Executive Summary

This section summarizes the key findings of this Environmental Impact Report (EIR) for the Caltrain Peninsula Corridor Electrification Project (Proposed Project or PCEP). This section summarizes the Proposed Project's background, purpose and need, description, costs and funding, environmental impacts and mitigation, alternatives, areas of controversy and areas to be resolved.

S.1 Project Background

Caltrain trains presently consist of diesel locomotive-hauled, bi-level passenger cars. As of mid-2013, Caltrain operates 46 northbound and 46 southbound (for a total of 92) trains per day between San Jose and San Francisco during the week. Three of these trains start in Gilroy during the morning commute period, and three terminate in Gilroy during the evening commute period. Eleven trains in each direction are "Baby Bullet" express service trains that make the trip between San Francisco and San Jose in less than 1 hour. Service is frequent during the peak periods (five trains per peak hour per direction [pphpd]) and is provided every hour in both directions during the midday. Caltrain provides hourly service in both directions on Saturdays and Sundays (36 trains on Saturdays and 32 trains on Sundays) between San Jose Diridon and San Francisco 4th and King Stations only. Weekend service includes two "Baby Bullet" express service trains per day in each direction. Caltrain also provides extra service for special events such as San Jose Sharks and San Francisco Giants games.

In addition to Caltrain commuter rail service, Union Pacific Rail Road (UPRR) operates approximately six daily freight trains between Santa Clara and San Francisco under a "Trackage Rights Agreement" with Caltrain. From Santa Clara to San Jose, on a joint use corridor, UPRR operates approximately 9 daily freight trains. Three passenger train services also operate on the Santa Clara to San Jose segment: the Capitol Corridor (14 daily trains), the Altamont Commuter Express (ACE, eight daily trains during weekdays only), and the Amtrak Coast Starlight (two daily trains).

The Proposed Project is part of a program to modernize operation of the Caltrain rail corridor between San Jose and San Francisco. There is a lengthy history of planning for modernization of the Caltrain Peninsula Corridor. Modernization projects include the installation of an advanced signal system and the electrification of the rail line. The advanced signal project (Caltrain Communications Based Overlay Signal System Positive Train Control (commonly referred to as CBOSS PTC or CBOSS), and corridor electrification are discussed below. The Peninsula Corridor Joint Powers Board (JPB) previously evaluated corridor electrification in a prior EIR, for which a draft was completed in 2004 and a final was completed in 2009. The JPB did not certify the Final EIR because of the need for resolution of issues regarding joint planning for shared use of the Caltrain corridor for Caltrain service and for future high-speed rail (HSR) service. The Federal Transit Administration (FTA) completed the final environmental assessment (EA) and adopted a Finding of No Significant Impact in 2009.

Since 2009, the JPB, the California High-Speed Rail Authority (CHSRA), the California Legislature, the Metropolitan Transportation Commission (MTC), and other parties have worked together to develop a vision of a "blended system" whereby both Caltrain and HSR would utilize the existing

Caltrain Peninsula Corridor. This vision for implementing Blended Service was included in the *Revised 2012 Business Plan* that the CHSRA Board adopted in April 2012 for the California High-Speed Rail System (CHSRA 2012a).

The JPB and CHSRA are committed to advancing a blended system concept. In 2013, the JPB and CHSRA signed a Memorandum of Understanding (MOU) to this effect. This local vision was developed with stakeholders interested in the corridor. The blended system would remain substantially within the existing Caltrain right-of-way (ROW) and accommodate future high-speed rail and modernized Caltrain service by primarily utilizing the existing track configuration.

Based on the blended system vision, the Caltrain Peninsula Corridor has been designated to receive an initial investment of Proposition 1A bond funds that would benefit Caltrain's modernization program and HSR. The JPB, CHSRA and seven other San Francisco Bay Area agencies (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) have approved an MOU (*High Speed Rail Early Investment Strategy for a Blended System in the San Francisco to San Jose Segment known as the Peninsula Corridor of the Statewide High-Speed Rail System*) to pursue shared use of the corridor between San Jose and San Francisco to provide Blended Service of both Caltrain commuter rail service and HSR intercity service (JPB 2012). The MOU includes agency and funding commitments toward making an initial investment of approximately $1.5 billion in the corridor for purchasing and installing an advanced signal system, electrifying the rail line from San Francisco to San Jose, and purchasing electrified rolling stock for Caltrain. The MOU also conceptually outlines potential additional improvements (i.e., "Core Capacity" projects[1]) needed beyond the first incremental investment to accommodate Blended Service in the corridor.

Corridor improvements identified in the MOU include the following:

- **Advanced Signal System (commonly referred to as CBOSS PTC or CBOSS):** This project (currently being installed, including a new fiber optic backbone) will increase the operating performance of the current signal system, improve the efficiency of at-grade crossing warning functions, and automatically stop a train when there is violation of safe operating parameters. This project, which includes implementation of safety improvements mandated by federal law, is scheduled to be operational by 2015 as mandated by the Federal Railroad Administration (FRA).
- **Corridor Electrification:** The JPB decided to prepare this new EIR for the corridor electrification due to the changes in existing conditions[2] that have occurred along the corridor since the prior EIR analyses was conducted, to update the environmental analysis, and to update the cumulative analysis of Blended Service and other cumulative developments along the corridor. Completion of a new EIR will also allow public agencies, stakeholders, the public and

[1] "Core Capacity" projects (as described in the nine-party MOU) consist of needed upgrades to stations, tunnel, bridges, potential passing tracks, other track modifications, and rail crossing improvements, including selected grade separations, and will be required to accommodate the mixed traffic capacity requirements of high-speed rail service and commuter services on the Caltrain corridor. The specific Core Capacity projects have not been identified or defined at this time. These projects will be identified in future discussions and evaluations between CHSRA and the JPB. Core Capacity projects would be subject to separate, project-level environmental evaluation by the implementing agency.

[2] For example, there have been changes in existing development adjacent to the Caltrain ROW and stations, in levels of traffic, and in adopted land use plans around stations.

decision-makers the opportunity to review and comment on the Proposed Project's environmental effects in light of current information and analyses. This project will provide for operation of up to 6 Caltrain trains per peak hour per direction (an increase from 5 trains per peak hour per direction at present). Electrification can be analyzed as a separate project under the California Environmental Quality Act (CEQA) because it has independent utility (providing Caltrain electrified service) and logical termini (station end points). Electrification of the rail line is scheduled to be operational by 2019. The Proposed Project includes 114 trains per day between San Jose and San Francisco and six trains per day between Gilroy and San Jose. Future proposed actions to expand service beyond 114 trains per day may require additional environmental review.

- **Blended Service:** The JPB, CHSRA, and the MOU partners have agreed on shared use of the Caltrain corridor for use of up to six Caltrain trains per peak hour per direction and up to four HSR trains per peak hour per direction.[3] The operational feasibility of Blended Service has been studied, but this project is presently only at the conceptual planning phase. The potential addition of HSR service to this corridor will be the subject of a separate environmental review process that will be undertaken by CHSRA as the lead agency subsequent to the environmental process for the Proposed Project. Based on the current CHSRA *Revised 2012 Business Plan* and the Draft *2014 Business Plan* (CHSRA 2014), Blended Service along the Corridor is scheduled to commence sometime between 2026 and 2029.

S.2 Purpose and Need

The Proposed Project's purpose and need are summarized below.

S.2.1 Need for the Project

The needs addressed by the Proposed Project consist of the following: meeting current and future transportation demand between San Jose and San Francisco; offsetting existing and future worsening roadway congestion; addressing continuing regional air quality issues; reducing greenhouse gas emissions because of their effect on climate change; modernizing the Caltrain service; and providing electrical infrastructure compatible with future high-speed rail service.

[3] The CHSRA 2012 Revised Business Plan *Ridership and Revenue Forecasting* (CHSRA 2012b) and the 2014 Business Plan (CHSRA 2014) both presume Phase 1 Blended Service would have up to four trains per peak hour and up to four trains per off-peak hour. As explained in Chapter 4, Section 4.1 *Cumulative Impacts,* this EIR presumes up to 40 daily round-trip high-speed trains in 2040 based on the CHSRA 2012 Business Plan, *Estimating High-Speed Train Operating and Maintenance Cost for the CHSRA 2012 Business Plan* (CHSRA 2012c). The Draft 2014 Business Plan *Service Planning Methodology* document (CHSRA 2014b) includes an assumption of 53 daily round trip trains starting in 2029 and continuing beyond 2040. Caltrain's Blended Service planning to date has not studied the 2014 Business Plan estimates because the plan was released on February 7, 2014 and conceptual Blended Service studies were completed in 2012 and 2013. Thus, the cumulative analysis in this EIR is based on the 40 daily round-trip high-speed trains consistent with Blended Service studies by Caltrain completed to date. The subsequent CHSRA project-level environmental evaluation will address proposed high-speed train service levels along the San Francisco Peninsula.

S.2.1.1 Current and Future Transportation Demand in the Caltrain Service Area

The population of the Bay Area is increasing and, with it, traffic congestion. Commute traffic between major employment centers in San Francisco, the San Francisco Peninsula, and the South Bay is growing, and there has been a substantial increase in "reverse commute" trips from San Francisco to Peninsula and South Bay locations over the past decade. Off-peak travel between San Francisco and Peninsula and South Bay locations is also on the rise. Caltrain has experienced increases in ridership as people seek alternate ways to meet these travel needs. Caltrain anticipates continued increases in demand for its rail services over time.

The long-term rise in gas prices has contributed to increased use of public transportation. Commuting to work by automobile has decreased approximately 4 percent in Santa Clara and San Mateo Counties from 2000 to 2010 in part due to increases in gas prices as well as traffic congestion and other factors. Regional commuter transportation systems, including Caltrain, would be the logical beneficiaries of a shift from private autos to public transportation, because these systems accommodate the home-work trip. Home-work trips constitute the largest share of person trips and they are the easiest trips to shift modes, assuming convenient origin-destination pairs. Should gasoline prices remain at high levels over the long-term or increase further, increased Caltrain ridership from this source would be reasonable to expect.

S.2.1.2 Current and Future Roadway Congestion in the Caltrain Corridor

Economic growth and the corresponding demand for transportation services in the San Francisco Bay Area have exceeded the region's ability to provide the needed roadway capacity. Existing demand for north-south travel along the Peninsula via U.S. Highway 101 (U.S. 101) and Interstate 280 (I-280) regularly exceeds existing highway capacities and results in congestion that is increasing in both frequency and duration. U.S. 101 is the most severely congested freeway through the corridor (MTC 2009). Between San Francisco and San Jose, many roadway segments are at or over capacity during the peak commute hour.

Without future roadway improvements, congestion on corridor freeways is bound to worsen to the point at which travel would partially divert to surface routes and the peak periods would spread both into the midday and to later in the evening. Bottlenecks would continue to constrain movement through the corridor. Job growth in the Bay Area is expected to increase approximately 33 percent between 2010 and 2040 (ABAG and MTC 2013). The resultant new transportation demand will lead to high levels of congestion that will take a toll on economic development by constraining goods and people movements.

Opportunities to improve highway capacity are constrained by a number of factors, including funding availability, the need for extensive and costly ROW acquisitions, and potentially adverse environmental impacts, such as displacements of residences and businesses, and impacts on natural resources and redesign of local roadways beyond the interchanges. For these reasons, substantial capacity improvements to U.S. 101 and I-280 cannot be relied upon to fully address long-term travel demands in the corridor.

S.2.1.3 Corridor Air Quality and Greenhouse Gas Emissions

High rates of auto ownership and increasing vehicle miles of travel (VMT) have contributed to air quality problems throughout California. Pollutants of concern include ozone (O_3); nitrogen oxides

(NO_X) and sulfur dioxides (SO_2) (precursors of smog); carbon monoxide (CO); and particulate matter (PM). Greenhouse gases (including carbon dioxide, nitrous oxide and methane) are now a focus of environmental planning in California because of their role in global climate change. Motor vehicles are substantial contributors to the production of all of these pollutants.

The San Francisco Bay Area's air quality has improved in recent years, largely in response to technological improvements in motor vehicles and fuels that are less polluting but is still designated as in nonattainment area under state and federal standards for certain pollutants. Because transportation is the major contributor to ozone precursors, increasing auto travel threatens the area's improvement in air quality. Growing congestion will add to the potential problems because of increased emissions of vehicles operating in stop-and-go traffic

California also has ambitious goals to reduce greenhouse gas emissions throughout the state in or der to help face the challenge posed by climate change. Most of the communities in the Peninsula Corridor have also adopted climate action plans to lower their community contributions of greenhouse gas emissions, with all seeking to lower transportation emissions given that transportation is usually the largest source of such emissions in most areas.

S.2.1.4 Modernizing the Caltrain Service

Improving the appearance and attractiveness of Caltrain to potential consumers has long been suggested as a means of increasing ridership. Caltrain put new diesel locomotives and bi-level passenger cars into service as part of the "Baby Bullet" express service program in 2004. Rider response to this service has demonstrated the benefits of modernizing image, improving passenger comfort, and reducing travel times between major origins and destinations. The increase in ridership associated with the introduction of the Baby Bullet and new passenger cars suggests that there is an unmet demand for rapid transit along the Peninsula corridor. With the Proposed Project, additional stops could be added (optimized stops) without loss of travel times or travel times could be reduced.

S.2.1.5 Accommodating Future High-Speed Rail

An electrified Caltrain system would set the stage for an expanded modern regional electric train service and a statewide HSR service. The Proposed Project facilities evaluated herein would be designed to accommodate HSR service, as well as Caltrain service. The term "accommodate" is being used in this case to mean that the Caltrain Proposed Project would install the same type of power supply and distribution system proposed for the HSR system. Other improvements needed to enable high-speed trains to use the Caltrain line would be evaluated in a separate environmental process.

Extension of Caltrain from its present 4th and King Street terminus to the site of the Transbay Terminal was evaluated in a separate environmental document, the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project EIS/EIR, by FTA, the City and County of San Francisco, the San Francisco Redevelopment Agency, and the JPB. The Final EIS/EIR was certified in 2004 and the Record of Decision on the EIS was issued in February 2005. The Transbay Terminal project includes electrification of the Caltrain line from 4th and King Streets to the Transbay Terminal. Subsequent addenda have been completed, and a Supplemental EIS/EIR is presently being prepared for certain limited proposed changes to the design of the project.

S.3 Purpose of Project

The primary purposes of the Proposed Project are to improve train performance and reduce costs, reduce long-term environmental impact by reducing noise and vibration, improve regional air quality and reduce greenhouse gas emissions, and provide electrical infrastructure that would be compatible with separate later use for Blended Service. An electrified Caltrain system would address Peninsula commuters' vision of an environmentally friendly and reliable service. Electrification also is expected to help accommodate increased system ridership through improved system operations.

Electrification would modernize Caltrain and supports increased service levels and it offers several advantages in comparison with existing diesel power use. These benefits serve the primary purposes of the Proposed Project, as follows:

- **Provide electrical infrastructure compatible with high-speed rail:** An electrified Caltrain system would set the stage for an expanded modern regional electric express service and for Blended Service. While the Proposed Project would not include all infrastructure necessary to implement HSR service in the corridor (such as HSR maintenance facilities, station platform improvements, or passing tracks), the electrical infrastructure (such as overhead wire systems) would accommodate future Blended Service.
- **Improve train performance, increase ridership and increase service:** The Proposed Project envisions the use of electric multiple unit (EMU) trains, which are self-propelled electric rail vehicles that can accelerate and decelerate at faster rates than diesel-powered trains, even with longer trains. With EMUs, Caltrain could run longer trains without degrading speeds, thus increasing peak-period capacity. Electrification performance would support increased peak service levels from the current five trains per peak hour per direction to six with existing trackage.

  A substantial portion of a Caltrain trip is spent accelerating and decelerating between stations because of Caltrain's close-set station stops. For the same service profile of stops, EMUs can provide travel time reductions. Alternatively, due to the time savings, additional stops could be added without increasing existing total transit time from San Jose to San Francisco. Travel time savings and/or additional stops are expected to stimulate additional Caltrain ridership.
- **Increase revenue and reduce cost**: Anticipated increased ridership would increase fare revenues, and conversion from diesel to electricity would reduce fuel costs. These efforts would substantially reduce but not eliminate the need for financial subsidy.
- **Reduce environmental impact by reducing noise emanating from trains**: Noise emanating from the passage of electrified train sets is measurably less than diesel operations. With the increases in peak and off-peak Caltrain service that are either under way or planned for implementation during the next decades, electrification would be an important consideration for reducing noise of train passersby and maintaining Peninsula quality of life. Train horns would continue to be sounded at at-grade crossings, consistent with FRA and California Public Utilities Commission safety regulations, whether or not electrification is pursued.
- **Reduce environmental impact by improving regional air quality and reducing greenhouse gas emissions:** Electric operations would produce substantial reductions in corridor air pollution emissions when compared with diesel locomotives, even when the indirect emissions from electrical power generation are included in the analysis. In addition, the increased ridership allowed by the Proposed Project would reduce automobile usage, thereby

resulting in additional air quality benefits. Electrically powered trains are more energy efficient than diesel-electric trains. Reduced energy use also translates into reduced air emissions. Reductions in air pollutant emissions represent long-term health benefits for Caltrain riders, and for residents and employees along the Caltrain corridor. In addition, reduction of greenhouse gas emissions with electrification would help California to meet its goals under AB 32, the 2006 Global Warming Solutions Act, as well as post-2020 state greenhouse gas emission reductions goals.

S.4 Project Description

The Proposed Project consists of converting Caltrain from diesel-hauled to EMU trains for service between the 4th and King Street Station terminus station in San Francisco and the Tamien Station in San Jose. Operating speed would be up to 79 mph, which would match the existing maximum speed.

By 2019, approximately 75 percent of the service fleet between San Jose and San Francisco would be electrified, with the remaining 25 percent being diesel-powered. After 2019, diesel locomotives used for San Francisco to San Jose service would be replaced with EMUs over time as diesel locomotives reach the end of their service life. Because the Proposed Project only involves electrification of the Caltrain ROW from San Francisco to a point approximately 2 miles south of Tamien Station, Caltrain's diesel-powered locomotives would continue to provide service between the San Jose Diridon Station and Gilroy.

The Proposed Project would require the installation of 130 to 140 single-track miles of overhead contact system (OCS) for the distribution of electrical power to the new electric rolling stock. The OCS would be powered from a 25 kilovolt (kV), 60 Hertz (Hz), single-phase, alternating current (AC) traction power system consisting of two traction power substations (TPSs), one switching station and seven paralleling stations. These facilities are described in more detail in Chapter 2, *Project Description*.

The Proposed Project is the electrification of the Caltrain line from its current northern terminus at 4th and King Street in the City of San Francisco to 2 miles south of the Tamien Station in San Jose, a total distance of approximately 51 miles. The Proposed Project location is shown in Figure ES-1, and a project vicinity map showing each of the stations on the line is provided in Figure ES-2.

S.4.1 Project Elements

S.4.1.1 Overhead Contact System

This Proposed Project would utilize a 25 kV AC OCS operating at 60 Hz. A mainline OCS typically consists of two conductors above each track in what is known as a catenary configuration: A messenger wire (much like a utility transmission line) sags between support points, below which a near-level contact wire is suspended. Both main wires are energized and are part of the same circuit. The pantograph, mounted on top of the electric vehicles, slides along the underside of the contact wire and collects the traction current from it.

The messenger wire is typically supported by means of cantilevered, hinged bracket arms that extend horizontally over the track from vertical steel poles mounted clear of the dynamic envelope (i.e., the range of motion of the train on the track) of the vehicles. These poles are placed

approximately 10 to 12 feet of the centerline of the tracks they serve. Multi-track support structures, such as multi-wire headspans attached to taller steel poles, are also employed where necessary. Depending upon the clearance requirements of particular sections of the route, the contact wire height would vary from approximately 16 feet to 23 feet. Pole heights would range from 30 to 50 feet.

Clearances for maintenance and operation of the OCS would be designed to allow for existing freight railroad and tenant passenger rail clearances and operations. Normal design clearances up to 23 feet would be provided in all open, unconstrained areas. Special designs could be employed in close clearance tunnels or under bridges in order to provide sufficient clearances to existing freight and diesel passenger trains.

On tangent, or straight, sections of track, the OCS supports can be spaced up to 230 feet apart, though they would typically be about 180 to 200 feet apart. On curved track sections, the span lengths between supports must be reduced.

As noted above, the OCS poles nominally need to be approximately 10 to 12 feet from the centerline of the railway tracks. In addition, there needs to be clearance of vegetation within approximately 10 feet of the OCS poles and catenary system for the electrical safety zone (ESZ). Trimming or removal of trees would be required along the tracks and electrical facilities where they would otherwise pose a maintenance or safety concern. In addition, structures cannot be closer than 6 feet to the OCS pole alignment (the 6 feet is within the 10-foot ESZ).

At three tunnel locations and four bridge overcrossings where vertical height is constrained, the Proposed Project also would involve minor tunnel modifications and/or track lowering to accommodate existing and future passenger vehicles as well as existing freight equipment.

S.4.1.2 Auto-Transformer Power Feed Arrangement

The auto-transformer power feed system arrangement reduces the need for traction power substations and would require the installation of only two traction power substations spaced 36 miles apart. There are three potential locations for the site of each of the traction power substations analyzed in this EIR. In addition, there would be one switching station (SWS1) and seven paralleling stations (PS1 through PS7) at a spacing of approximately 5 miles. Two potential locations have been identified for the PS4, PS5, and PS6 sites.

The paralleling stations provide additional power support to the power distribution system and permit increased spacing of the primary traction power substations. In addition to reducing the number of traction power substations—and thereby minimizing the introduction of new, large equipment installations into the corridor—the auto-transformer feed arrangement for implementation along the Caltrain corridor would help reduce electromagnetic fields (EMF) and electromagnetic interference (EMI) because the arrangement includes two parallel aerial feeders, one on each side of the alignment. The currents in the parallel feeders flow in the opposite direction to that in the main catenary conductors, reducing the EMF/EMI effects created by current flow in the OCS.

Figure ES-2 shows the proposed general locations for potential TPFs.

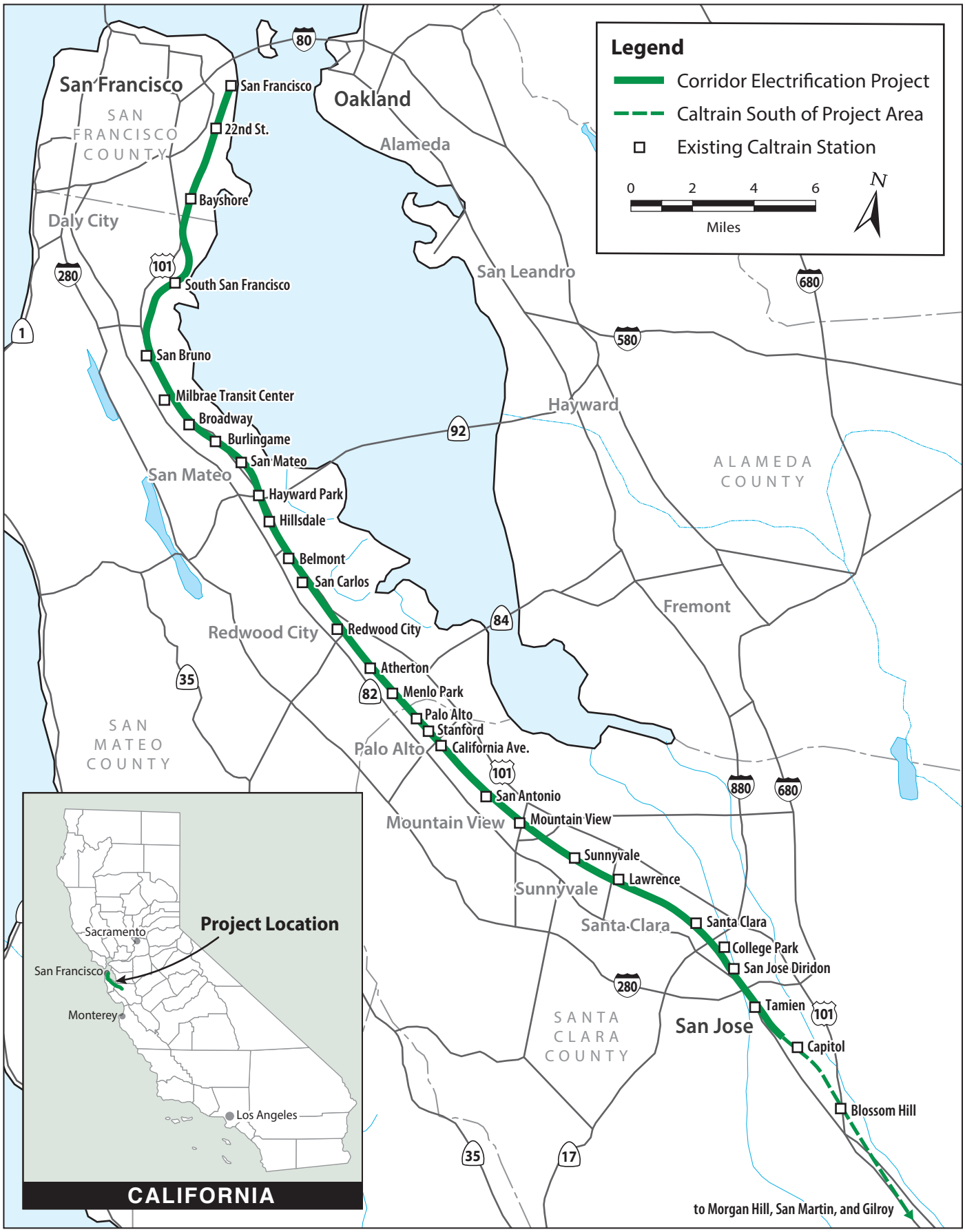

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Figure ES-1
Project Location
Peninsula Corridor Electrification Project

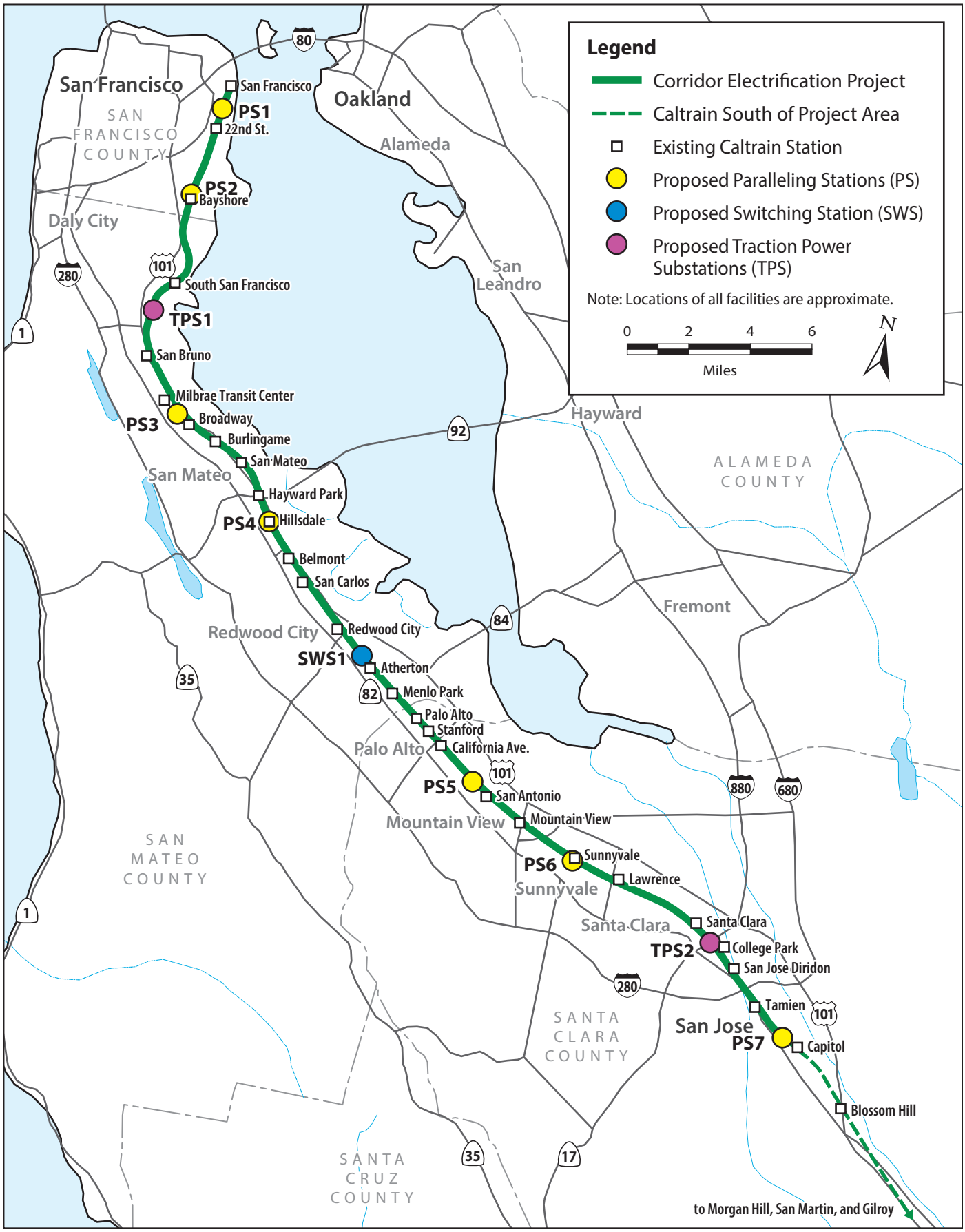

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Figure ES-2
Project Vicinity
Peninsula Corridor Electrification Project

S.4.1.3 Overbridge Protection Structures

Electrification of the corridor would require the construction or enhancement of overbridge protection barriers on 47 roadway or pedestrian bridges across the Caltrain alignment. These barriers are necessary to prohibit access to the rail corridor and prevent objects from being thrown off the bridges in a manner that would damage or interfere with the electrical facilities.

S.4.1.4 Grade Crossing Warning Devices

The Proposed Project would also require a change in the warning devices for at-grade crossings. As part of the Proposed Project, the existing warning devices would be removed because they operate on a DC circuit and the proposed EMUs would operate on an AC circuit. Caltrain trains equipped with onboard CBOSS PTC equipment will communicate with the grade crossings wirelessly, allowing the grade crossing gates to function safely. CBOSS PTC will be in place by 2015. For non-Caltrain trains (which will not have onboard CBOSS PTC equipment), Audio Frequency Overlays (AFOs), also known as track circuits, will be installed at fixed locations along the Caltrain ROW, allowing the grade crossing gates to function safely. An AFO is a sensor that activates the grade crossings when the train is approaching.

S.4.1.5 Rolling Stock

New EMUs are the preferred rolling stock option for the Proposed Project. New EMUs would replace the portion of Caltrain's existing diesel locomotives and passenger cars that will reach the end of its useful life by 2019. Caltrain would operate electric service between San Francisco and San Jose with EMUs. With EMUs, each car, or set of cars (unit), can have its own pantograph mounted on the roof and separate electric motor drives to each axle. EMUs can be operated in a variety of train consists, dependent upon the requirements of the rail system operator. Options include single motor cars (where each car is fitted with a driving cab at both ends) and paired cars (where there is a driving cab at only one end of each car). A pair can comprise two motor-cab cars, or a motor-cab plus a non-motored trailer-cab car. Another option would be two motorized cab cars with multiple non-motored trailer cab-cars in between. There is currently no United States-based prototype for the EMU proposed for the Proposed Project. The EMU vehicle for the Proposed Project would be a multi-level car of comparable dimensions to the existing Caltrain gallery car. Caltrain has received a waiver from the FRA that would allow modern European EMU equipment to operate on the Caltrain Peninsula Corridor provided that temporal separation is provided between the light-weight EMUs and heavy freight trains (this is referred to as the FRA waiver).[4]

S.4.2 Operations and Maintenance

S.4.2.1 Caltrain Operating Scenario(s) Under Electrification

Caltrain's existing schedule includes five trains per peak hour during the a.m. and p.m. peaks, as well as mid-day service, for a total of 92 trains per day between San Jose and San Francisco. In addition to local service (stopping at every station), existing weekday Caltrain service consists of six baby bullet

[4] It should be noted that the FRA is currently in a rulemaking process for "Alternative Compliant Vehicles" that is relevant to the EMUs in the Proposed Project. It is Caltrain's understanding that when the rule is in place, the FRA waiver and the temporal separation requirement may no longer be necessary. For the purposes of this EIR, it is assumed that the current FRA waiver requirement would be in force.

trains and ten limited-stop trains in the a.m. northbound and p.m. southbound and five baby bullet trains and 11 limited-stop trains in the a.m. southbound and p.m. northbound. There is approximately one train per hour per direction from 10 a.m. until 2 p.m. and after 7 p.m.

The proposed level of Caltrain operations consists of six trains per peak hour during the a.m. and p.m. peaks, as well as mid-day service, for a total of 114 trains per day between San Jose and San Francisco. Based on a prototypical schedule, with Proposed Project implementation there would be approximately six a.m. and p.m. baby bullet trains per direction. There would be approximately two trains per hour per direction from 9 a.m. until 4 p.m. and after 7 p.m.

S.4.2.2 Ridership

Implementation of the Proposed Project is anticipated to result in increased ridership by 2020 and by 2040. Table ES-1 shows the existing Caltrain ridership and the projected Caltrain ridership from 2020 and 2040, with and without the Proposed Project.

Table ES-1. Estimated Ridership with the Proposed Project

	2013	2020[a]	2040
Existing/No Project[b]	47,000	57,000	84,000
With Project[c, d]	N/A	69,000	111,000

Source: Appendix I, *Ridership Technical Memorandum*

[a] 2020 was used for ridership analysis to ensure full operation of the new electrified service.

[b] No Project analysis assumes the same schedule as at present (5 trains per peak hour; 1 train per off-peak hour per direction; total of 92 trains per day) for both 2020 and 2040

[c] For 2020, analysis assumed 75% electrified and 25% diesel service from San Jose to San Francisco.

[d] For 2040, analysis presumes fully electrified service between San Jose and San Francisco. As described above, the Proposed Project only has sufficient funding at present to provide 75% electrified service between San Jose and San Francisco. It is presumed that additional funding will be obtained to allow full electrified service between San Jose and San Francisco to occur by 2040.

S.4.2.3 Energy Consumption

With the Proposed Project, the primary energy source would be electricity. Through conversion of trains from diesel motor propulsion to EMUs, the Proposed Project would substantially decrease diesel fuel use and substantially increase annual electricity use. Existing fuel consumption is approximately 4.5 million gallons per year (mid-2012 to mid-2013). With the Proposed Project, in 2019 diesel trains would provide approximately 25 percent of service from San Francisco to San Jose and all of the service from San Jose to Gilroy. These diesel trains would require 1.1 million gallons of fuel per year, a reduction of approximately 3.4 million gallons per year from current conditions. Proposed Project operation would require approximately 83 million kWh of electricity in 2019. This includes energy expended during both train travel and idling.

S.4.2.4 Maintenance

Trimming or removal of trees will be required along the tracks and electrical facilities where they would otherwise pose a maintenance or safety concern. One maintenance item that is unique to electric vehicles is the need to inspect the pantograph carbon collector strips for wear and damage. Carbon is a relatively soft material, even when mixed with copper particles to create “metalized”

strips. However, carbon, rather than the contact wire, is designed to be the sacrificial element in the sliding current collection interface. As a result, the pantograph would need to be frequently inspected to ensure that there is sufficient carbon interface.

S.4.3 Construction Schedule/Durations

The preliminary project schedule (subject to change) is provided below.

- Environmental review/design/permitting: 1–2 years.
- Construction: 3–4 years.
- Testing: 1–2 years.

The goal is to commence electric revenue service in 2019.

The construction activities described above are not sequential; construction could occur simultaneously at several locations.

S.4.4 Right-of-Way and Easement Needs

Based on the current system design, and assuming a worst-case-pole-placement scenario, there would be a need for acquisition of new ROW for one TPS (and possibly a second TPS, depending on location) as well as for some areas where OCS poles and wires would need to be placed outside the current ROW.

For the two TPSs, the JPB is considering several different sites for each traction power substation. Sites for intermediate paralleling and switching station facilities have also been identified, but all of the locations are within the Caltrain ROW. The total estimated area needed for the two substations is up to 1.4 acres.

In most cases, the OCS poles would be placed within the Caltrain ROW. However, in certain locations, there may be insufficient clearance from the railway track centerlines and the JPB may need to acquire ROW for placement of poles and wires. At this time, based on 35 percent design and worst-case pole placements (i.e., side poles) in terms of ROW need, it is estimated that new easements on adjacent public roads and on rail ROW is estimated as 0.6 acres and ROW acquisition on private property is estimated as 0.2 acres, for a total of 0.9 acres.[5] These calculations presume placement of OCS poles on the outside of the outermost track. If alternative pole alignments are used in some locations, these estimates may change.

In addition, in some locations there is insufficient ROW width to provide for the necessary 10 feet of electrical safety clearance within the current ROW to adjacent vegetation and structures. Where electrical clearance is necessary outside the Caltrain ROW, the JPB will need to obtain an electrical safety easement from property owners to permit the trimming and removal of vegetation and to maintain structures outside a 6-foot safety zone from the OCS alignment. At this time, it is estimated that approximately 8 acres of new easement would be required on adjacent public road and rail ROW, 10 acres on private residential, commercial, or industrial property, and 0.3 acres on parklands for a total of approximately 18 acres. These calculations presume placement of OCS poles on the

[5] Total does not add because of rounding.

outside of the outermost track. If alternative pole alignments are used in some locations, these estimates may change.

The JPB is presently examining the design for Proposed Project facilities and the amount of needed ROW may be more or less than that discussed above.

S.4.5 Relation to the High-Speed Rail Project

The electrification system envisioned for the corridor would be configured in such a way that it would support the future operation of California HSR. The power supply system of choice for a steel-wheel-on-steel-rail high-speed train operation is 25-kV, 60-Hz, single-phase AC electrification. The Caltrain corridor is currently only rated for a maximum of 79 mph and, thus, there may be need for track and other system upgrades in order to support higher speeds than at present. The Proposed Project includes electrification infrastructure that would first be used by Caltrain and can later be used for high-speed trains. However, the Proposed Project does not include other improvements necessary for high-speed trains such as platform improvements, high-speed rail maintenance facilities, passing tracks or other Core Capacity projects. The Proposed Project does not include improvements to support speeds greater than 79 mph or high-speed rail operations on the Caltrain corridor at speeds up to 110 mph.[6] High-speed rail construction and operations would be the subject of a later, separate environmental analysis to be conducted by CHSRA and FRA. The cumulative impact analysis in this document does address cumulative impacts of Blended Service (see Chapter 4, Section 4.1, *Cumulative Impacts*) but only provides a conceptual analysis of those impacts given that HSR design for Blended Service has not been completed.

S.5 Costs and Funding

S.5.1 Capital Costs

An estimate of the capital costs associated with the Proposed Project including rolling stock and the fixed facilities was completed for the 2009 EA/EIR (FTA and JPB 2009). The cost of the fixed facilities (e.g., OCS, traction power facilities) was estimated at approximately $785 million and the cost of rolling stock was estimated to be $440 million for a total of $1,225 million (FTA and JPB 2009). The JPB is presently developing updated capital costs that will be presented in the Final EIR.

S.5.2 Capital Funding Sources and Programming

The Proposed Project's capital costs are proposed to be funded from the sources shown in Table ES-2.

[6] As described in Section 4.1, *Cumulative Impacts*, the cumulative analysis in this EIR presumes speeds for Blended Service up to 110 mph because the blended system has been simulated by Caltrain at speeds of up to 110 mph and shown to be viable. In addition, CHSRA has confirmed that with speeds up to 110 mph, a 30-minute express travel time can be achieved between San Jose and San Francisco as required by Proposition 1A (CHSRA 2013). If it is determined to be necessary to analyze speeds greater than 110 mph in the future, additional simulations will be performed to understand the viability and implications of the 100 to 125 mph speed range identified by CHSRA in the 2012 Partially Revised Program EIR (CHSRA 2012d). If speeds faster than 110 mph are ultimately proposed by CHSRA for the Caltrain corridor, they will be evaluated in the separate environmental document for high-speed train service on the San Francisco Peninsula.

Table ES-2. Funding Sources for Corridor Electrification Project (Millions of Dollars)

Source	Amount (YOE$)
State Proposition 1A[a], Proposition 1B[b]	$620
JPB	$121
Regional (Bay Area Air Quality Management District, Tolls)	$31
Federal (Federal Transit Administration)	$453
TOTAL	**$1,225**

[a] Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century of 2008.
[b] The Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006.
YOE = year of expenditure.

S.5.3 Operating and Maintenance Costs and Revenues

The prior 2009 EA/EIR (FTA and JPB 2009) presented estimates of operating and maintenances costs and revenues for the Proposed Project. The JPB is presently developing new estimates that reflect current assumptions and the recent ridership estimates. The updated operations and maintenance costs will be presented in the Final EIR.

S.6 Summary of Environmental Impacts and Mitigation

The potential impacts of the Proposed Project are presented in Chapter 3, *Settings, Impacts, and Mitigation Measures*, and cumulative impacts are presented in Chapter 4, *Other CEQA-Required Analysis*, and are summarized in Table ES-3. Mitigation measures were also identified, where available, for significant impacts identified in this EIR. These mitigation measures are also listed in Table ES-3. Please note that in Table ES-3, the term "significant" refers to the level of impact and the term "considerable" refers to Proposed Project contribution to a cumulative impact.

The Draft EIR analyzes the construction impacts, operational impacts, and cumulative impacts for each separate subject area. The following summary describes the key conclusions in this Draft EIR. This list is not a comprehensive list of impact conclusions; for a comprehensive review, please refer to Table ES-3, Chapter 3, and Chapter 4.

- Key Project Construction Impact Summary
  - *Aesthetics:* The Proposed Project would temporarily change aesthetic conditions and light and glare adjacent to residential areas and a number of parks. Project mitigation would minimize the duration and extent of these temporary impacts.
  - *Air Quality*: Proposed Project construction impacts regarding criteria pollutants and toxic air contaminants can be reduced to less-than-significant levels with routine project mitigation measures.
  - *Biological Resources*: The Caltrain ROW is primarily a disturbed urban rail corridor with only limited biological resources. The Proposed Project would impact limited areas of

habitat for special-status species as well as riparian vegetation, wetlands and sensitive natural communities during construction but routine project mitigation would reduce these impacts to a less-than-significant level. Project construction would also require removal of up to 2,200 trees[7] and pruning of an addition 3,600 trees for the OCS alignment and ESZ under worst-case assumptions. Project mitigation would require tree avoidance, minimization, and/or replacement. While the biological impacts of tree removal can be mitigated, this is considered a significant and unavoidable aesthetic impact (see discussion under operational impacts below).

- *Cultural Resources*: Construction of the Proposed Project's OCS has the potential to affect certain historic resources, specifically the Caltrain San Francisco tunnels, historic Caltrain stations, certain bridges and underpasses, and several other potential historic resources. Mitigation would require specific design treatments to reduce and avoid impacts where feasible. Tunnel modifications necessary to provide heights for Caltrain and freight rail cars may result in significant and unavoidable impacts on the San Francisco Tunnel 4 portal even with mitigation. Potential impacts on archaeological resources can be reduced to a less-than-significant level with routine project mitigation.
- *Geology, Soils and Seismicity*: Proposed Project construction impacts related to erosion, geological conditions, and soils can be reduced to less-than-significant levels with routine project mitigation measures.
- *Greenhouse Gas Emissions*: Proposed Project construction would result in greenhouse gas (GHG) emissions, but, as discussed below, those emissions would be offset by operational reductions within a matter of months.
- *Hazards and Hazardous Materials*: Some parts of the Caltrain ROW are contaminated because of prior activities. Project mitigation would control exposure of workers and the public to contamination where encountered. Project mitigation would also control potential spills of hazardous materials during construction, as well as potential effects on emergency plans.
- *Hydrology and Water Quality*: Proposed Project construction impacts on water quality can be reduced to less-than-significant levels with routine project mitigation measures.
- *Land Use and Recreation:* Temporary disruption of land use and recreation resulting from Proposed Project construction can be reduced to less-than-significant levels with routine project mitigation measures.
- *Noise and Vibration:* Construction would be required during the day and night in order to maintain Caltrain passenger service during construction. Although project mitigation would reduce noise in many locations, mitigation might not always reduce noise impacts during nighttime construction to a less-than-significant level. Project mitigation would reduce construction vibration impacts to a less-than-significant level.
- *Population and Housing*: The Proposed Project would not displace any housing and would not result in substantial changes in population during construction.

[7] Estimated tree removals based on the current tree survey and assessment. It was previously estimated that there are approximately 19,250 trees located within and immediately adjacent to Caltrain's ROW. See Appendix F, *Tree Inventory and Canopy Assessment*.

- *Public Services and Utilities*: The Proposed Project would require relocation of certain utilities and Caltrain would coordinate with all utility owners to conduct relocation activities in a way that minimizes potential disruption.
- *Transportation and Traffic*: The Proposed Project could result in temporary disruption of traffic as well as passenger and rail service during construction. Project controls would include coordination with local roadway agencies and other passenger and freight rail service operators to minimize disruption.

- Key Project Operational Impact Summary
  - *Aesthetics*: The Proposed Project would change local visual character through addition of the OCS and tree removal along the existing Caltrain ROW. While the effect of the OCS can be mitigated to a less-than-significant level, the change in aesthetics with tree removal is identified as a significant and unavoidable impact, even with tree avoidance, minimization, and replacement mitigation.
  - *Air Quality*: The Proposed Project would substantially improve both local and regional air quality. Reductions in Caltrain system criteria pollutant emissions compared with existing (2013) conditions would range from 56 to 84 percent in 2020 and more for 2040 with full electrification. Toxic air contaminant health risks along the Caltrain corridor due to train emissions would be reduced by 74 percent in 2020 and by 100 percent in 2040 with full electrification.
  - *Biological Resources*: Operationally, the Proposed Project would have limited impacts on biological resources except on nesting birds and bats during vegetation maintenance. These impacts would be less than significant with mitigation to control the timing of maintenance. The Proposed Project would have benefits for local and regional natural habitats by reducing diesel emissions and their effects on terrestrial and aquatic habitats.
  - *Cultural Resources*: The Proposed Project would have no impact on cultural resources during operations.
  - *Electromagnetic Fields/Electromagnetic Interference (EMF/EMI):* EMF levels associated with EMU and OCS operation and traction power facilities would be less than health guidelines and, thus, the impacts would be less than significant. EMU and OCS operation could result in interference with sensitive equipment at discrete facilities, such as hospitals with imaging equipment, but design mitigation controls can address this potential similar to measures applied for prior electrified railroads including the Northeast Corridor.
  - *Geology, Soils and Seismicity*: With mitigation, the Proposed Project would have a less-than-significant impact on geology, soils, or seismicity during operation.
  - *Greenhouse Gas Emissions*: The Proposed Project would substantially reduce GHG emissions compared with existing conditions and future No Project conditions. Reductions in Caltrain system GHG emissions compared with existing (2013) conditions would be 24,000 metric tons (MT) of carbon dioxide equivalent (CO_2e) in 2020 and 31,000 MT CO_2e for 2040 with full electrification. When taking into account the reduction in regional vehicle miles traveled with increased Caltrain ridership, the Proposed Project would reduce GHG emissions compared with No Project conditions by 68,000 MT CO_2e in 2020 and 177,000 MT CO_2e for 2040 with full electrification. Construction GHG emissions would be offset within a matter of months of operation.

- *Hazards and Hazardous Materials*: With mitigation, the Proposed Project would have a less–than-significant impact on hazards and hazardous materials during operation.
- *Hydrology and Water Quality*: Some of the new project facilities would be located within the 100-year floodplain, but project mitigation would reduce impacts to a less-than-significant level. Minor increases in impervious spaces would occur, but runoff impacts would be controlled with implementation of stormwater regulation requirements Portions of the Caltrain ROW and some of the new project facilities are at risk of future coastal flooding due to the projected sea level rise with climate change. Given that effective coastal flooding mitigation requires the involvement of multiple parties beyond Caltrain, at this time it cannot be concluded that future flooding impacts on the Caltrain system would be fully avoided. Mitigation to develop and implement a seal level rise adaptation plan is proposed in the Draft EIR. Given the *Ballona Wetlands* court decision, it is unknown whether or not the impacts of sea level rise on a project are properly considered significant impacts under CEQA and, thus, this EIR explains this impact for disclosure purposes.
- *Land Use and Recreation:* The Proposed Project would be located along an existing rail corridor. Traction power substations constructed separate from the Caltrain ROW would be allowable compatible uses in the proposed commercial/industrial locations. The Proposed Project would not divide existing communities. Aesthetic impact mitigation would help reduce potential operational impacts at one park location where a paralleling station is proposed. Tree mitigation would also help to reduce impacts on park amenities where tree removal in parks is required.
- *Noise and Vibration*: EMUs are quieter than the current diesel locomotives, but increased service will mean more train horn events at the at-grade crossings. The Draft EIR evaluated noise impacts with the Proposed Project at 49 locations along the project corridor and found that the Proposed Project would lower noise levels at 33 locations, would not change levels at eight locations and would result in small increases in noise at eight other locations. However, the increases would be less than FTA noise thresholds. Noise associated with the traction power facilities was also evaluated and significant impacts were only identified at one potential location for a traction power substation in South San Francisco; noise design treatments proposed as mitigation would reduce impacts at this location to a less-than-significant level. Vibration effects were also analyzed in the Draft EIR and found to be less than significant for the Proposed Project.
- *Population and Housing*: The Proposed Project would not result in substantial changes in population or housing demand during operation.
- *Public Services and Utilities*: The Proposed Project would have less-than-significant impact on public services and utilities during operations.
- *Transportation and Traffic*:
  - The Draft EIR analyzes the potential traffic benefits and adverse effects of the Proposed Project. In 2020, the Proposed Project would reduce daily regional VMT by 235,000 miles and would reduce daily VMT in every city along the corridor from San Jose to San Francisco. In 2040, with full electrification, daily VMT reductions would be even greater (619,000 miles).
  - Despite the overall traffic reduction benefits, the Proposed Project would result in localized traffic impacts at certain intersections near at-grade crossings and around

Caltrain stations. The impact at the at-grade crossings is a combination of more gate-down time due to more train service and less gate-down time due to faster acceleration and deceleration of the EMUS. Compared to No Project conditions, at the at-grade crossings with gates, the net effect of the Proposed Project would be to have longer gate-down times at about 50 percent, shorter gate-down times at about 25 percent, and mixed results at the remaining 25 percent (shorter gate-down times in one peak period and longer in the other). With increased ridership, there will also be increased traffic around Caltrain stations.

- The Draft EIR studied a total of 82 intersections along the Caltrain corridor that were selected as the most likely locations of potential project impact. Of those intersections, the Proposed Project in 2020 would have significant impacts at 21 intersections. Project-level mitigation would reduce these impacts to a less-than-significant at all but nine intersections.
- The Proposed Project would have less-than-significant impacts on other transit services and station access and parking and less-than-significant impacts with mitigation on pedestrian and bicycle facilities.
- The Proposed Project would have less-than-significant impacts on freight rail service and operations as existing freight heights would be accommodated by the Proposed Project and the limited amount of existing freight service can continue to function with the reduction in operational windows due to the temporal separation requirements of the FRA waiver. If current FRA rule-making for alternative compliant vehicles results in elimination of the temporal separation requirement, then impacts on freight service would be less than disclosed in this EIR.

- Key Cumulative Impacts, Including those Related to Blended Service
  - *Aesthetics*: Blended service with more than two high-speed trains would require a set of passing tracks. Depending on location, this may result in a significant change in local visual character in combination with the Proposed Project's impacts related to tree removal and OCS installation. Because the Proposed Project would result in changes in visual character at some locations due to tree removal where tree replacement is not possible on-site, the Proposed Project may contribute considerably to localized changes in visual character.
  - *Air Quality*: Since the Proposed Project would improve air quality, it would not contribute adversely to cumulative air quality impacts.
  - *Biological Resources*: Blended Service improvements and other cumulative projects may affect some of the same biological resources affected by the Proposed Project but these impacts can likely be mitigated to a less than significant level with mitigation similar to the Proposed Project. With mitigation, the Proposed Project would not contribute to any cumulatively significant impacts.
  - *Cultural Resources*: Cultural resource impacts usually result from construction; therefore, no significant cumulative impacts on cultural resources were identified.
  - *Electromagnetic Fields/Electromagnetic Interference (EMF/EMI):* Combined Proposed Project and HSR EMF levels are expected to be less than EMF threshold levels. HSR operations could also result in EMI impacts on facilities with sensitive equipment like the

Proposed Project. Design level treatments could address potential contributions of the Proposed Project to EMI impacts.

- *Geology, Soils and Seismicity*: Proposed Project contributions to cumulative impacts related to geology, soils and seismicity can be reduced to less than significant levels with routine project mitigation measures.
- *Greenhouse Gas Emissions*: As noted above, the Proposed Project would reduce GHG emissions and thus would not contribute to cumulative impacts related to GHG emissions.
- *Hazards and Hazardous Materials:* Proposed Project contributions to cumulative impacts related to hazards and hazardous materials can be reduced to less-than-significant levels with routine project mitigation measures.
- *Hydrology and Water Quality*: Proposed Project contributions to cumulative impacts related to hydrology and water quality can be reduced to less than significant levels with routine project mitigation measures except potentially related to flooding associated with sea level rise, which may be considerable and unavoidable.
- *Land Use and Recreation:* Proposed Project contributions to cumulative impacts related to land use and recreation can be reduced to less-than-significant levels with project mitigation related to tree avoidance and replacement, and with aesthetic mitigation addressing new infrastructure.
- *Noise and Vibration*:
  - Cumulative noise impacts were evaluated for 2040 with the combined effect of the Proposed Project, HSR trains, increases in freight service, and increases in other tenant passenger rail services (ACE, Capitol Corridor, AMTRAK, and Dumbarton Rail Corridor). Cumulative noise increases were found to increase noise levels in excess of FTA noise thresholds in 2040 at all study locations if all rail increases come to fruition. Cumulative noise mitigation is proposed to consider a long-term program of noise reductions including multiple approaches such as wayside horns, building sound insulation and quiet zones[8]. Long-term grade separations and road closures are also considered, where acceptable to local jurisdictions and where funding is available.
  - Cumulative vibration impacts were evaluated with cumulative rail service increases and were found to be significant due to the cumulative number of increases trains and potentially due to the increase in vibration associated with potential increased speeds for the Blended Service 110 mph scenario. Cumulative vibration mitigation is proposed that includes track treatments and design that would address potential cumulative effects.
- *Population and Housing*: The Proposed Project would not contribute considerably to any cumulative impacts related to population and housing.
- *Public Services and Utilities*: The Proposed Project would not contribute considerably to any cumulative impacts related to public services and utilities.

[8] Quiet zones may be adopted only by local jurisdictions (i.e., cities and counties), not by rail operators like Caltrain. As discussed in Section 4.1, *Cumulative Impacts*, in this EIR, this mitigation strategy would only apply where a local jurisdiction is willing to approve a quiet zone and where feasible at-grade crossing improvements are identified that meet the FRA requirements for quiet zones.

- *Transportation and Traffic*:
  - Since the Proposed Project would reduce regional VMT, it would not contribute adversely to cumulative regional traffic.
  - The Draft EIR studied cumulative impacts with and without the Proposed Project at 82 intersections along the Caltrain corridor. Of those intersections, there would be 39 locations where the Proposed Project would contribute considerably to significant localized cumulative traffic impacts. Cumulative mitigation includes signalization a minor roadway improvements. Proposed mitigation would reduce the Proposed Project's cumulative contribution to less than significant at all but 17 intersections. While grade separations are a technically feasible mitigation, as noted above it is financially infeasible for Caltrain to adopt a comprehensive program of grade separations as mitigation. However, in the long-term where funding becomes available and it is acceptable to local jurisdictions, Caltrain would support grade separations in the long run.
  - The Proposed Project would have less-than-considerable contributions or less-than-considerable contributions with mitigation to cumulative impacts on other transit services, pedestrian and bike facilities, and station access and parking.
  - Blended Service operations could further limit the freight operational window depending on the specific HSR operational windows. Future freight increases may also be challenged with the narrowing of operational windows. Lowering of existing overhead heights at certain locations may limit the ability of freight operators to use freight train equipment with higher heights than at present. While it is likely that freight operators can adapt to these changed conditions with scheduling and equipment selection options, it is possible that a limited amount of future freight service might not be accommodated on the Caltrain corridor and could be diverted to other locations or to other modes (such as trucks) that may result in secondary impacts on localized traffic and localized noise[9]. Limiting of passenger rail service to avoid narrowing of freight operational windows would be counterproductive to Proposed Project and Blended Service purposes and would only decrease project benefits to regional traffic, air quality, and noise. However, mitigation is identified to provide for restoration of existing effective vertical clearances where needed and feasible.

S.7 Alternatives

The JPB considered a wide range of alternatives suggested during the scoping process and then conducted a three-part screening evaluation to select the alternatives to be analyzed in this EIR. Alternatives determined to be infeasible, to not avoid or substantially reduce one or more significant impacts of the Proposed Project, or to not meet all or most of the project's purpose and need were dismissed from further analysis. Based on the screening process results, this EIR selected the

[9] As described in Section 4.1, *Cumulative Impacts,* due to the Proposed Project's substantial regional traffic, air quality, and greenhouse gas emission benefits, a limited amount of freight diversion from rail to truck would not result in significant cumulative regional traffic, air quality, or greenhouse gas impacts. The impact identified associated with limited diversion, if it occurs, would be confined to potential localized traffic and noise along truck haul routes.

following alternatives for further analysis: the No Project Alternative and three other alternatives: a Diesel Multiple Unit (DMU) Alternative, a Dual-Mode Multiple Unit Alternative and an Electrification with OCS Installation by Factory Train Alternative.

A key feature of different train alternatives that is critical to providing train service along a commute corridor with many potential stops is acceleration and deceleration. Table ES-4 compares the initial acceleration rates of the alternatives analyzed in this EIR:

Table ES-4. Estimated Initial Acceleration Rates of Different Alternatives

Operator	Diesel Locomotives (No Project)	Dual-Mode Multiple Units	Diesel Multiple Units	Electric Multiple Units (Proposed Project)
Initial Acceleration Rate (mph/second)	0.5	1.1 (Diesel) 1.5 (Electric)	1.4	2.1
Sources provided in Chapter 5, *Alternatives*				

S.7.1 The No Project Alternative

Section 15126.6 (e) of the State CEQA Guidelines requires the analysis of a No Project Alternative.

The No Project Alternative would include no electrification of the Caltrain ROW between San Jose and San Francisco, no purchase of EMUs, and no increase in train service. The current train service is assumed to continue unchanged to 2020 and 2040. As noted above, this service consists of five trains per peak hour, 92 trains per day, through use of diesel engine–hauled locomotive trains.

While this alternative would not increase train service, ridership would still increase, similar to how ridership has been increasing in recent years, meaning that trains would have a higher occupancy average in the future.

S.7.2 Diesel Multiple Unit Alternative

Diesel Multiple Units (DMUs) are self-propelled diesel-mechanical vehicles with engines located below the passenger compartment. The key DMU characteristic related to desired service improvements is the reduction of running times due to faster acceleration than traditional diesel locomotive push-pull service. DMUs require less time to accelerate up to full speed from stations stops and slow areas, reducing overall travel times, particularly on a corridor featuring frequent stops.

A DMU Alternative is considered feasible, would avoid or substantially reduce one or more significant impacts of the Proposed Project and would meet some, but not all of the project's purpose and need. Specifically, a DMU Alternative would not meet the project's purpose to provide electrical infrastructure compatible with high-speed rail. In addition, while the increase train service under this alternative would increase revenue, this alternative would also increase diesel

fuel consumption compared with existing conditions[10] which would increase operating costs and would have lower ridership than the Proposed Project. Because this alternative fails to meet the project's fundamental purposes, the JPB could decide not to analyze it in this EIR. However, there has been community interest, expressed most recently in scoping comments, in the analysis of a DMU Alternative and, thus, the JPB decided to provide this alternative analysis for informational purposes.

For the purposes of this EIR, this alternative assumed the following:

- An eight-car single-level DMU train, with a capacity of 78 passengers per car (624 passengers per train) was analyzed in order to analyze an alternative that would roughly match the ridership per train capacity of the Proposed Project Only a single-level is being evaluated because a double-deck would not fit in the Caltrain system tunnels.
- Caltrain service schedule for the DMU Alternative would be the same as the Proposed Project but with lower ridership. DMUs do not accelerate or decelerate as fast as EMUs and thus the number of station steps would likely have to be reduced to maintain the same trip time as the Proposed Project EMUs or travel times would be less.
- The eight-car single-level DMU train length of 680 feet would exceed the length of Caltrain platforms at most Caltrain stations and would require platform extension construction.
- The DMU Alternative is assumed to terminate at the San Francisco 4th and King Station and would not proceed to the Transbay Terminal Center (TTC) because the Downtown Extension (DTX) tunnel and the TTC are designed only for electric trains.

S.7.3 Dual-Mode Multiple Unit (Dual-Mode MU) Alternative

Dual-mode MUs are self-propelled vehicles that can operate in both a diesel mode and in an electrified mode. While there are dual-mode locomotives in operation on the East Coast, there are no known dual-mode MUs in operation in the United States at present. However, there are dual-mode MUs in operation in Europe and others in construction that can operate in both a diesel mode in non-electrified territory and in an electrified mode using an overhead 25 kVA OCS.

A Dual-Mode MU Alternative is considered feasible, would avoid or substantially reduce one or more significant impacts of the Proposed Project and would meet some, but not all of the project's purpose and need. The Dual-Mode MU Alternative would not meet the project's purpose to provide electrical infrastructure compatible with high-speed rail. In addition, while the increase train service under this alternative would increase revenue, this alternative would also increase diesel fuel consumption compared with existing conditions[11] which would increase operating costs and would have lower ridership than the Proposed Project. Because this alternative fails to meet the project's fundamental purposes, the JPB could decide not to analyze it in this EIR. However, there

[10] In general, DMUs are more fuel efficient than diesel locomotives for consists of five cars or fewer but less fuel efficient for consists longer than five cars. The Proposed Project includes six-car consists to accommodate approximately 600 passengers per train to meet ridership demands. Thus, an eight-car DMU was assumed to accommodate a similar level of passengers. Among many other considerations described in Chapter 5, *Alternatives*, train length and fuel efficiency are two reasons that a DMU option is not as favorable for the Caltrain service as EMUs would be.

[11] A Dual-Mode MU Alternative would have similar, but likely somewhat greater, fuel consumption than the DMU Alternative would have because the multiple units are often heavier (due to dual-mode equipment) and the train consist would likely be longer, as assumed in this EIR.

has been community interest, expressed most recently in scoping comments, in the analysis of a Dual-Mode MU Alternative and, thus, the JPB decided to provide this alternative analysis for informational purposes.

For the purposes of this alternative analysis, existing European train designs were used to derive alternative assumptions.

- A 10-car single-level dual-mode MU train, consisting of two coupled five-car trainsets, with a capacity of 600 passengers per train was analyzed in order to analyze an alternative that would roughly match the per train capacity of the Proposed Project.
- Caltrain service schedule for the Dual-Mode MU Alternative would be the same as the Proposed Project but with lower ridership. Dual-mode MUs do not accelerate or decelerate as fast as EMUs and thus the number of station steps would likely have to be reduced to maintain the same trip time as the Proposed Project EMUs or travel times would be less.
- This alternative does not include electrification between San Jose and the 4th and King Station in San Francisco. However, this alternative would need to include traction power facilities to link the electrified lines in the DTX to power from PG&E. This electrification would involve connecting overhead or underground transmission wires from PG&E to a new traction power substation, and connecting transmission lines from the new traction power substation to the OCS for the DTX.
- This Alternative is assumed to operate in a diesel mode from San Jose to San Francisco and then either terminate at the San Francisco 4th and King Station or proceed in an electric mode to the TTC. In 2020, this alternative, like the Proposed Project, would terminate at the 4th and King Station. In 2040, this alternative is presumed to operate with split service with 4 trains terminating at the 4th and King Station and two trains proceeding to TTC.

S.7.4 Electrification with OCS Installation by Factory Train Alternative

This alternative consists of the same operational elements as the Proposed Project (electrified service with EMUs) but with a different method for construction of the OCS.

An alternative method of installing the OCS could be through the use of a so-called “Factory Train” (also called an “Electrification Train” and a “High Output Plant System” or the HOPS train), which is a moveable assembly line system, mounted on rails. One of the prime advantages of a Factory Train is the rate of progress in OCS installation. Rates of progress up to 1 mile/night have been reported, and the system can reportedly be used while allowing for adjacent rail lines to be used by existing trains although there may be speed restrictions for the use of adjacent lines.

This alternative is only a construction methodology alternative to conventional construction of the OCS. Thus, analysis is limited to differences between the Proposed Project and this alternative relative to OCS construction. As noted above, about 80 percent of the OCS is presumed to be installed using a Factory Train with the remaining 20 percent assumed to be installed using conventional construction. Thus, the discussion below is only relevant to the 80 percent installed by a Factory Train. Construction impacts for the other 20 percent would be the same as for the Proposed Project.

S.8 Comparison of Alternatives and the Environmentally Superior Alternative

The State CEQA Guidelines require a comparison of alternatives analyzed in an EIR and identification of an environmentally superior alternative. The environmentally superior alternative is the alternative that would avoid or substantially lessen, to the greatest extent, the environmental impacts associated with the project while feasibly obtaining most of the major project objectives. If the alternative with the least environmental impact is determined to be the No Project Alternative, the EIR must also identify an environmentally superior alternative among the other alternatives.

For construction, the No Project Alternative would be the environmentally superior alternative because it would have no electrification infrastructure (OCS or TPFs) construction. Excluding the No Project Alternative, the Dual-Mode MU Alternative would be the environmentally superior construction alternative because it would result in a lower level of construction than the DMU Alternative, the Proposed Project and the Electrification with OCS Installation by Factory Train Alternative. Given what is known about the Factory Train construction at this time,[12] it is considered environmentally superior to the Proposed Project for construction.

For operations, the No Project Alternative would be environmentally inferior to the DMU Alternative, the Dual-Mode MU Alternative and the Proposed Project because it would result in substantially lower ridership and, thus, higher criteria pollutant and GHG emissions, higher noise levels at a majority of locations, and worse regional traffic conditions. The Dual-Mode Alternative would have higher 2020 operational impacts than the DMU Alternative for 2020, but due to likely higher ridership in the long run with DTX/TTC, the Dual Mode Alternative is likely to result in long-term better air quality, lower GHG emissions and better regional traffic conditions. Thus, for operations of the alternatives to the Proposed Project, the Dual-Mode Alternative would be the environmentally superior alternative.

However, compared with the Proposed Project, the Dual-Mode MU Alternative and the DMU Alternative would result in higher criteria pollutant and GHG emissions, higher noise levels, and worse regional traffic, but would avoid the long-term impacts of the OCS infrastructure and tree removal.[13] The tradeoff between aesthetics impacts versus air quality, GHG emissions, noise and traffic impacts is not easily evaluated given the dissimilar nature of these different impacts.

The following summarizes the key differentiators between the Dual-Mode Alternative, the DMU Alternative and the Proposed Project.

- Residents, park users, and other sensitive receptors along the Caltrain ROW would have less aesthetic impacts, higher TAC emission health risks, and higher noise impacts with the Dual-Mode Alternative and the DMU Alternative.

[12] As noted above, this is a new technology, and the first OCS installation using it starts in early 2014, so there is no in-practice data by which to judge the impacts of that project, only the one single Environmental Statement completed for the Great Western Main Line Electrification Project. Despite that project lacking certain data, such as quantification of construction air quality or GHG emissions, the evidence in the Environmental Statement appears to support a conclusion that taking into account all construction subjects, a Factory Train alternative would be environmentally superior.

[13] As described in Section 3.3, *Biological Resources*, the Proposed Project's biological impacts relative to tree removal can be mitigated to less-than-significant levels, but as noted in Section 3.1, *Aesthetics*, the visual aesthetic impacts of tree removal may not always be mitigable to a less-than-significant level; thus, the comparison herein focuses on the visual aesthetic impacts of tree removal.

- Bay Area residents would be more affected relative to air quality and regional traffic by the Dual-Mode Alternative and the DMU Alternative than by the Proposed Project.
- Contributions to GHG emissions, which cumulatively affect the entire planet, would be higher with the Dual-Mode Alternative and the DMU Alternative than with the Proposed Project

While respecting the negative aesthetic impacts that would be experienced by individual receptors, on balance, the Proposed Project is considered environmentally superior to the Dual-Mode Alternative and the DMU Alternative for operations because the air quality, TAC emission, GHG emissions, noise levels, and regional traffic all affect the physical health or safety of receptors along the Caltrain ROW, in the San Francisco Bay Area, and on the planet as a whole. Comparison of different impact subjects requires one to make value judgments; on balance, the JPB places a greater value on overall public health and safety in making this judgment.

When considering construction and operations together, a similar reasoning is applied. Given the long-term benefits to public health and safety and the temporary nature of construction, the Proposed Project is considered environmentally superior to the No Project Alternative, the Dual-Mode Alternative and the DMU Alternative. Inclusion of the Factory Train Alternative as part of the Proposed Project would be environmentally superior to the Proposed Project only using conventional OCS construction methods. Excluding the Factory Train Alternative, which is only a partial alternative, the Dual-Mode MU Alternative would be the environmentally superior alternative among the full alternatives because it would result in better long-term benefits to public health and safety by having lower criteria pollutant emissions, lower GHG emissions, and lower regional traffic than the DMU Alternative and the No Project Alternative.

S.9 Issues of Controversy and Issues to be Resolved

There are a number of notable areas of controversy for the Proposed Project including, but not limited to, the following:

- *Relation of the Project to the California High-Speed Rail Project:* This EIR describes the relation of the Proposed Project both in terms of funding, electrical infrastructure compatibility, as well as separate environmental review of the electrification project by Caltrain and of Blended Service by CHSRA. Some individuals may oppose high-speed rail or may oppose the electrification project because of its relation to the high-speed rail project. Some individuals may prefer to delay project analysis of the electrification project until a project analysis of Blended Service is connected.
- *Aesthetic Impacts of the Overhead Contact System and Tree Removal*[14]: This EIR discloses the impacts of new overhead infrastructure and tree removal on local visual character and proposes feasible mitigation to minimize the change in visual aesthetics. Affected parties may object to these impacts and may advocate for non-electrification alternatives or rejection of the Proposed Project to avoid the potential for these impacts to occur.
- *Noise Impacts of Existing and Future Trains*: As noted above, project-level train noise impacts would be less than significant but cumulative train noise impacts would be significant at many

[14] The EIR addresses tree removal as both a biological resource impact and an aesthetic impact. A key controversy is the aesthetic impact on local visual character due to tree removal, but individuals may also be highly concerned about the biological resource impacts of tree removal.

locations along the Caltrain corridor. Given funding limitations, Caltrain alone cannot commit to a comprehensive set of improvements to avoid all cumulative noise impacts. Affected parties may advocate that the Proposed Project should commit to these improvements, despite the financial limitations, think that the Proposed Project should be delayed until funding is obtained to make such a commitment, or that the Proposed Project should not go forward with these impacts.

- *Traffic Impacts of Future Train Service Increases*: As noted above, project-level and cumulative localized traffic impacts would be reduced to a less than significant level at some, but not all locations with proposed mitigation. Given funding limitations, Caltrain alone cannot commit to a comprehensive set of improvements to avoid all project or cumulative traffic impacts. Affected parties may advocate that the Proposed Project should commit to these improvements, despite the financial limitations, think that the Proposed Project should be delayed until funding is obtained to make such a commitment, or that the Proposed Project should not go forward with these impacts.
- *Project Impacts on Freight Service*: As described above, the Proposed Project could affect freight service because of changes in freight operational hours, which would be of concern to Union Pacific Railroad and freight users. The Proposed Project would provide adequate vertical clearances to accommodate existing freight equipment, and the Draft EIR identifies mitigation to restore existing effective vertical clearances where necessary and appropriate. Still, changes in vertical clearance would be of concern to the affected parties.
- *Consideration of Alternatives*: The Draft EIR analyzes several alternatives to the Proposed Project at a lesser level of detail as allowed by CEQA. Some individuals may desire that Caltrain consider alternatives to electrification at an equal level to the Proposed Project and that the JPB Board would select one of such alternatives instead of the Proposed Project.

The following issues remain to be resolved:

- *Consideration of Comments on this Draft EIR*: Caltrain will consider and respond to substantive comments on the Draft EIR in the Final EIR scheduled for completion later in 2014.
- *Certification of the EIR and Adoption of the Project:* The JPB will need to consider the Final EIR, once prepared, and decide whether to certify the document. If certified, then the Board would need to decide whether to adopt the Proposed Project.
- *Design of the Proposed Project and Procurement of Rolling Stock*: The final design of the Proposed Project needs to be completed following the environmental process as does the procurement process for EMU rolling stock.
- *FRA Rule-Making on Alternative Compliant Vehicles:* The FRA is currently engaged in rule-making that may influence Proposed Project operations, including whether or not the current FRA waiver requirements concerning temporal separation need to be retained.
- *California Public Utility Commission (CPUC) Draft General Order:* The CPUC initiated rule-making (13-03-009) in 2013 pursuant to Petition 12-10-011 concerning a new General Order governing safety standards for the use of 25 kVA electrical lines to power high-speed trains. Because the OCS for the Proposed Project would be used in the future by both Caltrain and high-speed rail, some of the issues addressed in the draft General Order may apply to the Proposed Project OCS. It also appears additional CPUC rule-making proceedings would be needed for the Proposed Project because it would not be a fully grade-separated shared system.

- *Resolution of Legal Challenges to the Use of Proposition 1A Funds by CHSRA*: There are existing challenges to the current proposed use of Proposition 1A bond funds for the high-speed rail project. Depending on the resolution of these legal challenges, there might be affects to the proposed use of Proposition 1A funds to fund a significant portion of the capital costs of the Proposed Project.
- *Planning and Design of the Blended Service Improvements*: Blended Service needs further evaluation and design in order to define specific improvements necessary along the Caltrain corridor, including station design, track improvements, passing track location and design, maintenance facility design and location, as well as other details.
- *Project-Level Evaluation of Blended Service Improvements by CHSRA*: Following further design, CHSRA will need to conduct project-level environmental evaluation of Blended Service in accordance with federal and state environmental regulations.

Table ES-3. Summary of Project Impacts and Required Mitigation Measures

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
Aesthetics				
AES-1: Have a substantial adverse effect on a scenic vista	Both	Less than significant	--	--
AES-2: Substantially degrade the existing visual character or quality of the site and its surroundings	Construction	Significant	AES-2a: Minimize OCS construction activity on residential and park areas outside the Caltrain ROW	Less than significant
	Operations	Significant	AES-2b: Apply aesthetic surface treatments to new infrastructure to and provide screening vegetation at TPFs in sensitive visual locations BIO-5: Tree Avoidance, Minimization, and Replacement Plan CUL-1d: Implement design commitments at historic railroad stations	Significant and unavoidable (tree removal/pruning); Less than significant (TPFs, OCS, and overbridge protection structures)
AES-3: Substantially damage scenic resources, including trees, rock outcroppings, and historic buildings, along a scenic roadway	Both	Less than significant	--	--
AES-4: Create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area	Construction	Significant	AES-4a: Minimize spill over light during nighttime construction	Less than significant
	Operations	Significant	AES-2b: Apply aesthetic surface treatments to new infrastructure to and provide screening vegetation at TPFs in sensitive visual locations AES-4b: Minimize light spillover at TPFs	Less than significant
CUMUL-1-AES: Cumulative impacts on visual aesthetics	Construction	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
	Operation	Considerable (significant)	Project-level mitigation noted above	Considerable and unavoidable (significant)

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
Air Quality				
AQ-1: Conflict with or obstruct implementation of the applicable air quality plan	Operations	Less than significant	--	--
AQ-2: Violate any air quality standard or contribute substantially to an existing or projected air quality violation	Construction	Significant	AQ-2a: Implement BAAQMD basic and additional construction mitigation measures to reduce construction-related dust AQ-2b: Implement BAAQMD basic and additional construction mitigation measures to control construction-related ROG and NO_X emissions AQ-2c: Utilize clean diesel-powered equipment during construction to control construction-related ROG and NO_X emissions	Less than significant
	Operations	Less than significant (Beneficial)	--	--
AQ-3: Cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard	Construction	Significant	AQ-2a: Implement BAAQMD basic and additional construction mitigation measures to reduce construction-related dust AQ-2b: Implement BAAQMD basic and additional construction mitigation measures to control construction-related ROG and NO_X emissions AQ-2c: Utilize clean diesel-powered equipment during construction to control construction-related ROG and NO_X emissions	Less than significant
	Operations	Less than significant	--	--
AQ-4: Expose sensitive receptors to substantial pollutant concentrations	Construction	Less than Significant	--	--
	Operations	Less than Significant	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
AQ-5: Creation of objectionable odors affecting a substantial number of people.	Both	Less than significant	--	--
CUMUL-2-AQ: Cumulative effects on air quality	Construction	Considerable (significant)	Project-level mitigation noted above.	Less than considerable (less than significant)
	Operations	Beneficial	--	--
Biological Resources				
BIO-1: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service	Construction	Significant	BIO-1a: Implement general biological impact avoidance measures BIO-1b: Implement special-status plant species avoidance and revegetation measures BIO-1c: Implement California red-legged frog and San Francisco garter snake avoidance measures BIO-1d: Implement western pond turtle avoidance measures BIO-1e: Implement Townsend's big-eared bat, pallid bat, hoary bat, and fringed myotis avoidance measures BIO-1f: Implement western burrowing owl avoidance measures BIO-1g: Implement northern harrier, white-tailed kite, American peregrine falcon, saltmarsh common yellowthroat, purple martin, and other nesting bird avoidance measures BIO-1h: Conduct biological resource survey of future contractor-determined staging areas BIO-1i: Minimize impacts on Monarch butterfly overwintering sites	Less than significant
	Operations	Significant	BIO-1j: Avoid nesting birds and bats during vegetation maintenance	Less than significant

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
BIO-2: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations	Construction	Significant	BIO-1a: Implement general biological impact avoidance measures BIO-1b: Implement special-status plant species avoidance and revegetation measures BIO-2: Implement serpentine bunchgrass avoidance and revegetation measures BIO-5: Implement Tree Avoidance, Minimization, and Replacement Plan	Less than significant
	Operation	Less than significant	--	--
BIO-3: Have a substantial adverse effect on federally protected waters or wetlands as defined by Section 404 of the Clean Water Act or state waters or wetlands through direct removal, filling, hydrological interruption, or other means	Construction	Significant	BIO-1a: Implement general biological impact avoidance measures BIO-1h: Conduct biological resource survey of future contractor-determined staging areas BIO-3: Avoid or compensate for impacts on wetlands and waters HYD-1: Implement construction dewatering treatment	Less than significant
	Operation	Less than significant	--	--
BIO-4: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites	Both	Less than significant	--	--
BIO-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance	Construction	Significant	BIO-5: Implement Tree Avoidance, Minimization, and Replacement Plan	Less than significant
	Operation	Less than significant	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
BIO-6: Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan	Construction	Significant	BIO-6: Pay *Santa Clara Valley Habitat Plan* land cover fee (if necessary)	Less than significant
	Operation	Less than significant	--	--
CUMUL-3-BIO: Cumulative effects on biological resources	Construction	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
	Operation	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
Cultural Resources				
CUL-1: Cause a substantial adverse change in the significance of historic built resources pursuant to Section 15064.5	Both	Significant	CUL-1a: Evaluate and minimize impacts on structural integrity of historic tunnels CUL-1b: Minimize impacts on historic decorative tunnel material CUL 1-c: Install project facilities in a way that minimizes impacts on historic tunnel interiors CUL-1d: Implement design commitments at historic railroad stations CUL-1e: Implement specific tree mitigation considerations at two potentially historic properties and landscape recordation, as necessary CUL-1f: Implement historic bridge and underpass design requirements BIO-5: Implement Tree Avoidance, Minimization, and Replacement Plan	Less than significant for all resources except possibly significant and unavoidable at Tunnel 4 and possibly for several potential historic resources affected by tree removal

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
CUL-2: Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5	Both	Significant	CUL-2a: Conduct an archaeological resource survey and/or monitoring of the removal of pavement or other obstructions to determine if historical resources under CEQA or unique archaeological resources under PRC 21083.2 are present CUL-2b: Conduct exploratory trenching or coring of areas where subsurface project disturbance is planned in those areas with "high" or "very high" potential for buried site CUL-2c: Conduct limited subsurface testing before performing ground-disturbing work within 50 meters of a known archaeological site CUL-2d: Conduct exploratory trenching or coring of areas within the three zones of special sensitivity where subsurface project disturbance is planned CUL-2e: Stop work if cultural resources are encountered during ground-disturbing activities CUL-2f: Conduct archaeological monitoring of ground-disturbing activities in areas as determined by JPB and SHPO	Less than significant
CUL-3: Disturb any human remains, including those interred outside of formal cemeteries	Both	Significant	CUL-3: Comply with state and county procedures for the treatment of human remains discoveries	Less than significant
CUMUL-4-CUL: Cumulative effects on cultural resources	Construction	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
	Operation	No impacts	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
Electromagnetic Fields and Electromagnetic Interference				
EMF-1: Substantially increase electromagnetic fields along the Caltrain corridor	Operation	Less than significant	--	--
EMF-2: Substantially increase electromagnetic interference along the Corridor	Operation	Significant	EMF-2: Minimize EMI effects during final design	Less than significant
CUMUL-5-EMF: Cumulative increase in electromagnetic fields or electromagnetic interference	Construction	Less than Considerable	--	--
	Operation	Less than considerable (less than significant) (EMF)	--	--
		Considerable (significant) (EMI)	Project-level mitigation noted above	Less than considerable (less than significant)
Geology and Soils				
GEO-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, or landslides.	Both	Significant	GEO-1: Perform a site-specific geotechnical study for traction power facilities	Less than significant
GEO-2: Result in substantial soil erosion or the loss of topsoil.	Both	Less than Significant	--	--
GEO-3: Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse.	Both	Significant	GEO-1: Perform a site-specific geotechnical study for traction power facilities	Less than significant

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
GEO-4: Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.	Both	Significant	GEO-4a: Identification of expansive soils GEO-4b: Mitigation of expansive soils	Less than significant
GEO-5: Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater.	Both	No Impact	--	--
GEO-6: Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature	Both	No Impact	--	--
CUMUL-6-GEO: Cumulative exposure of people or structures to geologic or seismic hazards or destruction of unique paleontological/geologic resources	Construction	Less than considerable (less than significant)	--	--
	Operation	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
Greenhouse Gas Emissions and Climate Change				
GHG-1: Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.	Both	Less than significant (beneficial)	--	--
GHG-2: Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.	Both	Less than significant	--	--
GHG-3: Place people or structures at substantial risk of harm due to predicted climate change effects (other than sea level rise)	Both	Less than significant	--	--
CUMUL-7-GHG: Cumulative greenhouse gas emissions or exposure of people or structures to reasonably foreseeable impacts of climate change	Both	Less than considerable (less than significant)	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
Hazards and Hazardous Materials				
HAZ-1: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	Both	Less than significant	--	--
HAZ-2: Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment	Both	Significant	HAZ-2a: Conduct a Phase II Environmental Site Assessment prior to construction HAZ-2b: Implement engineering controls and best management practices during construction	Less than significant
HAZ-3: Emit hazardous emissions or involve handling hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.	Both	Less than significant	--	--
HAZ-4: Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.	Both	Significant	HAZ-2a: Conduct a Phase II Environmental Site Assessment prior to construction HAZ-2b: Implement engineering controls and best management practices during construction	Less than significant
HAZ-5: Result in an airport-related safety hazard for people residing or working in the project area.	Both	Less than significant	--	--
HAZ-6: Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.	Both	Significant	TRA-1a: Implement construction road Traffic Control Plan	Less than significant
HAZ-7: Expose people or structures to a significant risk of loss, injury or death involving wildland fires.	Both	Less than significant	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
CUMUL-8-HAZ: Cumulative effects related to hazards and hazardous materials	Construction	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
	Operation	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
Hydrology and Water Quality				
HYD-1: Violate any water quality standards or WDRs, or otherwise substantially degrade water quality	Construction	Significant	HYD-1: Implement construction dewatering treatment	Less than significant
	Operation	Less than Significant	--	--
HYD-2: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, resulting in a net deficit in aquifer volume or a lowering of the local groundwater table level	Construction	Significant	HYD-1: Implement construction dewatering treatment	Less than significant
	Operation	Less than significant	--	--
HYD-3: Substantially alter the existing drainage pattern of the site or area, or substantially increase the rate or amount of surface runoff, in a manner that would cause substantial erosion or siltation onsite or offsite, exceed the capacity of existing or planned stormwater drainage systems, or provide substantial additional sources of polluted runoff	Both	Less than significant	--	--
HYD-4: Place housing within a 100-year flood hazard area, or place structures that would impede or redirect flood flows within a 100-year flood hazard area, as mapped on a federal Flood Hazard Boundary or FIRM or other flood hazard delineation map	Construction	Less than significant	--	--
	Operation	Significant	HYD-4: Minimize floodplain impacts by minimizing new impervious areas for new TPFs or relocating these facilities	Less than significant

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
HYD-5: Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam	Construction	Less than significant	--	--
	Operation	Significant	HYD-5: Provide for electrical safety for all new TPFs subject to periodic or potential flooding	Less than significant
HYD-6: Contribute to inundation by seiche, tsunami, or mudflow	Both	Less than significant	--	--
HYD-7: Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of SLR	Operation	Significant	HYD-7: Implement a sea level rise vulnerability assessment and adaptation plan	Potentially significant and unavoidable
CUMUL-9-HYD: Cumulative impacts related to hydrology and water quality (including flooding due to sea level rise)	Construction	Considerable (significant)	Project-level mitigation noted above	Less than considerable
	Operation	Considerable (significant)	Project-level mitigation noted above	Potentially considerable and unavoidable (flooding associated with sea level rise) (significant)
Land Use and Recreation				
LUR-1: Physically divide an established community	Both	Less than significant	--	--
LUR-2: Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Proposed Project adopted for the purpose of avoiding or mitigating an environmental effect and compatibility with existing surrounding land uses.	Both	Less than significant	--	--
LUR-3: Conflict with any applicable habitat conservation plan or natural community conservation plan.	Both	Less than significant	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
LUR-4: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.	Construction	Significant	BIO-5: Implement Tree Avoidance, Minimization, and Replacement Plan	Less than significant
	Operation	Significant	AES-2b: Apply aesthetic surface treatments to new infrastructure to and provide screening vegetation at TPFs in sensitive visual locations	Less than significant
LUR-5: Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.	Both	No impact	--	--
CUMUL-10-LUR: Cumulative effects related to land use and recreation	Construction	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
	Operation	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
Noise and Vibration				
NOI-1: Expose sensitive receptors to substantial increase in noise levels	Construction	Significant	NOI-1a: Implement Construction Noise Control Plan	Significant and unavoidable (certain locations)
	Operation	Significant	NOI-1b: Conduct site-specific acoustical analysis of ancillary facilities based on the final mechanical equipment and site design and implement noise control treatments where required.	Less than significant
NOI-2: Expose sensitive receptors to substantial increase in ground-borne vibration levels from proposed operations	Construction	Significant	NOI-2a: Implement Construction Vibration Control Plan	Less than significant
	Operation	Less than significant	--	--
CUMUL-11-NOI: Cumulative increase in noise or vibration	Construction	Considerable (significant)	NOI-1a: Implement Construction Noise Control Plan NOI-2a: Implement Construction Vibration Control Plan	Less than considerable (less than significant)

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
	Operation	Considerable (significant)	Project-level mitigation noted above NOI-CUMUL-1: Implement a phased program to reduce cumulative train noise along the Caltrain corridor, as necessary to address future cumulative noise increases over FTA thresholds. NOI-CUMUL-2: Conduct project-level vibration analysis for Blended System operations and implement vibration reduction measures as necessary and appropriate for the Caltrain corridor.	Considerable and unavoidable for noise (significant); Less than considerable for vibration (less than significant)
Population and Housing				
POP-1: Induce substantial population growth, either directly or indirectly	Both	Less than significant	--	--
POP-2: Displace a substantial number of existing housing units, necessitating the construction of replacement housing elsewhere	Both	No impact	--	--
POP-3: Displace a substantial number of people, necessitating the construction of replacement housing elsewhere	Both	No impact	--	--
CUMUL-12-POP: Cumulative impact to population and housing	Both	No impact	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
Public Services and Utilities				
PSU-1: Substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities or a need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the following public services: fire protection, police protection, schools, or other public facilities	Both	Less than significant	--	--
PSU-2: Exceed wastewater treatment requirements of the applicable Regional Water Board	Construction	Significant	HYD-1: Implement construction dewatering treatment	Less than significant
	Operations	Less than significant	--	--
PSU-3: Require or result in the construction of new water, wastewater, or stormwater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects	Both	No impact	--	--
PSU-4: Have sufficient water supplies available to serve the project from existing entitlements and resources, or would new or expanded entitlements be needed	Both	Less than significant	--	--
PSU-5: Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments	Both	Less than significant	--	--

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
PSU-6: Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs	Both	Less than significant	--	--
PSU-7: Comply with federal, state, and local statutes and regulations related to solid waste	Both	Less than significant	--	--
PSU-8: Construction activities would result in a substantial disruption to utility service systems	Construction	Significant	PSU-8a: Provide continuous coordination with all utility providers PSU-8b: Adjust OCS pole foundation locations PSU-8c: Schedule and notify users about potential service interruptions	Less than significant
PSU-9: Construction activities would result in the construction of new utility facilities or expansion of existing utility facilities, the construction of which could cause significant environmental effects	Construction	Significant	PSU-9: Require application of relevant construction mitigation measures to utility relocation and transmission line construction by others	Less than significant
CUMUL-13-PSU: Cumulative impacts related to public services and utilities	Both	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
Transportation and Traffic				
TRA-1a: Substantially disrupts existing or future traffic operations during construction	Construction	Significant	TRA-1a: Implement construction Road Traffic Control Plan	Less than significant
TRA-1b: Conflicts or creates inconsistencies with regional traffic plans or substantially disrupts future regional traffic operations from Proposed Project operation	Operation	Less than significant	--	--
TRA-1c: Conflicts or creates inconsistencies with local traffic plans or substantially disrupts future local traffic operations from Proposed Project operation in 2020	Operation	Significant	TRA-1c: Implement signal optimization and roadway geometry improvements at impacted intersections for the 2020 Project Condition	Significant and unavoidable

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
TRA-2a: Disrupts existing or planned transit services or facilities during construction	Construction	Significant	TRA-1a: Implement construction road Traffic Control Plan TRA-2a: Implement railway disruption control plan	Less than significant
TRA-2b: Creates demand for public transit services above the capacity which is provided or planned; interferes with existing or planned transit services or facilities; or conflicts or creates inconsistencies with adopted transit system plans, guidelines, policies, or standards from Proposed Project operations	Operations	Beneficial (Caltrain); Less than significant (other transit services)	--	--
TRA-2c: Substantially increase hazards for transit system operations because of a design feature or otherwise substantially compromise the safety of transit facilities	Operations	Less than significant	--	--
TRA-3a: Disrupts existing or planned pedestrian facilities during construction	Construction	Significant	TRA-1a: Implement construction road Traffic Control Plan	Less than significant
TRA-3b: Disrupts existing pedestrian facilities, interferes with planned pedestrian facilities, or conflicts or creates inconsistencies with adopted pedestrian system plans, guidelines, policies, or standards from Proposed Project operations	Operations	Significant	TRA-3b: In cooperation with the City and County of San Francisco, implement surface pedestrian facility improvements to address the Proposed Project's additional pedestrian movements at and immediately adjacent to the San Francisco 4th and King Station	Less than significant
TRA-4a: Substantially disrupts existing bicycle facilities or interferes with planned bicycle facilities during construction	Construction	Significant	TRA-1a: Implement construction road Traffic Control Plan	Less than significant

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
Substantially disrupts existing bicycle facilities or interferes with planned bicycle facilities; or conflicts or creates substantial inconsistencies with adopted bicycle system plans from Proposed Project operations	Operations	Significant	TRA-4b: Continue to improve bicycle facilities at Caltrain stations and partner with bike share programs where available, using the guidance in the Caltrain's Bicycle Access and Parking Plan	Less than significant
TRA-5: Results in inadequate emergency vehicle circulation and/or access.	Construction	Significant	TRA-1a: Implement construction road Traffic Control Plan	Less than significant
	Operations	Less than significant	--	--
TRA-6a: Provide inadequate parking supply during construction	Construction	Less than significant	--	--
TRA-6b: Does not meet Caltrain's *Comprehensive Access Program Policy Statement* or *Bicycle Access and Parking Plan* or would result in the construction of off-site parking facilities that would have secondary physical impacts on the environment from Proposed Project operations	Operations	Less than significant	--	--
TRA-7: Results in a change in freight rail service such that resultant diversions to truck or other freight modes would result in significant secondary impacts during operations	Construction	Significant	TRA-2a: Implement railway disruption control plan	Less than significant
	Operations	Less than significant	--	--
CUMUL-14-TRA: Cumulative effects to transportation and traffic	Construction	Considerable (significant)	Project-level mitigation noted above	Less than considerable (less than significant)
Regional Traffic	Operation	Beneficial	--	--
Localized Traffic	Operation	Considerable (significant)	TRA-CUMUL-1: Implement a phased program to provide traffic improvements to reduce traffic delays near at-grade crossings and Caltrain stations	Considerable and unavoidable

Impact	Phase	Significance before Mitigation	Mitigation	Significance after Mitigation
Transit Systems	Operation	Considerable (significant)	TRA-CUMUL-2: Implement technical solution to allow electric trolley bus transit across 16th Street without OCS conflicts in cooperation with SFMTA	Less than considerable (less than significant)
Pedestrian and Bicycle Facilities	Operation	Considerable (significant)	Project level mitigation noted above	Less than considerable (less than significant)
Station Access and Parking	Operation	Less than considerable (less than significant)	--	--
Freight Service	Operation	Considerable (significant)	TRA-CUMUL-3: As warranted, Caltrain and freight operators will partner to provide site improvements to restore existing effective vertical height clearances along the Caltrain corridor.	Considerable and unavoidable for operational window change (significant); Less than considerable for vertical height clearance (less than significant)

-- = not applicable
BAAQMD = Bay Area Air Quality Management District
EMF = electromagnetic field
EMI = electromagnetic interference
FTA = Federal Transit Administration
GHG = greenhouse gas
JPB = Peninsula Corridor Joint Powers Board
NO_x = oxides of nitrogen
OCS = overhead contact system
ROG = reactive organic gases
ROW = right-of-way
PRC = Public Resources Code
SFMTA = San Francisco Municipal Transportation Agency
SHPO = State Historic Preservation Officer
TPFs = traction power facilities

1