the West Brisbane LMF (Alternative B) located west of the Caltrain corridor.

There are also plans for a bus rapid transit (BRT) line along Geneva Avenue, relocation of the Caltrain Bayshore Station to just north of the Geneva BRT terminus, and a MUNI T-Line extension to the relocated Caltrain Bayshore Station.

Cultural Resources

The Project Section is in an area that is sensitive for archaeological deposits and contains NRHP properties and known archaeological sites as well as built historic resources. A total of 21 known built historic resources were identified within the study area. Table 6-2 presents the record search findings for the previously recorded built resources within the study area. Not all of the resources listed in Table 6-2 would be affected by the project.

Table 6-2 Known Built Historic Resources in the Study Area

Historic Name (NRHP Number)	City	Year Built	Status[1]
San Francisco Fire Department Auxiliary Water Supply System	San Francisco	1908+	NA
Central Waterfront Historic District	San Francisco		NA
22nd Street overpass	San Francisco	1906	NA
23rd Street overpass	San Francisco	1906	NA
Airport Boulevard underpass/South San Francisco subway	South San Francisco	1927	NRHP Eligible
Southern Pacific Depot/Millbrae Station (78000770)	Millbrae	1907	NRHP Listed
Jules Francard Grove/Francard Tree Rows	Burlingame	1874-80c	NA
Southern Pacific Depot/Burlingame Railroad Station (78000769)	Burlingame	1894	NRHP Listed
East Poplar Avenue undercrossing	San Mateo	1903	NRHP Eligible
East Santa Inez Avenue underpass	San Mateo	1903	NRHP Eligible
Tilton Avenue underpass	San Mateo	1903	NRHP Eligible
Monte Diablo Avenue underpass	San Mateo	1903	NRHP Eligible
Retaining wall associated with Monte Diablo & Tilton Bridge	San Mateo	1903	NA
Southern Pacific Depot/San Carlos Station (84001191)	San Carlos	1888	NRHP Listed
Southern Pacific Depot (Atherton Station)	Atherton	1913	NRHP Eligible
Southern Pacific Depot/Menlo Park Station (74000556)	Menlo Park	1867	NRHP Listed
Southern Pacific Railroad San Francisquito Creek Bridge	Palo Alto	1902	NRHP Eligible
El Palo Alto	Palo Alto	940-950c	NA
Palo Alto Station	Palo Alto	1940	NA
University Avenue underpass	Palo Alto	1941	NRHP Eligible
Embarcadero underpass	Palo Alto	1936	NA

Sources: Authority and FRA 2016a; PCJPB 2015d
NRHP = National Register of Historic Places
NA = not available
[1] Cultural resources status included if available.

A total of 19 archaeological resources, shown in Table 6-3, were identified as being in the study area. Although 15 sites have not been formally evaluated, one site was recommended as not eligible, and three of these sites have been previously recommended as NRHP-eligible resources.

Table 6-3 Archaeological Resources in the Study Area

Archaeological Resources Trinomial	Type/Description	NRHP Eligibility Status
CA-SFR-171	Pre-contact shell midden buried below artificial fill—appears intact and have potential for being eligible	Not formally evaluated
CA-SMA-6	Pre-contact shell midden—buried.	Recommended eligible (not through testing)
CA-SMA-4	Pre-contact shell midden with human burials; Nelson mound	Not formally evaluated
CA-SMA-047	Pre-contact shell midden; Nelson Shellmound #386	Not formally evaluated
CA-SMA-102	Pre-contact shell midden	Recommended eligible
CA-SMA-232	Pre-contact shell midden; Hamilton Shellmound #9	Not formally evaluated
CA-SMA-233	Pre-contact shell midden; Hamilton Shellmound #12	Recommended eligible
CA-SMA-316/317	Pre-contact shell midden; Hamilton Shellmound	Not formally evaluated
CA-SMA-358/H	Pre-contact, protohistoric, and historic site on surface and buried	Not formally evaluated
CA_SMA-378H	Historic-era trash scatter	Recommended not eligible (not through testing)
CA-SMA-418H	Historic-era trash scatter	Not formally evaluated
CA-SMA-419	Pre-contact shell midden	Not formally evaluated
CA-SMA-420	Pre-contact shell midden	Not formally evaluated
CA-SMA-421	Pre-contact shell midden in disturbed context	Not formally evaluated
CA-SMA-422	Pre-contact shell midden with surface and buried component	Not formally evaluated
CA-SMA-424	Buried pre-contact shell midden along San Francisquito Creek	Not formally evaluated
CA-SCL-022	Pre-contact shell midden	Not formally evaluated
CA-SCL-600	Pre-contact shell midden	Not formally evaluated
CA-SCL-939	Pre-contact shell midden	Not formally evaluated

Source: Authority and FRA 2016b
NRHP = National Register of Historic Places

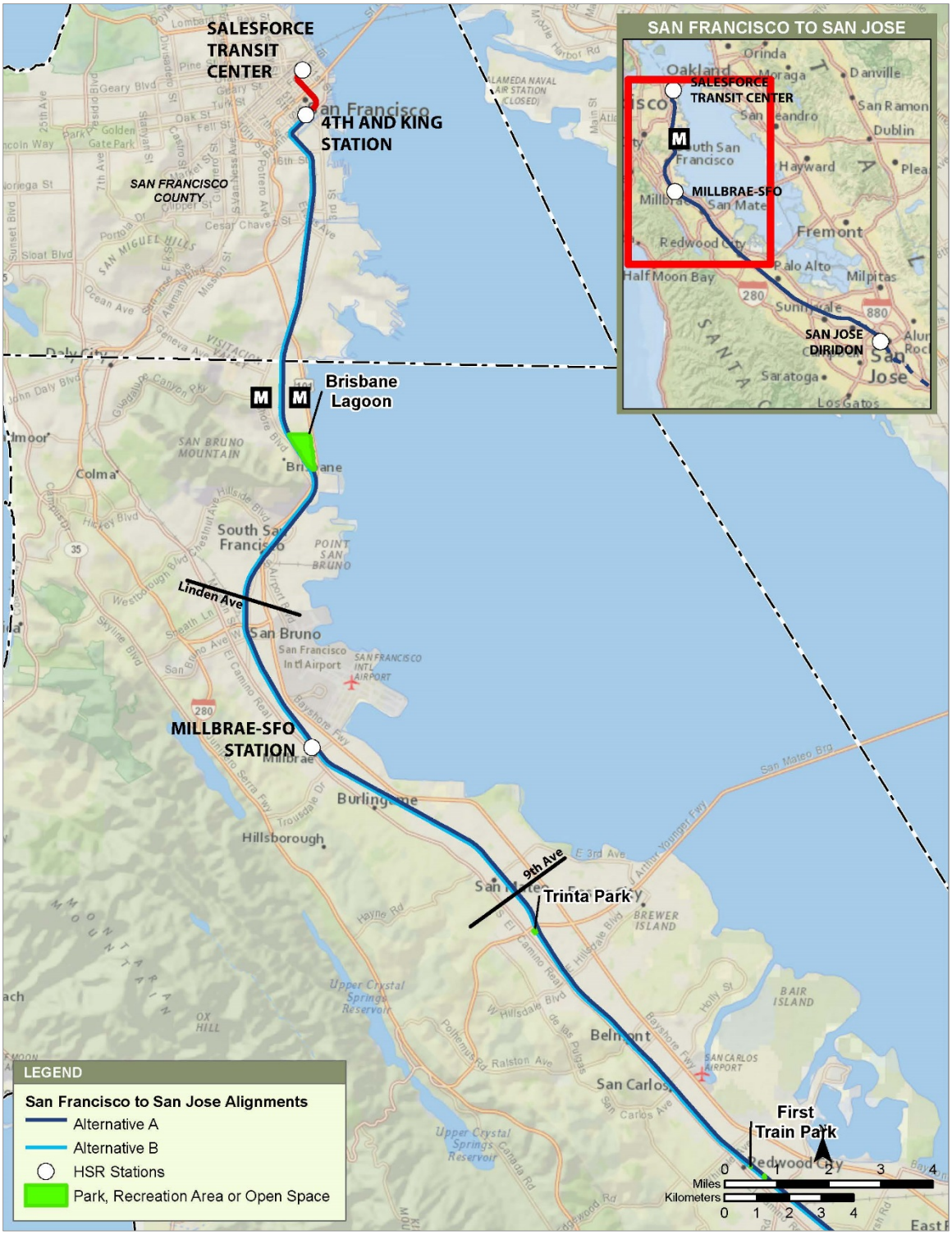
Parks, Recreation, and Open-Space Resources

Table 6-4 identifies the parks, recreation, and open-space resources where there is an intersection between the project footprint and the park. These parks, recreation, and open-space resources are also identified on Figures 6-1 and 6-2. All of these resources are immediately adjacent to the corridor. There are no wilderness areas or wildlife and waterfowl refuges in the study area.

Table 6-4 Parks, Recreation, and Open-Space Resources in the Study Area

Parks, Recreation, and Open Space Resources	Description
Brisbane Lagoon	Location: Sierra Point Parkway, Brisbane Size: 150 acres Features: Benches and surface parking Agency with Jurisdiction: City of Brisbane Parks and Recreation Department
Trinta Park	Location: 150 19th Avenue, San Mateo Size: 2.16 acres Features: Playground, baseball field, basketball court, and restrooms Agency with Jurisdiction: City of San Mateo Parks and Recreation
Holbrook-Palmer Park	Location: 150 Watkins Ave, Atherton Size: 22 acres Features: Ball field, tennis courts, playground, gardens and walking paths Agency with Jurisdiction: Town of Atherton
El Palo Alto Park	Location: 117 Palo Alto Avenue, Menlo Park Size: 0.5 acre Features: Pedestrian/bike pathway Agency with Jurisdiction: City of Palo Alto Community Services
El Camino Park	Location: 155 El Camino Real, Palo Alto Size: 12.19 acres Features: Synthetic soccer field, lighted softball diamond with bleachers, restrooms and parking lot Agency with Jurisdiction: City of Palo Alto Community Services leases from Stanford University
Bracher Park	Location: 2560 Alhambra Drive, Santa Clara Size: 3.5 acres Features: Picnic area, BBQs, restrooms, and play area Agency with Jurisdiction: City of Santa Clara Parks and Recreation

Sources: Authority 2018c; Burlingame School District 2016; City and County of San Francisco 2010; City of Belmont 2012; City of Sunnyvale 2016; Millbrae School District n.d.; Palo Alto Unified School District 2016; Redwood City School District 2016; San Mateo-Foster City School District 2016; San Mateo Union High School District 2016; Santa Clara Unified School District 2016; Sequoia Union High School District 2016



Sources: Authority 2018c; Burlingame School District 2016; City and County of San Francisco 2010; City of Belmont 2012; City of Sunnyvale 2016; Millbrae School District n.d; Palo Alto Unified School District 2016; Redwood City School District 2016; San Mateo-Foster City School District 2016; San Mateo Union High School District 2016; Santa Clara Unified School District 2016; Sequoia Union High School District 2016

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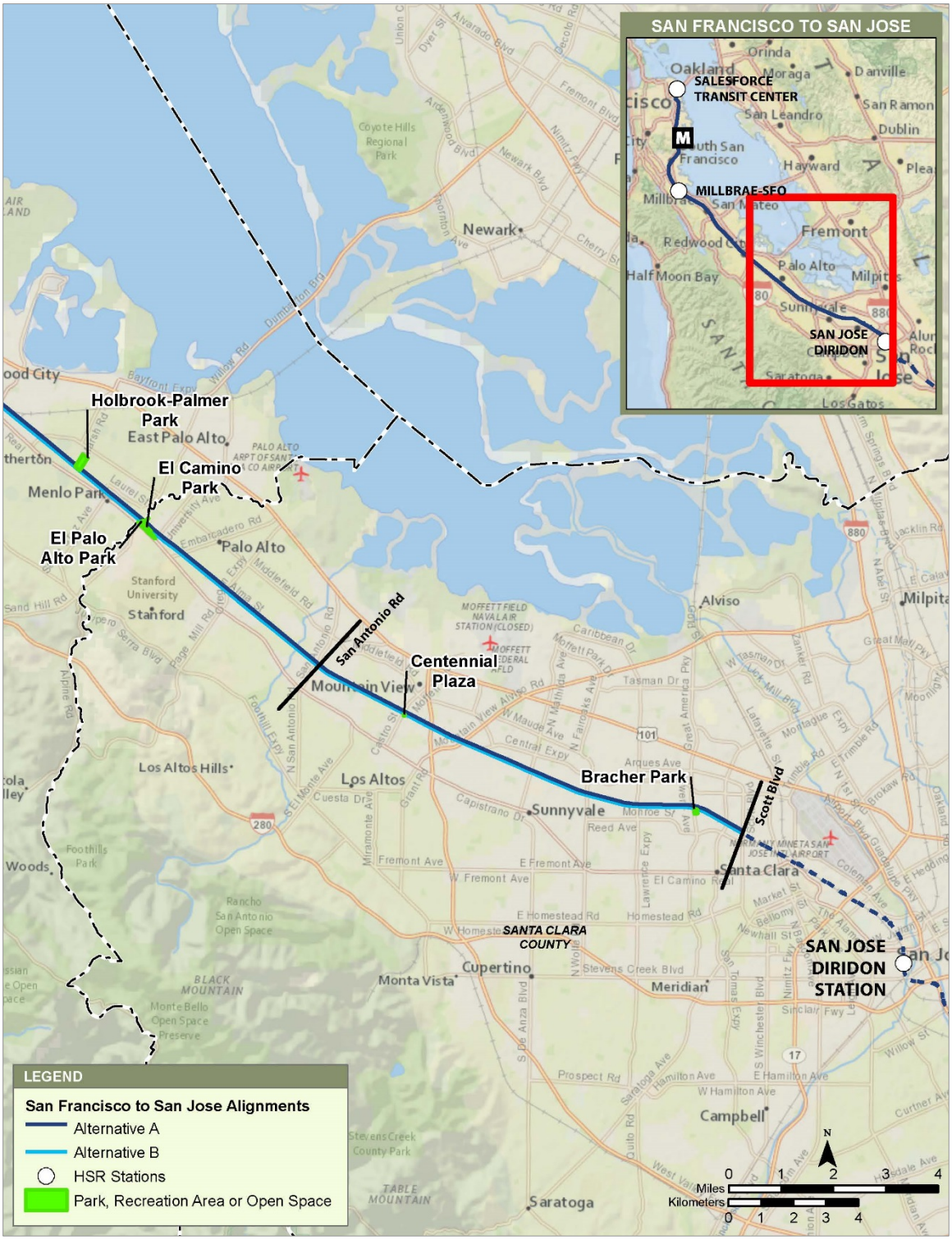
Figure 6-1 Parks, Recreation and Open-Space Resources (North)



Sources: Authority 2018c; Burlingame School District 2016; City and County of San Francisco 2010; City of Belmont 2012; City of Sunnyvale 2016; Millbrae School District n.d.; Palo Alto Unified School District 2016; Redwood City School District 2016; San Mateo-Foster City School District 2016; San Mateo Union High School District 2016; Santa Clara Unified School District 2016; Sequoia Union High School District 2016

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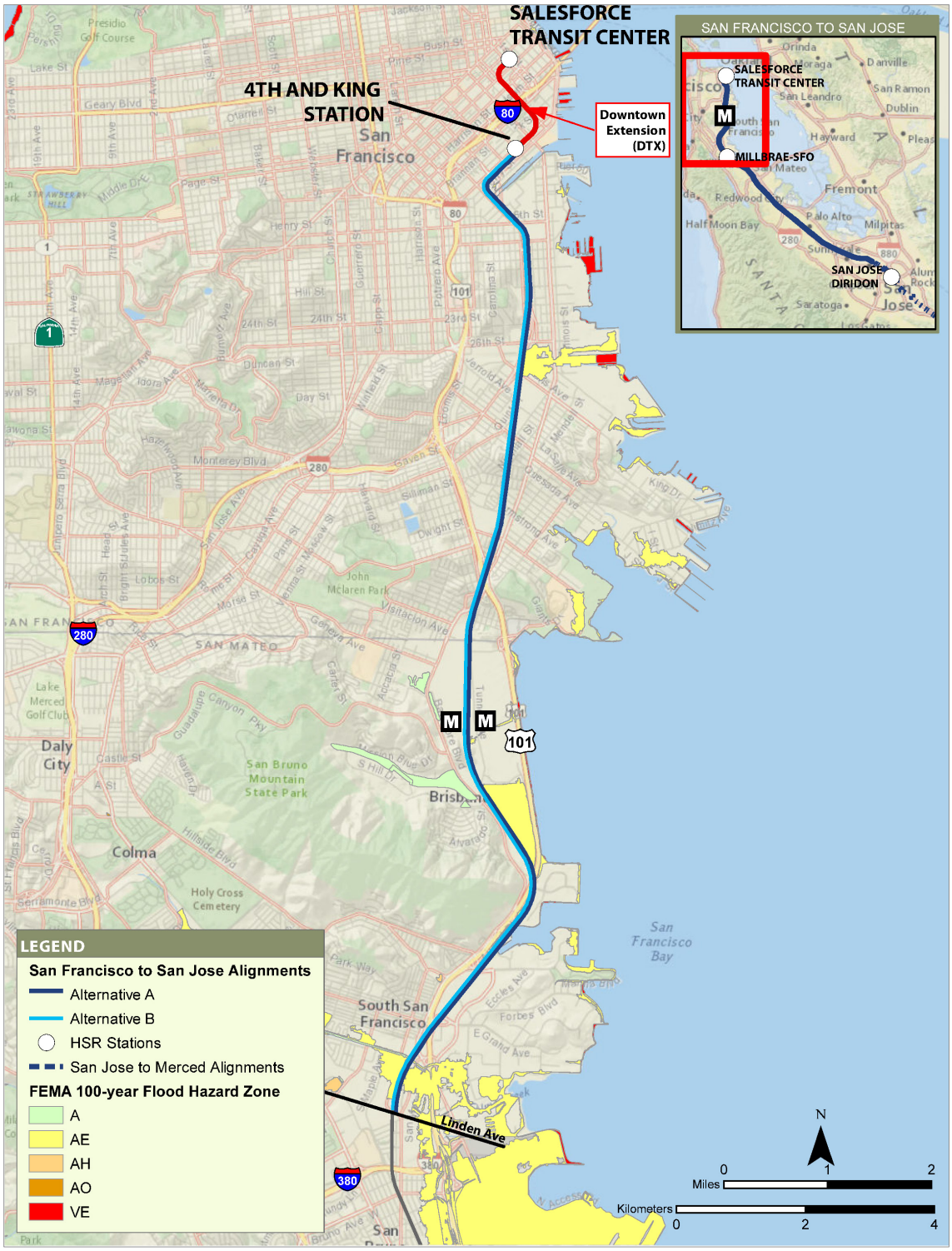
Figure 6-2 Parks, Recreation and Open-Space Resources (South)

Federal Emergency Management Agency Flood Hazard Zones

The study area for Alternative A intersects a total of 59.72 acres of FEMA 100-year flood hazard zones, while the study area for Alternative B intersects a total of 63.54 acres (FEMA 2015, 2019a, 2019b). As illustrated on Figure 6-3 through Figure 6-6 there are a number of locations in the study area that are subject to current risk of flooding in a 100-year flood event. These locations are distributed relatively evenly across the alignment.



Sources: FEMA 2015, 2019a, 2019b

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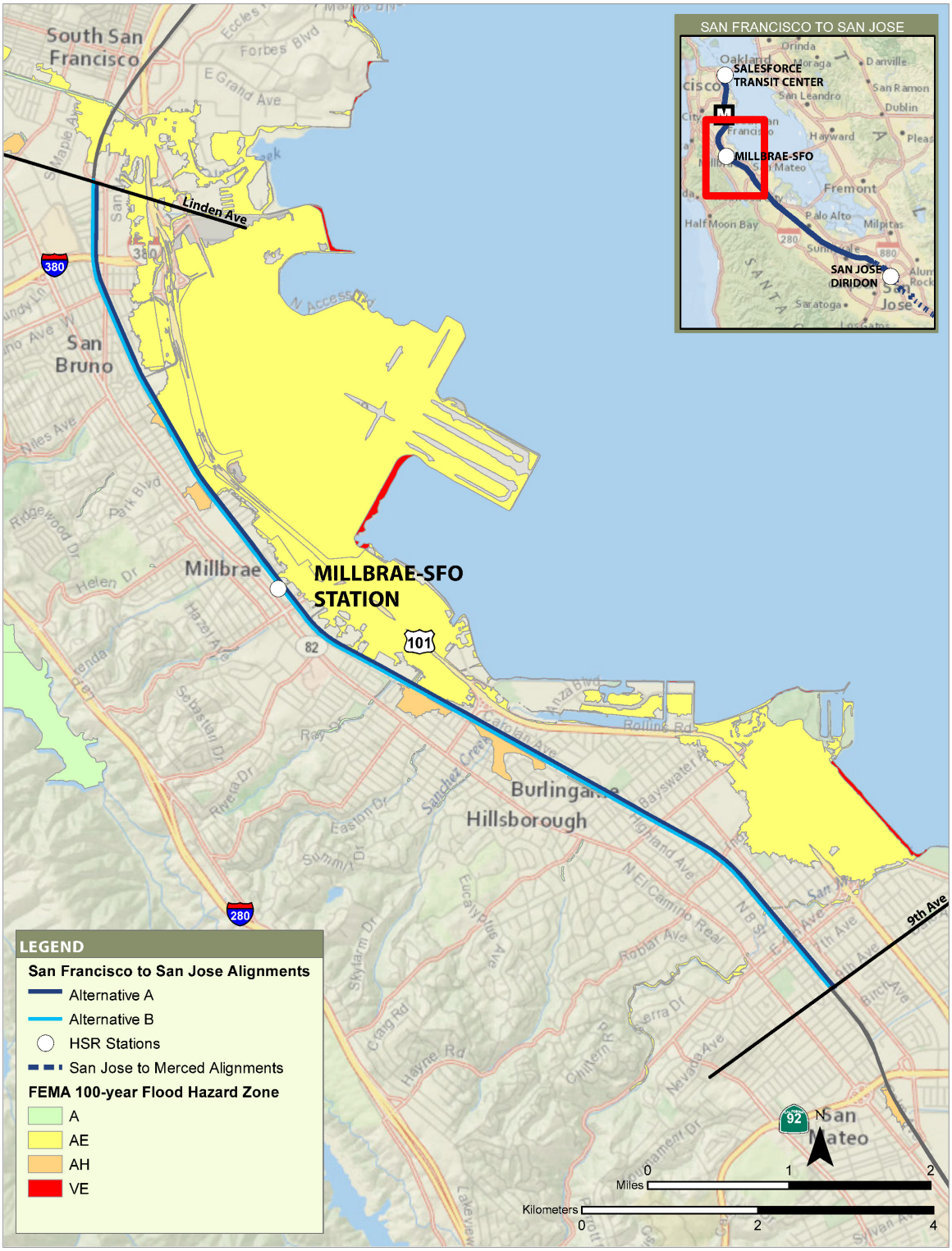
Figure 6-3 FEMA 100-Year Flood Hazard Zones—Part 1 of 4



Sources: FEMA 2015, 2019a, 2019b

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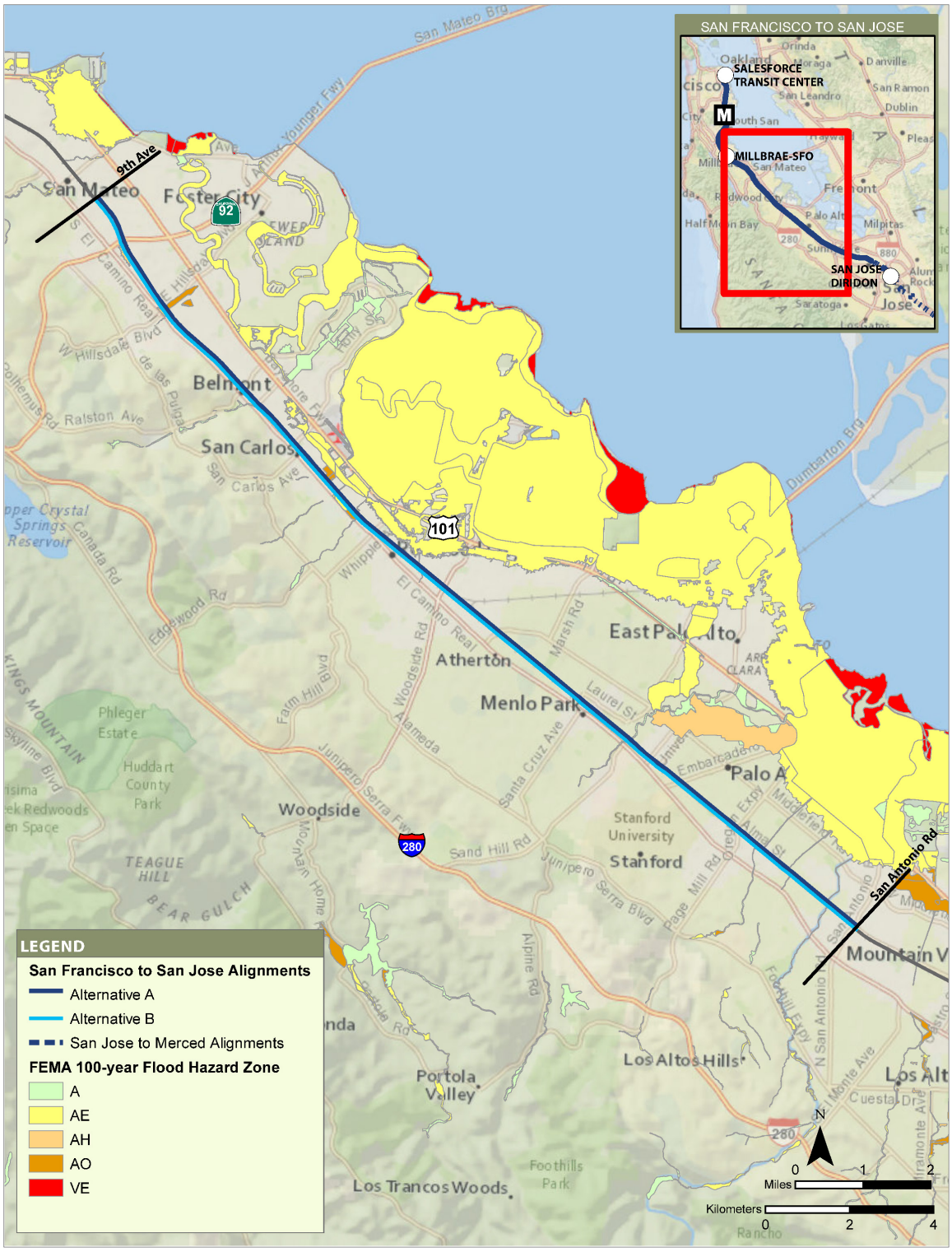
Figure 6-4 FEMA 100-Year Flood Hazard Zones—Part 2 of 4



Sources: FEMA 2015, 2019a, 2019b

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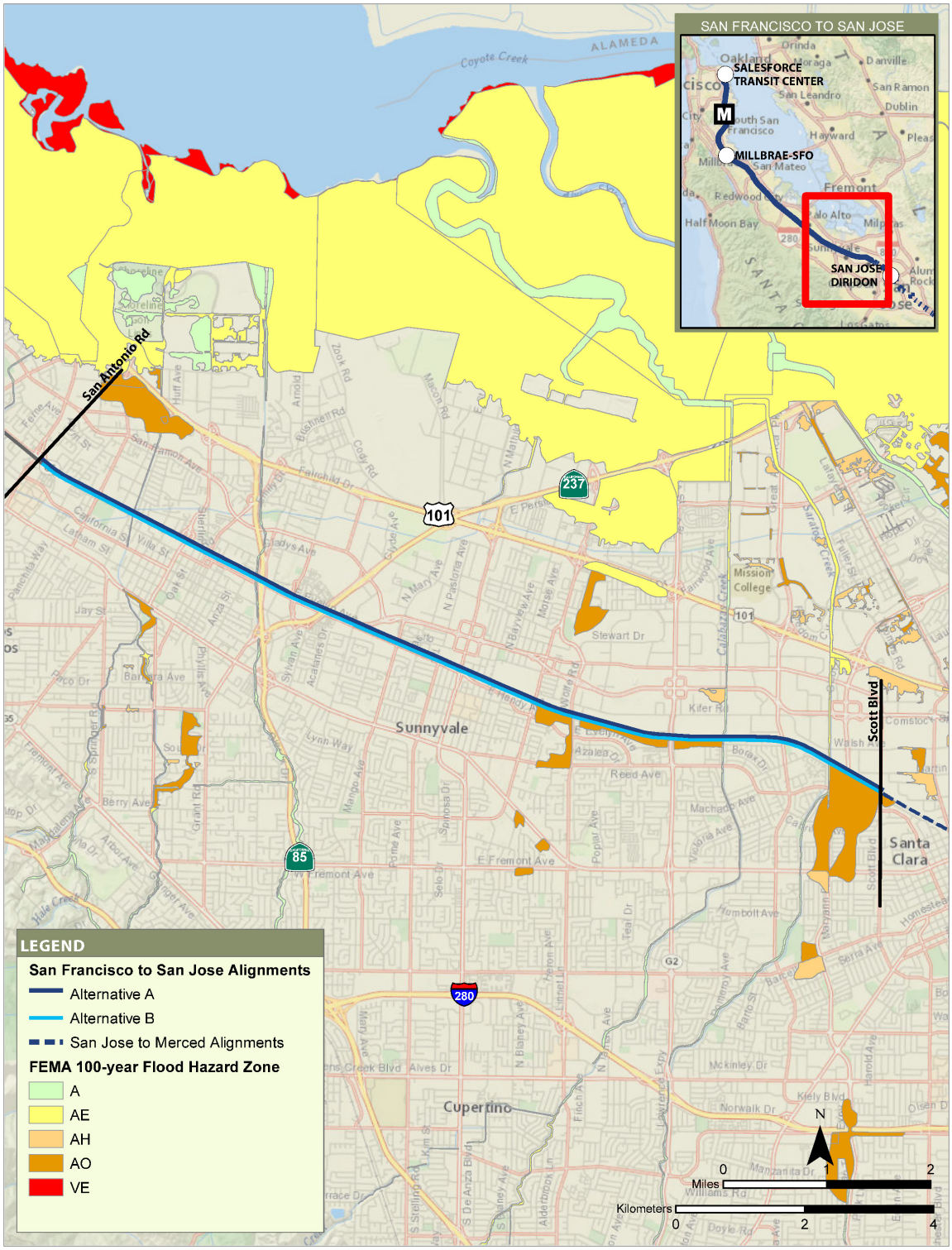
Figure 6-5 FEMA 100-Year Flood Hazard Zones—Part 3 of 4



Sources: FEMA 2015, 2019a, 2019b

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Figure 6-6 FEMA 100-Year Flood Hazard Zones—Part 4 of 4

San Francisco Bay and Shoreline Band (BCDC Jurisdictional Areas)

The study area intersects a total of 31.0 acres of land under BCDC jurisdiction. Of these 31.0 acres, approximately 26.3 acres are within BCDC's 100-foot Shoreline Band jurisdiction and 4.7 acres are within Bay(tidal) jurisdiction (located primarily along Visitacion Creek, Brisbane Lagoon, and at Guadalupe Valley Creek where it flows into Brisbane Lagoon). BCDC has jurisdiction over the San Francisco Bay and tidal waterways up to the mean high water mark in areas devoid of tidal marsh vegetation and 5 feet above mean sea level in areas where tidal marsh vegetation is present. Areas under BCDC jurisdiction in the study area are summarized in Tables 6-5 and 6-6 and are illustrated on Figure 6-7. No portion of the project crosses the open Bay itself or would require fill in the open Bay.

Table 6-5 BCDC Bay(Tidal) Jurisdiction in the Study Area

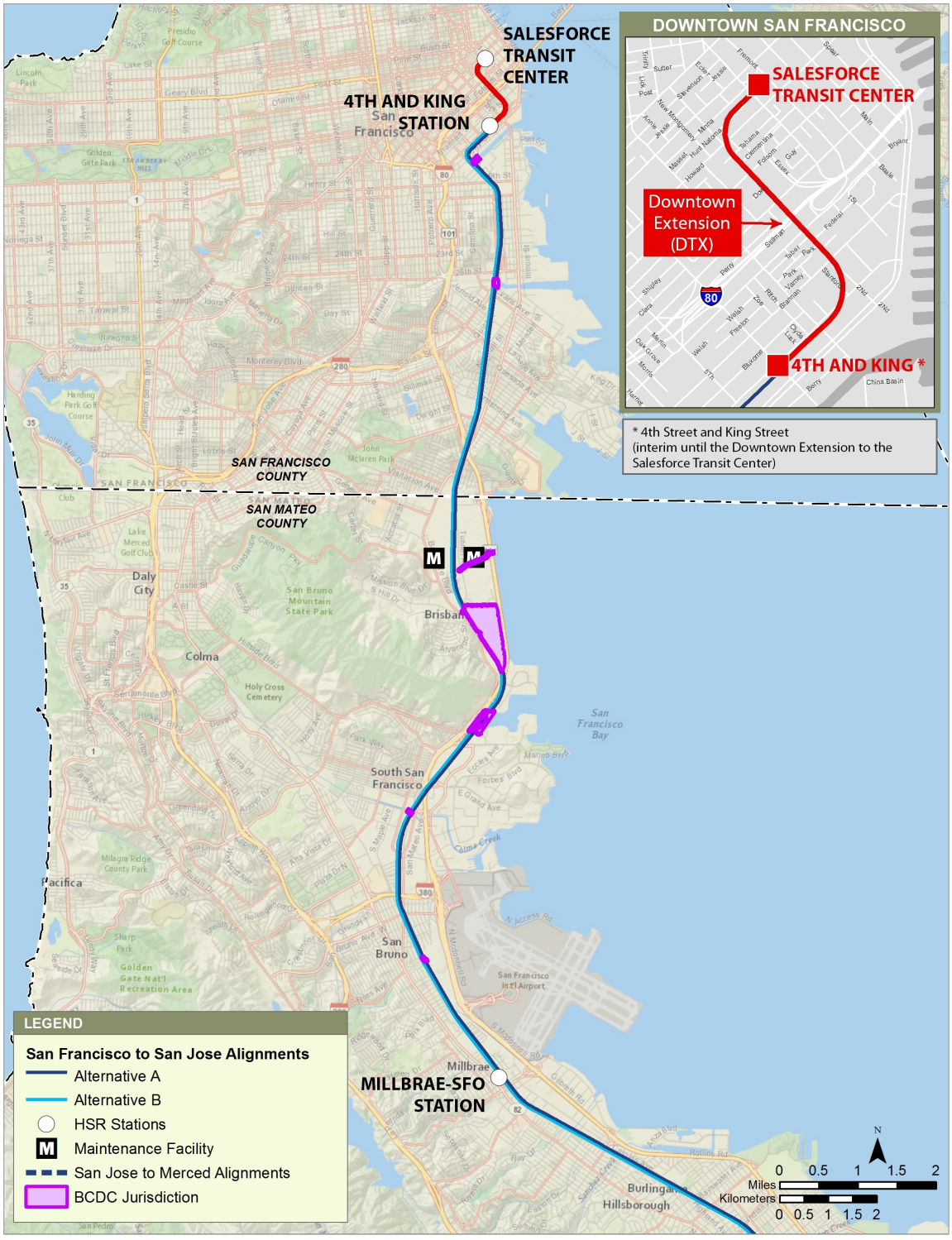
BCDC Resource	Estimated Jurisdictional Area (acres) Bay/Tidal Waterway
Mission Creek	0.0
Islais Creek	0.0
Visitacion Creek	0.7
Brisbane Lagoon and Guadalupe Valley Creek	3.8
Oyster Point Channel/San Francisco Bay and Unnamed Tidal Channel	0.1
Colma Creek	0.1
El Zanjon	0.0
Total	4.7

Source: Compiled by ICF 2018
BCDC = San Francisco Bay Conservation and Development Commission

Table 6-6 BCDC Shoreline Band Jurisdiction in the Study Area

BCDC Resource	Estimated Jurisdictional Area (acres) Shoreline Band
Mission Creek	0.2
Islais Creek	0.8
Visitacion Creek	6.4
Brisbane Lagoon and Guadalupe Valley Creek	17.0
Oyster Point Channel/San Francisco Bay and Unnamed Tidal Channel	0.9
Colma Creek	0.4
El Zanjon	0.6
Total	26.3

Source: Compiled by ICF 2018
BCDC = San Francisco Bay Conservation and Development Commission



Source: Compiled by ICF 2018

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Figure 6-7 BCDC Jurisdiction in the Study Area

6.1.2 Impacts of Project Alternatives on Other Environmental Resources

6.1.2.1 Land Uses

Construction of the Project Section would temporarily use land outside the permanent rights-of-way for construction staging, laydown, and fabrication areas. Construction also would require acquisition and permanent conversion of land that is not currently in transportation-related use. Additionally, operation of both the East Brisbane LMF associated with Alternative A and the West Brisbane LMF associated with Alternative B would affect plans for TOD in Brisbane. Construction of the East Brisbane LMF would affect plans for approximately 100 acres of nonresidential uses (e.g., open space, office space, and light industrial development) allowed in the recent amendment to the City of Brisbane General Plan. Construction of the West Brisbane LMF would affect plans for approximately 110 acres of residential and nonresidential uses (e.g., open space, residential development, and office space) allowed by the recent General Plan amendment. To help reduce this impact, the Authority and FRA would encourage context-sensitive designs by working with local governments to enhance the public benefits of HSR development to help meet the needs of the local communities, including housing and job opportunities. The East and West Brisbane LMF options would be compatible with the 25-acre Schlage Lock development, development of the Geneva Avenue BRT, relocation of the Bayshore Caltrain Station, and extension the MUNI T-Line extension to the relocated Caltrain Bayshore Station. Neither alternative was withdrawn from further analysis based on potential land use impacts.

6.1.2.2 Cultural Resources

Table 6-7 identifies the 21 known built resources that have the potential to be directly affected by each of the two project alternatives. Both alternatives affect the same resources.

Table 6-7 Impacts on Known Built Resources

Historic Name (NRHP Number)	Alternative A	Alternative B
San Francisco Fire Department Auxiliary Water Supply System	X	X
Central Waterfront Historic District	X	X
22nd Street overpass	X	X
23rd Street overpass	X	X
Airport Boulevard Underpass/South San Francisco Subway	X	X
Southern Pacific Depot/Millbrae Station (78000770)	X	X
Jules Francard Grove/Francard Tree Rows	X	X
Southern Pacific Depot/Burlingame Railroad Station (78000769)	X	X
East Poplar Avenue undercrossing	X	X
East Santa Inez Avenue underpass	X	X
Tilton Avenue underpass	X	X
Monte Diablo Avenue underpass	X	X
Retaining wall associated with Monte Diablo & Tilton Bridge	X	X
Southern Pacific Depot/San Carlos Station (84001191)	X	X
Southern Pacific Depot (Atherton Station)	X	X
Southern Pacific Depot/Menlo Park Station (74000556)	X	X
Southern Pacific Railroad San Francisquito Creek Bridge	X	X

Historic Name (NRHP Number)	Alternative A	Alternative B
El Palo Alto	X	X
Palo Alto Station	X	X
University Avenue underpass	X	X
Embarcadero underpass	X	X
Potentially affected known built historic resources	21	21

Sources: Authority 2018c; Authority and FRA 2016a
NRHP = National Register of Historic Places

All 19 archaeological resources identified in Table 6-3 have the potential to be directly affected by both alternatives based on this footprint-level analysis. Since both alternatives would affect the same archaeological resources and there are no differences between the impacts each alternative would have on built resources, neither of the alternatives was withdrawn from further analysis based on potential impacts on cultural resources.

6.1.2.3 Parks, Recreation, and Open-Space Resources

Alternatives A and B would directly affect six parks, recreation, and open-space resources, as shown in Table 6-8 and illustrated on Figures 6-1 and 6-2. The affected resources are the same for both alternatives. Many of these resources would only have a small portion of land acquired by the alternatives, typically at the boundary of the resource. As a result, the acreage that would be affected is relatively low at 0.72 acre for both alternatives. Because only small amounts of land would be acquired at most resources, and the land to be acquired would be at the periphery of the park land, the acquisition would not permanently change the activities, features, or attributes of the park.

Table 6-8 Impacts on Parks, Recreation, and Open-Space Resources

Parks, Recreation, and Open Space Resources	Alternative A	Alternative B
Bracher Park	X	X
Trinta Park	X	X
El Palo Alto Park	X	X
El Camino Park	X	X
Holbrook-Palmer Park	X	X
Brisbane Lagoon	X	X
Park/Recreational resources (number of resources/acres of impact)	6/0.72	6/0.72

Sources: Authority 2018c; Burlingame School District 2016; City and County of San Francisco 2010; City of Belmont 2012; City of Sunnyvale 2016; Millbrae School District n.d.; Palo Alto Unified School District 2016; Redwood City School District 2016; San Mateo-Foster City School District 2016; San Mateo Union High School District 2016; Santa Clara Unified School District 2016; Sequoia Union High School District 2016

6.1.2.4 Federal Emergency Management Agency Flood Hazard Zones

Alternative A would encroach on approximately 59.72 acres of 100-year flood hazard zones, and Alternative B would encroach on 63.54 acres, thereby affecting approximately 3.82 more acres within the flood hazard zone. Most of the additional floodplain impacts under Alternative B are associated with the Short Middle Four-Track Passing Track. Neither alternative was withdrawn from further analysis based on potential impacts on FEMA flood hazard zones.

6.1.2.5 San Francisco Bay and Shoreline Band (BCDC Jurisdictional Areas)

Alternative A would result in approximately 4.65 acres of Bay(tidal) impacts and 25.15 acres of Shoreline Band impacts within BCDC jurisdictional areas, whereas Alternative B would result in 4.02 acres of impacts to the Bay (tidal) and 19.84 acres of Shoreline Band impacts. The primary difference in impacts occurs in relation to Visitacion Creek, with some minor differences in Brisbane Lagoon/Guadalupe Valley Creek. Impacts within BCDC jurisdictional areas are summarized in Table 6-9 and Table 6-10. Neither alternative was withdrawn from further analysis based on potential impacts on BCDC jurisdictional areas.

Table 6-9 Impacts in BCDC Bay/Tidal Jurisdictional Areas

Jurisdictional Area	Alternative A	Alternative B
	Bay/Tidal Waterway	Bay/Tidal Waterway
Mission Creek	0.00	0.00
Islais Creek	0.01	0.01
Visitacion Creek	0.74	0.00
Brisbane Lagoon and Guadalupe Valley Creek	3.68	3.79
Oyster Point Channel/San Francisco Bay and Unnamed Tidal Channel	0.08	0.08
Colma Creek	0.14	0.14
El Zanjon	0.00	0.00
Total	4.65	4.02

Source: Compiled by ICF 2018

Table 6-10 Impacts in BCDC Shoreline Band Jurisdictional Areas

Jurisdictional Area	Alternative A	Alternative B
	Shoreline Band	Shoreline Band
Mission Creek	0.19	0.19
Islais Creek	0.76	0.76
Visitacion Creek	6.35	0.00
Brisbane Lagoon and Guadalupe Valley Creek	15.93	16.97
Oyster Point Channel/San Francisco Bay and Unnamed Tidal Channel	0.93	0.93
Colma Creek	0.41	0.41
El Zanjon	0.58	0.58
Total	25.15	19.84

Source: Compiled by ICF 2018

6.2 Community Resources

6.2.1 Scope of Analysis

6.2.1.1 Study Area

Low-Income and Minority Populations

The study area for low-income and minority populations is defined as the census tracts partially or fully within 0.5 mile of the project footprint. This study area is then compared to the broader reference community of San Francisco, San Mateo, and Santa Clara Counties.

Residential and Business Displacements

The study area for assessing residential and business displacements for the purpose of this analysis is the combined footprint for both alternatives. This is the area within which demolition of structures is anticipated to occur.

6.2.1.2 Methods

Low-Income and Minority Populations

A screening of potential environmental justice populations was conducted by obtaining income and demographic data from the 2010–2014 ACS 5-Year Estimates for the cities, counties, and census-designated places along the Project Section. The percent of low-income populations within the study area was determined based on the population below 200 percent of the federal poverty level, consistent with the thresholds set by the MTC. This threshold is used for the Bay Area due to the region's high costs of living. Low-income and minority data were mapped using GIS to determine the location and distribution of low-income and minority populations in relation to the alternatives and in the context of the broader region.

Residential and Business Displacements

Affected properties were identified by reviewing aerial imagery in relation to the project footprints of the two alternatives. If any portion of a residential or commercial/industrial building was located partially or fully within the project footprint, it was considered a full acquisition and the building was determined to be displaced for this analysis. It was assumed that any buildings within the temporary impact area would be avoided during construction.

6.2.1.3 Existing Conditions

Low-Income and Minority Populations

The Project Section extends across three counties and a number of local jurisdictions (from north to south) in San Francisco, San Mateo, and Santa Clara Counties. Cities and communities transected by the alternatives include (from north to south): San Francisco, South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Belmont, San Carlos, Redwood City, North Fair Oaks, Atherton, Menlo Park, Palo Alto, Mountain View, Sunnyvale, and Santa Clara.

Low-income and minority characteristics for the reference community comprised of San Francisco, San Mateo, and Santa Clara Counties, and the low-income and minority study area (defined as census tracts within 0.5 mile of the project footprint) are presented in Table 6-11. The low-income and minority populations within the study area (24.4 percent and 59.6 percent of the population, respectively) are relatively comparable to that of the reference community as a whole (23.9 percent and 62.6 percent of the population). The highest rates of low-income and minority populations within the study area occur in San Francisco County (within the Bayview community), South San Francisco, and the community of North Fair Oaks. Low-income populations in the study area are illustrated on Figure 6-8.

Table 6-11 Low-Income and Minority Characteristics (2014 Estimates)

Geographic Area	Total Area			Study Area		
	Population	Low Income (%)[1]	Minority (%)	Population	Low Income (%)	Minority (%)
San Francisco County	829,072	28.3	58.6	104,369	31.5	73.7
San Mateo County	739,837	20.4	58.8	289,848	23.1	55.0
Santa Clara County	1,841,569	23.3	65.9	254,890	22.9	59.0
Region	3,410,478	23.9	62.6	649,107	24.4	59.6

Sources: U.S. Census Bureau ACS 2010–2014a, 2010–2014b, 2010–2014c
[1] Percent low income within the Project Section has been determined based on the population below 200% of the federal poverty level, consistent with the thresholds set by the MTC.

Table 6-12 presents the racial and ethnic composition of the study area, which are also displayed on Figure 6-9 and Figure 6-10. There is substantial variation in the racial and ethnic composition of the population within the study area. The study area as a whole has large Hispanic and Asian populations, which comprise 25 percent and 26.6 of the population, respectively.

Table 6-12 Minority Group Representation within the Study Area (2014 Estimates)

Study Area	Percent Population (%)				
	Hispanic	Non Hispanic Asian	Non Hispanic Black	Non Hispanic Other	Total Minority
Study Area Within San Francisco County	17.3	39.5	13.6	3.3	73.7
Study Area Within San Mateo County	30.3	18.9	1.9	3.9	55.0
Study Area Within Santa Clara County	22.1	30.2	2.9	3.8	59.0
Study Area	25.0	26.6	4.2	3.8	59.6

Source: U.S. Census Bureau ACS 2010–2014c

Sources: U.S. Census Bureau ACS 2010–2014a; U.S. Census Bureau 2015

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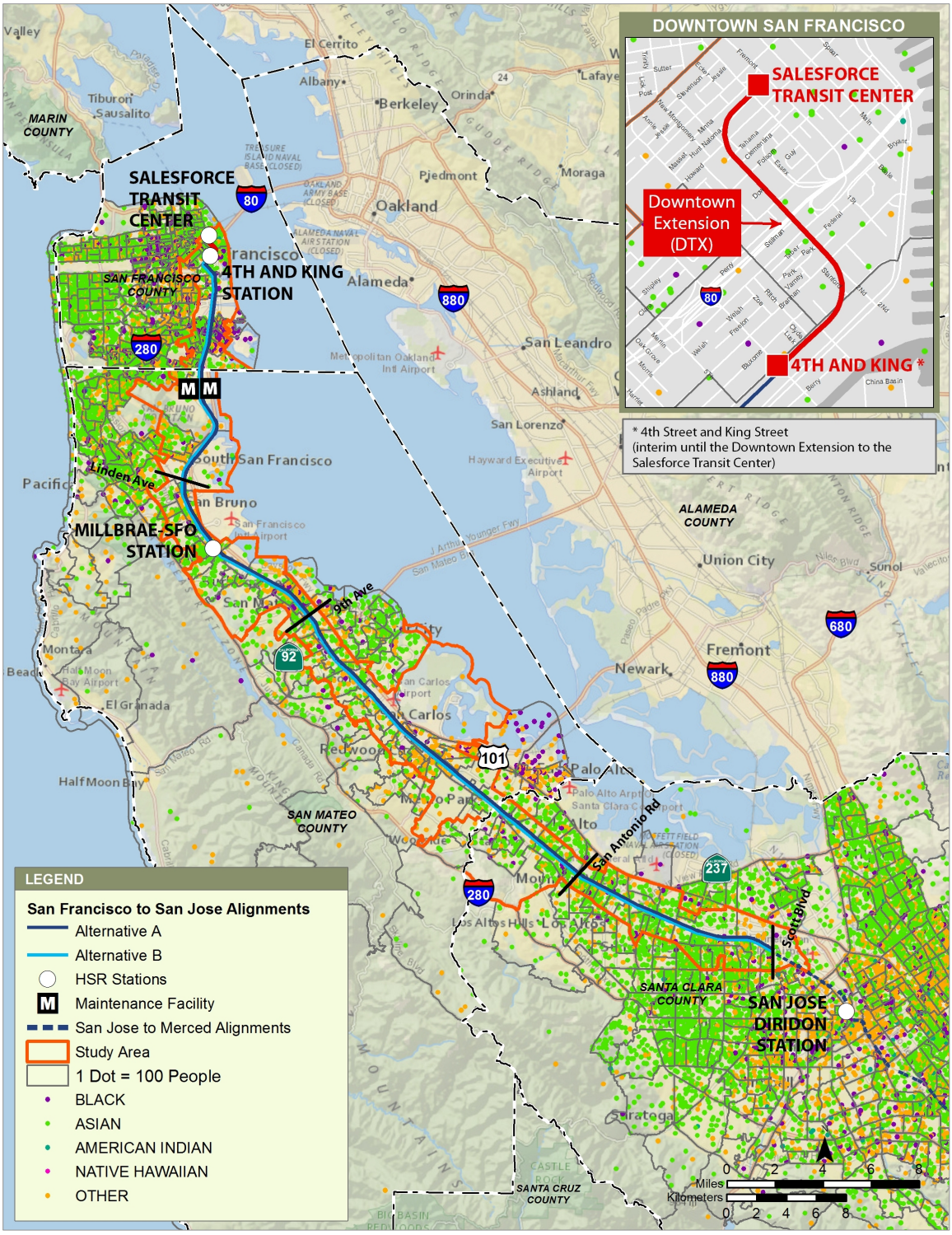
Figure 6-8 Low-Income Populations



Sources: U.S. Census Bureau ACS 2010–2014b; U.S. Census Bureau 2015

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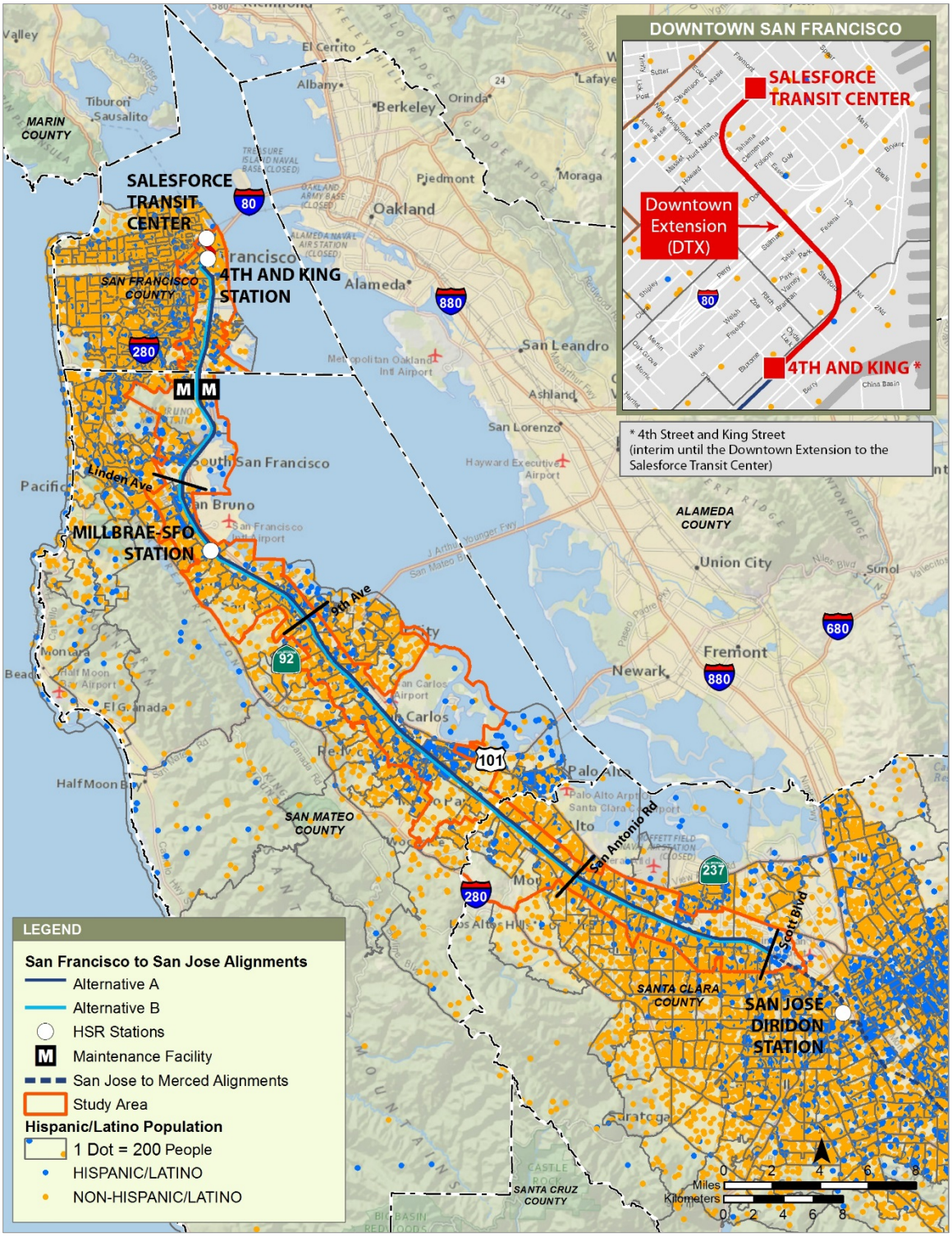
Figure 6-9 Racial Minority Populations



Sources: U.S. Census Bureau ACS 2010–2014b; U.S. Census Bureau 2015

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Figure 6-10 Hispanic and Non-Hispanic Populations

Residential and Business Displacements

The Project Section is located in a dense urban corridor, that extends through a number of cities and communities—San Francisco, South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Belmont, San Carlos, Redwood City, North Fair Oaks, Atherton, Menlo Park, Palo Alto, Mountain View, Sunnyvale, and Santa Clara. As shown in Table 6-1, existing land uses adjacent to the corridor consist of predominantly residential and commercial uses. These land uses are representative of the land uses that would be acquired, and facilities that would be displaced, by construction of the project alternatives in areas where the project's right-of-way would extend beyond the existing Caltrain right-of-way.

6.2.2 Impacts of Project Alternatives on Other Community Resources

6.2.2.1 Low-Income and Minority Populations

Based on this preliminary analysis of the presence and proximity of low-income and minority populations along the Project Section, the potential for substantial adverse effects on low-income and minority populations would be low. Construction and operations of the project have the potential to result in some temporary and permanent adverse effects on minority and low-income populations associated with traffic congestion, noise and vibration, and aesthetics and visual changes. However, no residential displacements were identified within communities with high percentages of minority and low-income populations, and no community facilities that serve environmental justice populations would be directly affected by the project.

Long-term beneficial effects associated with HSR would also accrue to low-income and minority populations, including improved regional mobility, improved traffic conditions on freeways as people increasingly use HSR, improved safety of intersections due to improvements at the at-grade intersections, and declines in regional air quality emissions. Due to the similarities between the alternatives, the alternatives are expected to have comparable impacts on low-income and minority populations. Neither alternative was withdrawn from further analysis based on potential impacts on these populations.

6.2.2.2 Residential and Business Displacements

The project alternatives would travel through extremely urbanized areas. Although the alternatives remain within the existing Caltrain right-of-way for most of their alignments, each alternative would require the acquisition of some additional right-of-way in areas where the existing Caltrain right-of-way is narrow. Table 6-13 presents a summary of residential units and businesses that are anticipated to be fully displaced by the two alternatives.

Table 6-13 Summary of Displacements

Displacements	Alternative A	Alternative B
Residential displacements (units)	15	34
Business displacement (affected parcels/square feet of impacts)	34/251,000	117/530,000

Source: Authority 2018c

As shown in Table 6-11, Alternative A has the potential to require the displacement of 15 residential units (single-family and multifamily units), while Alternative B has the potential to displace 34 residential units. The 19 additional residential displacements associated with Alternative B are predominantly associated with the Short Middle Four-Track Passing Track north of the San Carlos Station.

Business displacements would occur under both Alternative A and Alternative B. The types of businesses affected include office space, coffee shops, gas stations, automobile shops, a lumber yard, parking areas, and industrial sites. Alternative A has the potential to displace 34 commercial or industrial properties, with a building square footage of approximately 251,000. Alternative B has the potential to displace 117 commercial or industrial business properties, with a building

square footage of approximately 530,000. The additional business displacements under Alternative B result from the Short Middle Four-Track Passing Track and are primarily concentrated in Belmont. Neither alternative was withdrawn from further analysis based on potential displacement impacts on residences or businesses.

7 SECTION 4(f)

Projects undertaken by an operating administration of the U.S. Department of Transportation (USDOT) or that may receive federal funding or discretionary approvals from such an operating administration of USDOT must demonstrate compliance with Section 4(f). Section 4(f) protects publicly owned land of parks, recreational areas, and wildlife refuges. Section 4(f) also protects historic sites of national, state, or local significance located on public or private land. The FRA's Procedures for Considering Environmental Impacts (64 C.F.R. Part 25445) contains FRA processes and protocols for analyzing the potential use of Section 4(f) resources. In addition, although not subject to the 23 C.F.R. Part 774 regulations regarding Section 4(f) for highways and transit projects, the FRA uses these regulations as additional guidance when applying the requirements established in Section 4(f).

FRA may not approve the use of a Section 4(f) property, as described in 49 United States Code (U.S.C.) Section 303(c), unless it determines that there is no feasible and prudent alternative to avoid the use of the property and the action includes all possible planning to minimize harm resulting from such use, or the project has a *de minimis* impact consistent with the requirements of 49 U.S.C. Section 303(d).

If FRA determines there is both the use of a Section 4(f) property and that there is no prudent and feasible alternative to the use of a Section 4(f) resource, FRA must include in the project all possible planning (including concurrence of the property owner for any affected historic resources) to minimize harm to the property, which includes all reasonable measures to minimize harm or mitigate impacts (49 U.S.C. § 303(c)(2)).

After making a Section 4(f) determination and identifying the reasonable measures to minimize harm, if there is more than one alternative that results in the use of a Section 4(f) property, FRA must also compare the alternatives to determine which alternative has the potential to cause the least overall harm in light of the preservationist purpose of the statute.

7.1 Scope of Analysis

7.1.1 Study Area

For the purposes of this analysis, the study area is limited to the project footprint of each alternative, as described in Section 3.2. Because the footprint represents all permanent and temporary right-of-way required for the Project Section, the parks, recreation, and open-space resources and cultural resource information presented in this section represents an estimate of the relative effect of each alternative on features regulated under Section 4(f). Not every resource that is identified would be affected.

7.1.2 Methods

Analysts identified the Section 4(f) resources by conducting an inventory of all public parks, recreation areas, NRHP-listed or potentially eligible historic properties, and wildlife/waterfowl refuges in the study area. A park or recreational area qualifies for protection under Section 4(f) if it: (1) is publicly owned at the time at which the "use" occurs, (2) is open to the general public, (3) is being used for recreation, and (4) is considered significant by the authority with jurisdiction. School playfields can be considered a Section 4(f) resource if a joint use agreement for public recreation use of the school grounds/recreation facilities exists, or recreation facilities are available for public use. Analysts conducted background research to identify the historic properties listed or eligible for listing in the NRHP that qualify as Section 4(f) resources.

7.1.3 Existing Conditions

Table 6-2 and Table 6-3 present the built environment and archaeological resources in the study area that could be Section 4(f) resources if found to be NRHP-listed or potentially eligible historic properties. Table 6-4 identifies the parks, recreation, or open-space Section 4(f) resources that are directly affected by Alternatives A and B. These Section 4(f) resources could incur a use.

7.2 Impacts of Project Alternatives on Section 4(f) Resources

Alternatives A and B would directly affect six parks, recreation, and open-space Section 4(f) resources, as shown in Table 6-7. The affected resources are the same between alternatives. Many of these Section 4(f) resources would only have a small portion of land acquired by the alternatives, typically at the boundary of the resource. As a result, the acreage that would be affected is relatively low at 0.72 acre for both alternatives. Because only small amounts of land would be acquired at most Section 4(f) resources, and the land to be acquired would be at the periphery of the park site, the acquisition would not permanently change the protected activities, features, or attributes of the park. Therefore, the Authority anticipates that FRA will determine that these alternatives result in *de minimis* uses.

All three archaeological sites recommended as eligible for the NRHP would be affected by both alternatives. The Authority has preliminarily determined that each of the three NRHP-eligible or likely eligible sites is valuable for what can be learned through data recovery, with minimal value for preservation in place. Therefore, according to 23 C.F.R. Section 774.13(b), the Authority anticipates that these sites would be exempt from Section 4(f) approval as determined in consultation with the State Historic Preservation Officer (SHPO). Any NRHP-eligible built environment resource would be considered a Section 4(f) resource. Impacts would be similar between the alternatives and mitigation for potential impacts will be discussed with SHPO to minimize and avoid impacts.

If FRA does not make findings of *de minimis* impact for use of a Section 4(f) property, the Authority and FRA will then prepare a full Section 4(f) evaluation for that proposed use. The Section 4(f) evaluation would consider whether there is any prudent and feasible alternative to the use of a Section 4(f) resource, and whether the project includes all possible planning to minimize harm to the property, which includes all reasonable measures to minimize harm or mitigate impacts. After making a Section 4(f) determination and identifying the reasonable measures to minimize harm, the FRA would compare the alternatives to determine which alternative has the potential to cause the least overall harm in light of the preservationist purpose of the statute.

8 FACILITIES REGULATED UNDER SECTION 14 OF THE RIVERS AND HARBORS ACT

Section 14 of the Rivers and Harbors Act of 1899 and codified in 33 U.S.C. Section 408 (commonly referred to as "Section 408") authorizes the USACE to grant permission for the alteration, occupation, or use of a USACE civil works project (also known as Section 408 facilities) if it is determined that the activity will not be injurious to the public interest and will not impair the usefulness of the project.

In determining if a Section 408 facility occurs in the study area, USACE's National Levee Database Interactive Map was reviewed. Specifically, areas protected by levees and the locations of levees in the database were reviewed to identify potential conflicts with either alternative. In addition, local flood control agencies along the project corridor including the San Francisco Public Utilities Commission, San Mateo County Flood Control District, and Santa Clara Valley Water District were consulted to confirm the presence or absence of Section 408 facilities.

Following review of available mapping and consultation with the USACE, it was determined that a retaining wall at the Caltrain bridge over San Francisquito Creek is regulated under Section 14 of the Rivers and Harbors Act. The Authority's current design would not require alteration of the bridge or retaining wall. Therefore, neither alternative has the potential to alter any Section 408 facilities.

9 PRACTICABILITY

This Checkpoint B Summary Report analyzes the potential practicability of the alternatives carried forward for analysis at a general level of detail to check for apparent practicability issues based on the current level of design and environmental data available at this time. The Checkpoint C Summary Report will include a more detailed assessment of the practicability of each alternative.

The 404(b)(1) Guidelines state that an alternative is *practicable* "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purposes" (40 C.F.R. § 230.10(a)(2)). This report presents an initial review of the alternatives so only potentially practicable alternatives are carried forward.

Alternative A and Alternative B are potentially practicable from a technical standpoint. While there are differences between the alternatives in terms of capital costs and logistical and operational considerations, both alternatives are potentially practicable based on currently available information.

10 PUBLIC OUTREACH AND COMMUNITY INPUT

This chapter summarizes stakeholder, public, and community concerns identified during scoping that are relevant to the selection of alternatives and design within this corridor. The chapter also includes a brief summary of previous environmental review, planning efforts, legislation that resulted in the selection of this corridor, and the requirement for blended service,[27] followed by a summary of scoping comments.

10.1 Summary of Previous Environmental Review and Planning

The Authority developed the concept of shared use of the Caltrain right-of-way between San Francisco and San Jose. The Authority and Caltrain entered into a cooperative agreement in 2004 to evaluate shared use of the rail corridor at the program level of environmental review.[28] Following approval of Prop 1A in 2008, the agencies entered into another agreement to continue to work in partnership identifying design alternatives supporting HSR and modernized Caltrain service. As described in Section 3.1, the Authority and FRA began a Tier 2 environmental review process in 2009 for the Project Section evaluating shared use of a fully grade-separated four-track system. Based on community concerns, work was suspended on the San Francisco to San Jose Project Section EIR/EIS in mid-2011. In November 2011, the Authority reinitiated work on a predominantly two-track blended system. Comments received on environmental review and planning efforts prior to the selection of the blended system are not included in this document because the project was fundamentally different from the current range of alternatives.

10.2 Reinitiated Public Scoping (May 2016–July 2016)

On May 9, 2016, the FRA and the Authority distributed an NOP and NOI, and reinitiated scoping for the San Francisco to San Jose Project Section EIR/EIS. The Authority filed the NOP with the State Clearinghouse and FRA published the NOI in the *Federal Register*. The 2016 NOP/NOI rescinded the 2009 NOP and 2008 NOI and presented the blended system for the Project Section, which implements the strategy identified by the Authority's 2012 Business Plan and subsequent 2014, 2016, and 2018 business plans.

The scoping period ran between May 9, 2016, and July 20, 2016. Outreach included scoping meetings in late May 2016 in San Francisco, San Mateo, and Mountain View. Approximately 153 people attended the three scoping meetings and the Authority collected 45 verbal or written comments at these meetings. Outreach activities also included approximately 30 meetings with business and community groups, early agency coordination, and elected official briefings.

10.2.1 Specific Issues Identified in Public Participation in 2016

The following summary describes comments relevant to the selection of alternatives and design choices within the section.

Grade Separations: Individuals and agencies requested that the EIR/EIS evaluate the potential environmental, financial, and community impacts of a full range of grade-separation alternatives and their impacts on congestion, multimodal transportation, and safety. Several commenters asked for information on the sequencing, costs, and timeline of grade-separation alternatives. Other comments requested that the cost for cities to develop automobile, bike, and pedestrian crossings be compared to the cost of including grade separations in the project. Specifically, commenters expressed concern regarding traffic effects due to increased gate down time at the at-grade crossings and related effects such as air quality, noise, and emergency response times. The potential for neighborhood isolation because of the impeded surface traffic flow also was a concern.

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[27] A more detailed description of the project history is provided in Section 3.1, Background.

[28] Two program-level environmental documents were prepared: the Statewide Program EIR/EIS (Authority and FRA 2005) and the Bay Area to Central Valley Program EIR/EIS (Authority and FRA 2008) that evaluated the impacts of proposed HSR corridors and selected the HSR sections comprising the California statewide system.

Commenters requested the Authority and FRA study the effect of not proceeding with grade separations and also describe the relationship between grade separations and train frequencies. Commenters further requested that the Authority have a long-term plan for all grade separations to manage and mitigate traffic, safety, and noise issues. Commenters also expressed an interest in constructing grade separations as a priority either before or concurrent with the HSR project as opposed to a phased approach over time. Commenters raised concerns regarding the construction of the project relative to Caltrain PCEP, as project components such as passing tracks, grade separations and curve straightening may affect components of the electrification project. Some commenters suggested the use of higher grades (up to 2 percent) and lower clearances (freight) for grade separations to allow more flexibility in their design and construction. Commenters also requested that the Authority consider alternative access points to US 101 around high-traffic crossings. Commenters suggested that the Authority consider grade-separation options that maximize derailment prevention.

Tunneling and trenching: Commenters suggested that the Authority could minimize traffic flow and the number of parcels required by tunneling or trenching the tracks below the ground, and requested that the EIR/EIS study benefits of trenching as compared to aboveground grade-separated crossings.

Aesthetic impacts: Commenters requested the Authority mitigate the adverse aesthetic effects of raised berm grade separations by creating iconic features within the urban cityscape or blending well with the existing urban design.

Gates at at-grade crossings: Commenters requested a discussion of the benefits of four-quadrant gates as compared to the existing gate systems for crossings that would remain at grade, and the effects on safety for automobiles, bicycles and pedestrians compared to the existing gates at the existing crossings.

Storage and maintenance facilities: Several commenters asked that the EIR/EIS consider alternative locations for track alignments, the LMF, and stations. They requested that the EIR/EIS consider opportunities for shared train storage and maintenance facilities as part of the project alternatives with other transit operators (Altamont Corridor Express, VTA, BART), and identify train storage and maintenance solutions that would make the best use of limited track space, use land around stations efficiently, and minimize impacts on communities and public funds.

Commenters suggested the Authority consider the following factors in selecting the location of the LMF: consistency with municipal goals and priorities, consistency with state and regional policies (e.g., Plan Bay Area); consistency with planned BRT service; minimizing effects on active farm production; compatibility with desired mixed-use development and affordable housing; and effect on zero waste goals.

Train route alignment: Several commenters requested that the EIR/EIS consider routes that would terminate service outside of San Francisco (such as at the San Jose Diridon Station) to minimize environmental and community impacts of construction and to take advantage of other regional transportation connections, such as Caltrain. Other comments supported the convenience of a no-transfer trip that would terminate in San Francisco.

Alternative corridors: Some commenters requested consideration of other corridors, such as along US 101; within the US 101 median; east of US 101 in the Baylands; in the East Bay to Oakland and Sacramento; or the Altamont Corridor instead of on the San Francisco Peninsula in the Caltrain corridor. Within the proposed corridor, commenters requested consideration of alternatives that would eliminate or minimize the need to acquire right-of-way and condemn residences. Commenters suggested consideration of a hybrid or stacked Caltrain/HSR option to reduce the footprint and right-of-way requirements. Still others suggested tunneling or cut-and-cover construction to minimize impacts on the right-of-way.

Displacements and community impacts: Commenters suggested that the Authority select train route alignments that would minimize displacements and effects on communities, reduce traffic, provide opportunities for increased existing and future rail connectivity, and that include stations at urbanized downtown areas.

Stations: Commenters expressed a range of recommendations for station amenities and design to improve the boarding process, safety, and transfer times, including passenger walkways, level boarding, platform width, and visual and auditory warnings for trains. These recommendations included consideration of common level boarding at all HSR and Caltrain stations to improve the boarding process, and including passenger walkways between main terminals to speed up transfer times. Commenters requested that the EIR/EIS evaluate station improvement options and infrastructure related to those improvements. A variety of commenters suggested the importance of preserving and reusing existing buildings as new stations and the need to better analyze and mitigate maintenance facility effects. The Authority was asked to consider opportunities for increased future rail connectivity and expansion when determining station footprints.

Commenters requested definition of amenities needed for HSR for the joint station locations and the effects of grade separation. Commenters suggested that each station have a center bypass high-speed track, so that local trains can stop and the high-speed train pass by on a center track, allowing the HSR to maintain speed and improve safety at the commuter stations. Any station plans should consider existing plans developed by local municipalities, in particular planning at existing stations, and develop a parking resources management plan at each station. Several commenters requested that the EIR/EIS consider a mid-Peninsula Station (such as Palo Alto) to serve the communities between the proposed San Jose Diridon and Millbrae Stations.

Station design: Numerous commenters requested that the EIR/EIS analyze impacts on Caltrain stations that are not also HSR stations. Commenters suggested that the Authority should consider modifying remaining stations, such as South San Francisco, Broadway, Atherton, that have at-grade center platforms that are still subject to the hold-out rule (no trains may move through the station while another train is stopped). The Authority was also asked to study opportunities to use the existing third track at stations to reduce station modifications. Comments suggested having four tracks at all the Caltrain commuter stations to allow HSR to bypass Caltrain at these stations. Other commenters suggested that the Authority integrate in the planning process opportunities for expansion, such as building four tracks.

Commenters expressed concerns regarding traffic, parking, transit, and pedestrian and bicycle access to stations. Commenters suggested creating a station access policy that prioritizes space-efficient and sustainable modes of travel including multimodal access to stations, in particular bicycle and pedestrian access to stations; identifying parking needs for all transportation operators at stations; providing walkways between main stations, and including current and projected use of transportation networking companies (e.g., Lyft, Uber, future services). Commenters also requested that the Authority consider the constraints on visual and functional improvements such as parking, pedestrian, and bicycle access associated with limitations in the Authority's 2016 business plan's funding.

Traffic and transportation: Many commenters discussed the effects of HSR on congestion and multimodal transportation. Commenters expressed concern regarding maintenance of bicycle and pedestrian access at stations and effects on roadway congestion if access is not maintained. Commenters are concerned with congestion during peak traffic, peak train crossings, and times when schools are in session and their associated safety implications. Other common concerns included parking needs and the need to analyze and mitigate the effects on traffic congestion. Commenters suggested the EIR/EIS should describe HSR effects on increased parking needs, freight trains, commuter services, and expressways. Commenters also requested that the EIR/EIS evaluate construction effects on traffic and the effects of the blended system on VMT. Additionally, commenters were concerned about effects from the increased congestion on Caltrain stations and the effects on Caltrain schedule quality, travel time, and reliability.

Mitigation of the effects of the project: Commenters indicated that tunneling or trenching tracks below ground, considering alternative access points around high-traffic crossings, grade-separation studies, and utilizing and updating ridership data could reduce traffic impacts and increase multimodal mobility. Recommended mitigation projects included bicycle and pedestrian improvements, including upgrades between local destinations (e.g., schools, parks) through a

bicycle and pedestrian facilities improvement program. Commenters further suggested consulting the *San Mateo County Transportation Authority Grade Separation Program Footprint Study* and the preliminary *Comprehensive County Expressway Planning Study-2040* (County of Santa Clara 2009) project list for mitigation measures for significant effects on expressways.

10.2.2 Specific Issues Identified by Municipalities

This section summarizes comments submitted by local municipalities that are relevant to the selection of alternatives. These concerns were expressed at a variety of Community Working Group, City/County Staff Coordination Group, Local Policy Maker Group, Stakeholder, and federal, state and local agency coordination meetings and through written correspondence in the form of comment cards, letters, and emails. Not every municipality responded, or submitted comments regarding all alternatives.

The City and County of San Francisco: The City and County of San Francisco requested that HSR construct a grade-separated crossing at 16th Street adjacent to Seventh Street. 16th Street is a major arterial for a 2-mile stretch along the existing tracks that connects the rapidly developing dense urban districts of Mission Bay (including the new University of California, San Francisco campus and Children's Hospital) and the Central Waterfront on the eastern waterfront, to the existing dense neighborhoods to the west. Mission Bay Drive, north of 16th Street, also crosses the Caltrain tracks at grade. The City/County requested that the EIR/EIS address the full range of impacts (auto, transit operations, bicycle, pedestrian, urban design, and land use) of the at-grade crossings and work with the City/County to prepare alternative designs that minimize community and transportation impacts.

The City/County is concerned that siting the potential LMF at the Brisbane/San Francisco border may conflict with existing, approved, and potential future land uses in this area, in particular compatibility with desirable mixed-use development. Commenters suggested the Authority study the impacts on the adjacent Caltrain Bayshore Station operations associated with the LMF. Commenters also requested that the Authority analyze impacts on planned BRT service connecting Geneva Avenue and the Candlestick development.

Brisbane Baylands: The proposed Baylands project developer expressed concerns about the HSR project's conflict with the proposed Baylands project, a TOD with new housing units at the Brisbane LMF site. The developer asked that alternative sites for the LMF be assessed. In addition, they requested that the project minimize impacts on the planned street network and planned infrastructure, in particular the Geneva Avenue overcrossing; minimize impacts on planned smaller residential blocks and larger employment development blocks; provide buffers and open space around the LMF to minimize impacts on open space; avoid compromising access to the Bayshore Station; avoid the development under construction north of Bayshore Station; and avoid impacts on the Visitacion Valley project. In particular, commenters asked the Authority evaluate reductions in the footprint of the LMF project by assessing curvature of tracks and possibilities for minimizing the footprint.

The City of Brisbane: The City requested that the Authority evaluate alternative LMF locations other than the proposed Brisbane Baylands site. In particular, the City is concerned that the LMF would affect future land uses at the site, as well as current revenue-producing operations. Fencing the HSR tracks would limit direct overland access from Brisbane to the San Francisco Bay. Accordingly, the City suggested that both community and biological impacts should be addressed in the EIR/EIS. They also requested consideration of opportunities for shared train storage and LMF, such as with the Altamont Corridor Express, VTA, and BART.

The City of South San Francisco: The City of South San Francisco requested that the project analyze the need for grade separations with the projected increase of train traffic with the blended Caltrain and HSR system. The City noted potential for impacts on automobile traffic at crossings and the local street network in the vicinity of the one at-grade crossing in South San Francisco. Parking usage at the Caltrain station in South San Francisco may result in impacts on local ridership and station access/egress. Impacts on commuter service and freight traffic and use

should be assessed, as well as the potential for activity associated with the LMF to be located in adjacent Brisbane to affect commuter service at the South San Francisco Station.

The City of Burlingame: The City of Burlingame expressed concerns about potential traffic and safety impacts from increased train traffic along the corridor at the six at-grade rail crossings within the city, in particular at Broadway. Broadway consists of a major arterial that is currently experiencing congestion and has had train-vehicle and vehicle-vehicle collisions in the recent past. The City requested that the Authority include a Broadway grade separation as part of the project. In addition, they requested coordination with other regional projects in the area, including the US 101/Broadway interchange project, the Caltrain electrification improvements, and Union Pacific Railroad freight services. They also noted that, because the proposed Millbrae HSR Station is near the northern limits of the city, the potential for parking impacts, increased traffic congestions, and other impacts should be assessed in the EIR/EIS. The City is concerned about the potential increase in train horn noise and requested that the Authority mitigate noise impacts and implement a Quiet Zone through Burlingame. The City also identified potential impacts on two historic train stations in the vicinity of the track and on a historic eucalyptus grove as a concern.

The City of Menlo Park: The City supports the blended system proposal for the Project Section. The city is opposed to the addition of a third passing track along the rail line through Menlo Park, unless it is an underground configuration. The City is concerned that construction of grade separations at any of the four at-grade crossings within Menlo Park would create impacts due to the constrained nature of development in Menlo Park, and the City requested to make final decisions regarding any grade separations. They requested that the project effects on the transportation network due to additional train traffic should be fully analyzed in the EIR/EIS, and mitigated. They also suggested that a site-specific noise and vibration analysis specific to the city be conducted and mitigated as part of the project in a manner that avoids impacts on the city character. They felt that the EIR/EIS should evaluate the potential for use of a steeper slope on the tracks instead of a 1 percent grade limitation as a steeper slope may reduce the number of impacts and allow opportunities for other options to be analyzed.

The City of Palo Alto: The City of Palo Alto requested that the Authority include grade separation as part of the project. The City further requested the Authority disclose the impacts at the at-grade crossings and the necessary mitigation. The City requested consideration of grade separations at the four rail crossings within the city limits. They requested that any at-grade crossings that remain after HSR implementation should consider use of automated intrusion detection technology and automated enforcement to enforce prohibitions against stopping on tracks. The City also indicated that they are not supportive of passing tracks within the city limits due to the increased right-of-way requirements, cost, and visual impacts. The City expressed concern about the freight impacts on the corridor and the lack of level boarding at all Caltrain stations. The City requested consideration of an off-site alternative such as an East Bay alignment with a connection to BART.

The Planning and Community Environment Department commented on a proposed list of study intersections for the Draft EIR/EIS by requesting that the Authority study an additional five intersections within the Palo Alto city limits, and also account for bicycle and pedestrian safety and convenience as part of the study.

San Mateo County (Planning and Building): The County commented on the need for the addition of at-grade crossing(s) in the North Fair Oaks neighborhood, a community with identified minority and low-income populations, where the existing Caltrain line acts as a significant barrier to movement within the neighborhood. The County also requested that the EIR/EIS evaluate an open/covered trench or other below-grade option for the alignment in this area.

SamTrans: SamTrans requested that the EIR/EIS consider the feasibility of interlining trains from a potential Dumbarton commuter line onto the Caltrain mainline. SamTrans requested that the Authority consider commuter rail alternatives in the Dumbarton Transportation Corridor Study in the blended system operational feasibility studies.

The City of Belmont: The City of Belmont requested that the EIR/EIS provide a complete analysis of all linear rail corridor elevation options within the city; evaluate alternatives that would eliminate or substantially minimize the need to acquire additional right-of-way; and include an alternative that does not retain freight service on the Caltrain right-of-way. The City requested that the HSR evaluate incorporating new and upgraded auto/pedestrian/bicycle grade separations of the railroad at the Ralston and Harbor Boulevard crossings.

10.2.3 Specific Issues Identified by Caltrain and the Peninsula Corridor Joint Powers Board

The PCJPB that operates Caltrain requested more detailed project definition infrastructure and operations information for station platforms, passing tracks, curve straightening and track modifications. More detailed operational information regarding the proposed HSR stations at 4th and King Street and Millbrae was requested. The PCJPB also encouraged the Authority to develop a more robust service planning methodology to better understand the service plan and associated infrastructure needs.

The PCJPB requested that the EIR/EIS discuss the impacts of phased implementation, including transportation and ridership impacts for 2025 and 2029, and construction impacts on Caltrain service and Caltrain facilities, such as the stations, parking lots, and existing infrastructure. Mitigation should be proposed to minimize disruption to Caltrain service during HSR construction. Impacts of recently completed capital projects and potential impacts on future projects should also be included in the EIR/EIS, along with a regulatory discussion.

11 CONCLUSION

In consideration of the major operational constraints in this Project Section, the Authority and FRA have identified two end-to-end alternatives that meet the Purpose and Need, provide consistent and predictable travel, consistent with Prop 1A requirements, and are potentially practicable. These alternatives comprise a reasonable range of alternatives.

The blended system substantially reduces environmental and community impacts relative to the previously evaluated four-track fully grade-separated HSR system described in Section 3.1.3.1. Alternative A and B are similar, but specific features of each alternative present differences in level and location of impact, as presented in Table 11-1. The Authority and FRA therefore propose to carry Alternative A and Alternative B forward for detailed analysis in the Project Section EIR/EIS.

Table 11-1 Summary of Impacts of the Blended System Alternatives

Measure	Alternative A	Alternative B
Aquatic Resources		
Wetlands		
Freshwater emergent wetland (acres)	3.75	11.56
Saline emergent wetland (acres)	1.28	1.28
Scrub/shrub wetland (acres)	0.74	0.19
Nonwetland Waters		
Constructed watercourse (acres)	2.27	1.91
Constructed basin (acres)	0.44	0
Natural watercourse (acres)	0.44	0.48
Open water (acres)	0.94	0.94
Subtotal of Wetland and Nonwetland Water Impacts (acres)	*9.86*	*16.36*
Biological Resources		
Special-Status Plant Habitat (acre)[1]		
California seablite (FE, 1B.2)	1.3	1.3
Point Reyes salty birds-beak (1B.2)	1.3	1.3
Bristly sedge (2.1)	3.75	11.56
Saline clover (1B.2)	1.3	1.3
Special-Status Wildlife Habitat (acres per species/habitat) [1]		
Central California Coast steelhead (FT)	0.20	0.20
California red-legged frog (FT, SSC)	1.71	1.79
San Francisco garter snake (FE, SE)	0.09	0.09
Salt marsh harvest mouse (FE, SE, FP)	1.3	1.3
California Ridgway's rail (FE, SE, FP)	1.3	1.3
California black rail (ST, FP)	1.3	1.3
Western pond turtle (SSC)	1.71	1.79

Measure	Alternative A	Alternative B
Townsend's big-eared bat (CFT, SSC)	1.00	1.05
Pallid bat (SSC)	1.00	1.05
Western red bat (SSC)	66.90	70.79
Salt marsh common yellowthroat (SSC)	2.94	11.22
Alameda song sparrow (SSC)	1.3	1.3
White-tailed kite (FP)	66.90	70.79
Salt marsh wandering shrew (SSC)	1.3	1.3
Other Biological Resources		
Riparian habitat (acres)	0.76	0.81
Wildlife movement corridors (number/acres)	8 / 0.86	8 / 0.93
Conservation areas (acre)	None	None
Other Environmental Resources		
Known built historic resources	21	21
Archaeological sites	19	19
Park/recreational resources (number of resources/acres of impact)	6 / 0.72	6 / 0.72
100-year floodplain (acre)	59.72	63.54
BCDC jurisdictional impacts (acres) bay/tidal waterway	4.65	4.02
BCDC jurisdictional impacts (acres) Shoreline Band	25.15	19.84
Community Resources		
Residential displacement (units)	15	34
Business displacement (affected parcels/square feet of impacts)	34 / 251,000	117 / 530,000

Sources: Authority 2018c; *Land cover generated using ESRI ArcGIS version 10.3 from data gathered during field surveys and aerial photo interpretation using NAIP aerial imagery dated 2010–2015; PCJPB 2015a, 2015b; Authority and FRA 2016a, 2016b; Burlingame School District 2016; City and County of San Francisco 2010; City of Belmont 2012; City of Sunnyvale 2016; Millbrae School District n.d.; Palo Alto Unified School District 2016; Redwood City School District 2016; San Mateo-Foster City School District 2016; San Mateo Union High School District 2016; Santa Clara Unified School District 2016; Sequoia Union High School District 2016; FEMA 2015, 2019a, 2019b*

[1] Federal/State Status Codes:
FE = listed as endangered under the FESA
FT = listed as threatened under the FESA
CFT = candidate for listing as threatened under the FESA
SE = Listed as endangered under the CESA
ST = Listed as threatened under the CESA
SSC = California Species of Special Concern
FP = California Fully Protected Species
1B.2 = California Rare Plant Rank (0.2 indicates a species that is moderately endangered in California)

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