California High-Speed Rail Authority

Burbank to Los Angeles Project Section

Air Quality and Global Climate Change Technical Report

May 2020

CALIFORNIA
High-Speed Rail Authority

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.

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ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	microgram(s) per cubic meter
°F	degree(s) Fahrenheit
AB	(California) Assembly Bill
Amtrak	National Railroad Passenger Corporation
AQMP	air quality management plan
Authority	California High-Speed Rail Authority
Basin	South Coast Air Basin
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CALINE4	California LINE Source Dispersion Model, Version 4
CARB	California Air Resources Board
CalEEMod	California Emissions Estimator Model
Cal-EPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
C.F.R.	Code of Federal Regulations
CH_4	methane
CMF	Central Maintenance Facility
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DE	diesel exhaust
DPM	diesel particulate matter
EIR	environmental impact report
EO	(California) Executive Order
EIS	environmental impact statement
EMFAC2014	Emission Factors 2014
Fed. Reg.	*Federal Register*
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
GHG	greenhouse gas
GWP	global warming potential
HEI	Health Effects Institute
HFC	hydrofluorocarbons

HFE	hydrofluorinated ethers
HMF	heavy maintenance facility
HSR	high-speed rail
IAMF	impact avoidance and minimization feature
IPCC	Intergovernmental Panel on Climate Change
LADOT	(City of) Los Angeles Department of Transportation
LAUS	Los Angeles Union Station
Link US	Link Union Station
LMF	light maintenance facility
LOS	level-of-service
LST	localized significance threshold
Metro	Los Angeles County Metropolitan Transportation Authority
MMT	million metric tons
MOIF	maintenance of infrastructure facilities
MOIS	maintenance of infrastructure siding facilities
MOVES	Motor Vehicle Emission Simulator
mph	miles per hour
MPO	metropolitan planning organization
MSAT	mobile-source air toxic
MT	metric ton
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NF_3	nitrogen trifluoride
NHTSA	National Highway Traffic Safety Administration
NO	nitric oxide
NOA	naturally occurring asbestos
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
O_3	ozone
OCS	overhead catenary system
OEHHA	Office of Environmental Health Hazard Assessment
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PM	particulate matter
$PM_{2.5}$	particulate matter smaller than or equal to 2.5 micrometers in diameter

PM_{10}	particulate matter smaller than or equal to 10 micrometers in diameter
POM	polycyclic organic matter
ppm	parts per million
PTC	positive train control
ROG	reactive organic gas
RSA	resource study area
RTP	regional transportation plan
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
SAA	Supplemental Alternatives Analysis
SB	(California) Senate Bill
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCS	sustainable community strategies
SEM	sequential excavation method
SIP	state implementation plan
SO_2	sulfur dioxide
SR	State Route
TAC	toxic air contaminant
TOG	total organic gas
TPSS	traction power substation
tons/yr	tons per year
UPRR	Union Pacific Railroad
USEPA	United States Environmental Protection Agency
VMT	vehicle miles traveled
VOC	volatile organic compound

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EXECUTIVE SUMMARY

The California High-Speed Rail Authority (Authority) proposes to construct, operate, and maintain an electric-powered high-speed rail (HSR) system in California. When completed, it will run from San Francisco to Los Angeles in under three hours at speeds capable of exceeding 200 miles per hour (mph). The system will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations.

The Authority and the Federal Railroad Administration (FRA) have prepared program-wide, Tier 1 environmental documents for the California HSR System under the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). Specifically, the Authority and FRA prepared the *Statewide Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS)* (Authority and FRA 2005) to evaluate the ability of the HSR system to meet existing and future demands on the capacity of California's intercity transportation system. The Authority and FRA also prepared the *Bay Area to Central Valley HSR Program EIR/EIS* (Authority and FRA 2008) to identify a corridor alignment and the station locations for the connection between the Bay Area and the Central Valley.

The Authority is now undertaking second-tier project environmental evaluations for several sections of the statewide system. This technical report provides an analysis of air quality and global climate change associated with the Burbank to Los Angeles Project Section of the HSR. This project section is approximately 14 miles long and would cross the cities of Burbank, Glendale, and Los Angeles on an existing railroad corridor. It would be located within a narrow and constrained urban environment, crossing major streets and highways, and in portions adjacent to the Los Angeles River. From the north, this project section begins at the Burbank Airport Station and travels into Los Angeles where it terminates at Los Angeles Union Station in the south.

Because the HSR project would not commence service for almost 10 years and would not reach full operation for almost 25 years, use of only existing conditions as a baseline for air quality and global climate change effects would be misleading. The substantial differences in timing and circumstances associated with HSR construction, the initiation of HSR operations, and both interim and full HSR operation and analysis requires use of progressive baselines for thorough examination of potential air quality and greenhouse gas (GHG) effects. This approach is necessary to capture changes in air quality and GHG conditions, and emissions resulting from planned traffic improvement projects and the anticipated different stages of HSR operation. An accurate prediction of expected conditions for evaluation of the HSR project's air quality and GHG effects must consider these planned transportation improvements in the underlying background conditions to which HSR project effects would be added.

Therefore, the air quality and GHG analysis uses a multiple baseline approach. That is, the HSR project's air quality and global climate change effects are evaluated both against existing conditions and against background (i.e., No Project) conditions as they are expected to be for the opening year of the project in 2029 and the horizon year in 2040. This approach complies with CEQA (see *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority*, et al. [2013] 57 Cal. 4th 439, 454). Emissions data for the three baselines are presented and the effects of the project compared to those baseline conditions are presented in this report. The results comparing the project with existing conditions are summarized in this report.

The analysis estimated the emission changes due to projected reductions of on-road vehicle miles traveled (VMT) and intrastate air travel, and increases in electrical demand (required to power the HSR). In the With Project analyses, the HSR project is predicted to have a beneficial effect on (i.e., reduce) statewide emissions of all applicable pollutants, with the exception of total organic gas emissions in the opening year (2029), which would increase as compared to the existing conditions.

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1 INTRODUCTION

1.1 California High-Speed Rail System Background

The California High-Speed Rail Authority (Authority) is responsible for planning, designing, building, and operating the first high-speed passenger rail service in the nation. The California High-Speed Rail (HSR) System will connect the mega-regions of the state, contribute to economic development and a cleaner environment, create jobs, and preserve agricultural and protected lands. When it is completed, it will run from San Francisco to the Los Angeles basin in under three hours at speeds capable of exceeding 200 miles per hour. The system will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations, as shown on Figure 1-1.[1] In addition, the Authority is working with regional partners to implement a statewide rail modernization plan that will invest billions of dollars in local and regional rail lines to meet the state's 21st century transportation needs.

The California HSR System is planned to be implemented in two phases. Phase 1 would connect San Francisco to Los Angeles and Anaheim via the Pacheco Pass and the Central Valley.[2] Phase 2 would connect the Central Valley to Sacramento, and another extension is planned from Los Angeles to San Diego. The California HSR System would meet the requirements of Proposition 1A,[3] including the requirement for a maximum nonstop service travel time between San Francisco and Los Angeles of two hours and 40 minutes.

1.2 Burbank to Los Angeles Project Section Background

The Burbank to Los Angeles Project Section would be a critical link in Phase 1 of the California HSR System connecting the San Francisco Bay Area to the Los Angeles Basin. The Authority and the Federal Railroad Administration (FRA) selected the existing railroad right-of-way as the corridor for the preferred alternative between Sylmar and Los Angeles Union Station (LAUS) in the 2005 *Statewide Program Environmental Impact Report/Environmental Impact Statement* (EIR/EIS) (Authority and FRA 2005). The Sylmar to Los Angeles railroad corridor includes Burbank, which is southeast of Sylmar. Therefore, the Project EIR/EIS for the Burbank to Los Angeles Project Section focuses on alignment alternatives along the existing Sylmar to Los Angeles railroad corridor.

The Burbank to Los Angeles Project Section was initially considered as part of the Palmdale to Los Angeles Project Section. The Authority and FRA announced their intention to prepare a joint EIR/EIS for the Palmdale to Los Angeles Project Section in March 2007. On March 12, 2007, the Authority released a Notice of Preparation, and the FRA published a Notice of Intent on March 15, 2007. Over the next several years, the Authority and FRA conducted scoping and prepared alternatives analysis documents for that section. The 2010 Palmdale to Los Angeles Preliminary Alternatives Analysis recommended alignment alternatives and station options for the Palmdale to Los Angeles Project Section based on the program-level corridor selected in 2005. The 2011 Palmdale to Los Angeles Supplemental Alternatives Analysis (SAA) focused specifically on the subsections from the community of Sylmar to LAUS, and reevaluated the alternatives and station options. In June 2014, the Authority published a Palmdale to Los Angeles SAA Report, which introduced the concept of splitting the Palmdale to Los Angeles Project Section into two sections. On July 24, 2014, the Authority released a Notice of Preparation and the FRA published a Notice of Intent to prepare EIR/EIS documents for the Palmdale to Burbank and Burbank to Los Angeles project sections.

[1] The alignments on Figure 1-1 are based on Authority/FRA decisions made in the 2005, 2008, and 2012 Programmatic EIR/EIS documents.

[2] Phase 1 may be constructed in smaller operational segments, depending on available funds.

[3] http://www.catc.ca.gov/programs/hsptbp.htm.

Source: California High-Speed Rail Authority and Federal Railroad Administration, 2017

Figure 1-1 California High-Speed Rail System

One of the main reasons for the project section split was the Initial Operating Section[4] concept and its interim terminus in the San Fernando Valley, which was discussed in the Authority's 2012 and 2014 Business Plans. Additionally, the Authority and FRA determined that separate environmental documents would be more beneficial to address environmental impacts and conduct stakeholder outreach. The key environmental resources likely to be impacted were different between the two sections, and separate environmental documents better supported project phasing and sequencing.

In April 2016, the Authority released the Burbank to Los Angeles SAA, which refined the previously studied alignments. Additionally, the Authority released the 2016 Palmdale to Burbank SAA, which refined the concepts at the Burbank Airport Station and the alignments from south of the Burbank Airport Station to Alameda Avenue in the City of Burbank. The 2016 Burbank to Los Angeles SAA Report proposed to evaluate one build alternative south of Alameda Avenue to LAUS. The subsection between the Burbank Airport Station and Alameda Avenue was studied in the 2016 Palmdale to Burbank SAA, which proposed two station options and two alignment options. Table 1-1 summarizes the conclusions of the two SAA reports.

Table 1-1 2016 Supplemental Alternatives Analysis Recommendations for the Burbank to Los Angeles Project Section

Alternative	Alignment/ Station	Area/Station	Alignment/Station Type
No Project Alternative			
HSR Build Alternative	Alignments	Burbank Airport Station to Alameda Avenue	Alignment Option A (Surface) Alignment Option B (Below-Grade and Surface)
		Alameda Avenue to LAUS	Surface Alignment
	Stations	Burbank Airport Station	Station Option A (Surface) Station Option B (Below-Grade)
		LAUS	Surface Station Option

Sources: California High-Speed Rail Authority and Federal Railroad Administration, 2016. "Palmdale to Burbank Supplemental Alternatives Analysis"; "Burbank to Los Angeles Supplemental Alternatives Analysis."
HSR = high-speed rail
LAUS = Los Angeles Union Station

Since the release of the two SAA documents in 2016, the design has undergone further refinements. The surface options from Burbank Airport to Alameda Avenue (Alignment Option A and Station Option A) have been eliminated from consideration. The below-grade options (Alignment Option B and Station Option B) have been refined in order to minimize potential environmental effects and reduce cost. Therefore, this environmental document evaluates one build alternative for the project section.

FRA requires logical termini for project level analysis. The Authority has determined that logical termini are defined by stations, with Burbank Airport Station as the northern terminus and LAUS as the southern terminus for the Burbank to Los Angeles Project Section. These two stations are also termini for the Palmdale to Burbank and Los Angeles to Anaheim Project Sections. The analysis for the Burbank Airport Station is consistent with what is included in the Palmdale to Burbank EIR/EIS. Similarly, the analysis for LAUS is consistent with what is included in the Los Angeles to Anaheim EIR/EIS.

[4] The Initial Operating Section was the first segment planned for construction and operations, as outlined in the 2014 Business Plan. The segment permitted operation of HSR service from Merced to the San Fernando Valley. The 2016 Business Plan revised the initial segment termini to the Central Valley and Silicon Valley.

1.3 Project Description Purpose

This project description describes the project for use during environmental impact analyses to complete technical reports to inform the Burbank to Los Angeles Project Section EIR/EIS. The basis of this project description is the HSR Build Alternative as defined in the *Burbank to Los Angeles Project Section Draft Preliminary Engineering for Project Definition* document. This project description describes the physical design elements of the project and does not define all operating plans and scenarios, construction plans, or capital and operating costs. This project description will serve as the basis for Chapter 2, Alternatives, of the project EIR/EIS. Chapter 2 of the EIR/EIS will include additional detail beyond the content of this report.

This report documents the detailed environmental resource analysis conducted for the Burbank to Los Angeles Project Section of the California HSR System and includes the following:

- A brief description of the project and the alternatives under study
- A discussion of pertinent statutes and regulations
- A description of the existing environmental resource conditions in the study area
- A description of the analytical methodologies and assumptions used for this study
- The results of these analyses, including effects or benefits resulting from the project

2 PROJECT DESCRIPTION

The Burbank to Los Angeles Project Section of the California HSR System is approximately 14 miles long, crossing the cities of Burbank, Glendale, and Los Angeles on an existing railroad corridor. HSR for this project section would be within a narrow and constrained urban environment, crossing major streets and highways and, in some portions, adjacent to the Los Angeles River. The Los Angeles County Metropolitan Transportation Authority (Metro) owns the railroad right-of-way, the Southern California Regional Rail Authority owns the track and operates the Metrolink commuter rail service, the National Railroad Passenger Corporation (Amtrak) provides intercity passenger service, and the Union Pacific Railroad (UPRR) holds track access rights and operates freight trains.

This section describes the No Project Alternative and the HSR Build Alternative to be evaluated in the Burbank to Los Angeles Project EIR/EIS.

2.1 No Project Alternative

Under the No Project Alternative, the California HSR System would not be built. The No Project Alternative represents the condition of the Burbank to Los Angeles Project Section as it existed in 2015, and as it would exist without the HSR System at the horizon year (2040).

The No Project Alternative assumes that all currently known programmed and funded improvements to the intercity transportation system (highway, transit, and rail) and reasonably foreseeable local land development projects (with funding sources identified) would be developed by 2040. The No Project Alternative is based on a review of the following: regional transportation plans for all modes of travel; the State Transportation Improvement Program; the Federal Transportation Improvement Program; Southern California Regional Rail Authority strategic plans, transportation plans and programs for Los Angeles County; airport master plans; and city and county general plans.

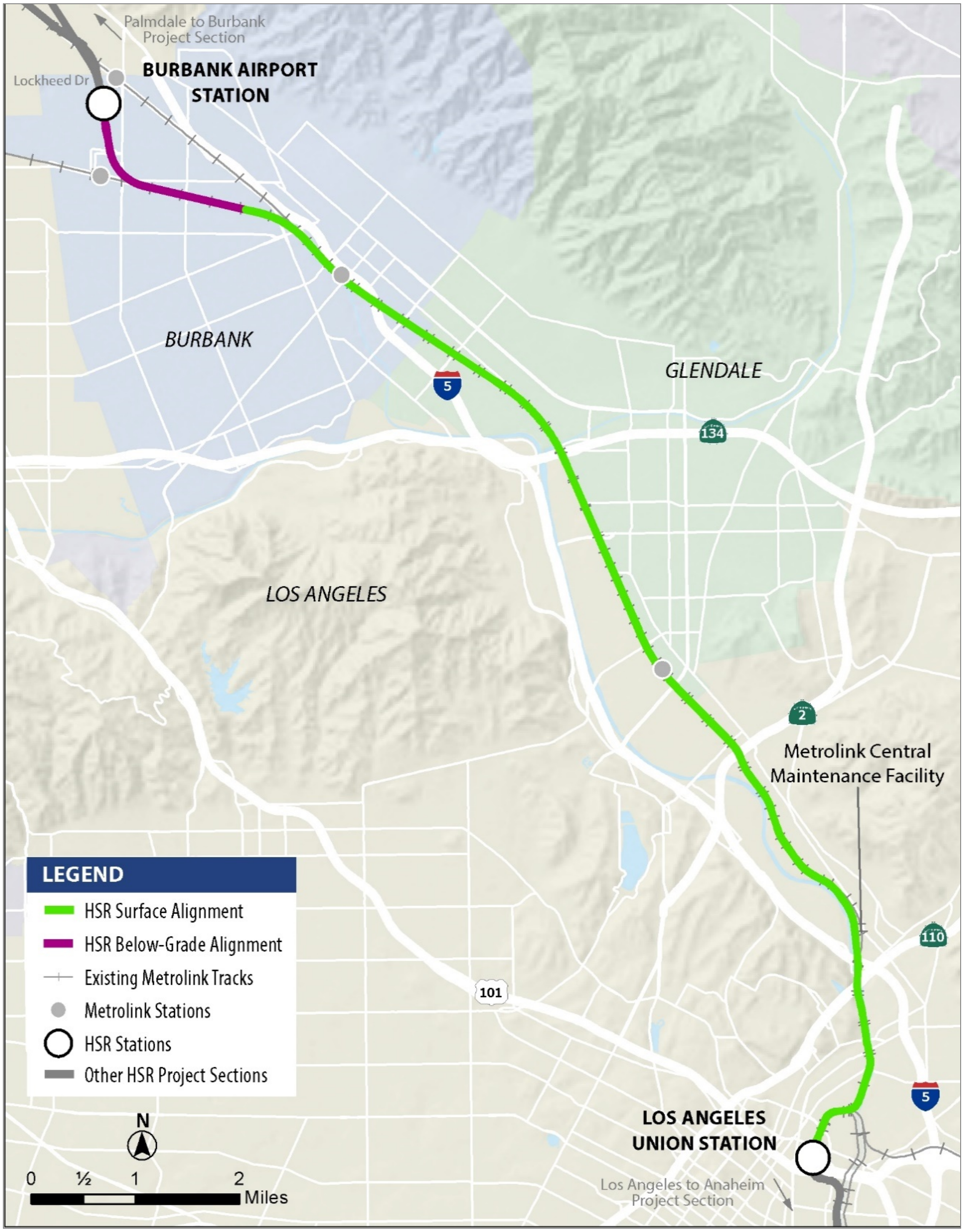
2.2 High-Speed Rail Build Alternative

The HSR Build Alternative includes new and upgraded track, maintenance facilities, grade separations, drainage improvements, communications towers, security fencing, passenger train stations, and other necessary facilities to introduce HSR service into the Los Angeles-San Diego-San Luis Obispo (LOSSAN) Corridor from near Hollywood Burbank Airport to LAUS. In portions of the alignment, new and upgraded tracks would allow other passenger trains to share tracks with the HSR system. HSR stations would be located near Hollywood Burbank Airport and at LAUS. The alignment would be entirely grade-separated at crossings, meaning that roads, railroads, and other transport facilities would be at different heights so the HSR system would not interrupt or interface with other modes of transportation, including vehicle, bicycle, and pedestrian.

For most of the project section, the HSR alignment would be within the existing railroad right-of-way, which is typically 70 to 100 feet wide. The HSR alignment includes northbound and southbound electrified tracks for high-speed trains. The right-of-way would be fenced to prohibit pedestrian and public or unauthorized vehicle access.

The project footprint (the area required to build, operate, and maintain HSR service) is based on the following elements of design: station areas, hydrology, track, roadway, structures, systems, and utilities.

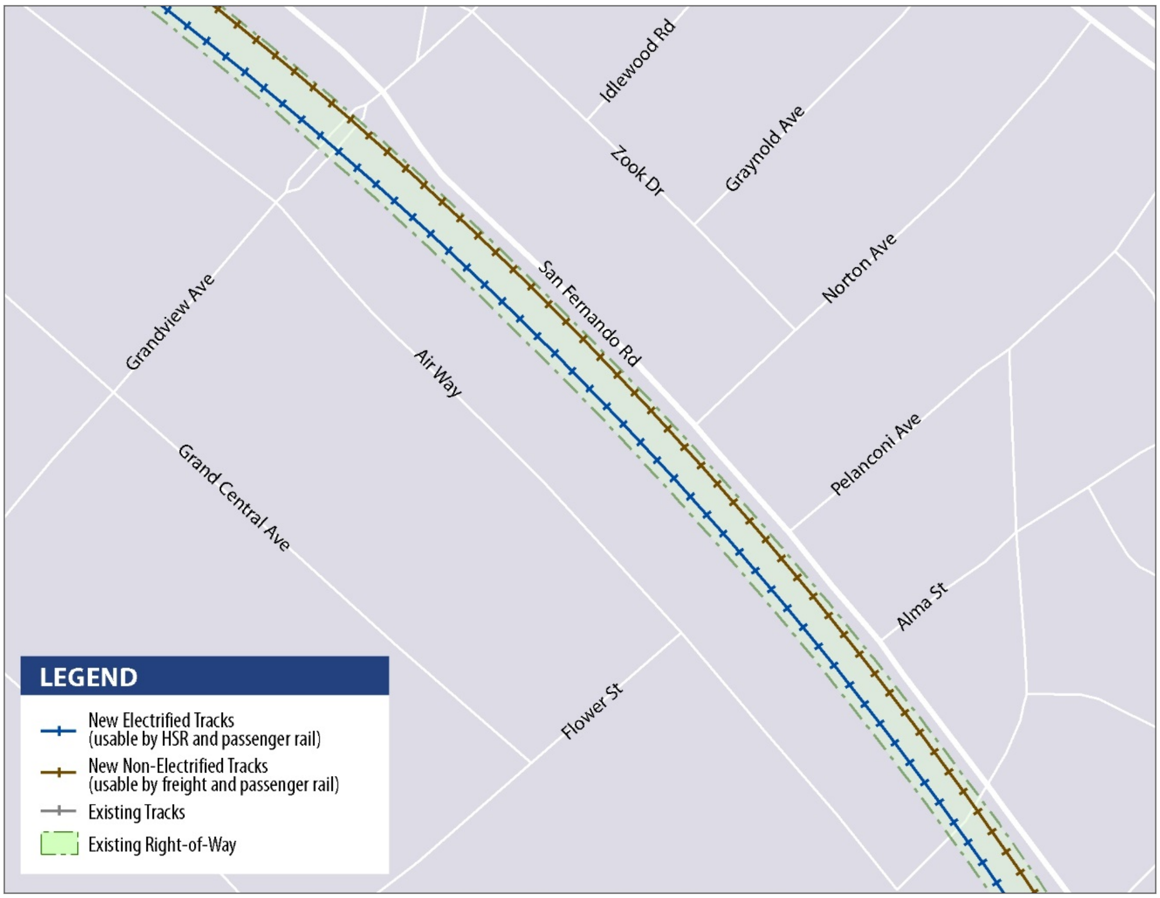
Figure 2-1 shows an overview of the Burbank to Los Angeles Project Section.



Source: California High-Speed Rail Authority, 2019

Figure 2-1 Overview of Burbank to Los Angeles Project Section

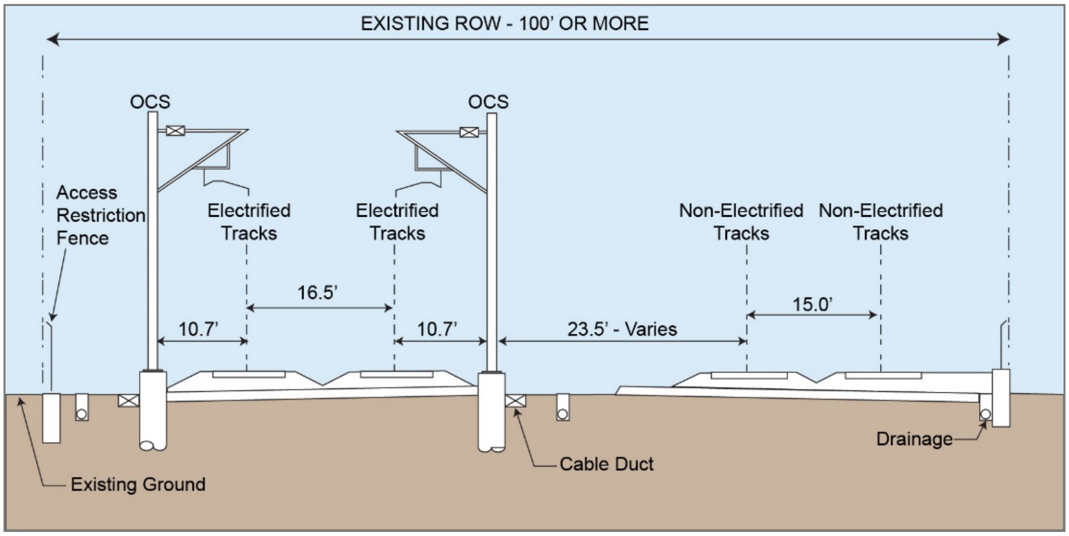
The Burbank to Los Angeles Project Section includes a combination of at-grade, below-grade, and retained-fill track, depending on corridor and design constraints. The at-grade and retained-fill portions of the alignment would be designed with structural flexibility to accommodate shared operations with other passenger rail operators. Throughout most of the project section (between Alameda Avenue and State Route [SR] 110), two new electrified tracks would be placed along the west side of the existing railroad right-of-way and would be useable for HSR and other passenger rail operators. The existing non-electrified tracks would be realigned closer to the east side of the existing right-of-way, for a total of four tracks; these realigned, non-electrified tracks would be usable for freight and other passenger rail operators, but not for HSR. Figure 2-2 illustrates the placement of the new electrified tracks and realigned, non-electrified tracks relative to the existing tracks.



Source: California High-Speed Rail Authority, 2019

Figure 2-2 New Electrified and Non-Electrified Tracks Within Existing Right-of-Way

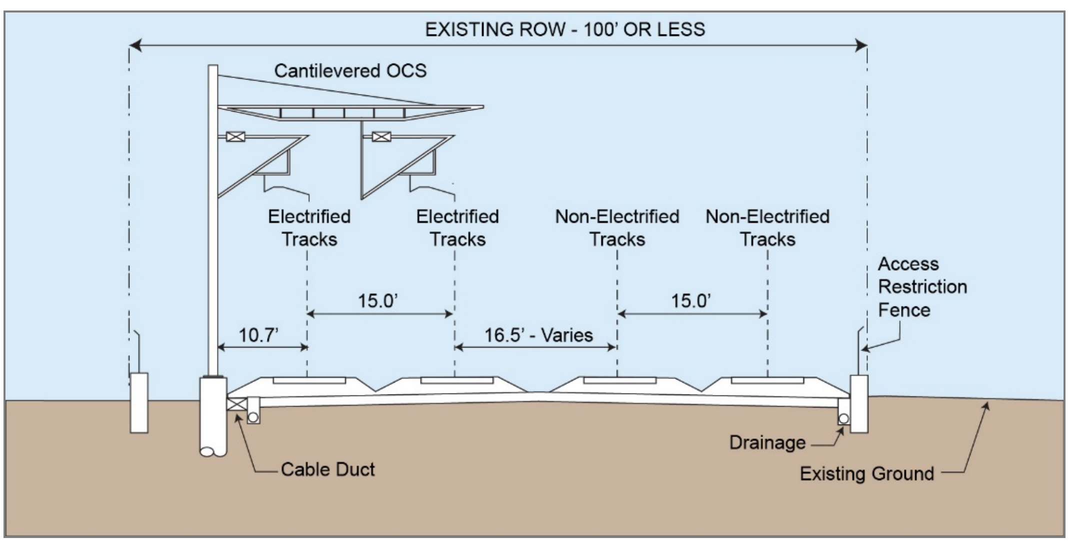
Throughout most of the Burbank to Los Angeles Project Section, the electrified track centerline and the non-electrified track centerline would have a minimum separation of 23.5 feet, and the northbound and southbound electrified tracks would have a separation of 16.5 feet, following the Authority's *Technical Memorandum 1.1.21 Typical Cross Sections for 15% Design* (2013). These standard separations are illustrated on Figure 2-3.



Source: California High-Speed Rail Authority, 2019
This illustration shows the standard separations between the electrified and non-electrified tracks in areas where the railroad right-of-way is at least 100 feet wide. (Figure not to scale.)

Figure 2-3 Standard Track Separations within Non-Constrained Right-of-Way

However, in several areas of the corridor, the right-of-way is less than 100 feet wide, a threshold that constrains the design. As a result, reduced track separations were used in these constrained areas in order to stay within the existing right-of-way to the greatest extent possible and thus minimize property impacts. The reduced separations between the electrified and non-electrified track centerlines would be a minimum of 16.5 feet, and between the two electrified track centerlines would be 15 feet. The narrower cross-section separations are illustrated on Figure 2-4.



Source: California High-Speed Rail Authority, 2019
This illustration shows the narrow separations between the electrified and non-electrified tracks, which would minimize property impacts in areas where right-of-way is constrained. The reduced separations are applied in areas where the railroad right-of-way is less than 100 feet wide. (Figure not to scale.)

Figure 2-4 Reduced Track Separations within Constrained Right-of-Way

2.2.1 High-Speed Rail Build Alternative Description

The following section describes the HSR Build Alternative in greater detail. Figure 2-5 (Sheets 1 to 3) shows the HSR Build Alternative, including the HSR alignment, new/modified non-electrified tracks, and roadway crossings.

The HSR alignment would begin at the underground Burbank Airport Station and would consist of two new electrified tracks. After exiting the underground station, the alignment would travel southeast beneath the Hollywood Burbank Airport runway in a tunnel, which would be constructed using the sequential excavation method without any disruptions to airport operations. The alignment from south of the airport to where it would join the Metrolink Ventura Subdivision would be constructed as cut-and-cover, and the alignment would then transition to a trench within the Metrolink Ventura Subdivision. The existing Metrolink Ventura Subdivision tracks would be realigned north within the existing right-of-way, and an existing UPRR siding track between Buena Vista Street and Beachwood Drive would be realigned north of the relocated Metrolink Subdivision tracks within the existing right-of-way. These non-electrified tracks would remain at grade. The trench, which would be south of and parallel to the relocated non-electrified tracks, would be dedicated for HSR tracks only. Figure 2-6, Figure 2-7, and Figure 2-8 depict the typical cross-sections of the below-grade portion of the alignment. During construction of the below-grade alignment, shoofly tracks would be provided to support Metrolink operations. The proposed shoofly tracks would be aligned between Hollywood Way and Buena Vista Street outside the existing right-of-way and would result in temporary roadway impacts to Vanowen Street.

The HSR tracks would transition from the trench and emerge to at-grade within the existing railroad right-of-way near Beachwood Drive in the city of Burbank. Near Beachwood Drive, the HSR tracks would curve south out of the existing railroad right-of-way and cross Victory Place on a new railroad bridge, which would be directly south of the existing Victory Place bridge. South of Burbank Boulevard, the HSR tracks would re-enter the railroad right-of-way and run parallel to the Metrolink Antelope Valley Subdivision tracks. Between Burbank Boulevard and Magnolia Boulevard, several UPRR industry tracks west of the right-of-way would be removed.

Continuing south, the HSR alignment would pass the Downtown Burbank Metrolink Station, which would be modified. HSR tracks would be placed within the existing parking lot west of the southbound platforms, and new pedestrian connections and relocated parking would be provided. Section 2.6.1 provides more details on design modifications for the Downtown Burbank Metrolink station.

Source: California High-Speed Rail Authority, 2019

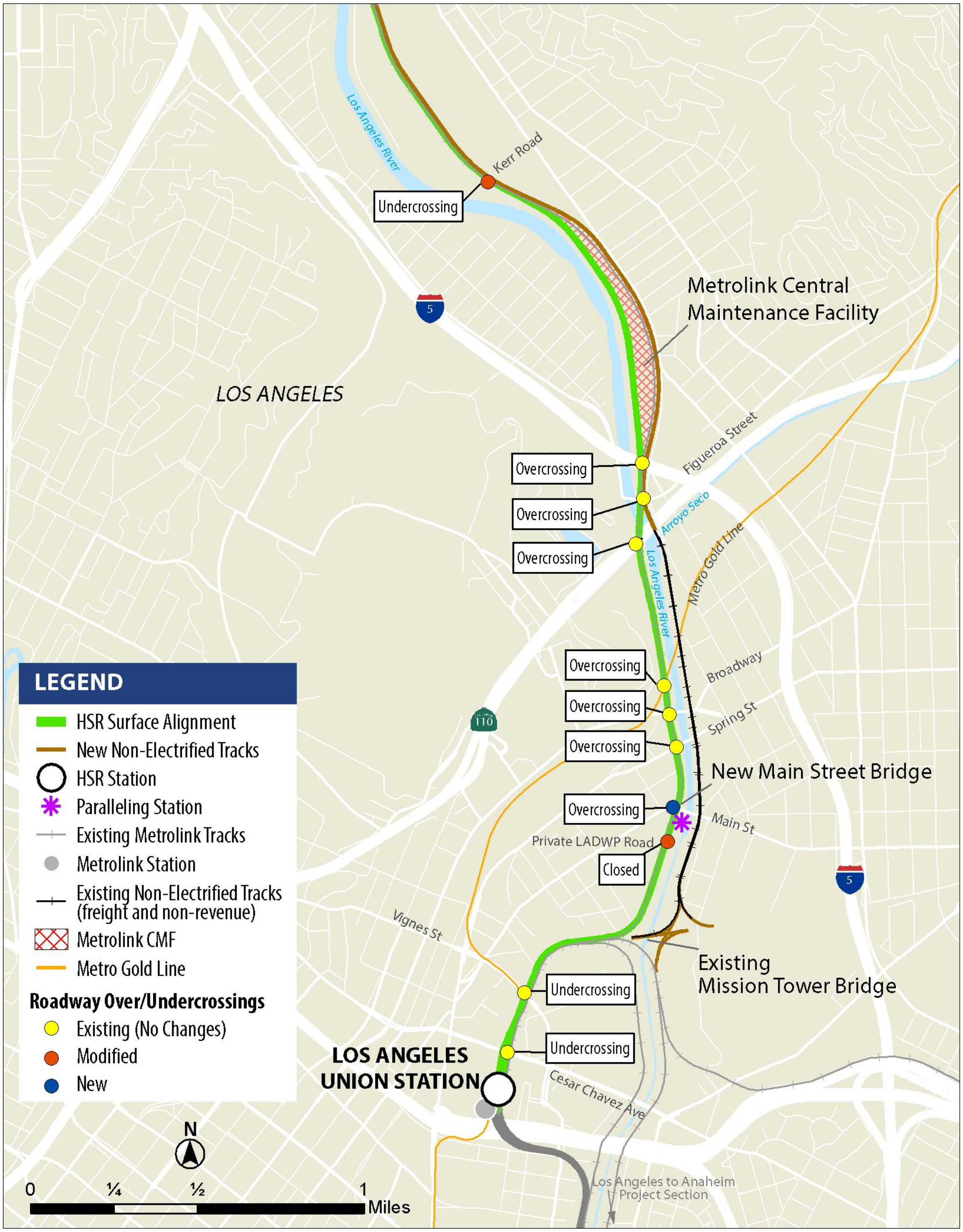
Figure 2-5 HSR Build Alternative Overview

(Sheet 1 of 3)

Source: California High-Speed Rail Authority, 2019

Figure 2-5 HSR Build Alternative Overview

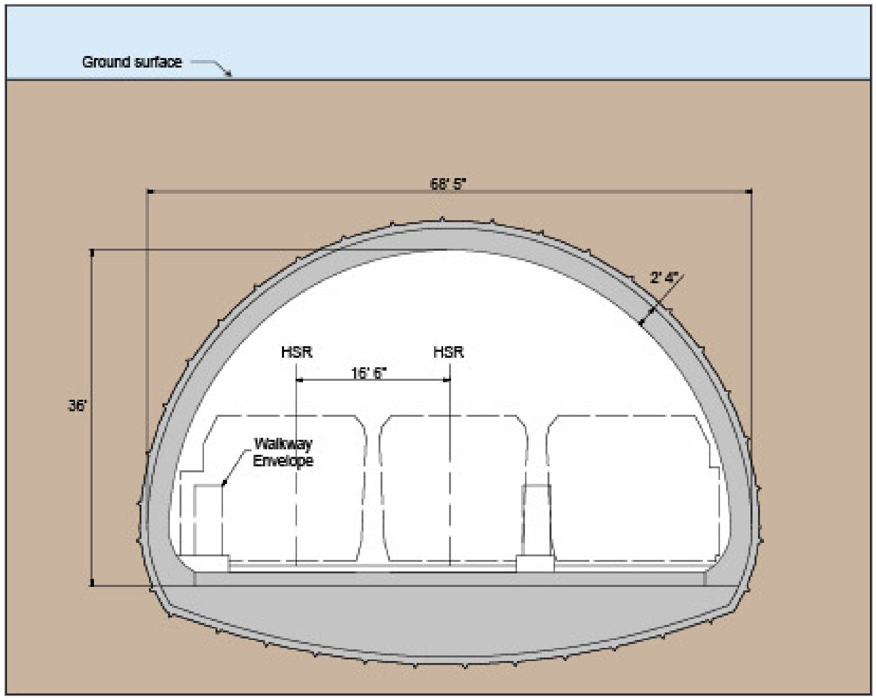
(Sheet 2 of 3)



Source: California High-Speed Rail Authority, 2019

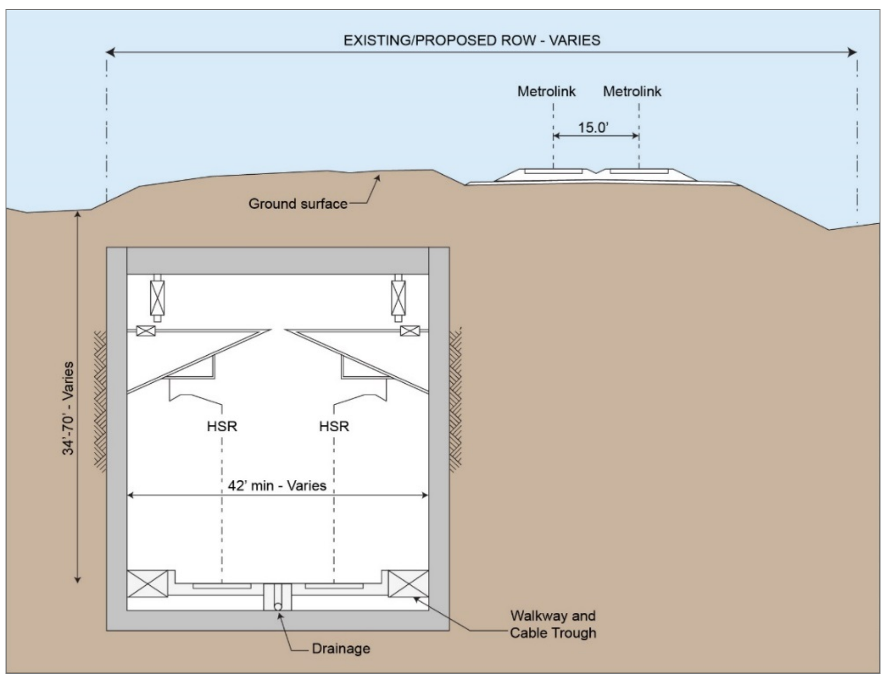
Figure 2-5 HSR Build Alternative Overview

(Sheet 3 of 3)



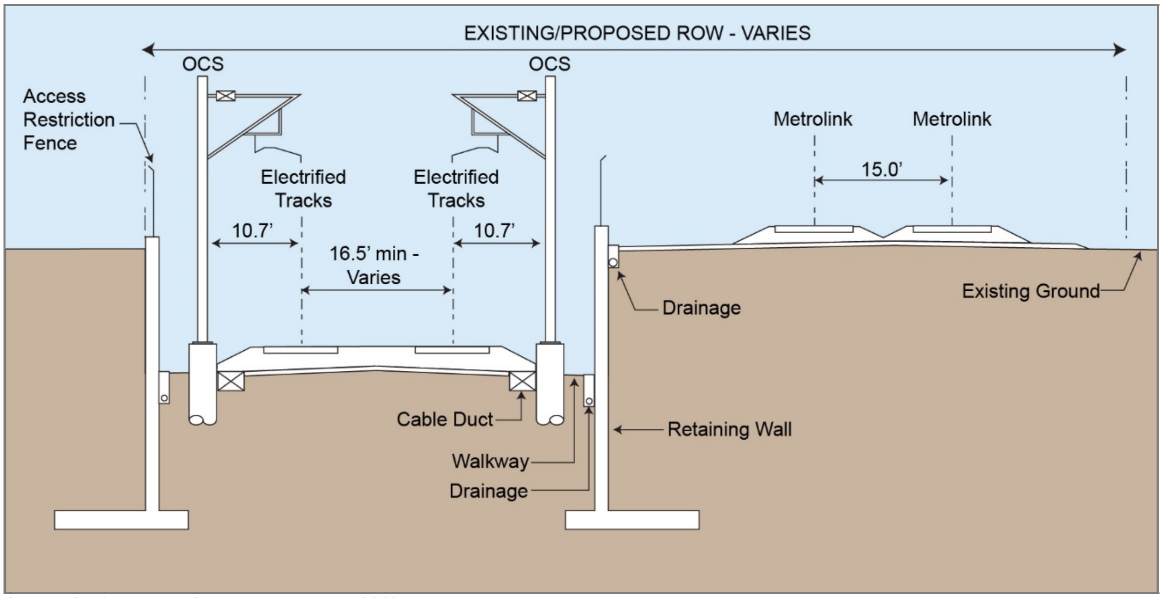
Source: California High-Speed Rail Authority, 2019

Figure 2-6 Typical Tunnel Cross-Section



Source: California High-Speed Rail Authority, 2019

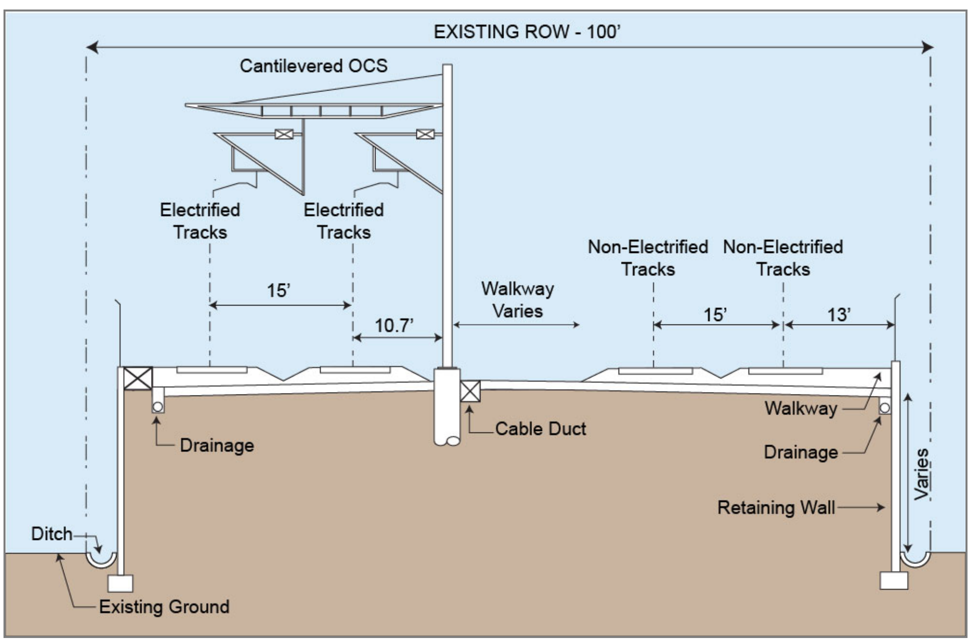
Figure 2-7 Typical Cut-and-Cover Tunnel Cross-Section



Source: California High-Speed Rail Authority, 2019

Figure 2-8 Typical Trench Cross-Section

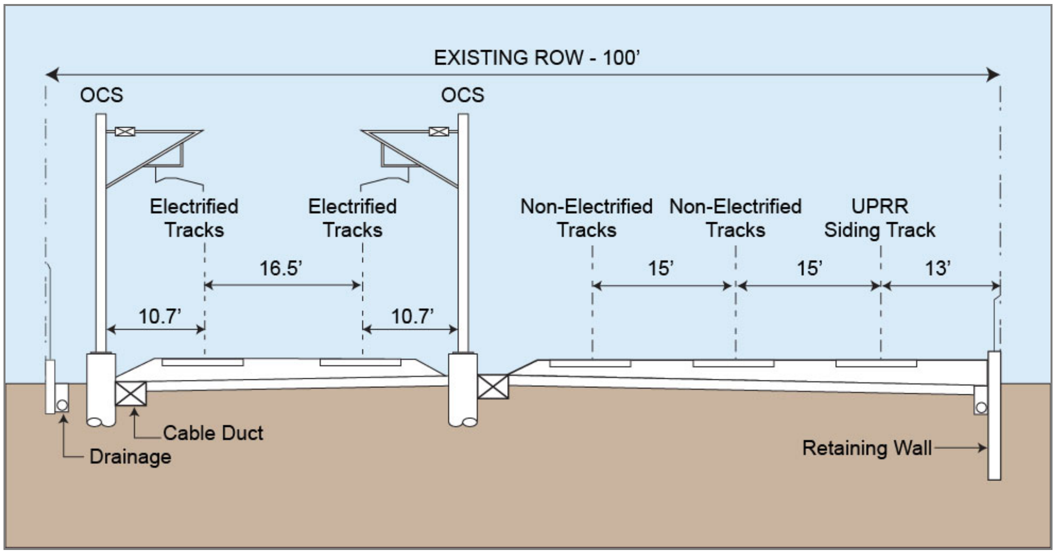
Between Olive Avenue to the north end of the Metrolink Central Maintenance Facility (CMF), the existing non-electrified tracks would be shifted east within the right-of-way to accommodate the addition of the electrified tracks within the right-of-way. Throughout this area, both sets of tracks would be at-grade, with a retained fill segment between Western Avenue and SR 134. Figure 2-9 shows a typical cross-section of the alignment on retained fill.



Source: California High-Speed Rail Authority, 2019

Figure 2-9 Typical Retained-Fill Cross-Section

The alignment would cross Verdugo Wash, where an existing railroad bridge would be rebuilt as a new clear-span structure, to accommodate the additional set of electrified tracks. The alignment would continue south within the existing railroad right-of-way, which follows the Glendale and Los Angeles city borders. Between SR 134 and Chevy Chase Drive, a UPRR siding track would be realigned to the east of the non-electrified tracks, for a total of five tracks within the right-of-way through this area. This siding track is currently located at the Metrolink Central Maintenance CMF but would need to be relocated to accommodate HSR at the CMF. Figure 2-10 shows the typical cross-section for this area.



Source: California High-Speed Rail Authority, 2019

Figure 2-10 Typical Cross-Section Between State Route 134 and Chevy Chase Drive

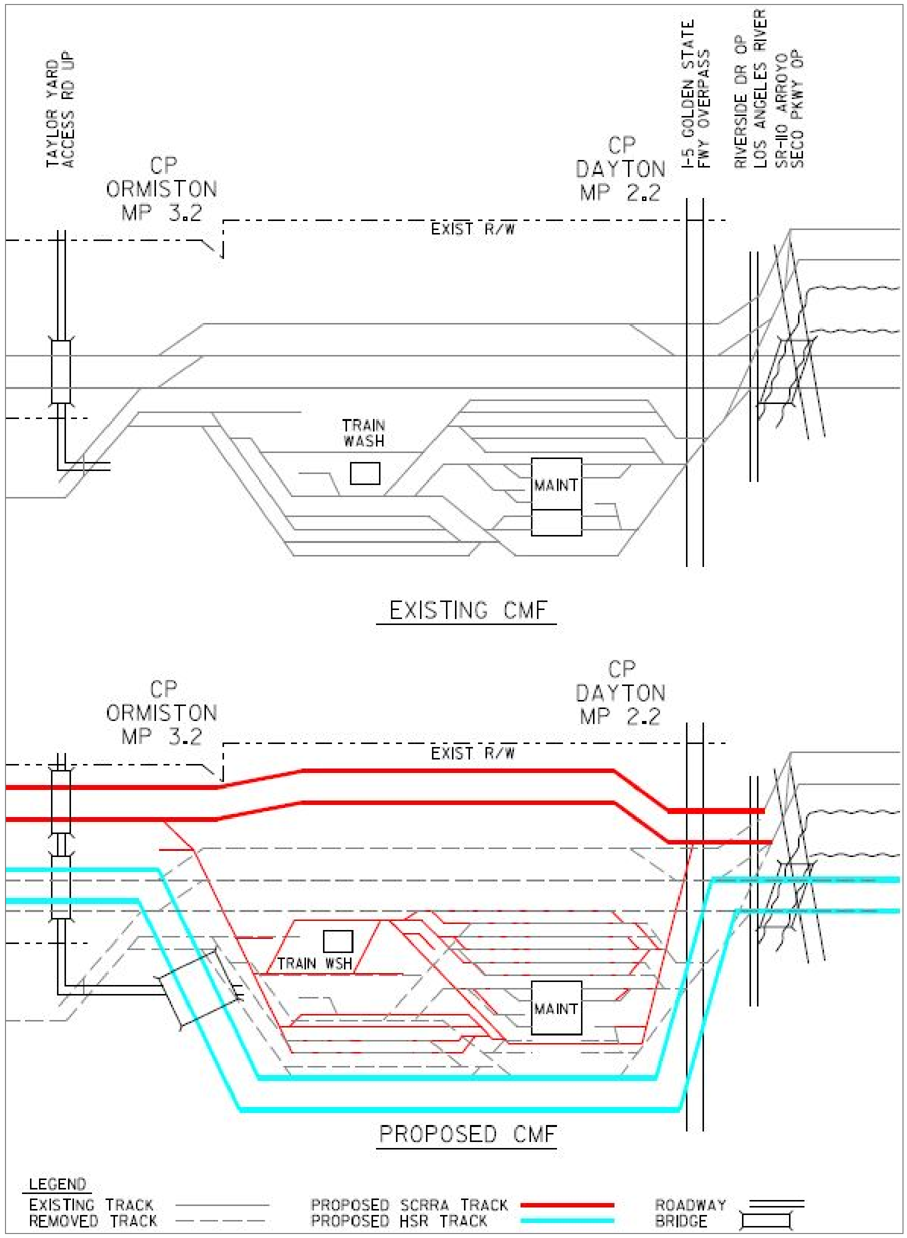
The alignment would pass by the Glendale Metrolink Station (originally known as the Southern Pacific Railroad Depot), a known historical resource listed on the National Register of Historic Places and located north of Glendale Boulevard. No modifications would be needed for the Glendale Metrolink Station. At Tyburn Street, the alignment would enter the city of Los Angeles. Continuing south, the two sets of tracks would diverge at the north end of the Metrolink CMF. The electrified tracks would travel along the west side of the CMF, and the non-electrified, mainline tracks would travel along the east side of the facility.

The CMF is Metrolink's major daily servicing location and maintenance facility in the region. The Burbank to Los Angeles Project Section proposes reconfiguring the various yard and maintenance facilities within the CMF to accommodate HSR, while maintaining as many of the existing yard operations as possible. Figure 2-11 displays a schematic diagram of the existing CMF and the proposed changes, which include new mainline-to-yard track connections, partial demolition of the existing maintenance shop, a revised roadway network with reconfigured parking areas, track relocation shifts, and construction to provide additional storage capacity. Additionally, several facilities would need to be relocated or reconstructed within the CMF, including a train washing/reclamation building, a yard pumphouse, and two service and inspection tracks. Utilities would also need to be relocated with the CMF, including domestic and fire water, underdrains and reconstructed catch basins, power facilities, fueling facilities and storage tanks, and sanitary sewer systems. The proposed design would not be able to accommodate wheel truing operations or progressive maintenance bays; these would relocate to another Metrolink facility. All other facilities and infrastructure would remain in place. The construction work at the CMF would be phased to minimize the disruption to the existing operations and to maintain the key operational facilities.

At the south end of the CMF, the two electrified and two non-electrified tracks would converge briefly within the right-of-way and then diverge again south of Figueroa Street. The electrified tracks would cross over to the west bank of the Los Angeles River on the existing Metrolink Downey Bridge. The existing tracks on the Downey Bridge would be electrified, which would allow for both HSR and passenger rail operations. The non-electrified tracks would remain on the east bank of the Los Angeles River and cross the Arroyo Seco on an existing railroad bridge, which would not require modifications. These non-electrified tracks would connect with the existing tracks on the east bank, which currently serve UPRR and nonrevenue trains. An illustrative cross-section for this area is shown on Figure 2-12.

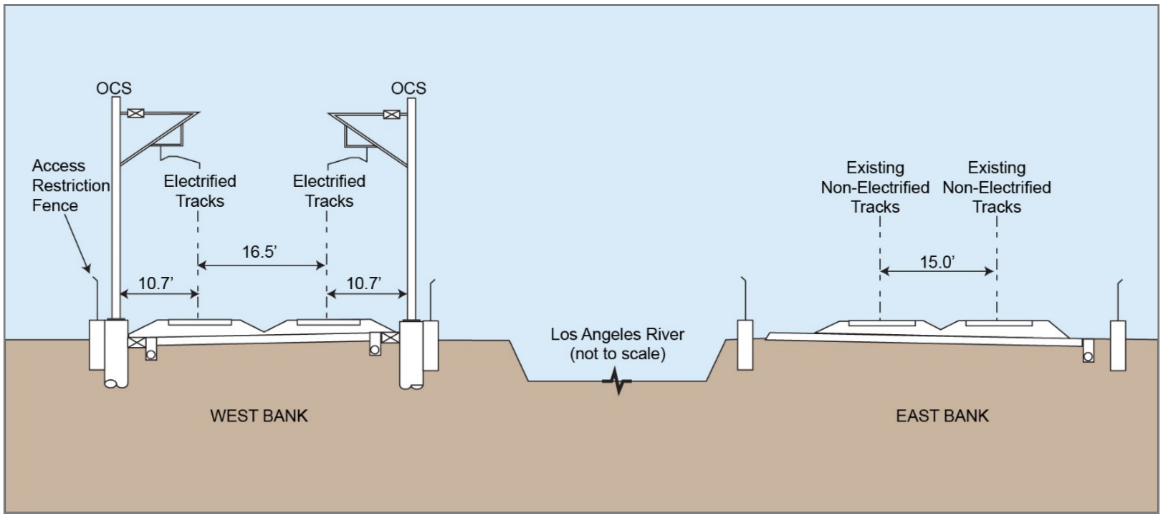
South of Main Street, on the east bank of the river, the existing tracks would be modified at Mission Junction to be used by freight and passenger rail. They would cross the Los Angeles River on the existing Mission Tower bridge to join the electrified tracks within the railroad right-of-way. The existing Mission Tower bridge has two tracks, but currently only one track is functional and used by Metrolink. The HSR Build Alternative would replace the trackwork to conform to the most current design standards and specifications, which may require a retrofit to the bridge.

The two sets of tracks would continue south to terminate at LAUS. The electrified tracks and HSR station platforms would be located on the west side of the station, while the non-electrified tracks would merge with the Metrolink and Amtrak tracks. The configuration at LAUS is described in further detail in Section 2.3.2.



Source: Burbank to Los Angeles Draft Preliminary Engineering for Project Description Design, 2018

Figure 2-11 Diagram of Existing and Proposed Metrolink Central Maintenance Facility



Source: California High-Speed Rail Authority, 2019
The electrified tracks would cross the Los Angeles River just north of State Route 110 and run along the west bank of the river. The non-electrified tracks would run along the east bank of the river. (Figure not to scale.)

Figure 2-12 Typical Cross-Section from State Route 110 to Mission Junction

2.2.2 Roadway Crossings

The HSR Build Alternative would cross a total of 34 roadways, 15 of which would require modifications. Figure 2-5 shows the crossings throughout the project section, and lists their configurations before and after the introduction of the HSR Build Alternative.

Modifications to existing crossings

- Victory Place: A new bridge for the HSR tracks would be constructed directly south of the existing railroad bridge over Victory Place, and the roadway would be lowered to cross under the new bridge.
- Burbank Boulevard: The roadway bridge would be reconstructed to cross over the tracks, and Burbank Boulevard would be raised in elevation on the west side.
- Alameda Avenue: The railroad bridge would be reconstructed to be wider.
- Colorado Street: The railroad bridge would be reconstructed to be wider.
- Los Feliz Boulevard: The railroad bridge would be reconstructed to be wider, and the roadway would be lowered slightly.
- Glendale Boulevard: The railroad bridge would be reconstructed to be wider, and the roadway would be lowered slightly.
- Kerr Road: The railroad bridge would be reconstructed to be wider, and the roadway would be lowered slightly.

New grade separations

- Buena Vista Street: The crossing would be modified and remain at-grade for Metrolink and UPRR tracks, but a new undercrossing would be constructed to grade-separate the HSR tracks only from the roadway.
- Sonora Avenue: A new roadway undercrossing would be constructed, with the tracks slightly raised on retained fill and the roadway slightly lowered (see Section 2.6).
- Grandview Avenue: A new roadway undercrossing would be constructed, with the tracks slightly raised on retained fill and the roadway slightly lowered (see Section 2.6).

- Flower Street: A new roadway undercrossing would be constructed, with the tracks slightly raised on retained fill and the roadway slightly lowered (see Section 2.6).
- Goodwin Avenue: The road currently does not cross the railroad right-of-way, but the project would grade-separate it as a new roadway undercrossing (see Section 2.6).
- Main Street: A new roadway bridge would be constructed north of the existing Main Street bridge, which would cross the railroad right-of-way and the Los Angeles River (see Section 2.6).

Closures

- Chevy Chase Drive: The roadway would be closed, and a new pedestrian undercrossing would be provided (see Section 2.6).
- Private driveway: A driveway that currently provides access to a Los Angeles Department of Water and Power facility parking lot would be closed, and the Los Angeles Department of Water and Power parking would be relocated to a new facility on Main Street.

Table 2-1 Roadway Crossings within the Burbank to Los Angeles Project Section

Roadway	Current Crossing Configuration	Proposed Crossing Configuration[1]
Buena Vista Street	At-Grade*	**At-Grade* (modified)** **Undercrossing** (new)**
Victory Place	Undercrossing"	Undercrossing* **Undercrossing (new)**
Burbank Boulevard	Overcrossing	**Overcrossing (modified)**
Magnolia Boulevard	Overcrossing	Overcrossing
Olive Avenue	Overcrossing	Overcrossing
Interstate 5	Overcrossing	Overcrossing
Alameda Avenue	Undercrossing	**Undercrossing (modified)**
Western Avenue	Overcrossing	Overcrossing
Sonora Avenue	At-Grade	**Undercrossing (new)**
Grandview Avenue	At-Grade	**Undercrossing (new)**
Flower Street	At-Grade	**Undercrossing (new)**
Fairmont Avenue	Overcrossing	Overcrossing
SR 134	Overcrossing	Overcrossing
Salem/Sperry St[2]	No Crossing	Overcrossing (Metro project)
Colorado Street	Undercrossing	**Undercrossing (modified)**
Goodwin Avenue	No Crossing	**Undercrossing (new)**
Chevy Chase Drive	At-Grade	**Closed**
Los Feliz Boulevard	Undercrossing	**Undercrossing (modified)**
Glendale Boulevard	Undercrossing	**Undercrossing (modified)**
Fletcher Drive	Undercrossing	Undercrossing
SR 2	Overcrossing	Overcrossing
Kerr Road	Undercrossing	**Undercrossing (modified)**
Interstate 5	Overcrossing	Overcrossing
Figueroa Street	Overcrossing	Overcrossing

Roadway	Current Crossing Configuration	Proposed Crossing Configuration[1]
SR 110	Overcrossing	Overcrossing
Metro Gold Line	Overcrossing	Overcrossing
Broadway	Overcrossing	Overcrossing
Spring Street	Overcrossing	Overcrossing
Main Street	At-Grade	**Overcrossing (new)**
Private LADWP road	At-Grade	**Closed**
Vignes Street	Undercrossing	Undercrossing
Cesar E. Chavez Avenue	Undercrossing	Undercrossing

Source: California High-Speed Rail Authority and Federal Railroad Administration, 2019
[1] All proposed grade crossing configurations are pending Public Utilities Commission approval.
[2] Salem/Sperry Street would be grade-separated as a part of the Metro Doran Street and Broadway/Brazil Grade Separation Project. The project also proposes closing the existing at-grade railroad crossings at Doran Street and Broadway/Brazil Street. As the Metro project would be completed before the introduction of HSR service, the crossing configurations are considered part of the existing conditions for the HSR project.
**Crossings apply to Metrolink and/or UPRR tracks only*
***Crossing applies to HSR tracks only*
***Bold** denotes change from existing condition under the HSR Build Alternative.*
Overcrossing = Road over train tracks *Undercrossing = Road under train tracks*
HSR = high-speed rail
LADWP = Los Angeles Department of Water and Power
Metro = Los Angeles County Metropolitan Transportation Authority
SR = State Route
UPRR = Union Pacific Railroad

2.3 Station Sites

The HSR stations for the Burbank to Los Angeles Project Section would be in the vicinity of Hollywood Burbank Airport and at LAUS. Stations would be designed to optimize access to the California HSR System, particularly to allow for intercity travel and connections to local transit, airports, highways, and the bicycle and pedestrian network. Both stations would include the following elements:

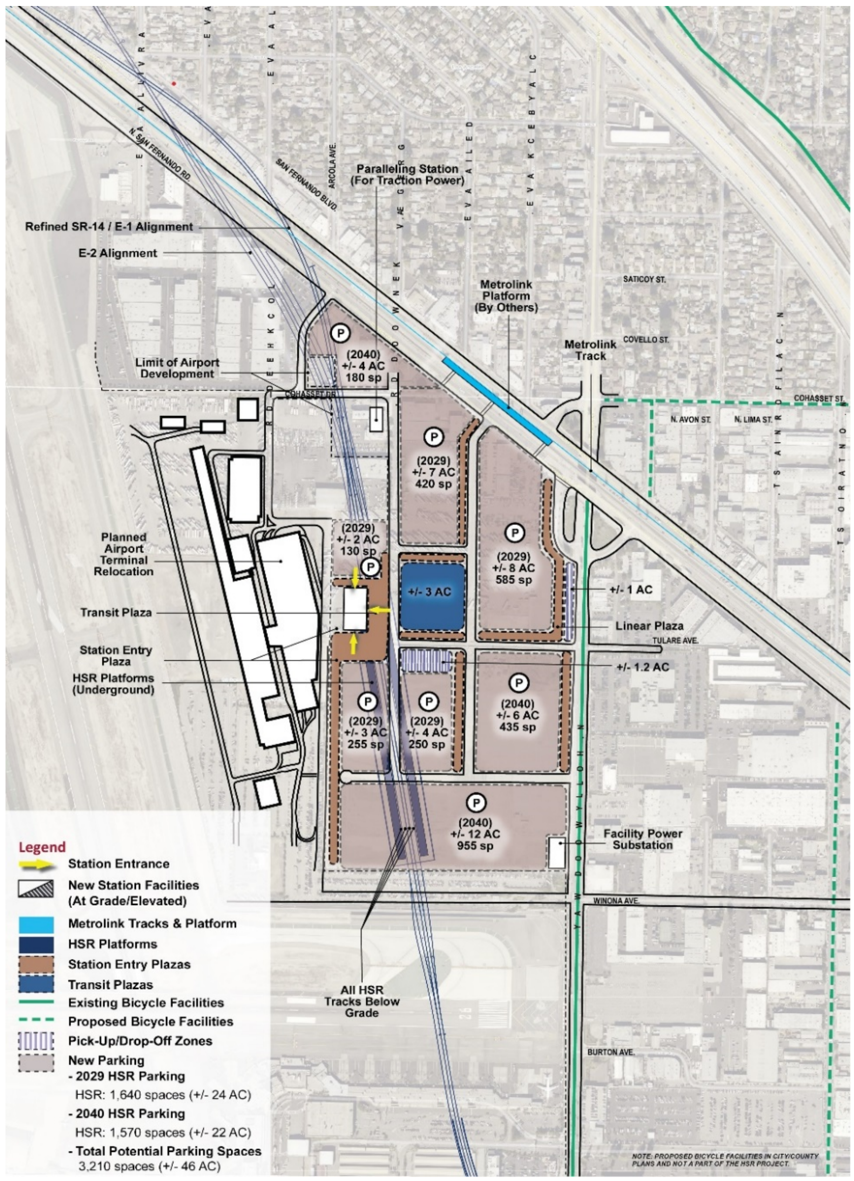
- Passenger boarding and alighting platforms
- Station head house with ticketing, waiting areas, passenger amenities, vertical circulation, administration and employee areas, and baggage and freight-handling service
- Vehicle parking (short-term and long-term)
- Pick-up and drop-off areas
- Motorcycle/scooter parking
- Bicycle parking
- Waiting areas and queuing space for taxis and shuttle buses
- Pedestrian walkway connections

2.3.1 Burbank Airport Station

The Burbank Airport Station site would be located west of Hollywood Way and east of Hollywood Burbank Airport. The airport and ancillary properties occupy much of the land south of the Burbank Airport Station site, while industrial and light industrial land uses are located to the east and residential land uses are found north of the Burbank Airport Station site. Interstate (I-) 5 runs parallel to the station site, approximately 0.25 mile north of the proposed Metrolink platform.

The Burbank Airport Station would have both underground and aboveground facilities that would span approximately 70 acres. Station facilities would include train boarding platforms, a station building (that would house ticketing areas, passenger waiting areas, restrooms, and related facilities), pick-up/drop-off facilities for private autos, a transit center for buses and shuttles, and surface parking areas. Underground portions of the station would be beneath Cohasset Street, along which runs the boundary between the city of Los Angeles to the north and the city of Burbank to the south. There would be two HSR tracks at the station.

The Burbank Airport Station would have up to 3,200 surface parking spaces. About 2,980 spaces would be located between the proposed Replacement Terminal and N Hollywood Way. An additional 220 spaces would be located in surface lots in the area bounded by Lockheed Drive to the west, Cohasset Street to the south, and N San Fernando Boulevard to the north and east. The preliminary station layout concept plan is shown on Figure 2-13. The Burbank to Los Angeles Project Section EIR/EIS analyzes the Burbank Airport Station project footprint displayed on Figure 2-13 as permanently impacted because no additional temporary construction easements are identified beyond the permanent area required to construct, operate, and maintain the station. This is the assumption based on the current level of design.



Source: California High-Speed Rail Authority, 2019

Figure 2-13 Preliminary Station Concept Layout Plan, Burbank Airport Station

2.3.2 Los Angeles Union Station

The existing LAUS campus and surrounding tracks are being reconfigured as a part of the Metro Link Union Station (Link US) [5] Project. The Metro Link US Project would reconfigure the station entry tracks from north of Mission Junction and construct an elevated structure through the station arrival and boarding area, which would extend south over U.S. Route 101 and come back to grade near First Street. Reconfiguration would take place over two construction phases. The first phase would include an elevated structure for non-HSR passenger rail operators between Vignes Street and First Street. The second phase would add additional tracks to the structure for use by HSR. The Metro Link US EIR/EIS, on which the Authority is a cooperating agency, would evaluate these changes, along with an expanded passenger concourse area and changes to the Metro Gold Line. These changes would be completed prior to the introduction of HSR service.

While Metro would environmentally clear and construct the trackwork and new passenger concourse, the HSR project would require additional modifications within the Link US area. HSR improvements include raising the platform heights and installing an overhead contact system. The Burbank to Los Angeles Project EIR/EIS evaluates these modifications, as well as potential increases in traffic associated with the introduction of HSR service.

The proposed HSR station at LAUS would include up to four HSR tracks and two 870-foot platforms (with the possibility of extending to 1,000 feet). The HSR system would share passenger facilities, such as parking and pick-up/drop-off, with other operators. HSR would require 1,180 parking spaces in 2029 and 2,010 spaces in 2040. This new demand may be met by existing underutilized parking supply within 0.5 mile of LAUS. This parking would be shared with other LAUS service providers and businesses.

[5] Link US will transform LAUS from a “stub-end” station to a “run-through” station by extending tracks south over U.S. Route 101. The project will add a new passenger concourse that will provide improved operational flexibility for rail service. The Draft FIR is available at: https://www.metro.net/projects/link-us/final-ei-report/.

Sources: California High-Speed Rail Authority, 2019; Los Angeles Metropolitan Transportation Authority. 2018

Figure 2-14 Preliminary Station Elements Plan, Los Angeles Union Station

2.4 Maintenance of Infrastructure

The California HSR System includes four types of maintenance facilities: maintenance of infrastructure facilities (MOIF), Maintenance of infrastructure siding facilities (MOIS), heavy maintenance facilities, and light maintenance facilities (LMF).[6] The California HSR System would require one heavy maintenance facility for the system, located in the Central Valley. The design and spacing of maintenance facilities along the HSR system do not require the Burbank to Los Angeles Project Section to include any of the maintenance facilities within the limits of the project section.

[6] Maintenance facilities are described in the Authority's *Summary of Requirements for O&M Facilities* (2013).

For purposes of environmental analysis, FRA and the Authority have defined each project section to have the capability to operate as a stand-alone project in the event that other project sections of the HSR system are not constructed. Because this project section does not provide a heavy maintenance facility or MOIF, an independent contractor would need to be retained to handle all maintenance functions for vehicles and infrastructure if this project section were built as a stand-alone project for purposes of independent utility. Independent utility is discussed further in Section 2.9.

2.4.1 Maintenance of Infrastructure Facilities

The HSR system infrastructure will be maintained from regional MOIFs located at approximately 150-mile intervals. Each MOIF is estimated to be approximately 28 acres in size and would provide a location for regional maintenance machinery servicing storage, materials storage, and maintenance and administration. The MOIFs could be co-located with the MOIS within each 75-mile segment. The MOIFs would be outside of the Burbank to Los Angeles Project Section.

2.4.2 Maintenance of Infrastructure Sidings

The MOISs would be centrally located within the 75-mile maintenance sections on either side of each MOIF. Each MOIS would support MOIF activities by providing a location for the layover of maintenance of infrastructure equipment and temporary storage for materials. The MOIS is estimated to be about 4 acres in size. The MOISs would be outside of the Burbank to Los Angeles Project Section.

2.4.3 Heavy Maintenance Facility

Only one heavy maintenance facility is required for the HSR system, and it would be within either the Merced to Fresno Project Section or the Fresno to Bakersfield Project Section. The heavy maintenance facility would include all activities associated with train fleet assembly, disassembly, and complete rehabilitation; all on-board components of the trainsets; and overnight layover accommodations and servicing facilities. The site would include a maintenance shop, a yard Operations Control Center building, one traction power substation (TPSS), other support facilities, and a train interior cleaning platform.

2.4.4 Light Maintenance Facility

An LMF would be used for all activities associated with fleet storage, cleaning, repair, overnight layover accommodations, and servicing facilities. The LMF closest to the Burbank to Los Angeles Project Section would be sited in proximity to LAUS but within the Los Angeles to Anaheim Project Section, and would likely support the following functions:

- **Train Storage:** Some trains would be stored at the LMF prior to start of revenue service.
- **Examinations in Service:** Examinations would include inspections, tests, verifications, and quick replacement of certain train components on the train.
- **Inspection:** Periodic inspections would be part of the planned preventive maintenance program requiring specialized equipment and facilities.

The LMF site will be sized to support the level of daily revenue service dispatched by the nearby terminal at the start of each revenue service day. The Authority defines three levels of maintenance that can be performed at an LMF:

- **Level I:** Daily inspections, pre-departure cleaning, and testing
- **Level II:** Monthly inspections
- **Level III:** Quarterly inspections, including wheel-truing

A Level I LMF is proposed on the west bank of the Los Angeles River at the existing Amtrak Railroad Yard. The facility would be where the current BNSF Railway storage tracks are located and would require their relocation.

2.5 Ancillary and Support Facilities

2.5.1 Electrification

Trains on the California HSR System would draw power from California's existing electricity grid distributed via an overhead contact system. The Burbank to Los Angeles Project Section would not include the construction of a separate power source, although it would include the extension of power lines from potential TPSSs to a series of independently owned power substations positioned along the HSR corridor if necessary. The transformation and distribution of electricity would occur in three types of stations:

- TPSSs transform high-voltage electricity supplied by public utilities to the train operating voltage. TPSSs would be adjacent to existing utility transmission lines and the right-of-way, and would be located approximately every 30 miles along the HSR system route.
- Switching stations connect and balance the electrical load between tracks, and switch overhead contact system power on or off to tracks in the event of a power outage or emergency. Switching stations would be midway between, and approximately 15 miles from, the nearest TPSSs. Each switching station would be 120x80 feet and be adjacent to the HSR right-of-way.
- Paralleling stations, or autotransformer stations, provide voltage stabilization and equalize current flow. Paralleling stations would be located approximately every 5 miles between the TPSSs and the switching stations. Each paralleling station would approximately be 100x80 feet and located adjacent to the right-of-way.

Table 2-2 lists the proposed switching station and paralleling station sites within the Burbank to Los Angeles Project Section. A TPSS is not required for the Burbank to Los Angeles Project Section because of the HSR system's facilities spacing requirements. The Burbank to Los Angeles Project Section would be able to use the TPSSs within the Palmdale to Burbank Project Section and/or Los Angeles to Anaheim Project Section. In the event the other project sections of the HSR system are not constructed, a standalone TPSS would be required within the Burbank to Los Angeles Project Section for purposes of independent utility. Independent utility is discussed further in Section 2.8.

Table 2-2 Traction Power Facility Locations for the Burbank to Los Angeles Project Section

Type of Facility	Location
Paralleling Station	Los Angeles, south of Main Street between railroad right-of-way and Los Angeles River
Switching Station	Los Angeles, south of Verdant Street and west of railroad right-of-way

Source: California High-Speed Rail Authority, 2019

2.5.2 Signaling and Train-Control Elements

To reduce the safety risks associated with freight and passenger trains, the National Transportation Safety Board, the FRA, and other agencies have mandated Positive Train Control (PTC). PTC is a train safety system designed to automatically implement safety protocols and provide communication with other trains to reduce the risk of a potential collision. The U.S. Rail Safety Improvement Act of 2008 requires the implementation of PTC technology across most railroad systems; in October 2015, Congress extended the deadline for implementation to December 31, 2018. The FRA published the Final Rule regarding PTC regulations on January 15, 2010.

Communication towers and ancillary facilities are included in the Burbank to Los Angeles Project Section to implement the FRA PTC requirements. PTC infrastructure consists of integrated command, control, communications, and information systems for controlling train movements that improve railroad safety by significantly reducing the probability of collisions between trains, casualties to roadway workers and equipment, and over-speed accidents. PTC is especially important in "blended"[7] corridors, such as in the Burbank to Los Angeles Project Section, where passenger and freight trains need to share the same tracks safely.

PTC for the HSR project would use a radio-based communications network that would include a fiber-optic backbone and communications towers approximately every 2 to 3 miles, depending on the terrain and selected radio frequency. The towers would be located in the fenced HSR corridor in a fenced area of approximately 20x15 feet, including a 10x8-foot communications shelter and a 6- to 8-foot-diameter, 100-foot-tall communications pole. These communications facilities could be co-located within the TPSSs. Where communications towers cannot be located with TPSSs or other HSR facilities, the communications facilities would be located near the HSR corridor in a fenced area of approximately 20 feet by 15 feet.

2.6 Early Action Projects

As described in the 2016 Business Plan, the Authority has made a commitment to invest in regionally significant connectivity projects in order to provide early benefits to transit riders and local communities while laying a solid foundation for the HSR system. These early actions will be made in collaboration with local and regional agencies. These types of projects include grade separations and improvements at regional passenger rail stations, which increase capacity, improve safety, and provide immediate benefits to freight and passenger rail operations. Local and regional agencies may take the lead on coordinating the construction of these early action projects. Therefore, they are described in further detail below and are analyzed within the Burbank to Los Angeles Project Section EIR/EIS to allow the agencies, as Responsible Agencies under CEQA, to adopt the findings and mitigation measures as needed to construct these projects.

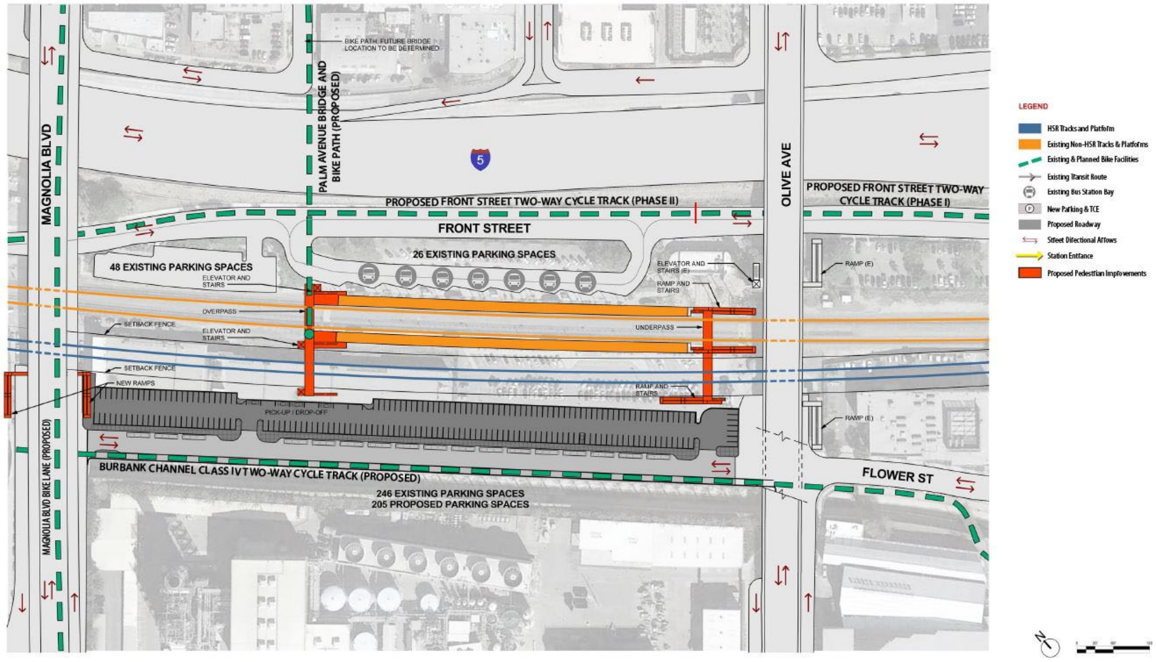
2.6.1 Downtown Burbank Metrolink Station

Although the HSR system will not serve the Downtown Burbank Metrolink Station, modifications at the station would be required to ensure continued operations of existing operators. The HSR tracks would be located within the existing parking lot west of the southbound platforms; the platforms and existing Metrolink tracks would not change. The parking would be relocated to between Magnolia Boulevard and Olive Avenue, and Flower Street would be extended from where it currently ends at the south side of the Metrolink Station. Pedestrian bridges would be provided for passengers to cross over the HSR tracks to access the Metrolink platforms. Other accessibility improvements would include additional vehicle parking, bus parking, and bicycle pathways. Figure 2-15 shows the proposed site plan for the Downtown Burbank Metrolink Station.

2.6.2 Sonora Avenue Grade Separation

Sonora Avenue is an existing at-grade crossing. The existing roadway configuration consists of two traffic lanes in both the eastbound and westbound directions. The Burbank to Los Angeles Project Section proposes a "hybrid" grade separation, with Sonora Avenue slightly depressed and the HSR alignment and non-electrified tracks raised on a retained-fill structure. A 10-foot-wide median would be added and the lanes would be narrowed, so the overall width of Sonora Avenue would not change. Sonora Avenue would be lowered in elevation between Air Way and San Fernando Road, and the lowest point of the undercrossing would be approximately 10 feet below the original grade. The height of the new retained-fill structure would be approximately 28 feet. Figure 2-16 shows the temporary and permanent project footprint areas.

[7] California HSR Project Business Plans (http://www.hsr.ca.gov/About/Business_Plans/) suggest blended railroad systems and operations. These terms refer to integrating the HSR system with existing intercity, and commuter and regional rail systems through coordinated infrastructure (blended systems) and scheduling, ticketing, and other means (blended operations).



Source: California High-Speed Rail Authority, 2019

Figure 2-15 Downtown Burbank Metrolink Station Site Plan

Source: California High-Speed Rail Authority, 2019

Figure 2-16 Sonora Avenue Grade Separation Footprint

2.6.3 Grandview Avenue Grade Separation

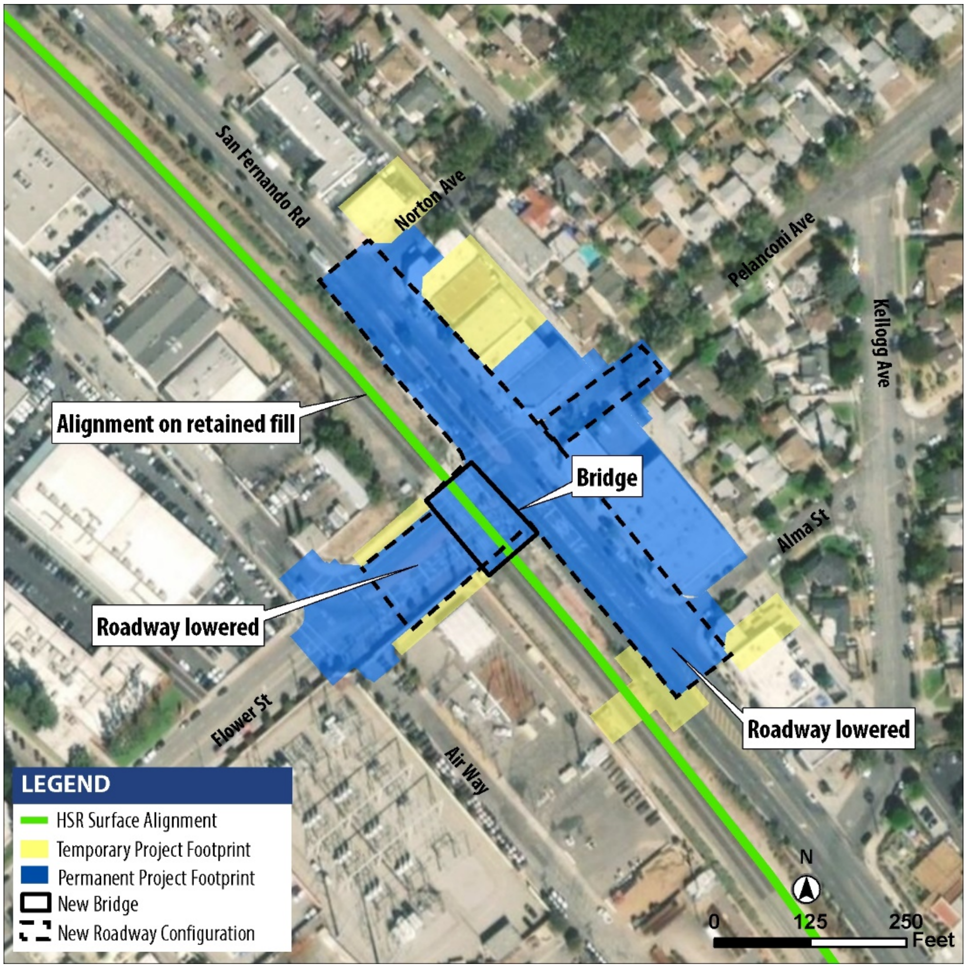
Grandview Avenue is an existing at-grade crossing. The existing roadway configuration consists of three traffic lanes in both the eastbound and westbound directions. The Burbank to Los Angeles Project Section proposes a “hybrid” grade separation, with Grandview Avenue slightly depressed and the HSR alignment and non-electrified tracks raised on retained fill. Grandview Avenue would be lowered in elevation between Air Way and San Fernando Road, and the lowest point of the undercrossing would be approximately 3 feet below original grade. The lanes and overall width of Grandview Avenue would not change. The height of the new retained-fill structure would be approximately 30 feet. Figure 2-17 shows the temporary and permanent project footprint areas.

Source: California High-Speed Rail Authority, 2019

Figure 2-17 Grandview Avenue Grade Separation Footprint

2.6.4 Flower Street Grade Separation

Flower Street is an existing at-grade crossing, with Flower Street ending in a T-shaped intersection with San Fernando Road, which runs parallel on the east side of the railroad right-of-way. Existing Flower Street consists of two traffic lanes in both the westbound and eastbound directions, with a right-turn-only lane in the westbound direction. The Burbank to Los Angeles Project Section proposes a “hybrid” grade separation, with Flower Street and San Fernando Road slightly depressed, and the HSR alignment and non-electrified tracks raised on a retained-fill structure. Flower Street would be lowered in elevation between Air Way and San Fernando Road, and the lowest point of the undercrossing would be approximately 10 feet below original grade. The existing median would be modified on Flower Street, and the overall width of Flower Street would remain the same. San Fernando Road would be lowered in grade between Norton Avenue and Alma Street, and Pelanconi Avenue would be extended to connect to San Fernando Road. The height of the new retained-fill structure would be approximately 28 feet. Figure 2-18 shows the temporary and permanent project footprint areas.



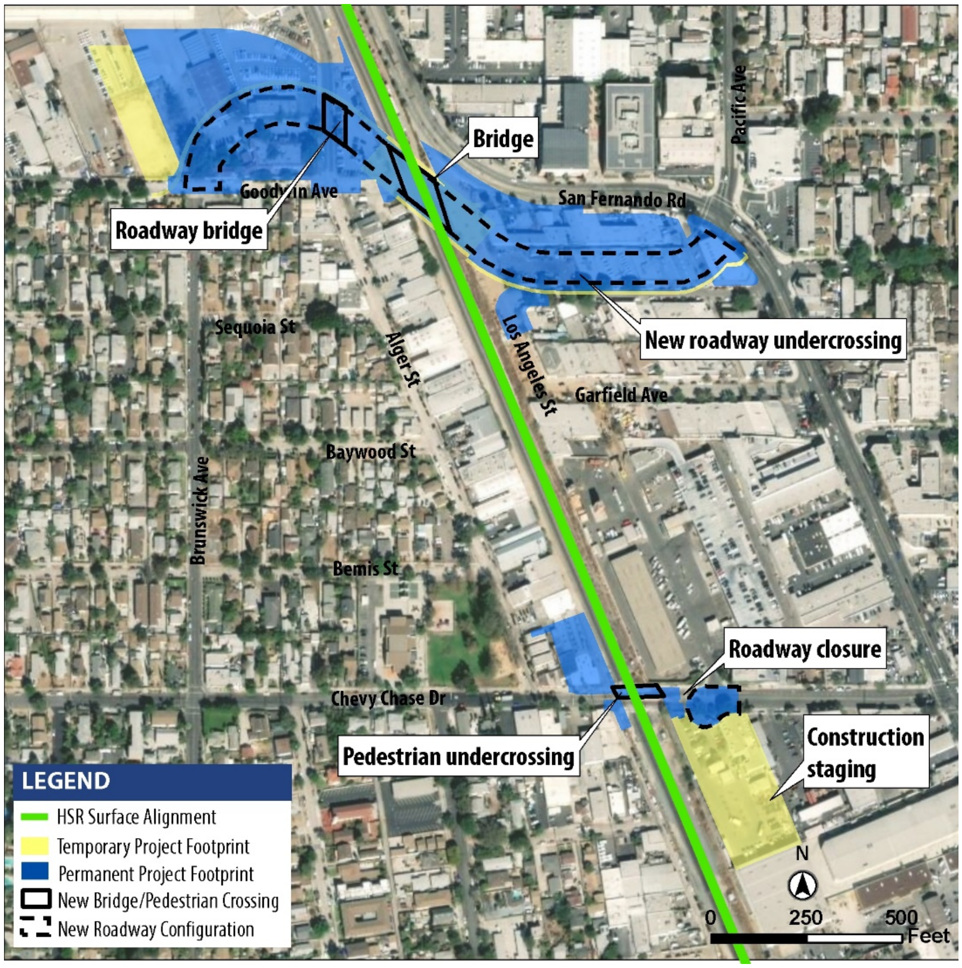
Source: California High-Speed Rail Authority, 2019

Figure 2-18 Flower Street Grade Separation Footprint

2.6.5 Goodwin Avenue/Chevy Chase Drive Grade Separation

There is currently no crossing at Goodwin Avenue, which ends in a cul-de-sac on the west side of the railroad right-of-way. The Burbank to Los Angeles Project Section proposes a grade separation, with Goodwin Avenue realigned and depressed to cross under a new railroad bridge supporting the HSR and non-electrified tracks. A new roadway bridge would also be required to carry Alger Street over the depressed Goodwin Avenue, connecting to W San Fernando Road. The new depressed roadway would curve north from Brunswick Avenue, cross under the new roadway and railroad bridges, and connect with Pacific Avenue on the east side of the railroad right-of-way. The lowest point of the undercrossing would be approximately 28 feet below original grade.

Chevy Chase Drive is an at-grade crossing. With the construction of a new grade separation at Goodwin Avenue, Chevy Chase Drive would be closed on either side of the rail crossing and a pedestrian undercrossing would be provided. Figure 2-19 shows the temporary and permanent project footprint areas for Goodwin Avenue and Chevy Chase Drive.



Source: California High-Speed Rail Authority, 2019

Figure 2-19 Goodwin Avenue Grade Separation

2.6.6 Main Street Grade Separation

Main Street is an existing at-grade crossing. It crosses the existing tracks at-grade on the west bank of the Los Angeles River, crosses over the river on a bridge, and then crosses the existing tracks at-grade on the east bank of the river. The existing bridge carries two traffic lanes in both directions. The Burbank to Los Angeles Project Section proposes a grade separation, with a new Main Street bridge spanning the tracks on the west bank, the Los Angeles River, and the tracks on the east bank. The new Main Street bridge would be 86 feet wide and 75 feet high at its highest point over the Los Angeles River and would place three columns within the river channel. Main Street would be raised in elevation, starting from just east of Sotello Street on the west side of the Los Angeles River. The new bridge would come down to grade at Clover Street on the east side of the Los Angeles River. Several roadways on the east side of the Los Angeles River would be reconfigured, including Albion Street, Lamar Street, Avenue 17, and Clover Street. The existing Main Street bridge would not be modified, but it would be closed to public access. Figure 2-20 shows the temporary and permanent project footprint areas.

Source: California High-Speed Rail Authority, 2019

Figure 2-20 Main Street Grade Separation Footprint

2.7 Project Construction

For the Burbank to Los Angeles Project Section of the California HSR System, specific construction elements would include at-grade and underground track, grade-separated roadway crossings, retaining walls, and installation of a PTC system. Surface track sections would be built using conventional railroad construction techniques. A typical construction sequence includes clearing, grubbing, grading, and compacting the railbed; applying crushed rock ballast; laying track; and installing electrical and communications systems. The at-grade track would be laid on an earthen railbed topped with rock ballast approximately 3 feet off the ground. Fill and ballast for the railbed would be obtained from permitted borrow sites and quarries.

Retaining walls are used when it is necessary to transition between an at-grade and elevated profile. In this project section, retained fill would be used between Western Avenue and SR 134. The tracks would be raised in elevation on a retained-fill platform made of reinforced walls, much like a freeway ramp. Short retaining walls would have a similar effect and would protect the adjacent properties from a slope extending beyond the proposed rail right-of-way.

The preferred construction method for the tunnel alignment underneath the Burbank Airport runway is the sequential excavation method. The tunnel alignment south of the airport would be constructed using cut-and-cover.

Pre-construction activities would be conducted during final design and would include geotechnical investigations, interpretation of anticipated ground behavior and ground support requirements, identification of staging areas, initiation of site preparation and demolition, relocation of utilities, and implementation of temporary, long-term, and permanent road closures. Additional studies and investigations to develop construction requirements and worksite traffic control plans would be conducted as needed.

Major construction activities for the Burbank to Los Angeles Project Section would include earthwork and excavation support, systems construction, bridge and aerial structure construction, and railway systems construction (including trackwork, traction electrification, signaling, and communications).

During peak construction periods, work is envisioned to be underway at several locations along the route simultaneously, with overlapping construction of various project elements. Working hours and the number of workers present at any time would vary depending on the activities being performed but could be expected to extend to 24 hours per day, seven days per week.

2.8 Independent Utility of the Burbank to Los Angeles Project Section

The Burbank to Los Angeles Project Section would have independent utility if it is able to operate as a standalone project in the event the other project sections of the HSR system are not constructed. As none of the four types of maintenance facilities would be located within the limits of the Burbank to Los Angeles Project Section, all maintenance functions for vehicles and infrastructure would be handled through an independent contractor to achieve independent utility. For power, one potential location for a TPSS has been preliminarily identified within the project section. Because the addition of a TPSS would alter the spacing of the other systems facilities, further design and environmental study would be required to environmentally clear the TPSS site and the alteration of the other systems facilities in the absence of the Palmdale to Burbank and Los Angeles to Anaheim project sections being built and operated.

Any electrical interconnections between a potential future TPSS site and existing utility providers would also have to be environmentally evaluated and cleared in subsequent documentation.

2.9 Operations of the Burbank to Los Angeles Project Section

The conceptual HSR service plan for Phase 1, starting in 2029, begins with service between Los Angeles/Anaheim running through the Central Valley from Bakersfield to Merced, and traveling northwest into the Bay Area. Subsequent sections in Phase 2 of the HSR system include a southern extension from Los Angeles to San Diego and an extension from Merced to north of Sacramento. These extensions do not have an anticipated implementation date.

Currently, the Metrolink Ventura and Antelope Valley Lines, Amtrak Pacific Surfliner and Coast Starlight, and UPRR freight trains operate within the Burbank to Los Angeles Project Section. As the proposed HSR Build Alternative is within the active Los Angeles–San Diego–San Luis Obispo passenger and freight rail corridor, all existing operators would have to change their operation patterns and frequency. New and realigned tracks would change the tracks on which the various users operate, with passenger rail and freight trains shifted closer to the east side of the right-of-way. With the introduction of HSR service, the proposed general operational characteristics are shown in Table 2-3.

Table 2-3 Existing and Future Trains per Day in the Los Angeles–San Diego–San Luis Obispo Rail Corridor Within the Burbank and Los Angeles Project Section

Operator	2016 Existing Conditions	2029 Opening Day	2040 Horizon Year
California High-Speed Rail Authority[1]	N/A	196	196
Metrolink[2]	61	99	99
Amtrak[3]	12	16	18
UPRR[4]	11	18	23

[1] 2029 Opening Day and 2040 Horizon Year projections are from the California High-Speed Rail Authority's "Year 2029 and Year 2040 Concept Timetable for EIR/EIS Analysis."
[2] Existing Conditions data are from the 2016 Metrolink Schedule (effective October 3, 2016); 2029 Opening Day projections are extrapolated from the 2016 Metrolink 10-Year Strategic Plan, "Growth Scenario 2: Overlay of Additional Service Patterns."
[3] Existing Conditions data are from the 2016 LOSSAN Corridor Schedule; 2029 Opening Day projections are extrapolated from 2012 LOSSAN Corridorwide Strategic Implementation Plan "Long-Term Operations Analysis" (increase of approximately one train every four years for the Amtrak Pacific Surfliner and no growth for the Amtrak Coast Starlight between Hollywood Burbank Airport and LAUS).
[4] Existing Conditions data are from the 2012 LOSSAN Corridorwide Strategic Implementation Plan "Long-Term Operations Analysis"; 2029 Opening Day projections are extrapolated from the 2012 LOSSAN Corridorwide Strategic Implementation Plan "Long-Term Operations Analysis" (increase of approximately one train every 2 years for UPRR between Hollywood Burbank Airport and LAUS).
Amtrak = National Railroad Passenger Corporation
LAUS = Los Angeles Union Station
N/A = not applicable
UPRR = Union Pacific Railroad

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3 LAWS, REGULATIONS, AND ORDERS

This section summarizes the federal, state, and local laws, regulations, orders, or plans relevant to air quality and global climate change in the resource study area (RSA).

Definition of Air Pollution and Air Quality

Air *pollution* is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Air *pollutants* degrade the atmosphere by reducing visibility, damaging property, combining to form smog, reducing the productivity or vigor of crops or natural vegetation, and reducing human or animal health.

Air quality describes the amount of air pollution to which the public is exposed.

Air quality in the United States is governed by the federal Clean Air Act (CAA), which is administered by the United States Environmental Protection Agency (USEPA). Air quality in California is also governed by the California Clean Air Act, which is administered by the California Air Resources Board (CARB).

The California Clean Air Act, as amended in 1992, delegates local enforcement of air quality regulations to air districts in the state, and requires them to endeavor to achieve and maintain state ambient air quality standards.

3.1 Federal

3.1.1 U.S. Environmental Protection Agency

The USEPA is responsible for establishing the National Ambient Air Quality Standards (NAAQS), enforcing the CAA, and regulating transportation-related emission sources, (e.g., aircraft, ships, and certain types of locomotives) under the exclusive authority of the federal government. The USEPA also has jurisdiction over emission sources outside of state waters (e.g., beyond the outer continental shelf) and establishes various emission standards, including standards for vehicles sold in states other than California. Automobiles sold in California must meet stricter emission standards established by CARB. For more information regarding this subject, the USEPA's internet home page is www.epa.gov. Additional information on the activities of the USEPA Region 9 (Pacific Southwest), which includes California, can be found at www.epa.gov/region9.

3.1.2 Clean Air Act and Conformity Rule

The CAA defines nonattainment areas as geographic regions designated as not meeting one or more of the NAAQS. It requires that a state implementation plan (SIP) be prepared for each nonattainment area and a maintenance plan be prepared for each former nonattainment area that subsequently demonstrated compliance with the standards. A SIP is a compilation of a state's air quality control plans and rules, approved by the USEPA. Section 176(c) of the CAA provides that federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project unless the project conforms to the applicable SIP. The state and the USEPA's goals are to eliminate or reduce the severity and number of violations of the NAAQS and to achieve expeditious attainment of these standards.

Pursuant to CAA Section 176(c) requirements, the USEPA promulgated Title 40 of the Code of Federal Regulations Part 51 (40 C.F.R. 51) Subpart W and 40 C.F.R. Part 93, Subpart B, —Determining Conformity of General Federal Actions to State or Federal Implementation Plans (see 58 Fed. Reg. 63214 [November 30, 1993], as amended, 75 Fed. Reg. 17253 [April 5, 2010]). The General Conformity Rule applies to all federal actions including those by the FRA and the U.S. Army Corps of Engineers, except for those federal actions which are excluded from review (e.g., stationary source emissions) or that involved transportation plans, programs, and projects funded by the Federal Highway Administration (FHWA) or Federal Transit Administration, which are subject to the Transportation Conformity Rule.

In states that have an approved SIP revision adopting General Conformity regulations, 40 C.F.R. Part 51W applies; in states that do not have an approved SIP revision adopting General Conformity regulations, 40 C.F.R. Part 93B applies.

The General Conformity Rule is used to determine if federal actions meet the requirements of the CAA and the applicable SIP by ensuring that air emissions related to the action do not:

- Cause or contribute to new violations of a NAAQS
- Increase the frequency or severity of any existing violation of a NAAQS
- Delay timely attainment of a NAAQS or interim emission reduction

A conformity determination under the General Conformity Rule is required if the federal agency determines the following:

- The action will occur in a nonattainment or maintenance area
- One or more specific exemptions do not apply to the action
- The action is not included in the federal agency's "presumed to conform" list
- The emissions from the proposed action are not within the approved emissions budget for an applicable facility
- The total direct and indirect emissions of a pollutant (or its precursors), are at or above the *de minimis* levels established in the General Conformity regulations (75 Fed. Reg. 17255).

Conformity regulatory criteria are listed in 40 C.F.R. 93.158. An action will be found to conform to the applicable SIP if, the annual direct and indirect emissions remain less than the applicable *de minimis* levels[8] for each pollutant in 40 C.F.R. 93.153(b). Otherwise, a conformity determination analysis would be required if the total of direct and indirect emissions exceeds the applicable *de minimis* levels for certain criteria pollutant. An air quality modeling analysis may be necessary to demonstrate conformity of the proposed action that does not cause or contribute to any new violation of the NAAQS, under the requirements of 40 C.F.R. 93.158(c).

However, if the total emissions of a pollutant from a federal action exceed 10 percent of a nonattainment area's emissions inventory of that pollutant, the action is defined as a regionally significant action and would also require a conformity determination. South Coast Air Quality Management District (SCAQMD) Rule 1901 implements the USEPA's General Conformity Rule. Within the Basin, if net annual emissions remain below 10 tons of volatile organic compounds (VOC) and nitrogen oxides (NO_X), 70 tons of particulate matter less than 10 microns in size (PM_{10}), and 100 tons of carbon monoxide (CO) and particulate matter less than 2.5 microns in size ($PM_{2.5}$), a CAA conformity determination is not required.

In addition, federal activities may not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with timely attainment or required interim emissions reductions toward attainment. The proposed project is subject to review under the General Conformity Rule. However, there may be some smaller highway elements of the project that will be dealt with through case-by-case modification of the Regional Transportation Plan (RTP) consistent with transportation conformity.

3.1.3 National and State Ambient Air Quality Standards

As required by the CAA, the USEPA has established NAAQS for six major air pollutants known as criteria pollutants. The criteria pollutants are ozone (O_3), particulate matter (PM) (i.e., PM_{10} and $PM_{2.5}$), CO, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). The California Ambient Air Quality Standards (CAAQS) are generally more stringent than the corresponding federal standards and incorporate additional standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. Table 3-1 summarizes state and federal standards (as of May 2016). The primary standards are intended to protect public health. The secondary standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

[8] A "*de minimis*" level is defined as an emission threshold established by the USEPA for air emissions caused by federally sponsored, approved, or funded activities in areas that do not meet the NAAQS thresholds. The *de minimis* levels established for each pollutant varies by the severity of nonattainment and sets an emission level, in tons per year, above which further analysis is required to demonstrate that the proposed activities would not cause or contribute to a violation of an NAAQS for a nonattainment pollutant.

Table 3-1 Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]		Federal Standards[2]		
		Concentration[3]	Method[4]	Primary[3,5]	Secondary[3,6]	Method[7]
Ozone[8] (O_3)	1-Hour	0.09 ppm (180 µg/m³)	Ultraviolet Photometry	–	Same as Primary Standard	Ultraviolet Photometry
	8-Hour	0.070 ppm (137 µg/m³)		0.070 ppm (137 µg/m³)		
Respirable Particulate Matter (PM_{10})[9]	24-Hour	50 µg/m³	Gravimetric or Beta Attenuation	150 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m³		–		
Fine Particulate Matter ($PM_{2.5}$)[9]	24-Hour	–	–	35 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m³	Gravimetric or Beta Attenuation	12.0 µg/m³	15 µg/m³	
Carbon Monoxide (CO)	1-Hour	20 ppm (23 mg/m³)	Non-Dispersive Infrared Photometry (NDIR)	35 ppm (40 mg/m³)	–	Non-Dispersive Infrared Photometry (NDIR)
	8-Hour	9 ppm (10 mg/m³)		9 ppm (10 mg/m³)	–	
	8-Hour (Lake Tahoe)	6 ppm (7 mg/m³)		–	–	
Nitrogen Dioxide (NO_2)[10]	1-Hour	0.18 ppm (339 µg/m³)	Gas Phase Chemiluminescence	0.100 ppm (188 µg/m³)	–	Gas Phase Chemilumi-nescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m³)		0.053 ppm (100 µg/m³)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	1-Hour	0.25 ppm (655 µg/m³)	Ultraviolet Fluorescence	0.075 ppm (196 µg/m³)	–	Ultraviolet Fluorescence; Spectrophoto-metry (Pararosaniline Method)
	3-Hour	–		–	0.5 ppm (1300 µg/m³)	
	24-Hour	0.04 ppm (105 µg/m³)		0.14 ppm (for certain areas)[11]	–	
	Annual Arithmetic Mean	–		0.030 ppm (for certain areas)[11]	–	
Lead (Pb)[12,13]	30-Day Average	1.5 µg/m³	Atomic Absorption	–	–	High-Volume Sampler and Atomic Absorption
	Calendar Quarter	–		1.5 µg/m³ (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	–		0.15 µg/m³		

Pollutant	Averaging Time	California Standards[1]		Federal Standards[2]		
		Concentration[3]	Method[4]	Primary[3,5]	Secondary[3,6]	Method[7]
Visibility-Reducing Particles[14]	8-Hour	See footnote 14	Beta Attenuation and Transmittance through Filter Tape	No Federal Standards		
Sulfates	24-Hour	25 μg/m^3	Ion Chromatography			
Hydrogen Sulfide	1-Hour	0.03 ppm (42 μg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride[12]	24-Hour	0.01 ppm (26 μg/m^3)	Gas Chromatography			

Sources: California Air Resources Board, Ambient Air Quality Standards, May 2016: www.arb.ca.gov/research/*aaqs*/aaqs2.pdf.
California Air Resources Board (May 4, 2016)

[1] California standards for O_3, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1- and 24-hour), nitrogen dioxide, suspended particulate matter (PM_{10} $PM_{2.5}$, and visibility-reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[2] National standards (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m^3 is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the USEPA for further clarification and current federal policies.

[3] Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[4] Any equivalent procedure which can be shown to the satisfaction of the CARB to give equivalent results at or near the level of the air quality standard may be used.

[5] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

[6] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[7] Reference method as described by the USEPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the USEPA.

[8] On October 1, 2015, the national 8-hour O_3 primary and secondary standards were lowered from 0.075 ppm to 0.070 ppm.

[9] On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 μg/m^3 to 12.0 μg/m^3. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 μg/m^3, as was the annual secondary standard of 15 μg/m^3. The existing 24-hour PM_{10} standards (primary and secondary) of 150 μg/m^3 also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

[10] To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national standards are in units of ppb. California standards are in units of ppm. To directly compare the national standards to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

[11] On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.
Note that the 1-hour national standard is in units of ppb. California standards are in units of ppm. To directly compare the 1-hour national standards to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

[12] The CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[13] The national standard for lead was revised on October 15, 2008, to a rolling 3-month average. The 1978 lead standard (1.5 μg/m^3 as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[14] In 1989, the CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

°C = degrees Celsius
μg/m^3 = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter
ppb = parts per billion
ppm = parts per million
USEPA = United States Environmental Protection Agency

3.1.4 Mobile-Source Air Toxics

In addition to the criteria pollutants for which there are NAAQS, the USEPA regulates mobile-source air toxics (MSAT). In February 2007, the USEPA finalized a rule (Control of Hazardous Air Pollutants from Mobile Sources) to reduce hazardous air pollutant emissions from mobile sources. The rule limits the benzene content of gasoline and reduces toxic emissions from passenger vehicles and gas cans. The USEPA estimates that in 2030 this rule would reduce total emissions of MSATs by 330,000 tons and VOC emissions (precursors to O_3 and $PM_{2.5}$) by more than 1 million tons. The latest revision to this rule occurred in October of 2008. This revision added additional specific benzene control technologies that the previous rule did not include. No federal or California ambient standards exist for MSATs. Specifically, the USEPA has not established NAAQS or provided standards for hazardous air pollutants.

On February 3, 2006, the Federal Highway Administration (FHWA) released *Interim Guidance on Air Toxic Analysis in NEPA Documents* (FHWA 2006). The FHWA most recently updated the guidance on October 18, 2016 (FHWA 2016). FHWA's guidance advises on when and how to analyze MSATs in the NEPA process for highway projects. This guidance is considered interim because MSAT science is still evolving. As the science progresses, FHWA is expected to update the guidance. The Authority considers the FHWA guidance when evaluating the impacts of projects that have the potential to affect MSAT emissions.

3.1.5 Federal Railroad Administration

FRA identifies *Procedures for Considering Environmental Impacts* (64 Fed. Reg. 28545) which states an EIS should consider possible effects on air quality. These FRA procedures supplement the Council on Environmental Quality (CEQ) Regulations (40 C.F.R. Part 1500 et seq.) and describe FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents (U.S. Code Title 42, Section 4321 et seq.). The FRA Procedures for Considering Environmental Impacts states that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4. These FRA procedures state that an EIS should consider possible impacts on air quality.

Pursuant to U.S. Code Title 23 Section 327, under the NEPA Assignment Memorandum of Understanding between FRA and the State of California, effective July 23, 2019, the Authority is the federal lead agency for environmental reviews for all Authority Phase 1 and Phase 2 California HSR System projects. The FRA performs Clean Air Act Conformity determinations and other federal approvals retained by the FRA under the NEPA Assignment Memorandum of Understanding. In addition to its involvement in the environmental analysis and documentation, the FRA is also providing partial funding for the final design and construction of the initial construction section of the HSR System, which includes activities analyzed in this technical report.

3.1.6 Federal Greenhouse Gas Regulations

GHG emissions are regulated at the federal and state level. Laws and regulations, as well as plans and policies, have been adopted to address global climate change issues. Key federal regulations relevant to the project are summarized below.

On September 22, 2009, the USEPA published the Final Rule that requires mandatory reporting of GHG emissions from large sources in the U.S. (USEPA 2010a). The gases covered by the Final Rule are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons, sulfur hexafluoride, and other fluorinated gases, including nitrogen trifluoride (NF_3), and hydrofluorinated ethers (HFE). Currently, this is not a transportation-related regulation and, therefore, does not apply to this project. However, the methodology developed as part of this regulation is helpful in identifying potential GHG emissions.

On December 7, 2009, the *Final Endangerment and Cause or Contribute Findings for Greenhouse Gases* under Section 202(a) of the CAA was signed by the USEPA administrator. The endangerment finding states that current and projected concentrations of the six key well-mixed GHGs in the atmosphere—CO_2, CH_4, N_2O, HFC, perfluorocarbons, and sulfur hexafluoride—threaten the public health and welfare of current and future generations. Furthermore, it states that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare (USEPA 2010b).

Based on the endangerment finding, the USEPA revised vehicle emission standards. The USEPA and the National Highway Traffic Safety Administration (NHTSA) updated the Corporate Average Fuel Economy fuel standards on October 15, 2012 (77 Fed. Reg. 62623), requiring substantial improvements in fuel economy for all vehicles sold in the U.S. The new standards apply to new passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2017 through 2025. The USEPA GHG standards require that these vehicles meet an estimated combined average emissions level of 163 grams of CO_2 per mile in model year 2025, which would be equivalent to 54.5 miles per gallon if the automotive industry were to meet this CO_2 level entirely through fuel economy improvements.

On September 15, 2011, the USEPA and the NHTSA issued a final rule of *Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles* (76 Fed. Reg. 7106). This final rule is tailored to each of three regulatory categories of heavy-duty vehicles—combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. The USEPA and the NHTSA estimated that the new standards in this rule will reduce CO_2 emissions by approximately 270 MMT and save 530 million barrels of oil over the life of vehicles sold during the 2014 through 2018 model years. The USEPA and NHTSA signed Phase 2 of these standards on August 16, 2016, which apply to model years 2019–2027 medium- and heavy-duty vehicles. The USEPA and NHTSA have determined that the Phase 2 standards will lower CO2 emissions by approximately 1.1 billion metric tons and save up to 2 billion barrels of oil over the life of vehicles sound under the program (USEPA 2016a).

In January 2012, CARB approved a vehicle emission control program for model years 2017 through 2025. This is called the Advanced Clean Cars Program. On August 28, 2012, the USEPA and the NHTSA issued a joint final rulemaking to establish 2017 through 2025 GHG emissions and Corporate Average Fuel Economy standards. To further California's support of the national program to regulate emissions, CARB submitted a proposal that would allow automobile manufacturer compliance with the USEPA’s requirements to show compliance with California's requirements for the same model years. The Final Rulemaking Package was filed on December 6, 2012, and the final rulemaking became effective on December 31, 2012. On August 2, 2018, the USEPA and NHTSA issued a joint notice of proposed rule that would freeze the vehicle fuel economy and emissions standards at 2020 levels for model years 2021 to 2026. The Safer Affordable Fuel-Efficient Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, if finalized, would amend certain existing Corporate Average Fuel Economy and tailpipe CO_2 emissions standards for passenger cars and light trucks and establish new standards, all covering model years 2021 through 2026. The rule also would revoke the waiver granted to California to establish more stringent standards for vehicle emissions, as well as the zero-emission vehicle regulation (USEPA 2018).

Effective April 5, 2017, CEQ has withdrawn its final guidance for federal agencies on how to consider GHG emissions and the effects of climate change in NEPA reviews.

3.2 State Air Quality and Greenhouse Gas Regulations

3.2.1 California Environmental Protection Agency

The California Environmental Protection Agency (Cal-EPA) is a state agency that includes CARB, the State Water Resources Control Board, nine Regional Water Quality Control Boards, the Integrated Waste Management Board, the Department of Toxic Substances Control, the Office of Environmental Health Hazard Assessment (OEHHA), and the Department of Pesticide

Regulation. The mission of the Cal-EPA is to restore, protect, and enhance the environment and to ensure public health, environmental quality, and economic vitality. CARB carries out this mission with respect to air quality and prepares the California SIP. Cal-EPA's internet address is www.calepa.ca.gov.

3.2.2 California Clean Air Act

The California Clean Air Act requires nonattainment areas to achieve and maintain the health-based State Ambient Air Quality Standards by the earliest practicable date. The Act is administered by CARB at the state level and by local air quality management districts at the regional level, whereby the air districts are required to develop plans and control programs for attaining the state standards.

CARB is responsible for ensuring implementation of the California Clean Air Act, meeting state requirements of the federal CAA, and establishing the CAAQS. It is also responsible for setting emission standards for vehicles sold in California and for other emission sources, such as consumer products and certain off-road equipment. CARB also establishes passenger vehicle fuel specifications.

The SIP consists of a number of elements directed toward achieving attaining the federal O_3, PM, and lead standards. On March 7, 2017, CARB released the *Revised Proposed 2016 State Strategy for the State Implementation Plan*, describing the proposed commitment to achieve the reductions necessary from mobile sources, fuels, and consumer products to meet federal O_3 and $PM_{2.5}$ standards over the next 15 years. This document proposes a suite of regulatory and incentive programs. These are referred to as State Strategy for the SIP measures. In combination with local actions, these measures are designed to achieve the required emission reductions to meet federal air quality standards.

3.2.3 California Asbestos Control Measures

CARB has adopted two airborne toxic control measures for controlling naturally occurring asbestos (NOA)—*the Asbestos Airborne Toxic Control Measure for Surfacing Applications* (California Code of Regulations, Title 17, Section 93106) and the *Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations* (California Code of Regulations, Title 17, Section 93105). In addition, the USEPA is responsible for enforcing regulations relating to asbestos renovations and demolitions; however, the USEPA can delegate this authority to state and local agencies. CARB and local air districts have been delegated authority to enforce the Federal National Emission Standards for Hazardous Air Pollutants regulations for asbestos.

3.2.4 California Airborne Toxic Control Measures

CARB has adopted regulations to reduce emissions from both on-road and off-road heavy-duty diesel vehicles (e.g., equipment used in construction). These regulations, known as Airborne Toxic Control Measures, reduce the idling of school buses and other commercial vehicles, control diesel particulate matter (DPM), and limit the emissions of ocean-going vessels in California waters. The regulations also include various measures to control emissions of air toxics from stationary sources. The California Toxics Inventory, developed by speciating CARB estimates of total organic gas (TOG) and PM, provides emissions estimates by stationary, areawide, on-road mobile, off-road mobile, and natural sources (CARB 2011).

3.2.5 California Public Resources Code, Section 21151.4

An EIR shall not be certified and a negative declaration shall not be approved for any project involving the construction or alteration of a facility within 0.25 mile of a school that might reasonably be anticipated to emit hazardous air emissions, that would handle extremely hazardous air emissions that would handle an extremely hazardous substance or a mixture containing extremely hazardous substances in a quantity equal to or greater than the state threshold quantity specified pursuant to Subdivision (j) of Section 25532 of the Health and Safety

Code, or that may pose a health or safety hazard to persons who would attend or would be employed at the school, unless both of the following occur:

1. The lead agency preparing the EIR or negative declaration has consulted with the school district having jurisdiction regarding the potential impact of the project on the school.
2. The school district has been given written notification of the project no less than 30 days prior to the proposed certification of the EIR or approval of the negative declaration.

3.2.6 California Environmental Quality Act

CEQA (Cal. Public Res. Code, § 21000 et seq.) and CEQA Guidelines (Cal. Code Regs. § 15000 et seq.) require state and local agencies to identify the significant environmental effects of their actions, including potential significant air quality and climate change effects, and to avoid or mitigate those effects, when feasible. The CEQA amendments of December 30, 2009, specifically require lead agencies to address GHG emissions in determining the significance of environmental effects caused by a project and to consider feasible means to mitigate the significant effects of GHG emissions.

3.2.7 California Greenhouse Gas Regulations

California has taken proactive steps, briefly described below, to address the issues associated with GHG emissions and climate change.

3.2.7.1 Assembly Bill 1493

In 2002, with the passage of Assembly Bill (AB) 1493 (Pavley), California launched an innovative and proactive approach to addressing GHG emissions and climate change at the state level. AB 1493 requires CARB to develop and implement regulations to reduce automobile and light-truck GHG emissions. These stricter emissions standards were designed to apply to automobiles and light trucks beginning with the model year 2009. Although litigation challenged these regulations and the USEPA initially denied California's related request for a waiver, the waiver request was granted (USEPA 2010c).

3.2.7.2 Executive Order S-3-05

On June 1, 2005, Governor Arnold Schwarzenegger signed Executive Order (EO) S-3-05. EO S-3-05 establishes targets to reduce California's GHG emissions to year 2000 levels by 2010; 1990 levels by 2020; and 80 percent below the 1990 levels by 2050. EO S-3-05 also calls for the Cal-EPA to prepare biennial science reports on the potential effect of continued global warming on certain sectors of the California economy. As a result of the scientific analysis presented in these biennial reports, a comprehensive *2009 Climate Adaptation Strategy* (California Natural Resources Agency 2009) was released following extensive interagency coordination and stakeholder input. The latest of these reports, *Climate Action Team Biennial Report*, was published December 2010 (Cal-EPA 2010).

3.2.7.3 Assembly Bill 32

In 2006, the goal of EO S-3-05 was further reinforced with the passage of AB 32 (Pavley; Chapter 488, Statutes of 2006), the *Global Warming Solutions Act of 2006*. AB 32 sets overall GHG emissions reduction goals and mandates CARB to create a plan, which includes market mechanisms, and implement rules to achieve *real, quantifiable, cost-effective reductions of GHGs*. EO S-20-06 further directs state agencies to begin implementing AB 32, including the recommendations made by the state's Climate Action Team.

Among AB 32's specific requirements are the following:

- CARB will prepare and approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions from sources or categories of sources of GHGs by 2020 (California Health and Safety Code 38561). The scoping plan, approved by CARB on December 12, 2008, and updated December 14, 2017, provides the outline for future actions to reduce GHG emissions in California via regulations, market mechanisms, and other measures.

- The scoping plan includes the implementation of high-speed rail as a GHG reduction measure.
- Identify the statewide level of GHG emissions in 1990 to serve as the emissions limit to be achieved by 2020 (California Health and Safety Code 38550). In December 2007, CARB approved the 2020 emission limit of 427 MMT of CO_2 equivalent (CO_2e) of GHG.
- Adopt a regulation requiring the mandatory reporting of GHG emissions (California Health and Safety Code 38530). In December 2007, CARB adopted a regulation requiring the largest industrial sources to report and verify their GHG emissions. The reporting regulation serves as a solid foundation to determine GHG emissions and track future changes in emission levels.

3.2.7.4 Governor's Executive Order S-01-07

With EO S-01-07, Governor Schwarzenegger set forth the Low Carbon Fuel Standard for California. This EO calls for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020.

3.2.7.5 Senate Bill 375

Senate Bill (SB) 375, the *Sustainable Communities and Climate Protection Act of 2008* (Chapter 728, Statutes of 2008), signed into law by the Governor on September 30, 2008, became effective January 1, 2009. This law requires CARB to develop regional reduction targets for GHG emissions and prompts the creation of regional land use and transportation plans to reduce emissions from passenger vehicle use throughout the state. The targets apply to the regions in the state covered by California's 18 metropolitan planning organizations (MPO). The 18 MPOs have been tasked with creating the regional land use and transportation plans called "sustainable community strategies" (SCS). The MPOs are required to develop the SCS through integrated land use and transportation planning and to demonstrate an ability to attain the proposed reduction targets by 2020 and 2035. This would be accomplished through either the financially constrained SCS as part of its RTP or through an unconstrained alternative planning strategy. If regions develop integrated land use, housing, and transportation plans that meet the SB 375 targets, new projects in these regions can be relieved of certain review requirements of CEQA.

Pursuant to SB 375, CARB appointed a Regional Targets Advisory Committee on January 23, 2009, to provide recommendations on factors to be considered and methodologies to be used in CARB's target-setting process. The Regional Targets Advisory Committee was required to provide its recommendations in a report to CARB by September 30, 2009. The report included relevant issues, such as data needs, modeling techniques, growth forecasts, jobs-housing balance, interregional travel, various land use/transportation issues affecting GHG emissions, and overall issues relating to setting these targets. CARB adopted the final targets on September 23, 2010. CARB must update the regional targets every eight years (or four years if it so chooses) consistent with each MPO update of its RTP.

3.2.7.6 Governor's Executive Order S-13-08

On November 14, 2008, the Governor signed an executive order to address the risk of sea level rise resulting from global climate change. It requires that all state agencies that are planning construction projects in the areas vulnerable to sea level rise consider a range of sea level rise scenarios to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise.

3.2.7.7 Governor's Executive Order B-30-15 and Senate Bill 350

On April 29, 2015, the Governor issued an executive order to establish a California GHG reduction target of 40 percent below 1990 levels by 2030. The new emission reduction target of

40 percent below 1990 levels by 2030 is intended to make it possible to reach the state's ultimate goal of reducing emissions 80 percent under 1990 levels by 2050.

In October 2015, the Governor signed into legislation SB 350, which requires retail sellers and publicly owned utilities to procure 50 percent of their electricity from eligible renewable energy sources by 2030, with interim goals of 40 percent by 2024, and 45 percent by 2027.

3.2.7.8 California Global Warming Solutions Act of 2006 (Senate Bill 32)

On September 8, 2016 Governor Jerry Brown signed into law SB 32, effectively extending California's landmark AB 32 to the year 2030. SB 32 effectively establishes a new GHG reduction goal for statewide emissions of 40 percent below 1990 levels by 2030. This goal is 40 percent more stringent than the current AB 32 mandated goal of 1990 levels by 2020. In terms of metric tons this means that statewide, to meet the SB 32 targets California's GHG emissions would be reduced from 441.5 million metric tons (MMT) of carbon dioxide equivalents (CO_2e) in 2014 to 431 MMT CO_2e by 2020, and an additional reduction to 258.6 MMT CO_2e would be required by 2030.

3.2.7.9 2017 Climate Change Scoping Plan

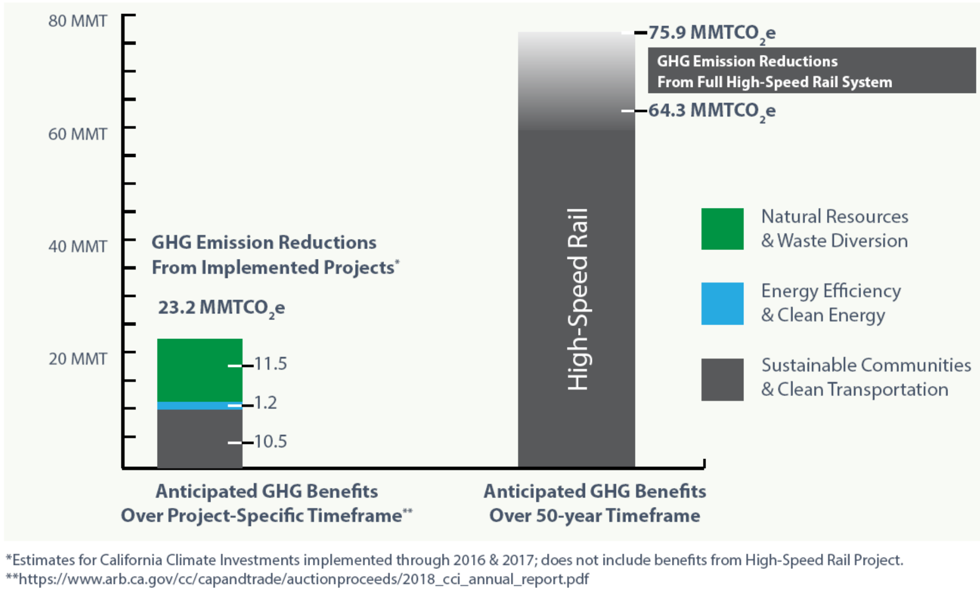
On December 14, 2017, CARB adopted the 2017 Climate Change Scoping Plan, the strategy for achieving California's 2030 GHG emissions target, per the Legislature's direction in SB 32. The 2030 mid-term target helps to frame the suite of policy measures, regulations, planning efforts, and investments in clean technologies and infrastructure needed to continue driving down emissions. The plan builds on the state's existing policy (namely the previous two scoping plans developed pursuant to AB 32); ties together a number of sector-specific strategies; and solidifies targets within sectors. This plan is intended to drive the state toward more electric vehicles; cleaner electricity to fuel those cars; denser, more walkable communities with more efficient buildings; and less-polluting agriculture. The scoping plan also reinforced legislative direction by confirming the role of the cap-and-trade program to achieve over one-third of the state's requisite reductions by 2030.

3.2.7.10 100 Percent Clean Energy Act (Senate Bill 100)

SB 100, the 100 Percent Clean Energy Act of 2018, establishes a state goal to acquire 100 percent of California electricity from eligible renewable energy resources and zero-carbon resources by December 31, 2045. SB 100 also requires electric utilities and other service providers to generate 60 percent of their power from renewable sources by 2030 and requires that the remaining 40 percent be generated by zero-carbon sources of electricity by 2045. In addition, 100 percent of electricity procured will serve all state agencies, including the California HSR System, by 2045.

3.2.7.11 California Climate Investments Program

California Climate Investments is a statewide initiative that puts billions of Cap-and-Trade dollars to work reducing GHG emissions, strengthening the economy and improving public health and the environment. The Cap-and-Trade program also creates a financial incentive for industries to invest in clean technologies and to develop innovative ways to reduce pollution. California Climate Investments projects include affordable housing, sustainable agriculture environmental restoration, waste diversion and recycling, renewable energy, public transportation, and zero-emission vehicles. According to the California Climate Investments program, the California HSR System will generate an aggregate reduction in statewide GHG emissions over a 50-year period. Figure 3-1 illustrates the estimated aggregate reductions in GHG emissions that would result from the high-speed rail over a 50-year timeframe.



Source: California High Speed Rail Authority, 2019

Figure 3-1 Aggregate GHG Emissions Reductions That Would Result from the California High-Speed Rail Project

3.3 Regional and Local

Adopted local and regional plans, policies, and regulations related to air quality and GHG emissions are provided in the sections below.

3.3.1 Air Quality Management District Plans and Regulations

The Burbank to Los Angeles Project Section would be located in the cities of Burbank, Glendale, and Los Angeles, which are also within the South Coast Air Quality Management District (SCAQMD). This air district includes all of Orange County, Los Angeles County except for the Antelope Valley, the non-desert portion of western San Bernardino County, and the western and Coachella Valley portions of Riverside County. The SCAQMD is the agency principally responsible for air pollution control in the South Coast Air Basin (Basin) and is tasked with implementing certain programs and regulations required by the CAA and the California Clean Air Act. The SCAQMD prepares plans to attain state and national ambient air quality standards. These plans include the regional air quality management plan (AQMP) and elements of the SIP that apply to the Basin.

SCAQMD is directly responsible for reducing emissions from stationary (area and point) sources. The SCAQMD develops rules and regulations, establishes permitting requirements, inspects emissions sources, and enforces such measures through educational programs or fines, when necessary. The following sections summarize the SCAQMD rules and regulations that may be applicable to the project.

3.3.1.1 Regulation II—Permits

This regulation requires that a permit be obtained from SCAQMD prior to construction and operation of certain stationary equipment and facilities that emit air pollutants. The LMF may require an air quality permit, depending on the equipment and facilities to be installed. The stations would not require air quality permits. Any emergency standby generator engines at the maintenance facilities and/or train stations that would operate for more than the regulation’s threshold of 200 hours per year would require a permit.

3.3.1.2 Regulation IV—Prohibitions

This regulation sets forth the restrictions for visible emissions, odor nuisance, fugitive dust, various air pollutant emissions, fuel contaminants, and start-up/shutdown exemptions.

Rule 402—Nuisance

This rule restricts the discharge of any contaminant in quantities that cause or have a natural ability to cause injury, damage, nuisance, or annoyance to businesses, property or the public. The proposed project does not plan on discharging any contaminants in quantities that would cause injury to the public or property.

Rule 403—Fugitive Dust

This rule requires the prevention, reduction, or mitigation of fugitive dust emissions from a project site. Rule 403 restricts visible fugitive dust to a project property line, restricts the net PM_{10} emissions to less than 50 micrograms per cubic meter ($\mu g/m^3$) and restricts the tracking out of bulk materials onto public roads. Additionally, Rule 403 requires an applicant to utilize one or more of the best available control measures (identified in the tables within the rule). Mitigation measures may include adding freeboard to haul vehicles, covering loose material on haul vehicles, the use of dust suppressants such as watering or chemical soil stabilizers, and/or ceasing all activities.

3.3.1.3 Regulation XI—Source Specific Standards

Regulation XI sets emissions standards for various stationary sources.

Rule 1113—Architectural Coatings

This rule limits the amount of VOCs from architectural coatings and solvents, which lowers the emissions of odorous compounds.

Rule 1171—Solvent Cleaning Operations

This rule limits the amount of VOCs from use of solvents for cleaning parts and equipment, which lowers the emissions of O_3-forming compounds. The LMF may be subject to this rule, depending on the type and amount of solvent usage.

3.3.1.4 Regulation XIII—New Source Review

This regulation sets forth pre-construction review requirements for new, modified, or relocated stationary facilities to ensure that the operation of such facilities does not interfere with progress toward attainment of the NAAQS, and that future economic growth within the Basin is not unnecessarily restricted. The specific air quality goal of this regulation is to achieve no net increases from new or modified permitted sources of nonattainment air contaminants or their precursors.

In addition to nonattainment air contaminants, this regulation will also limit emission increases of ammonia and O_3-depleting substances from new, modified, or relocated facilities by requiring the use of best available control technology.

The stations and LMF are estimated to have emissions less than the thresholds established by Regulation XIII, and therefore are not expected to be subject to new source review.

3.3.1.5 Regulation XIV—Toxics and Other Noncriteria Pollutants

The rules making up this regulation specify limits for maximum individual cancer risk, cancer burden, and noncancer acute and chronic hazard index from new permit units, relocations, or modifications to existing permit units that emit toxic air contaminants (TAC). The regulation establishes allowable risks for permit units requiring new permits.

3.3.1.6 *SCAQMD Rule 1403—Asbestos Emissions from Demolition/Renovation Activities*

The purpose of this rule is to limit emissions of asbestos, a TAC, from structural demolition/renovation activities. The rule requires people to notify the SCAQMD of proposed demolition/renovation activities and to survey these structures for the presence of asbestos-containing materials. The rule also includes: notification requirements for any intent to disturb asbestos-containing materials; emission control measures; and asbestos-containing material removal, handling, and disposal techniques. All proposed structural demolition activities associated with the proposed construction would need to comply with the requirements of Rule 1403.

3.3.2 Southern California Association of Governments Programs and Requirements

The Southern California Association of Governments (SCAG) is the MPO for Los Angeles, Orange, Riverside, San Bernardino, Imperial, and Ventura counties. It is a regional planning agency and serves as a forum for regional issues relating to transportation, the economy and community development, and the environment. SCAG is the federally designated MPO for the majority of the southern California region and is the largest MPO in the nation. With regard to air quality planning, SCAG prepares the Regional Transportation Plan (RTP) and Regional Transportation Improvement Program, which address regional development and growth forecasts and form the basis for the land use and transportation control portions of the AQMP and are utilized in the preparation of the air quality forecasts and consistency analysis included in the AQMP. The RTP, the Regional Transportation Improvement Program, and the AQMP are based on projections originating within local jurisdictions.

Although SCAG is not an air quality management agency, it is responsible for developing transportation, land use, and energy conservation measures that affect air quality. SCAG's Regional Comprehensive Plan provides growth forecasts that are used in the development of air quality-related land use and transportation control strategies by the SCAQMD. The regional comprehensive plan is a framework for decision-making for local governments, assisting them in meeting federal and state mandates for growth management, mobility, and environmental standards, while maintaining consistency with regional goals regarding growth and changes through the year 2016, and beyond. Policies within the regional comprehensive plan include consideration of air quality, land use, transportation, and economic relationships by all levels of government.

On April 7, 2016, SCAG adopted the 2016–2040 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). Using growth forecasts and economic trends, the RTP provides a vision for transportation throughout the region for the next 20 years. It considers the role of transportation in the broader context of economic, environmental, and quality-of-life goals for the future, and identifies regional transportation strategies to address mobility needs. The SCS is a newly required element of the RTP, which integrates land use and transportation strategies to achieve CARB emissions reduction targets. The inclusion of the SCS is required by SB 375. The RTP/SCS would successfully achieve and exceed the GHG emission-reduction targets set by the CARB by achieving an 8 percent reduction by 2020, an 18 percent reduction by 2035, and a 21 percent reduction by 2040 compared to the 2005 level on a per capita basis. This RTP/SCS also meets criteria pollutant emission budgets set by the USEPA.

The 2016–2040 RTP/SCS includes a strong commitment to reduce emissions from transportation sources to comply with SB 375, improve public health, and meet the NAAQS as set forth by the CAA. Even with ongoing aggressive control strategies, ever more stringent national O_3 standards require further NO_X emission reductions in the SCAG region. In the Basin, for example, it is estimated that NO_X emissions will need to be reduced by approximately 50 percent in 2023 and reduced by an additional 15 percent beyond 2023 levels by 2031. Most sources of NO_X emissions, cars and factories, are already reduced by over 90 percent from uncontrolled conditions. The 2030 emissions forecast indicates that substantial emissions reductions from three sources—ships, trains, and aircraft—would reduce O_3 levels to near the federal standard.

To accomplish the reduction required to meet O_3 standards, the 2016–2040 RTP/SCS contains a regional commitment for the broad deployment of zero- and near-zero emission transportation technologies in the 2023–2040 time frame and clears steps to move toward this objective.

3.3.3 Local Agencies

3.3.3.1 City of Burbank

City of Burbank General Plan

The City of Burbank addresses air quality and GHG emissions in the Air Quality and Climate Change Element of its General Plan. The Air Quality and Climate Change Element includes goals and policies that work to reduce air pollution, reduce the exposure of sensitive receptors to TACs and odors, reduce GHG emissions, and prepare for and adapt to climate change (City of Burbank 2013a).

City of Burbank Sustainability Action Plan

The City of Burbank also addresses GHG emissions in the City of Burbank *Greenhouse Gas Reduction Plan*. The *Greenhouse Gas Reduction Plan* addresses six main reduction strategies: energy, transportation, water, solid waste, green infrastructure, and City government. The *Greenhouse Gas Reduction Plan* identifies the following for each reduction strategy: specific measures, actions, and responsible departments for implementation; progress indicators and metrics against which to measure success; and estimated GHG reductions in 2020 and 2035 (City of Burbank 2013b).

3.3.3.2 City of Glendale

City of Glendale General Plan

The City of Glendale General Plan Air Quality Element recognizes and considers the relationship between land use and air quality in the City of Glendale's planning efforts, identifies ways in which the City of Glendale can reduce its emissions of air pollutants through various policies and programs, and complies with the region's AQMP. The overall goal of the Air Quality Element is for the City of Glendale to assist other governmental agencies in the attainment of healthful air for Glendale and other air basin residents, including those sensitive to air pollution (City of Glendale 1994).

Greener Glendale Plan

The City of Glendale addresses GHG emissions in the City of Glendale's Sustainability Plan: *Greener Glendale Plan*. The plan assesses what actions the City of Glendale and the community have already taken to be more sustainable and recommends how to build on these efforts. The plan addresses sustainability in the City of Glendale through nine topic areas: cross-cutting approaches, economic development, urban design, waste, energy, urban nature, water, transportation, and environmental health. Each of the nine topics, or focus areas, explores a series of objectives with supporting strategies with quantified GHG reductions in 2020 and 2035 (City of Glendale 2011).

3.3.3.3 City of Los Angeles

City of Los Angeles General Plan

The City of Los Angeles General Plan Air Quality Element includes goals, objectives, and policies that guide the city in the implementation of air quality improvement programs and strategies. Goals of the Air Quality Element include: good air quality in an environment of continued population growth and healthy economic structure; less reliance on single-occupant vehicles with fewer commute and non-work trips; efficient management of transportation facilities and system infrastructure using cost-effective system management and innovative demand-management techniques; minimal effect of existing land use patterns and future land use development on air quality by addressing the relationship between land use, transportation, and air quality; energy efficiency through land use and transportation planning, the use of renewable resources and less-polluting fuels, and the implementation of conservation measures including passive methods such as site orientation and tree planting; and citizen awareness of the linkages between personal behavior and air pollution, and participation in efforts to reduce air pollution (City of Los Angeles 1992).

City of Los Angeles Sustainable City Plan

The City of Los Angeles Sustainable City Plan also addresses air quality and GHG emissions. This plan is made up of short-term (by 2017) and longer-term (by 2025 and 2035) targets in 14 categories that will advance the city's environment, economy, and equity. These topic areas include local water; local solar power; energy-efficient buildings; carbon and climate leadership; waste and landfills; housing and development; mobility and transit; prosperity and green jobs; preparedness and resiliency; air quality; environmental justice; urban ecosystem; livable neighborhoods; and lead by example (City of Los Angeles 2015).

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4 POLLUTANTS OF CONCERN

Three general classes of pollutants are of concern for this project—criteria pollutants, TACs, and GHGs. Criteria pollutants are those for which the USEPA and the State of California have set ambient air quality standards or that are chemical precursors to compounds for which ambient standards have been set. TACs of concern for the proposed project are nine MSATs identified by the USEPA as having significant contributions from mobile sources—acetaldehyde, acrolein, benzene, 1,3-butadiene, DPM and diesel exhaust (DE) organic gases, ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter (POM). GHGs are gaseous compounds that limit the transmission of radiated heat from the earth's surface to the atmosphere. GHGs include CO_2, CH_4, N_2O, HFC, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases, including NF_3 and HFE.

4.1 Criteria Pollutants

For these pollutants, both federal and state ambient air quality standards have been established to protect public health and welfare. The following sections briefly describe each pollutant.

4.1.1 Ozone

Definition of O_3

O_3 is a colorless toxic gas found in the earth's upper and lower atmospheric levels. In the upper atmosphere, O_3 is naturally occurring and helps to prevent the sun's harmful ultraviolet rays from reaching the earth. In the lower atmosphere, O_3 is human-made. Although O_3 is not directly emitted, it forms in the lower atmosphere through a chemical reaction between hydrocarbons and oxides of nitrogen, also referred to as VOC and NO_X, which are emitted from industrial sources and from automobiles.

CARB inventories two classes of hydrocarbons—TOGs and reactive organic gases (ROG). ROGs have relatively high photochemical reactivity. The principal nonreactive hydrocarbon is CH_4, which is also a GHG. The major source of ROGs is the incomplete combustion of fossil fuels in internal combustion engines. Other sources of ROGs include the evaporative emissions associated with the use of paints and solvents, the application of asphalt paving, and the use of household consumer products. Adverse effects on human health are not caused directly by ROGs, but rather by reactions of ROGs that form secondary pollutants. ROGs are also transformed into organic aerosols in the atmosphere, contributing to higher levels of fine PM and lower visibility. CARB uses the term ROGs for air quality analysis and ROG has the same definition as the federal term VOC. SCAQMD also uses the term VOC in its CEQA Air Quality Significance Thresholds. For the air quality and global climate change analysis, ROG is assumed to be the equivalent to VOC.

Substantial O_3 formations generally require a stable atmosphere with strong sunlight; thus, high levels of O_3 are generally a concern in the summer. O_3 is the main ingredient of smog. O_3 enters the bloodstream through the respiratory system and interferes with the transfer of oxygen, depriving sensitive tissues in the heart and brain of oxygen. O_3 also damages vegetation by inhibiting its growth. The air quality and global climate change analysis examines the effects of changes in VOC and NO_X emissions for the proposed project on a regional and statewide level.

4.1.2 Particulate Matter

Particulate pollution is composed of solid particles or liquid droplets small enough to remain suspended in the air. In general, particulate pollution can include dust, soot, and smoke. These can be irritating but usually are not toxic. However, particulate pollution can include bits of solid or liquid substances that are highly toxic. The particulates of particular concern are PM_{10} and $PM_{2.5}$.

Major sources of PM_{10} include motor vehicles; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires, brush, and waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions.

Suspended particulates produce haze and reduce visibility. Data collected through numerous nationwide studies indicate that most of the PM_{10} comes from fugitive dust, wind erosion, and agricultural and forestry sources.

A small portion of PM is the product of fuel combustion processes. In the case of $PM_{2.5}$, the combustion of fossil fuels accounts for a significant portion of this pollutant. The main health effect of airborne PM is on the respiratory system. $PM_{2.5}$ results from fuel combustion (from motor vehicles, power generation, and industrial facilities), residential fireplaces, and wood stoves. In addition, $PM_{2.5}$ can form in the atmosphere from gases such as SO_2, NO_X, and VOC. Like PM_{10}, $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Whereas PM_{10} tends to collect in the upper portion of the respiratory system, $PM_{2.5}$ can penetrate deeper into the lungs and damage lung tissues. The effects of PM_{10} and $PM_{2.5}$ emissions for the project are examined on a localized—or microscale—basis, a regional basis, and a statewide basis.

Definition of PM_{10} and $PM_{2.5}$

PM_{10} refers to particulate matter less than 10 microns in diameter, about one-seventh the thickness of a human hair. Particulate matter pollution consists of small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals.

Particulate matter also forms when gases emitted from motor vehicles undergo chemical reactions in the atmosphere.

$PM_{2.5}$ is a subset of PM_{10} and refers to particulates that are 2.5 microns, or less, in diameter, roughly 1/28th the diameter of a human hair.

4.1.3 Carbon Monoxide

In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, or heart disease. CO levels are generally highest in the colder months when inversion conditions (when warmer air traps colder air near the ground) are more frequent.

CO concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban “street canyon” conditions. Consequently, CO concentrations must be predicted on a microscale basis.

Definition of CO

CO is a colorless gas that interferes with the transfer of oxygen to the brain. CO emits almost exclusively from the incomplete combustion of fossil fuels.

On-road motor-vehicle exhaust is the primary source of CO.

4.1.4 Nitrogen Dioxide

Nitrogen oxides, also known as nitric oxide (NO) and NO_2, collectively referred to as NO_X, are major contributors to O_3. NO_2 also contributes to the formation of PM_{10}. At atmospheric concentrations, NO_2 is only potentially irritating. In high concentrations, the result is a brownish-red cast to the atmosphere and reduced visibility. There is some indication of a relationship between NO_2 and chronic pulmonary fibrosis. In addition, an increase in bronchitis in children (two and three years old) has been observed at concentrations below 0.3 parts per million (ppm).

4.1.5 Lead

Lead is a metal that can be suspended in the atmosphere. Lead levels from mobile sources in the urban environment have decreased largely due to the federally mandated switch to lead-free gasoline, and they are expected to continually decrease. An analysis of lead emissions from transportation projects is, therefore, not warranted.

4.1.6 Sulfur Dioxide

SO_2 can cause acute respiratory symptoms and diminished ventilation in children. SO_2 can also yellow plant leaves and corrode iron and steel. Although diesel-fueled heavy-duty vehicles emit SO_2, transportation sources are not considered by the USEPA (and other regulatory agencies) to be large sources of this pollutant. Therefore, an analysis of the effects of SO_2 emissions from transportation projects is usually not warranted. However, an analysis of the effects of SO_2 emissions was conducted for this project.

4.2 Toxic Air Contaminants

California law defines a TAC as an air pollutant that “may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health.” The Toxic Air Contaminant Identification and Control Act (AB 1807) created California's program to reduce exposure to air toxics. The USEPA uses the term “hazardous air pollutant” in a similar sense. Controlling air toxic emissions became a national priority with the passage of the CAA, whereby Congress mandated that the USEPA regulate 188 air toxics, also known as hazardous air pollutants. TACs can be emitted from stationary and mobile sources.

Stationary sources of TACs from HSR operations would include use of solvent-based materials (cleaners and coatings) and combustion of fossil fuel in boilers, heaters, and ovens at maintenance facilities. Although the HSR trains would not emit TACs, MSATs would be associated with the project chiefly through motor vehicle traffic to and from the HSR stations.

For MSAT, the USEPA has assessed the expansive list of 188 air toxics in its latest rule on the Control of Hazardous Air Pollutants from Mobile Sources, and identified 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System. The USEPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (USEPA 2011). These nine compounds are 1,3-butadiene, acetaldehyde, acrolein, benzene, DPM, ethylbenzene, formaldehyde, naphthalene, and POM. This list, however, is subject to change and may be adjusted in consideration of future USEPA rules.

4.2.1 Asbestos

Asbestos minerals occur in rocks and soil as the result of natural geologic processes, often in veins near earthquake faults in the coastal ranges and the foothills of the Sierra Nevada, as well as other areas of California. Naturally occurring asbestos (NOA) takes the form of long, thin, flexible, separable fibers. Natural weathering or human disturbance can break NOA down to microscopic fibers, which are easily suspended in air.

The California Geological Survey identified ultramafic rocks in California to be the source of NOA. In August 2000, the California Department of Conservation, Division of Mines and Geology published a report, A General Location Guide for Ultramafic Rocks in California Areas More Likely to Contain Naturally Occurring Asbestos (California Department of Conservation, Division of Mines and Geology 2000). This study was used to determine if NOA occurs within the project vicinity.

Also, asbestos deposits from brake wear may be present on surfaces and in the ambient air along the HSR alignment. In addition, asbestos-containing materials may have been used in constructing buildings that will be demolished.

Asbestos is a known human carcinogen. When inhaled, these thin fibers irritate tissues and resist the body's natural defenses. It causes cancers of the lung and the lining of internal organs, as well as asbestosis and pleural disease, which inhibit lung function. Chronic inhalation exposure to asbestos in humans can lead to a lung disease called asbestosis, which is a diffuse fibrous scarring of the lungs. Symptoms of asbestosis include shortness of breath, difficulty in breathing, and coughing. Asbestosis is a progressive disease (i.e., the severity of symptoms tends to increase with time, even after the exposure has stopped). In severe cases, this disease can lead to death due to impairment of respiratory function. A large number of occupational studies have reported that exposure to asbestos by inhalation can cause lung cancer and mesothelioma, which is a rare cancer of the membranes lining the abdominal cavity and surrounding internal organs. The USEPA considers asbestos to be a human carcinogen (i.e., cancer-causing agent).

4.2.2 Air Toxics

Stationary sources of TACs from HSR operations will include use of solvent-based materials (cleaners and coatings) and combustion of fossil fuel in boilers, heaters, and ovens at HSR maintenance facilities. Although the HSR trains will not emit TACs, MSATs will be associated with the project, chiefly through motor vehicle traffic to and from the HSR stations.

The USEPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System. The USEPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (USEPA 2011). These are 1,3-butadiene, acetaldehyde, acrolein, benzene, DPM, ethylbenzene, formaldehyde, naphthalene, and POM. This list, however, is subject to change and may be adjusted in consideration of future USEPA rules. Following is a brief description of these MSATs.

- **Acetaldehyde** is a colorless mobile liquid that is flammable and miscible with water. It has a pungent suffocating odor, but at dilute concentrations, it has a fruity and pleasant odor. Acetaldehyde is ubiquitous in the ambient environment. It is an intermediate product of higher plant respiration and formed as a product of incomplete wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing. Acetaldehyde is considered to have low acute toxicity from inhalation and moderate acute toxicity from oral or dermal exposure. Acute (short-term) exposure to acetaldehyde results in effects including irritation of the eyes, skin, and respiratory tract. Symptoms of chronic (long-term) intoxication of acetaldehyde in humans resemble those of alcoholism. No information is available on the reproductive or developmental effects of acetaldehyde in humans. The USEPA considers acetaldehyde to be a probable human carcinogen.
- **Acrolein** is a water-white or yellow liquid that burns easily, is readily volatilized, and has a disagreeable odor. It is present as a product of incomplete combustion in the exhausts of stationary equipment (e.g., boilers and heaters) and mobile sources. It is also a secondary pollutant formed through the photochemical reaction of VOCs and NO_X in the atmosphere. Acrolein is considered to have high acute toxicity, and it causes upper respiratory tract irritation and congestion in humans. The major effects from chronic (long-term) inhalation exposure to acrolein in humans consist of general respiratory congestion and eye, nose, and throat irritation. No information is available on the reproductive, developmental, or carcinogenic effects of acrolein in humans. The USEPA considers acrolein data to be inadequate for an assessment of human carcinogenic potential.
- **Benzene** is a volatile, colorless, highly flammable liquid with a sweet odor. Most of the benzene in ambient air is from incomplete combustion of fossil fuels and evaporation from gasoline service stations. Acute inhalation exposure to benzene causes neurological symptoms, such as drowsiness, dizziness, headaches, and unconsciousness in humans. Chronic inhalation of certain levels of benzene causes disorders in the blood in humans. Benzene specifically affects bone marrow (the tissues that produce blood cells). Aplastic anemia, excessive bleeding, and damage to the immune system (by changes in blood levels of antibodies and loss of white blood cells) may develop. Available human data on the developmental effects of benzene are inconclusive because of concomitant exposure to other chemicals, inadequate sample size, and lack of quantitative exposure data. The USEPA has classified benzene as a known human carcinogen by inhalation.
- **1,3-Butadiene** is a colorless gas with a mild gasoline-like odor. Sources of 1,3-butadiene released into the air include motor vehicle exhaust, manufacturing and processing facilities, forest fires or other combustion, and cigarette smoke. Acute exposure to 1,3-butadiene by inhalation in humans results in irritation of the eyes, nasal passages, throat, and lungs. Neurological effects, such as blurred vision, fatigue, headache, and vertigo, have also been reported at very high exposure levels. One epidemiological study reported that chronic

exposure to 1,3-butadiene by inhalation resulted in an increase in cardiovascular diseases, such as rheumatic and arteriosclerotic heart diseases. Other human studies have reported effects on blood (Agency for Toxic Substances and Disease Registry 1992). No information is available on reproductive or developmental effects of 1,3-butadiene in humans. The USEPA has classified 1,3-butadiene as a probable human carcinogen by inhalation.

- **Diesel Particulate Matter/Diesel Exhaust Organic Gases** are a complex mixture of hundreds of constituents in either a gaseous or particle form. Gaseous components of DE include CO_2, oxygen, nitrogen, water vapor, CO, nitrogen compounds, sulfur compounds, and numerous low-molecular-weight hydrocarbons. Among the gaseous hydrocarbons components of DE that are individually known to be of toxicological relevance are several carbonyls (e.g., formaldehyde, acetaldehyde, and acrolein), benzene, 1,3-butadiene, and polycyclic aromatic hydrocarbons (PAH) and nitro-PAHs. DPM is composed of a center core of elemental carbon and adsorbed organic compounds, as well as small amounts of sulfate, nitrate, metals, and other trace elements. DPM consists primarily of $PM_{2.5}$, including a subgroup with a large number of particles having a diameter less than 0.1 micrometer (μm). Collectively, these particles have a large surface area, which makes them an excellent medium for adsorbing organic compounds. In addition, their small size makes them highly respirable and able to reach the deep lung. Several potentially toxicologically relevant organic compounds, including PAHs, nitro-PAHs, and oxidized PAH derivatives are on the particles. DE is emitted from on-road mobile sources, such as automobiles and trucks, and from off-road mobile sources (e.g., diesel locomotives, marine vessels, and construction equipment). DPM is directly emitted from diesel-powered engines (primary PM) and can be formed from the gaseous compounds emitted by diesel engines (secondary PM).

  Acute or short-term (e.g., episodic) exposure to DE can cause acute irritation (e.g., eye, throat and bronchial), neurophysiological symptoms (e.g., lightheadedness and nausea), and respiratory symptoms (e.g., cough and phlegm). Evidence also exists for an exacerbation of allergenic responses to known allergens and asthma-like symptoms. Information from available human studies is inadequate for a definitive evaluation of possible noncancer health effects from chronic exposure to DE. However, on the basis of extensive animal evidence, DE is judged to pose a chronic respiratory hazard to humans. The USEPA has determined that DE is likely to be carcinogenic to humans by inhalation and that this hazard applies to environmental exposures.

- **Ethylbenzene** is a colorless liquid that smells like gasoline. It is used primarily in the production of styrene. Ethylbenzene is also used as a solvent, as a constituent of asphalt and naphtha, and in fuels. Acute (short-term) exposure to ethylbenzene in humans results in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects such as dizziness. Chronic (long-term) exposure to ethylbenzene by inhalation in humans has shown conflicting results regarding its effects on the blood. No information is available on the reproductive or developmental effects of ethylbenzene in humans. The USEPA has classified ethylbenzene as a Group D, not classifiable as to human carcinogenicity.

- **Formaldehyde** is a colorless gas with a pungent, suffocating odor at room temperature. The major emission sources of formaldehyde appear to be power plants, manufacturing facilities, incinerators, and automobile exhaust. However, most of the formaldehyde in ambient air is a result of secondary formation through photochemical reaction of VOCs and NO_X. The major toxic effects caused by acute formaldehyde exposure by inhalation are eye, nose, and throat irritation, and effects on the nasal cavity. Other effects from exposure to high levels of formaldehyde in humans are coughing, wheezing, chest pains, and bronchitis. Chronic exposure to formaldehyde by inhalation in humans has been associated with respiratory symptoms and eye, nose, and throat irritation. The USEPA considers formaldehyde to be a probable human carcinogen.

- **Naphthalene** is used in the production of phthalic anhydride; it is also used in mothballs. Acute (short-term) exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and neurological damage. Cataracts have also been reported in workers acutely exposed to naphthalene by inhalation and ingestion. Chronic (long-term) exposure of workers and rodents to naphthalene reportedly causes cataracts and damage to the retina. Hemolytic anemia has been reported in infants born to mothers who sniffed and ingested naphthalene (as mothballs) during pregnancy. Available data are inadequate to establish a causal relationship between exposure to naphthalene and cancer in humans. The USEPA has classified naphthalene as a Group C, possible human carcinogen.

- **Polycyclic Organic Matter** defines a broad class of compounds that includes PAHs, of which benzo[a]pyrene is a member. POM compounds are formed primarily by combustion and are present in the atmosphere in particulate form. Sources of air emissions are diverse and include cigarette smoke, vehicle exhaust, home heating, laying tar, and grilling meat. Cancer is the major concern from exposure to POM. Epidemiologic studies have reported an increase in lung cancer in humans exposed to coke oven emissions, roofing tar emissions, and cigarette smoke; all of these mixtures contain POM compounds. Animal studies have reported respiratory tract tumors from inhalation exposure to benzo[a]pyrene and forestomach tumors, leukemia, and lung tumors from oral exposure to benzo[a]pyrene. The USEPA has classified seven PAHs (benzo[a]pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a h]anthracene, and indeno[1,2,3-cd]pyrene) as Group B2, probable human carcinogens.

4.3 Greenhouse Gases

GHGs trap heat in the atmosphere, keeping the earth's surface warmer than it otherwise would be. According to National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration data, the earth's average surface (land and ocean) temperature has increased by 1.6 degrees Fahrenheit (ºF) in the last 100 years. Eight of the top 10 warmest years on record have occurred since 1998. Average global temperatures show a similar trend, and all of the top 10 warmest years on record worldwide have occurred since 1998 (National Oceanographic and Atmospheric 2018). Most of the warming in recent decades is likely the result of human activities. Other aspects of the climate are also changing, such as rainfall patterns, snow and ice cover, and sea level.

Definition of Greenhouse Gases

Greenhouse gases (GHG) include any gases that absorb infrared radiation in the atmosphere. GHGs include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons, ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons, and sulfur hexafluoride. GHGs contribute to the global warming trend, a regional and ultimately worldwide concern. What was once a natural phenomenon of climate has been changing because of human activities, resulting in an increase in CO_2.

Some GHGs, such as CO_2, occur naturally and are emitted to the atmosphere through both natural processes and human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. GHGs differ in their ability to trap heat. For example, 1 ton of CO_2 emissions has a different effect than 1 ton of CH_4 emissions. To compare emissions of different GHGs, inventory compilers use a weighting factor called a global warming potential (GWP). To use a GWP, the heat-trapping ability of 1 metric ton (1,000 kilograms) of CO_2 is taken as the standard, and emissions are expressed in terms of CO_2 equivalents, but can also be expressed in terms of carbon equivalents. Therefore, the GWP of CO_2 is one, and the GWP of CH_4 is 21, whereas the GWP of N_2O is 310.

The principal GHGs that enter the atmosphere because of human activities are described below.

- **CO_2:** CO_2 enters the atmosphere via the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees, and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). CO_2 is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

- **CH_4:** CH_4 is emitted during the production and transport of coal, natural gas, and oil. CH_4 emissions also result from livestock and other agricultural practices and from the decay of organic waste in municipal solid waste landfills.
- **N_2O:** N_2O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- **Fluorinated Gases:** HFCs, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for O_3-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as high-GWP gases.

Due to the global nature of GHG emissions and the nature of the electrical grid system, GHGs will be examined on a statewide level.

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5 AFFECTED ENVIRONMENT

Air pollutant emissions have the potential to affect the environment on a local, regional, and global scale. From a local and regional perspective, meteorology and climate affect the dispersion of air pollutants within local communities as well as within an air basin. The ambient air quality is monitored by stations distributed within the air basin. These ambient air quality concentrations are evaluated against the state and federal ambient air quality standards to determine whether the air basin is in a state of attainment status of these standards. Air quality plans have been developed to guide air pollution control efforts to meet or maintain attainment of the ambient air quality standards. This section provides a discussion of the physical environment and air quality conditions of the air basin for which the project is located.

5.1 Meteorology and Climate

Air quality is affected by both the rate and location of pollutant emissions, and by meteorological conditions that influence movement and dispersal of pollutants in the atmosphere. Atmospheric conditions, such as wind speed, wind direction, and air temperature gradients, along with local topography, provide the link between air pollutant emissions and local air quality levels. Elevation and topography can affect localized air quality.

The Basin covers 6,745 square miles and includes all of Orange County, Los Angeles County except for the Antelope Valley, the non-desert portion of western San Bernardino County, and the western and Coachella Valley portions of Riverside County.

Low average wind speeds, together with a persistent temperature inversion limit the vertical dispersion of air pollutants throughout the Basin. Strong, dry, north or northeasterly winds, known as Santa Ana winds, occur during the fall and winter months, dispersing air contaminants. The Santa Ana conditions tend to last for several days at a time.

The combination of stagnant wind conditions and low inversions produces the greatest pollutant concentrations. On days of no inversion or high wind speeds, ambient air pollutant concentrations are the lowest. During periods of low inversions and low wind speeds, air pollutants generated in urbanized areas are transported into Riverside and San Bernardino counties. In the winter, the greatest pollution problems are CO and NO_X because of extremely low inversions and air stagnation during the night and early morning hours. In the summer, the longer daylight hours and the brighter sunshine combine to cause a reaction between hydrocarbons and NO_X to form photochemical smog.

The annual average temperature varies little throughout the Basin, ranging from the low to middle 60s°F. With a more pronounced oceanic influence, coastal areas show less variability in annual minimum and maximum temperatures than inland areas. The majority of annual rainfall in the Basin occurs between November and April. Summer rainfall is minimal and is generally limited to scattered thundershowers in coastal regions and slightly heavier showers in the eastern portion of the Basin and along the coastal side of the mountains. Average monthly rainfall during that period varies from 3.80 inches in February to 0.01 inch or less between June and July, with an annual total of 16.35 inches. Patterns in monthly and yearly rainfall totals are unpredictable due to fluctuations in the weather.

The Basin intermittently experiences a temperature inversion (increasing temperature with increasing altitude) as a result of the Pacific high. This inversion limits the vertical dispersion of air contaminants, holding them relatively near the ground. As the sun warms the ground and the lower air layer, the temperature of the lower air layer approaches the temperature of the base of the inversion (upper) layer until the inversion layer finally breaks, allowing vertical mixing with the lower layer. This phenomenon is observed in mid-afternoon to late afternoon on hot summer days, when the smog appears to clear up suddenly. Winter inversions frequently break by midmorning.

5.2 Ambient Air Quality

CARB maintains ambient air monitoring stations for criteria pollutants throughout California. The stations nearest to the HSR alignment alternative are the 1630 N Main Street station in the City of Los Angeles and the 752 Wilson Avenue station in the City of Pasadena. Monitoring data from these stations are shown in Table 5-1 and Figure 5-1. The stations monitor CO, O_3, NO_2, PM_{10}, $PM_{2.5}$, and SO_2. Full locations for the monitoring stations are shown on Table 5-1. A brief summary of the monitoring data includes the following:

- Monitored data from 2016 through 2018 do not exceed either the state or federal standards for CO.
- O_3 values for the region exceed the national 8-hour O_3 standards at both stations for every year. O_3 values exceed the state 8-hour O_3 standards at all stations every year from 2016 through 2018. O_3 values for the region also exceed the state 1-hour O_3 standard at both stations for every year from 2016 through 2018.
- The PM_{10} values for the region do not exceed the national 24-hour PM_{10} standard. The state 24-hour PM_{10} standard was exceeded at the Burbank station and Los Angeles station for every year except 2015 and 2016 at the Burbank station. PM_{10} emissions were not measured at the Pasadena station from 2014 through 2016 and were not measured at the Burbank station in 2015 and 2016.
- The $PM_{2.5}$ values for the region exceed the national 24-hour $PM_{2.5}$ standard for the Los Angeles station for the years 2016, 2017, and 2018. The Los Angeles station exceeded the national 24-hour $PM_{2.5}$ standard between 2016 and 2018.
- SO_2 values were not exceeded at any of the two stations between 2016 and 2018. SO_2 emissions were not measured at the Pasadena station from 2016 through 2018.
- The 1-hour and annual NO_2 values were not exceeded at any of the two stations between 2016 and 2018.

5.2.1 Attainment Status

The USEPA and CARB designate each county (or portions of counties) within California as nonattainment, maintenance, attainment, or unclassified, based on the area's ability to meet ambient air quality standards. The four designations are defined as:

- Nonattainment—Assigned to areas where monitored pollutant concentrations consistently violate the standard in question.
- Maintenance—Assigned to areas where monitored pollutant concentrations exceeded the standard in question in the past but are no longer in violation of that standard.
- Attainment—Assigned to areas where pollutant concentrations meet the standard in question over a designated period of time.
- Unclassified—Assigned to areas were data are insufficient to determine whether a pollutant is violating the standard in question.

Table 5-1 Ambient Criterial Pollutant Concentration Data at Air Quality Monitoring Stations Closest to the Project

Air Pollutant	Standard/Exceedance	1630 N Main Street, Los Angeles			752 Wilson Avenue, Pasadena		
		2016	2017	2018	2016	2017	2018
Carbon Monoxide (CO)[3]	Year Coverage	NM	NM	NM	NM	NM	NM
	Max. 1-hour Concentration (ppm)	1.9	2.0	2.0	1.5	2.2	2.0
	Max. 8-hour Concentration (ppm)	1.4	1.8	1.7	1.0	1.7	1.4
	# Days>Federal 1-hour Standard of >35 ppm	0	0	0	0	0	0
	# Days>Federal 8-hour Standard of >9 ppm	0	0	0	0	0	0
	# Days>California 8-hour Standard of >9 ppm	0	0	0	0	0	0
Ozone (O_3)	Year Coverage[1]	98%	96%	96%	95%	96%	98%
	Max. 1-hour Concentration (ppm)	0.103	0.116	0.098	0.126	0.139	0.112
	Max. 8-hour Concentration (ppm)	0.078	0.086	0.073	0.090	0.100	0.090
	# Days>Federal 8-hour Standard of >0.070 ppm	4	14	4	18	36	19
	# Days>California 1-hour Standard of >0.09 ppm	2	6	2	12	18	8
	# Days>California 8-hour Standard of >0.07 ppm	4	16	4	19	38	20
Nitrogen Dioxide (NO_2)	Year Coverage	97%	95%	97%	96%	94%	95%
	Max. 1-hour Concentration (ppb)	64.7	80.6	70.1	71.9	72.3	68.2
	Annual Average (ppb)	21	21	19	15	15	14
	# Days>Federal 1-hour Standard of >100 ppb	0	0	0	0	0	0
Sulfur Dioxide (SO_2)	Year Coverage	13.4	5.7	17.9	NM	NM	NM
	Max. 24-hour Concentration (ppm)	1.3	1.5	1.3	NM	NM	NM
	Annual Average (ppm)	0.30	0.36	0.34	NM	NM	NM
	# Days>California 24-hour Standard of >0.04 ppm	0	0	0	NM	NM	NM
Respirable Particulate Matter (PM_{10})	Year Coverage	98%	94%	90%	NM	NM	NM
	Max. 24-hour Concentration ($\mu g/m^3$)[2]	74.6	96.2	81.2	NM	NM	NM
	# Days>Federal 24-hour Standard of >150 $\mu g/m^3$	0	0	0	NM	NM	NM
	# Days>California 24-hour Standard of >50 $\mu g/m^3$	21	40	31	NM	NM	NM
	Annual Average[2] ($\mu g/m^3$)	25.8	25.7	30.2	NM	NM	NM
Fine	Year Coverage	98%	98%	95%	98%	100%	99%

Air Pollutant	Standard/Exceedance	1630 N Main Street, Los Angeles			752 Wilson Avenue, Pasadena		
		2016	2017	2018	2016	2017	2018
Particulate Matter ($PM_{2.5}$)	Max. 24-hour Concentration ($\mu g/m^3$)	49.4	61.7	65.3	29.2	22.8	32.5
	State Annual Average ($\mu g/m^3$)	12.0	16.3	16.0	9.5	9.7	10.3
	# Days>Federal 24-hour Standard of >35 $\mu g/m^3$	2	6	6	0	0	0
	Annual Average[2] ($\mu g/m^3$)	11.7	12.0	12.8	9.5	9.6	10.2

Source: California Air Resources Board and U.S. Environmental Protection Agency, 2019
[1] Coverage is for 8-hour standard.
[2] Coverage is for National Standard.
[3] CO data for the 752 Wilson Avenue, Pasadena station monitoring site.
> = greater than
$\mu g/m^3$ = micrograms per cubic meter
Max = maximum
NM = not monitored
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ppm = parts per million

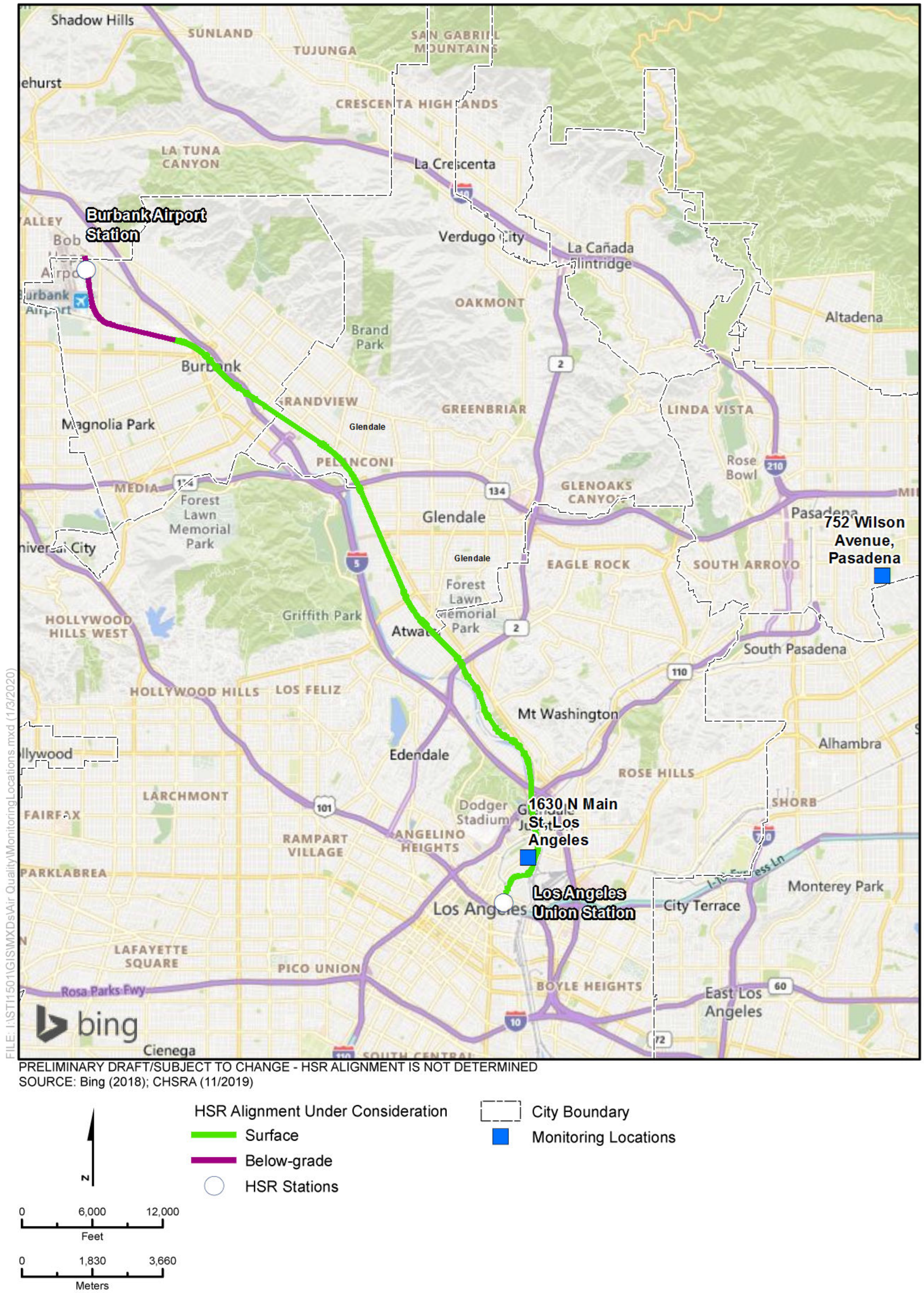


Figure 5-1 Air Quality Monitoring Stations Closest to Project

Table 5-2 summarizes the federal (under NAAQS) and state (under CAAQS) attainment status for the Basin.

Table 5-2 Federal and State Attainment Status in the South Coast Air Basin

Pollutants	Federal Classification	State Classification
O_3 1-hour	N/A	Nonattainment
O_3 8-hour	Nonattainment	Nonattainment
PM_{10}	Attainment/Maintenance	Nonattainment
$PM_{2.5}$	Nonattainment	Nonattainment
CO	Attainment/Maintenance	Unclassified
NO_2	Unclassified	Attainment
SO_2	Unclassified	Attainment
Lead	Nonattainment	Attainment
All Others	Attainment/Unclassified	Attainment/Unclassified

Source: California Air Resources Board, 2019

CO = carbon monoxide
NO_X = nitrogen oxides
O_3 = ozone
Pb = lead
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide

Under the federal criteria, the Basin is currently designated as nonattainment for the federal 8-hour O_3, $PM_{2.5}$, and Pb standards; unclassified for the federal NO_2 and SO_2 standards; attainment/maintenance for the federal PM_{10} and CO standards; and attainment/unclassified for all other standards. The Basin is considered in nonattainment for the state 1-hour O_3, 8-hour O_3, $PM_{2.5}$, and PM_{10} standards; unclassified for the state CO standards; in attainment for the state NO_2, SO_2, and Pb standards; and in attainment/unclassified for all other state standards.

5.3 Air Quality Management Plans

The SCAQMD and CARB develop planning documents for pollutants for which the study area is classified as a federal nonattainment or maintenance area, and the documents are approved by the USEPA. The SCAQMD is presently guided by the California SIP (CARB 2012) and other planning documents.

The SCAQMD is responsible for demonstrating regional compliance with ambient air quality standards but has limited indirect involvement in reducing emissions from fugitive, mobile, and natural sources. To that end, the SCAQMD works cooperatively with CARB, SCAG, county transportation commissions, local governments, and other federal and state government agencies. It has responded to this requirement by preparing a series of AQMPs to meet the CAAQS and NAAQS. The SCAQMD adopted the Final 2016 AQMP on March 17, 2017 (SCAQMD 2017), which incorporates the latest scientific and technological information and planning assumptions, including the 2016 RTP/SCS, and updated emission inventory methodologies for various emission source categories. The AQMP is the region’s Clean Air Plan, which guides the region’s air quality planning efforts to attain the CAAQS. The SCAQMD’s AQMP contains district-wide control measures to reduce O_3 precursor emissions (i.e., ROG and NO_X), PM, and GHG emissions.

The 2016 AQMP provides integrated strategies and measures to meet the following NAAQS:

- 8-hour O_3 (75 parts per billion [ppb]) by 2032
- Annual $PM_{2.5}$ (12 µg/m^3) by 2021–2025
- 8-hour O_3 (80 ppb) by 2024 (updated from the 2007 and 2012 AQMPs)
- 1-hour O_3 (120 ppb) by 2023 (updated from the 2012 AQMP)
- 24-hour $PM_{2.5}$ (35 µg/m^3) by 2019 (updated from the 2012 AQMP)

The 2016 AQMP also takes an initial look at the new 2015 federal 8-hour O_3 standard (70 ppb), as well as incorporate energy, climate, transportation, goods movement, infrastructure and other planning efforts that affect future air quality. The most significant air quality challenge in the Basin is to reduce NO_X emissions sufficiently to meet the upcoming O_3 standard deadlines. Based on preliminary analyses, the approximately 580 tons per day of total Basin NO_X emissions are projected to drop to approximately 300 tons per day and 250 tons per day in the attainment years of 2023 and 2031, respectively, due to continued implementation of already adopted control measures.

The primary challenge is that mobile sources currently contribute about 88 percent of the region's total NO_X emissions, and SCAQMD has limited authority to regulate mobile sources. SCAQMD is working closely with the CARB and the USEPA, which have primary authority over mobile sources in ensuring that mobile sources do their fair share of pollution reduction.

Since NO_X emissions also lead to the formation of $PM_{2.5}$, the NO_X reductions needed to meet the O_3 standards will lead to significant improvements in $PM_{2.5}$ levels. The 2016 AQMP includes $PM_{2.5}$ control strategies as needed to ensure that the $PM_{2.5}$ NAAQS will also be met on time.

The SCAQMD adopted land use planning guidelines in the May 2005 "Guidance Document for Addressing Air Quality Issues in General Plans and Local Planning" which, like the Handbook, also consider effects to sensitive receptors from facilities that emit TACs. The SCAQMD's distance recommendations are the same as those provided by the CARB (e.g., the same siting criteria for distribution centers and dry cleaning facilities). The SCAQMD's document introduces land use-related policies that rely on design and distance parameters to manage potential health risk. These guidelines are voluntary initiatives recommended for consideration by local planning agencies.

5.3.1 State Implementation Plan

When the USEPA designated the Los Angeles County portion of the Basin as nonattainment for the 2008 Pb lead NAAQS on December 31, 2010, SCAQMD was required to prepare a SIP for the Pb nonattainment area. This designation was based on two source-specific monitors in the city of Vernon and the City of Industry that exceeded the new standard in the 2007 to 2009 period. The remainder of the Basin, outside the Los Angeles County nonattainment area, remains in attainment of the new 2008 lead standard. The 2012 Lead State Implementation Plan for Los Angeles County outlines the strategies, planning, and pollution control activities that demonstrate attainment of the lead NAAQS (SCAQMD 2012). The SIP revision was submitted to the USEPA for approval. Lead concentrations in this nonattainment area have been below the level of the federal standard since December 2011.

5.3.1.1 2007 Ozone Plan

On January 12, 1999, the USEPA proposed partial approval/disapproval of the 1997 Ozone SIP revisions, citing concerns with the O_3 control strategy provided in the 1997 AQMP. To address these concerns, the SCAQMD staff prepared the Ozone Plan as an Amendment to the SIP.

The 1999 Amendment includes the following key elements:

- New short-term stationary source control measures
- Revisions of the adoption/implementation schedule for 13 short-term VOC and NO_X stationary source control measures from the 1997 Ozone SIP Revision
- Provisions for further VOC emission reductions in the near-term
- Revisions to the emission reduction commitments for the long-term control measures in the 1997 Ozone SIP Revision long-term stationary source control measures for which the SCAQMD is responsible to implement

5.3.1.2 Clean Communities Plan

The Clean Communities Plan (formerly known as the Air Toxics Control Plan) is designed to examine the overall direction of the SCAQMD's air toxics control program. It includes control strategies aimed at reducing toxic emissions and risk from both mobile and stationary sources (SCAQMD 2010).

5.3.1.3 Air Quality Monitoring Network Plan

The annual Air Quality Monitoring Network Plan describes the network of ambient air quality monitors located within the SCAQMD's four-county jurisdiction. Federal regulations require that the air quality monitoring network be reviewed annually to identify any need for additions, relocations, or terminations of monitoring sites or instrumentation (SCAQMD 2016).

5.3.2 Transportation Plans and Programs

The Regional Transportation Planning Agency within the Basin and the study area (i.e., SCAG) is responsible for preparing RTPs. The RTP addresses a region's transportation goals, objectives, and policies for the next 20 to 25 years and identifies the actions necessary to achieve those goals. MPOs prepare Federal Transportation Improvement Programs, which are five-year programs of proposed projects that incrementally develop the RTP and contain a listing of proposed transportation projects for which funding has been committed. Transportation projects are analyzed for air quality conformity with the SIP as components of the RTPs and the Federal Transportation Improvement Programs. The SCAG adopted its 2016–2040 RTP/SCS in April 2016. The 2016 RTP/SCS introduces the California HSR Project and includes strategies that support the California HSR Project.

5.4 Emission Inventory

5.4.1 Criteria Pollutants

CARB maintains an annual emission inventory for select counties and air basins in the state. The inventory for the Basin consists of data submitted to CARB by the SCAQMD plus estimates for certain source categories, which are provided by CARB staff. The 2012 inventory data for the SCAQMD is summarized in Table 5-3.

In the SCAQMD, mobile source emissions account for over 90 and 85 percent of the Basin's CO and NO_X emissions, respectively. Mobile source emissions also account for over 50 percent of the Basin's ROG emissions. Area source emissions account for over 80 percent of the Basin's PM, and stationary sources account for over 65 and 50 percent, respectively, of the Basin's VOC and SO_X emissions.

5.4.2 Statewide Greenhouse Gas

As a requirement of AB 32, CARB constructed a GHG emissions inventory to determine the 1990 emission level and 2020 limit of 431 MMT CO_2e, using the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report GWPs (CARB 2015). GHGs are inventoried on a statewide basis because their effects are not localized or regional; this is due to their rapid dispersion into the global atmosphere. Since climate change is a global and not a regional issue, specific inventories have not been prepared for the individual air basins. The original statewide 2020 limit of 427 MMT CO_2e was approved on December 6, 2007, and was not sector-specific. A revised statewide 2020 limit of 431 MMT CO_2e was approved on May 22, 2014, and also not sector-specific. Since development of the 1990 emissions inventory, CARB has prepared a statewide inventory for years 2000 through 2014. A summary of the 2014 statewide GHG emissions inventory is included in Table 5-4.

Table 5-3 Estimated Annual Average Emissions for the South Coast Air Quality Management District (Tons per Day)

Source Category	TOG	ROG	CO	NO_X	SO_X	PM	PM_{10}	$PM_{2.5}$
Stationary Sources								
Fuel Combustion	42.27	8.78	48.25	44.98	7.08	5.45	5.29	5.17
Waste Disposal	599.43	7.84	1.11	2.15	0.51	1.00	0.56	0.25
Cleaning and Surface Coatings	87.43	38.11	0.47	0.14	0.10	2.10	2.02	1.94
Petroleum Production and Marketing	130.93	41.84	4.55	1.43	2.16	2.57	1.64	1.41
Total Industrial Processes	12.32	10.45	1.17	0.39	0.28	19.55	11.56	5.02
Total Stationary Sources	872.39	107.02	55.55	49.09	10.14	30.68	21.06	13.78
Stationary Sources Percentage of Total	*65.1%*	*22.2%*	*2.4%*	*8.6%*	*52.1%*	*12.2%*	*12.1%*	*18.8%*
Areawide Sources								
Solvent Evaporation	129.90	1,039.39	–	–	–	0.02	0.02	0.02
Miscellaneous Processes	64.12	17.07	104.76	22.31	0.97	210.00	112.85	34.90
Total Areawide Sources	194.02	126.46	104.76	22.31	0.97	210.02	112.87	34.92
Areawide Sources Percentage of Total	*14.5%*	*26.2%*	*4.5%*	*3.9%*	*5.0%*	*83.5%*	*65.0%*	*47.5%*
Mobile Sources								
On-Road Motor Vehicles	151.23	138.16	1,408.17	328.04	2.12	–	29.28	15.71
Other Mobile Sources	122.45	110.96	780.25	170.73	6.25	10.75	10.40	9.04
Total Mobile Sources	273.68	249.13	2,188.42	498.77	8.37	10.75	39.68	24.75
Mobile Sources Percentage of Total	*20.4%*	*51.6%*	*93.2%*	*87.5%*	*43.0%*	*4.3%*	*22.9%*	*33.7%*
Grand Total	**1,340.09**	**482.61**	**2,348.74**	**570.16**	**19.48**	**251.44**	**173.62**	**73.45**

Source: California Air Resources Board (2013)
Rounded to the nearest percentage. Category percentages do not sum to 100 percent due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM = particulate matter
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SCAQMD = South Coast Air Quality Management District
SO_X = sulfur oxide
TOG = total organic gas

Table 5-4 2014 California Statewide Greenhouse Gas Emissions Inventory

GHG Emission Category	2017 (MMT CO_2e)	Percentage of Total
Transportation	170.0	40
Electric Power	62.3	15
Commercial and Residential	41.1	10
Industrial	89.5	21
Recycling and Waste	7.8	1
High GWP	21.2	5
Agriculture	32.2	8
Total California Emissions	**424.1**	**–**

Source: California Air Resources Board, 2019
Rounded to the nearest percentage. Category percentages do not sum to 100 percent due to rounding.
GHG = greenhouse gases MMT CO_2e = million metric tons of carbon dioxide equivalent
GWP = global warming potential

5.5 Sensitive Receptors

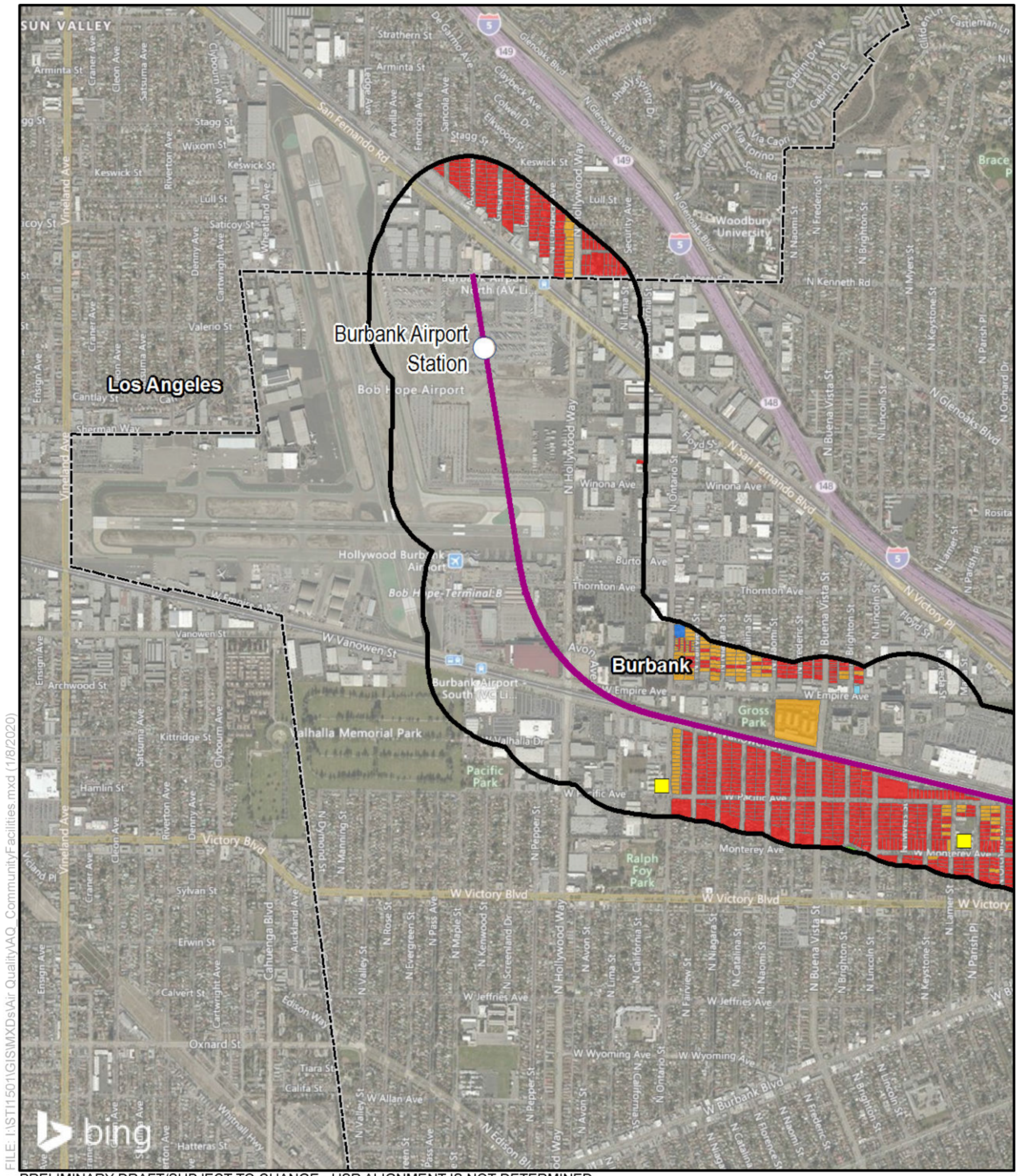
Some locations are considered more sensitive to adverse effects from air pollution than others. These locations are termed sensitive receptors, and include residences, schools, daycare facilities, elderly care establishments, medical facilities, active recreational uses, and other areas that are populated with people considered more vulnerable to the effects of poor air quality. Sensitive receptors within 1,000 feet of the HSR stations are shown in Table 5-5. Analyses performed by CARB indicate that providing a separation of at least 1,000 feet from diesel sources and high-traffic areas would substantially reduce the exposure to air contaminants and decrease asthma symptoms in children (CARB 2005). Figure 5-2 shows all the sensitive land uses within 1,000 feet of the project elements.

Table 5-5 Sensitive Receptors Within 1,000 Feet of the High-Speed Rail Stations

Sensitive Receptors	Distance (feet)
Proximate to Burbank Airport Station Option B	
Single Family Residential Homes north of San Fernando Road	290
BHC Child Development Center	820
North Ontario Street Apartments	840
Proximity to Rail Tracks	
Providence Elementary School	710
Monterey High School	315
Little Angles Academy	830
Scholars Preparatory School	977
Thomas Edison Elementary School	480
Glendale Memorial Hospital	1,000
Cerritos Elementary School	1,000
Holy Trinity Elementary School	1,000
Atwater Avenue Elementary School	1,000
Los Feliz Charter School for the Arts	32
Renaissance Arts Academy	440

Sensitive Receptors	Distance (feet)
Glassell Park Elementary School	1,000
Studio Middle School	120
Divine Saviour Elementary School	900
Albion Elementary School	860
PUC Excel Charter Academy	1,000
Ann Street Elementary School	710
Proximate to LAUS Platform	
Mosaic Apartments	20
Cathay Manor Apartments	880
Chinatown Senior Citizen Services Center [1]	880
Chinatown Teen Post [1]	880
Mixed Use—612 New High Street	714
Mixed Use—618 New High Street	763
Mixed Use—648 N Spring Street	526
Mixed Use—654 N Spring Street	526
Mixed Use—640 N Spring Street	526
Mixed Use—643 N Spring Street	684

[1] Receptor type: youth, cultural, and educational facility
LAUS = Los Angeles Union Station



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HSR ALIGNMENT IS NOT DETERMINED
SOURCE: Bing Maps (2018); CAHSRA (11/2019); Los Angeles Geohub (2016); City of Glendale (2016); City of Burbank (2016)

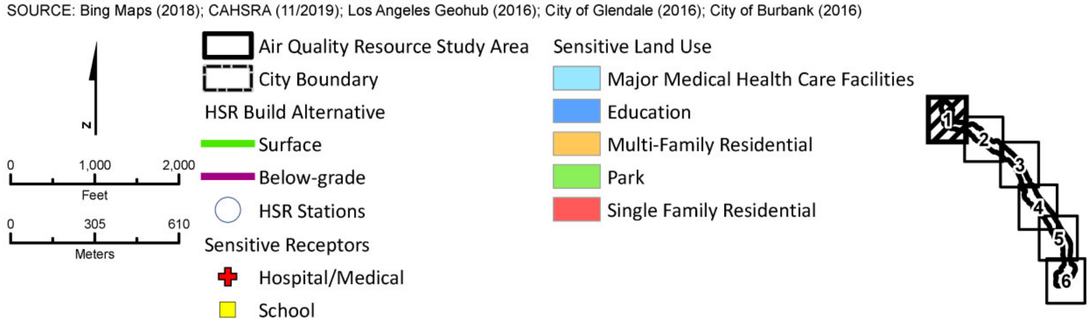


Figure 5-2 Sensitive Land Uses Within 1,000 Feet of the Project

(Sheet 1 of 6)

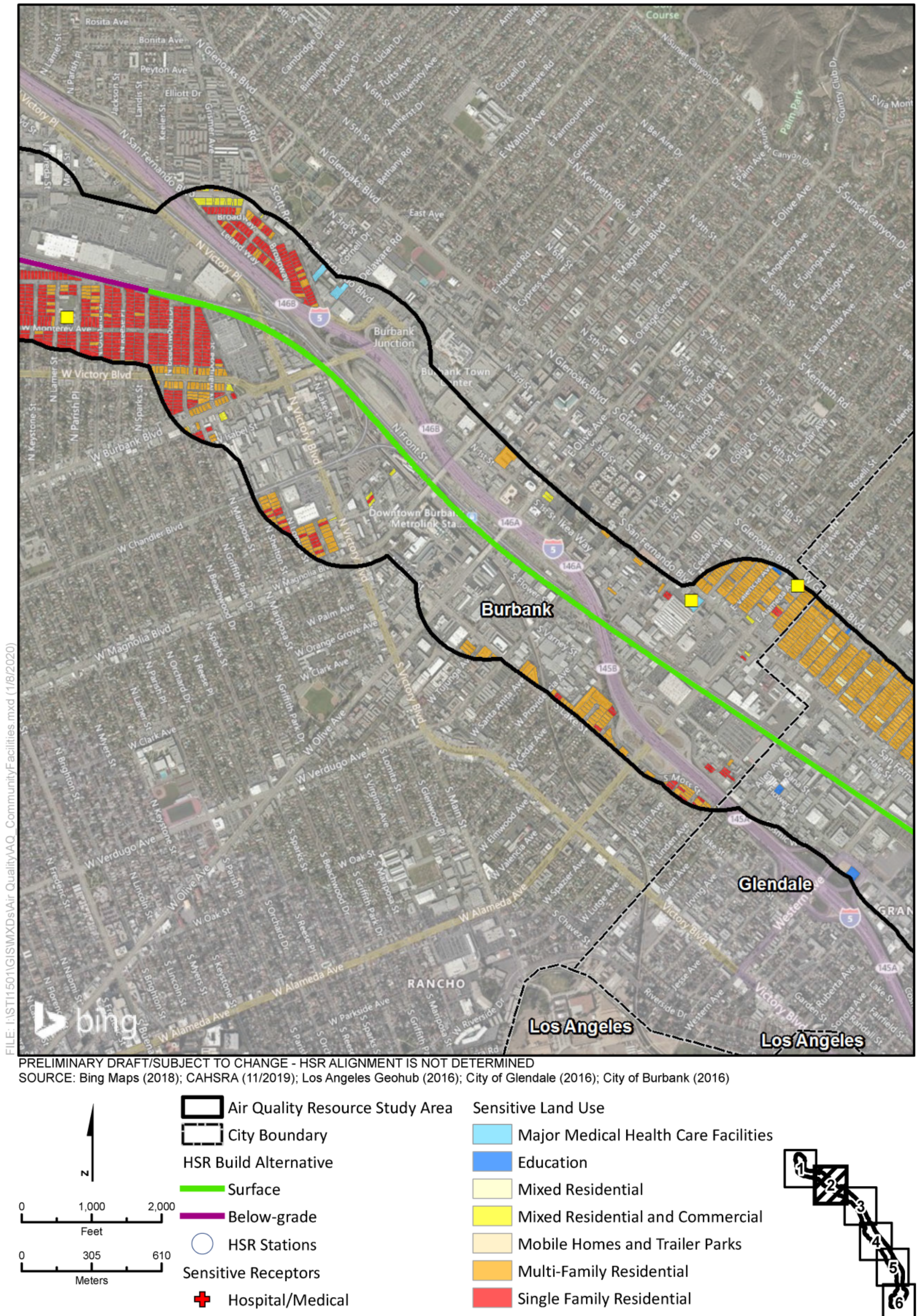


Figure 5-2 Sensitive Land Uses Within 1,000 Feet of the Project

(Sheet 2 of 6)

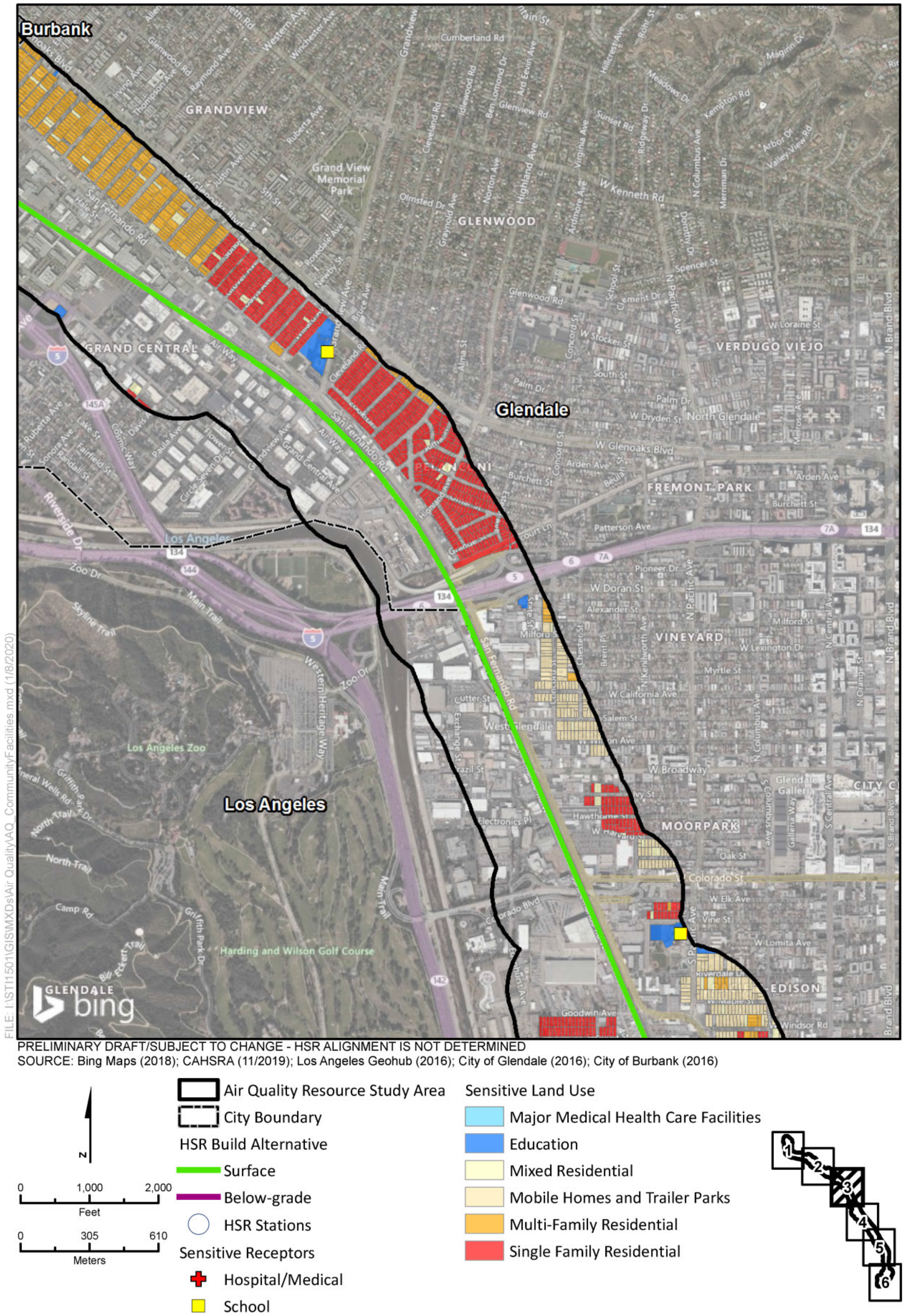


Figure 5-2 Sensitive Land Uses Within 1,000 Feet of the Project

(Sheet 3 of 6)

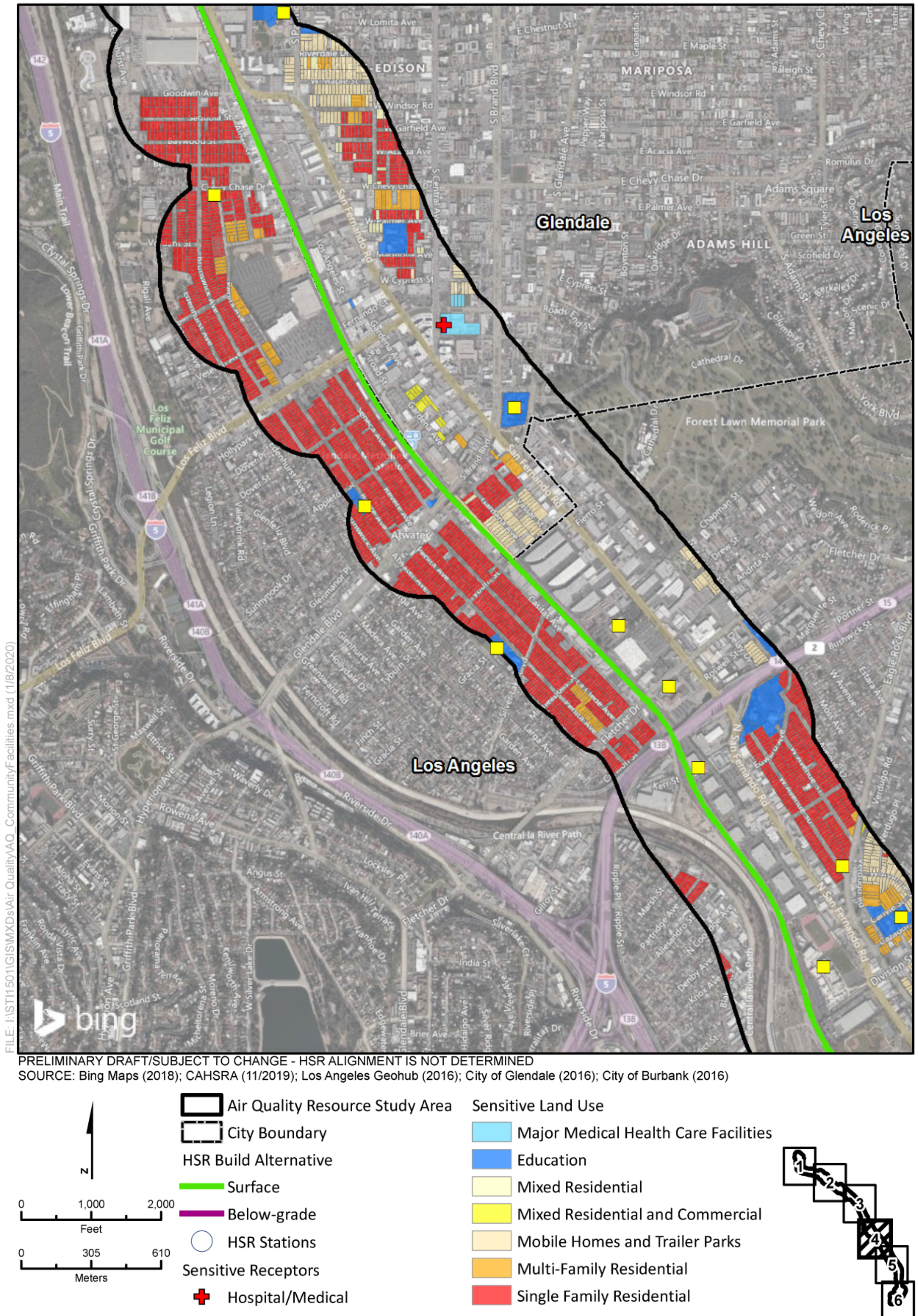
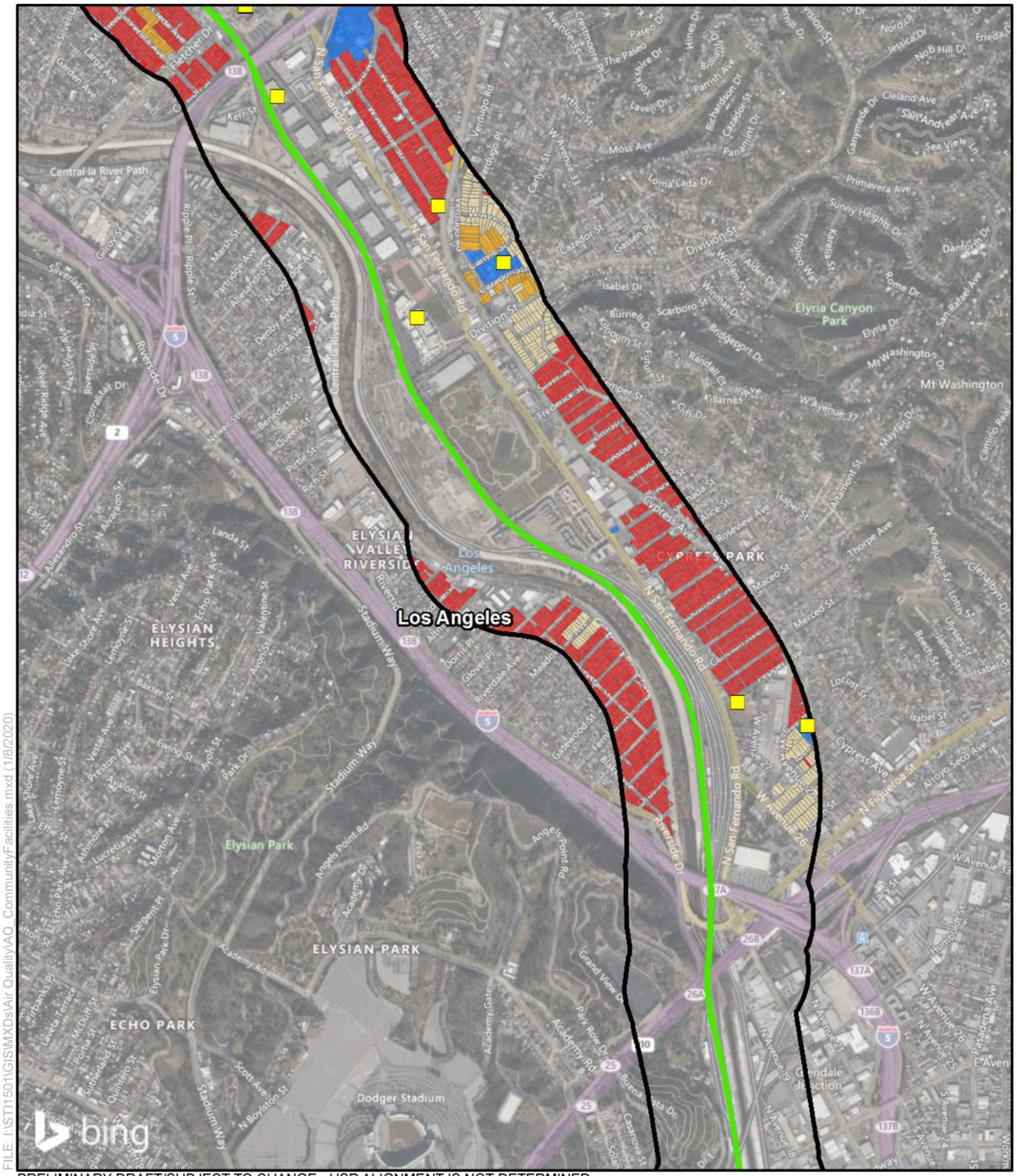


Figure 5-2 Sensitive Land Uses Within 1,000 Feet of the Project

(Sheet 4 of 6)



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HSR ALIGNMENT IS NOT DETERMINED
SOURCE: Bing Maps (2018); CAHSRA (11/2019); Los Angeles Geohub (2016); City of Glendale (2016); City of Burbank (2016)

N

0 1,000 2,000
Feet

0 305 610
Meters

Air Quality Resource Study Area
City Boundary

HSR Build Alternative
- Surface
- Below-grade
- HSR Stations

Sensitive Receptors
- Hospital/Medical
- School

Sensitive Land Use
- Major Medical Health Care Facilities
- Education
- Mixed Residential and Commercial
- Mobile Homes and Trailer Parks
- Multi-Family Residential
- Single Family Residential

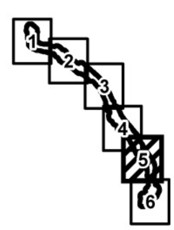


Figure 5-2 Sensitive Land Uses Within 1,000 Feet of the Project
(Sheet 5 of 6)

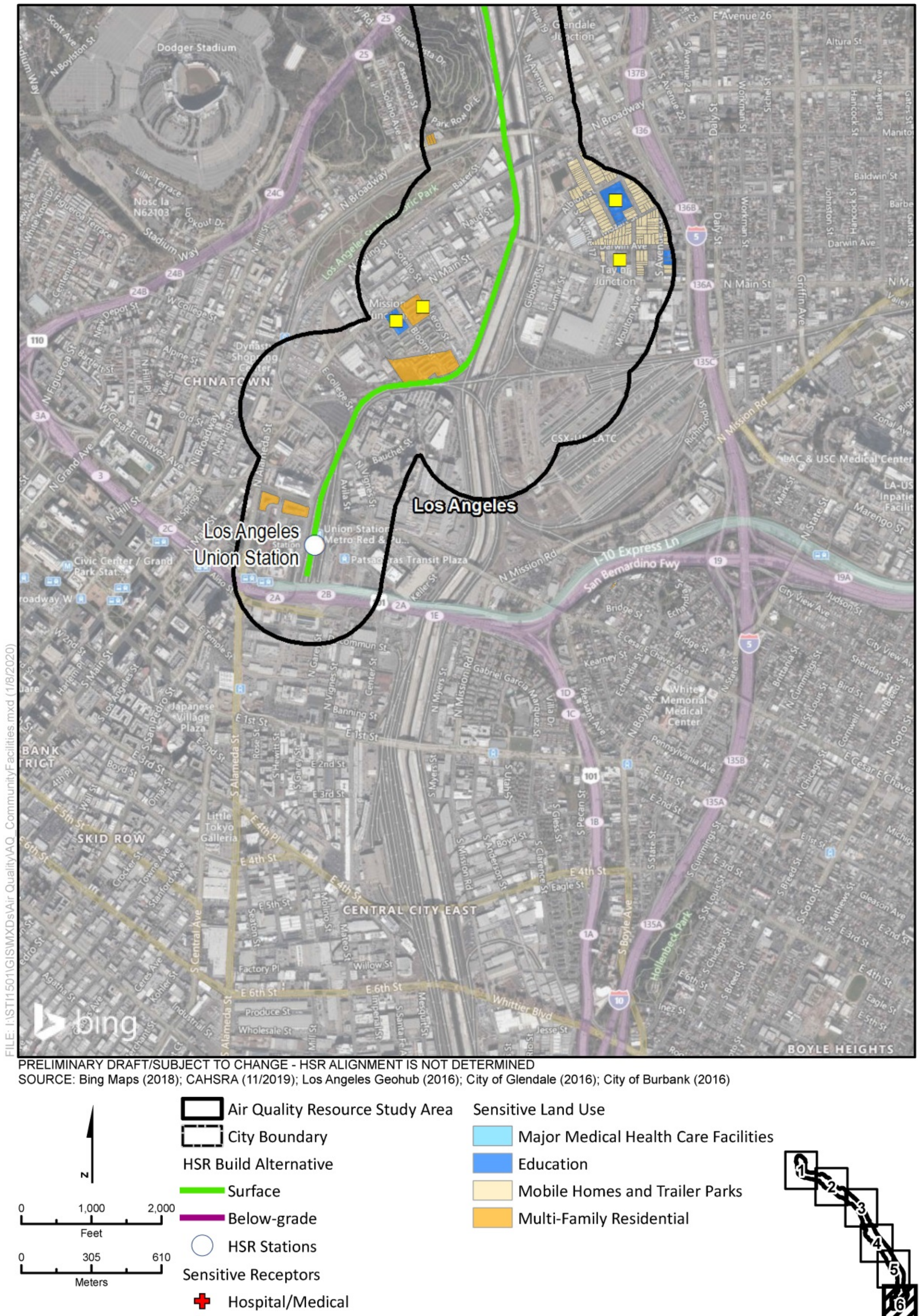


Figure 5-2 Sensitive Land Uses Within 1,000 Feet of the Project

(Sheet 6 of 6)

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6 METHODS FOR EVALUATING EFFECTS

The methods for evaluating effects are intended to satisfy the federal and state requirements including NEPA, CEQA, and general conformity. In accordance with CEQA requirements, an EIR must include a description of the existing physical environmental conditions in the vicinity of the project. Those conditions, in turn, "will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant" (CEQA Guidelines Section 15125[a]).

Because the HSR project would not commence service for almost 10 years and would not reach full operation for almost 25 years, use of only existing conditions as a baseline for air quality effects would be misleading. It is more likely that existing background traffic volumes (and background roadway changes from other programmed traffic improvement projects) and vehicle emission factors would change between today and 2020/2035 than it is that existing conditions would remain unchanged over the next 10 to 25 years. RTPs include funded transportation projects that are programmed to be constructed by 2040. It would be misleading to ignore the possibility that these projects would be in place before the HSR project reaches maturity (i.e., the point/year at which HSR-related traffic emissions reach their maximum), and to evaluate the HSR project's air quality effects without calculating that these RTP improvements would change the underlying background conditions to which HSR project traffic/emissions would be added.

Therefore, the air quality analysis uses a multiple baseline approach. This means the HSR project's air quality and GHG effects are evaluated against existing conditions, against background (i.e., No Project) conditions as they are expected to be in the opening year of 2029, and against background (i.e., No Project) conditions as they are expected to be in the horizon year of 2040. This approach complies with CEQA (see *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority*, et al. [2013] 57 Cal. 4th 439, 454). Details are presented in Appendix E**.**

6.1 Definition of Resource Study Area

The RSA is the area in which all environmental investigations specific to air quality and global climate change are conducted to determine the resource characteristics and potential effects of the Burbank to Los Angeles Project Section. The boundaries of the RSA for air quality and global climate change extend beyond the project footprint. The local air quality effect analysis focuses on the effects of criteria pollutant and MSAT emissions from both the construction and operations of the project on nearby sensitive receptors as shown in Table 5-5. Typical screening distances based on USEPA and CARB modeling guidance and project-specific factors of the HSR project, including the location of train stations, were used to determine the RSA.

The regional air quality analysis and the global climate change analysis evaluate the project's effect on criteria pollutants and GHGs on a statewide basis. GHGs are estimated on a statewide basis because their effects are not localized or regional; this is due to their rapid dispersion into the global atmosphere. Furthermore, the estimation of GHGs on a statewide basis provides a comprehensive study area for the analysis of the HSR's effect on statewide vehicle miles traveled (VMT), aircraft travel, and energy use consistent with State of California planning.

6.1.1 State

The state component of the air quality RSA (for operations), was identified to evaluate potential changes in air quality from large-scale, non-localized impacts, such as HSR project electric power requirements, changes in air traffic, and HSR project conformance with the SIP. Similarly, the state component of the global climate change RSA (for construction and operations) captures the effects of these activities as they relate to GHGs. A statewide RSA provides a policy context for California-specific goals within which to view air quality and global climate change issues.

6.1.2 Regional

The Burbank to Los Angeles Project Section of the HSR system would potentially affect regional air pollutant concentrations in the Basin. The Burbank to Los Angeles RSA is situated in Los Angeles County, which is located within the Basin. The Basin covers approximately 6,600 square miles and includes all of Orange County, Los Angeles County except for the Antelope Valley, the non-desert portion of western San Bernardino County, and the western and Coachella Valley portions of Riverside County.

6.1.3 Local

The local RSA consists of the project footprint and within 1,000 feet of the proposed stations and intersections operating at level-of-service (LOS) E or F.

6.1.4 Climate Change

This section describes the federal, state, and local guidance with respect to global climate change and GHG emissions. As described above, the RSA for GHG emission analysis is the State of California based on the properties of GHG pollutants and the statewide nature of the HSR's effect on VMT, aircraft, and energy use.

6.1.5 Pollutants for Analysis

Three general classes of pollutants are of concern for this project: criteria pollutants, TACs, and GHGs. Criteria pollutants are those for which the USEPA and the State of California have set ambient air quality standards or that are chemical precursors to compounds for which ambient standards have been set. TACs of concern for the proposed project are seven MSATs identified by the USEPA as having significant contributions from mobile sources—acrolein, benzene,1,3-butadiene, DPM and diesel DE organic gases, formaldehyde, naphthalene, and polycyclic organic matter. GHGs are gaseous compounds that limit the transmission of radiated heat from the earth's surface to the atmosphere. GHGs include CO_2, CH_4, N_2O, HFC, PFC, SF_6, and other fluorinated gases, including NF_3 and HFE.

6.1.6 Criteria Pollutant

For these pollutants, both NAAQS and CAAQS have been established to protect public health and welfare. Section 4.1 briefly describes each criteria pollutant.

6.2 Statewide Regional Operational Emission Calculations

The emission burden analysis of a project determines a project's overall effect on air quality levels. The project section would affect long-distance, city-to-city travel along freeways and highways throughout the state, as well as long-distance, city-to-city aircraft takeoffs and landings. The HSR system would also affect electrical demand throughout the state. Analysts calculated criteria pollutant and GHG operational emissions for three ridership scenarios: a medium ridership scenario of the Silicon Valley to Central Valley line (from San Jose to north of Bakersfield), a medium ridership scenario of an extended Silicon Valley to Central Valley line (from San Francisco to Bakersfield), and a high ridership scenario of the Silicon Valley to Central Valley line for Existing (2015) and Phase 1 of Statewide High-Speed Rail Build Out (2040) years. All applicable scenarios are based on the levels of ridership as presented in the *2016 Business Plan* (Authority 2016). Therefore, the effects analysis presents three values for operational emissions for each pollutant, corresponding to these three scenarios.

6.2.1 On-Road Vehicles

Analysts evaluated on-road vehicle emissions using average daily VMT estimates and associated average daily speed estimates for each affected county. Analysts estimated emission factors using the CARB emission factor program, Emission Factors 2014 (EMFAC2014), which accounts for existing regulations that would reduce emissions (e.g., the Pavley Clean Car Standards). Parameters were set in the program for each individual county to reflect conditions in each county and statewide parameters to reflect travel through each county. The analysis was conducted for the following modeling years:

- Existing (Year 2015)
- Opening Year (Year 2029)
- Horizon Year (Year 2040)

To determine the overall pollutant burdens generated by on-road vehicles, analysts multiplied the estimated VMT by the applicable pollutant's emission factors, which are based on speed, vehicle mix, and analysis year.

6.2.2 Aircraft

Analysts used the Federal Aviation Administration's Aviation Environmental Design Tool to estimate aircraft emissions. This tool estimates the emissions generated from specified numbers of landing and take-off cycles. Along with emissions from the aircraft themselves, emissions generated from associated ground maintenance requirements are included. Analysts calculated average aircraft emissions based on the profile of aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to HSR using the results of the travel demand modeling analyses conducted for the project section, based on the ridership estimates presented in the *2016 Business Plan* (Authority 2016).

6.2.3 Power Plants

Analysts conservatively estimated the electrical demands caused by propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities as part of the project section design. Analysts derived average emission factors for each kilowatt-hour required from CARB statewide emission inventories of electrical and cogeneration facilities data along with USEPA eGRID2012 (released October 2015) electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR include the use of regenerative brake power.

The HSR system is currently analyzed as if it would be powered by the state's current electric grid. This is a conservative assumption because of the state requirement that an increasing fraction of electricity (50 percent by 2030) generated for the state's power portfolio must come from renewable energy sources. As such, the emissions generated for the HSR system are expected to be lower in the future than the emissions estimated for this analysis. Furthermore, under the 2013 Policy Directive POLI-PLAN-03, the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources.

6.3 Analysis of Local Operation Emission Sources

Operation of the Burbank to Los Angeles Project Section HSR stations would affect emissions of criteria pollutants and GHGs. The operation of the traction power substations, including the switching station and paralleling station, would not result in appreciable air pollutants as site visits would be infrequent and power usage would be limited. Therefore, emissions from the switching station were not quantified. Sections 6.3.1 and 6.3.2 discuss the methodology used to estimate operational air emissions from the HSR stations and local mobile sources, respectively. Project information used for the operation emission estimates is presented in Appendix B. Detailed emission calculations are also provided in Appendix B.

6.3.1 Station Sites

Emissions associated with the operation of the Burbank and Los Angeles HSR stations would primarily result from space heating and facility landscaping, energy consumption for facility lighting, indirect emissions associated with water use and solid waste disposal, emergency generator testing, emissions from vehicle activity at the parking areas, and employee and passenger traffic.

6.3.1.1 Area and Stationary Sources

Emissions from area and stationary sources, including natural gas consumption for space heating and landscaping equipment, were calculated using the California Emissions Estimator Model (CalEEMod), Version 2016.3. Emissions were based on the land use data, entered as the size of the station buildings (in square feet). The parking areas were excluded from the land use as they would not require heating and would require minimal landscaping. The CalEEMod output files, the emissions estimated for each operational activity, and the activity data details used to perform the estimations are summarized in Appendix B.

6.3.1.2 Indirect Electricity

The Burbank and Los Angeles HSR stations would generate indirect emissions from purchased electricity consumed for facility lighting. It is expected that the power used by the HSR stations would be much less than the power used by train operations; however, the indirect emissions from power consumption have been included in the overall emission estimates.

Indirect emissions from purchased electricity consumed by the HSR stations were calculated based on the building square footage, electricity consumption rates provided by HSR (Authority 2016), and emission factors from eGRID (USEPA 2011a). The retail consumption rate of 14.3 kilowatt-hours per square foot per year was assumed to be representative for LAUS. The emission factors used were for the utility provider servicing the station area (Los Angeles Department of Water & Power [LADWP]) and were adjusted to account for state regulations requiring increased renewable energy sources in future years (33 percent by 2020 and 50 percent by 2030).

6.3.1.3 Indirect Water

The Burbank and Los Angeles HSR stations would generate indirect GHG emissions from purchased water consumed for facility restrooms, drinking fountains, landscaping, and other miscellaneous uses.

Indirect GHG emissions from purchased water consumed by the HSR stations were calculated based on the station building square footage, electricity associated with sourcing, treatment, and distribution of water (CEC 2006), and emission factors from eGRID (USEPA 2011a). LAUS water and sewer costs are estimated at $0.184 per year per square foot and $0.169 per year per square foot, respectively. These costs were compared to the LADWP and Los Angeles Sanitation Districts costs to convert this data into gallons used. The water consumption rate of 24.86 gallons per square foot was used at LAUS. Wastewater rates were estimated as 28.03 gallons per square foot for LAUS.

6.3.1.4 Indirect Solid Waste

The Burbank and Los Angeles HSR stations would generate indirect GHG emissions from solid waste disposal. CalRecycle tracks commercial sector waste generation, including Rail Transportation as part of a larger sector identified as “Not Elsewhere Classified.” This sector generates approximately 1.2 tons of waste per employee per year. Indirect emissions from solid waste disposed by the HSR stations were calculated based on this rate for LAUS. To estimate the amount of degradable organic carbon content of the waste, the solid waste was assumed to have the characteristics of general municipal solid waste. The emissions associated with decomposition of the solid waste in a landfill was estimated assuming a land fill gas capture system with combustion with a 94 percent landfill gas capture rate. This is consistent with the method used in CalEEMod.

6.3.2 Local Operational Mobile Sources

Local emissions associated with mobile sources would occur from passenger travel, station employee commutes and truck deliveries. Vehicular exhaust emissions were estimated using EMFAC2014. Employee commute and passenger emission factors were estimated using EMFAC2014 for light-duty automobiles and light-duty trucks and assuming that 80 percent of trips would use light-duty automobiles and 20 percent would use light-duty trucks.

As a conservative estimate, vehicle trips were expected to occur seven days per week, 24 hours per day. Based on traffic analysis zones, an average trip length of 28 miles (56 miles roundtrip) was assumed. Modeled traffic volumes and operating conditions were obtained from the traffic study. Vehicle emission rates were determined using CARB’s EMFAC2014 emission rate program and are used in conjunction with traffic data (e.g., vehicle speed and VMT) to calculate vehicle emissions associated with the proposed project. Composite vehicle speeds were calculated from the EMFAC2014 speed bins database. The temperature and relative humidity used in EMFAC2014 modeling were based on the annual averages of the Basin (59°F and 46 percent) (based on Western Regional Climate Center data and EMFAC relative humidity profiles).

The numbers of daily vehicle trips to and from the Burbank and Los Angeles HSR stations are estimated to be 10,806 originating trips and 9,315 destination passenger trips for the year 2029 and 21,922 originating passenger trips and 18,951 destination passenger trips for 2040. The majority of these trips (75 percent) were assumed to be passenger trips, with employee commutes and truck deliveries accounting for 5 percent and 20 percent of the vehicle trips, respectively.

6.4 Microscale Carbon Monoxide Emission Analysis

CO hot-spot analyses were conducted to evaluate the potential air quality effects of HSR-related changes in traffic conditions along heavily traveled roadways, congested intersections, and areas near train station parking structures. CO modeling was performed using the California LINE Source Dispersion Model, Version 4 (CALINE4) (California Department of Transportation [Caltrans] 1997) air quality dispersion model to estimate existing (2015), existing plus project (2015), opening year (2029) No Project Alternative, opening year (2029) plus project, horizon year (2040) No Project Alternative, and horizon year (2040) plus project CO concentrations at selected locations. The CO modeling results for 2015, 2029, and 2040 are all presented in Appendix C.

6.4.1 Intersection Microscale Analysis

6.4.1.1 Site Selection and Receptor Locations

Traffic conditions at affected intersections were evaluated to identify which intersections in the study area would have the potential to cause CO hot-spots. Intersections within the study area were screened based on changes in intersection volume, delay, and LOS between the existing condition, the No Project Alternative, and the HSR Build Alternative. Intersections were considered to have the potential to cause CO hot-spots if the LOS decreased from D or better to E or worse under the HSR Build Alternative. Intersections that were already below LOS D were considered to have the potential to cause CO hot-spots under the HSR Build Alternative if their LOS, delays, and/or volume would increase over the existing condition and the No Project Alternative. Using this criterion, intersections were ranked according to LOS, increased delay, and total traffic volume of the HSR Build Alternative relative to these factors for the existing condition and the No Project Alternative. The five ranked intersections with the worst LOS, delay, and/or traffic volumes would be selected for the CO hot-spot modeling.

Receptors for the intersection analyses were located in accordance with University of California, Davis, CO Protocol (Caltrans 1997). All receptors used were located at a height of 6 feet (1.8 meters). Receptors for the intersection analysis were located 10 feet (3 meters) from the roadway so they were not within the mixing zone of the travel lanes and were spaced at 0, 82, and 164 feet (0, 25, and 50 meters) from the intersection, respectively, for both the 1-hour and 8-hour analyses (Caltrans 1997). Although sidewalks do not exist around all the intersections, it was assumed that the public could access these locations.

6.4.1.2 Emission Model

Vehicular emissions were estimated using EMFAC2014, which is a mobile source emission estimate program that provides current and future estimates of emissions from highway motor vehicles. Consistent with the traffic analysis and the anticipated opening year and horizon year of the project, CO emission factors were generated using the CO emission factor associated with the years 2015, 2029, and 2040 for the total vehicle mix during conditions in winter at a temperature of 59ºF with relative humidity of 46 percent. EMFAC2014 was designed by CARB to address a wide variety of air pollution modeling needs, and incorporates updated information on basic emission rates, more realistic driving patterns, separation of start and running emissions, improved correction factors, and changing fleet composition. The EMFAC2014 output files are provided in Appendix C.

6.4.1.3 *Dispersion Model*

Mobile source dispersion models are the basic analytical tools used to estimate CO concentrations expected under given traffic, roadway geometry, and meteorological conditions. The mathematical expressions and formulations that constitute the various models attempt to describe as closely as possible a complex physical phenomenon. The dispersion modeling program used in this study for estimating pollutant concentrations near roadway intersections is the CALINE4 dispersion model developed by Caltrans.

CALINE4 is a Gaussian model recommended in the Caltrans CO Protocol. Gaussian models assume that the dispersion of pollutants downwind of a pollution source follow a normal distribution around the center of the pollution source. The model is described in *CALINE4 – A Dispersion Model for Predicting Air Pollutant Concentration near Roadways, FHWA/CA/TL-84/15* (Caltrans 1989). The analysis of roadway CO effects followed the CO Protocol (Caltrans 1997).

6.4.1.4 *Meteorological Conditions*

The transport and concentration of pollutants emitted from motor vehicles are influenced by three principal meteorological factors: wind direction, wind speed, and the temperature profile of the atmosphere. The values for these parameters were chosen to maximize pollutant concentrations at each prediction site (i.e., to establish a conservative worst-case situation).

- **Wind Direction**—Maximum CO concentrations are normally found when the wind is assumed to blow approximately parallel to a single roadway adjacent to the receptor location. However, at complex intersections, it is difficult to predict which wind angle will result in maximum concentrations. Therefore, at each receptor location the approximate wind angle that would result in maximum pollutant concentrations was used in the analysis. All wind angles from 0° to 360° were considered.
- **Wind Speed**—CO concentrations are greatest at low wind speeds. A conservative wind speed of 1 mph was used to predict CO concentrations during peak traffic periods.
- **Temperature and Profile of the Atmosphere**—An ambient temperature was chosen based on the CO protocol recommendation for the study area, a mixing height (the height in the atmosphere to which pollutants rise) of 1,000 feet; neutral atmospheric stability (stability class G) conditions will be used in estimating microscale CO concentrations. The ambient temperature was determined to be 59°F based on the average temperature in January over an approximately 30-year period (based on Western Regional Climate Center data accessed in August 2016). The stability class G was chosen, as recommended in Table B.11 of the CO Protocol.

The selection of these meteorological parameters was based on recommendations from the *CEQA Air Quality Handbook* (SCAQMD 1993), Caltrans' CO Protocol (Caltrans 1997), and the USEPA's Guidelines (USEPA 2015a). These data were found to be the most representative of the conditions existing in the project vicinity.

6.4.1.5 *Persistence Factor*

Peak 8-hour concentrations of CO were obtained by multiplying the highest peak-hour CO estimates by a persistence factor. The persistence factor accounts for the following:

- Over an 8-hour period (as distinct from a single hour), vehicle volumes will fluctuate downward from the peak hour.
- Vehicle speeds may vary.
- Meteorological conditions, including wind speed and wind direction, will vary compared with the conservative assumptions used for the single hour.
- A persistence factor of 0.7 was used in this analysis, which is recommended in the CO Protocol (Caltrans 1997).

6.4.1.6 Background Concentrations

Microscale modeling is used to predict CO concentrations resulting from emissions from motor vehicles using roadways immediately adjacent to the locations at which predictions are being made. A CO background level must be added to this value to account for CO entering the area from other sources upwind of the receptors. CO background levels were obtained from data collected at monitoring stations located away from the influence of local traffic congestion. For this study area, background data collected at the 1630 N Main Street and 228 W Palm Avenue monitoring stations were used. The second-highest monitored value was used as a background concentration. In addition, future CO background levels are anticipated to be lower than existing levels because of mandated emission-source reductions.

The use of this data is conservative because, while they are the closest monitoring stations to the general study area and have a neighborhood spatial scale, they are influenced by traffic-related emissions. At the 1630 N Main Street monitoring station, the second-highest monitored 1-hour CO concentration based on the years 2016 to 2018 was 2.0 ppm and the second-highest 8-hour average was 1.7 ppm.

6.4.1.7 Traffic Information

Traffic data for the air quality analysis were derived from traffic counts and other information developed as part of an overall traffic analysis for the project. The microscale CO analysis was performed based on data from this analysis for the a.m. and p.m. peak traffic periods. These are the periods when maximum traffic volumes occur on local streets and when the greatest traffic and air quality effects of the proposed project are expected.

6.4.1.8 Analysis Years

CO concentrations were predicted for the existing conditions (2015), project opening year (2029) and the project's horizon year (2040).

6.5 Particulate Matter (PM_{10}/$PM_{2.5}$) Emission Analysis

While the HSR Build Alternative is subject to the general conformity guidelines and not the transportation conformity guidelines, the project vicinity is classified as an attainment/ maintenance area for PM_{10} and a nonattainment area for $PM_{2.5}$ for the NAAQS.

The USEPA specifies in 40 C.F.R. Part 93.123(b)(1) that only projects of air quality concern are required to undergo a $PM_{2.5}$ and PM_{10} hot-spot analysis. The USEPA defines projects of air quality concern as certain highway and transit projects that involve significant levels of diesel traffic or any other project identified by the $PM_{2.5}$ SIP as a localized air quality concern. Projects of air quality concern, as defined by 40 C.F.R. Part 93.123(b)(1), are the following:

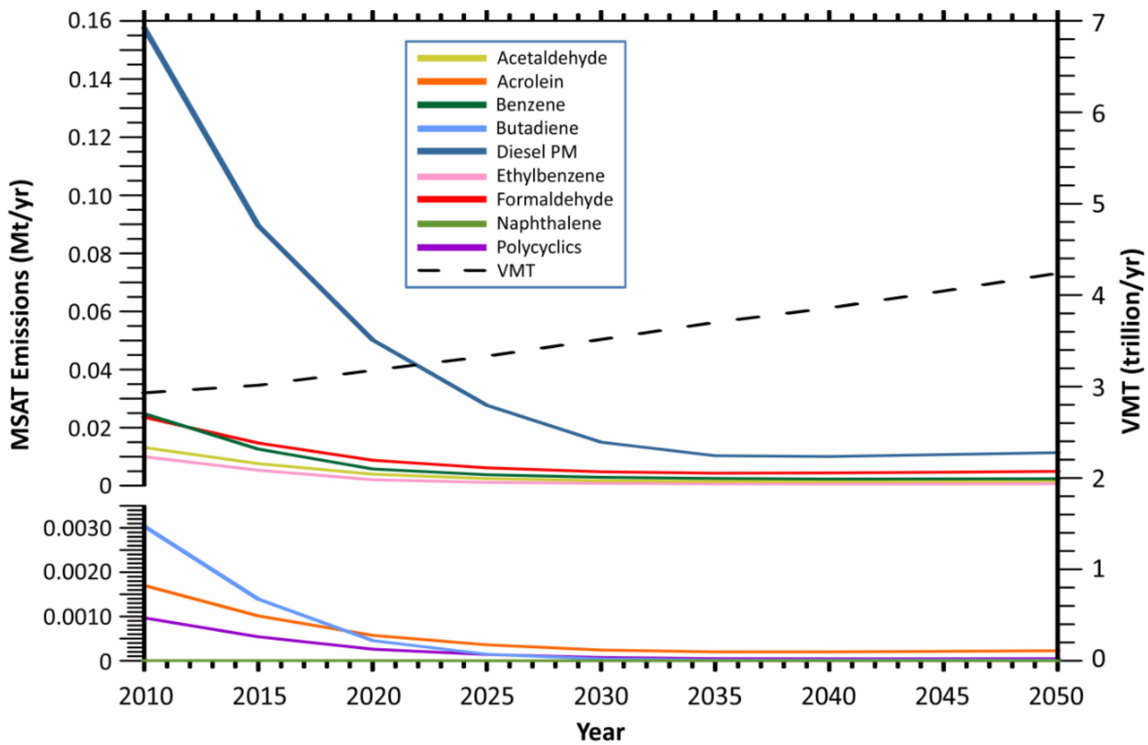
- New or expanded highway projects that have a significant number of or significant increase in diesel vehicles.
- Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles or those that will degrade to LOS D, E, or F because of increased traffic volumes from the significant number of diesel vehicles related to the project.
- New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location.
- Projects in, or affecting, locations, areas, or categories of sites that are identified in the $PM_{2.5}$- or PM_{10}-applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

Based on these criteria, the HSR Build Alternative is not considered a project of air quality concern. Therefore, a qualitative PM analysis was conducted instead of a hot-spot analysis and is further discussed in Section 7.8.

6.6 Mobile-Source Air Toxics Emission Analysis

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments of 1990, whereby Congress mandated that the USEPA regulate 188 air toxics, also known as hazardous air pollutants. The USEPA assessed this expansive list in its latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Fed. Reg. Vol. 72, No. 37, page 8430 [February 26, 2007]) and identified 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System (USEPA 2017). In addition, the USEPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and noncancer hazard contributors from the 2011 National Air Toxics Assessment (USEPA 2011). These nine compounds are 1,3-butadiene, acetaldehyde, acrolein, benzene, DPM, ethylbenzene, formaldehyde, naphthalene, and POM.

Under the 2007 rule, the USEPA sets standards on fuel composition, vehicle exhaust emissions, and evaporative losses from portable containers. According to an FHWA analysis using the EPA's Motor Vehicle Emission Simulator (MOVES) 2010a model, even if VMT increases by 45 percent from 2010 to 2050 as forecast, a combined reduction of 91 percent in the total annual emissions for the priority MSATs is projected for the same time period, as shown on Figure 6-1.



Source: Federal Highway Administration (2016)
Trends for specific locations may be different, depending on locally derived information representing vehicle miles traveled, vehicle speeds, vehicle mix, fuels, emission-control programs, meteorology, and other factors.

Figure 6-1 Projected National Mobile-Source Air Toxic Emission Trends (2010–2050) for Vehicles Operating on Roadways Using the U.S. Environmental Protection Agency's MOVES2010b Model

On February 3, 2006, the FHWA released the Interim Guidance on Air Toxic Analysis in NEPA Documents (FHWA 2006). The FHWA most recently updated the guidance on October 18, 2016 (FHWA 2016), which was prompted by recent changes in the emissions model required for conducting emissions analysis. The 2016 Updated Interim Guidance incorporates new analysis conducted using MOVES2014a (the most recent version of MOVES released by the EPA).

FHWA's guidance advises on when and how to analyze MSATs in the NEPA process for highway projects. This guidance is interim because MSAT science is still evolving. As the science progresses, FHWA is expected to update the guidance.

A qualitative analysis provides a basis for identifying potential MSAT emissions, if any, associated with the HSR Build Alternative. FHWA's Interim Guidance groups projects into the following tier categories:

- No analysis for projects without any potential for meaningful MSAT effects.
- Qualitative analysis for projects with low potential MSAT effects.
- Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

This project has a low potential for MSAT effects. Accordingly, a qualitative analysis was used to provide a basis for identifying and comparing the potential differences in MSAT emissions, if any, among the HSR Build Alternative. The qualitative assessment is derived, in part, from a study conducted by the FHWA titled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives* (FHWA 2010).

6.7 Asbestos Emission Sources

Asbestos minerals occur in rocks and soil as the result of natural geologic processes, often in veins near earthquake faults in the coastal ranges and the foothills of the Sierra Nevada and in other areas of California. NOA takes the form of long, thin, flexible, separable fibers. Natural weathering or human disturbance can break NOA down to microscopic fibers, easily suspended in air. When inhaled, these thin fibers irritate tissues and resist the body's natural defenses. In addition, asbestos-containing materials may have been used in constructing buildings that would be demolished.

Asbestos is a known human carcinogen. It causes cancers of the lung and the lining of internal organs, as well as asbestosis and pleural disease, which inhibit lung function. The USEPA is addressing concerns about potential effects of NOA in a number of areas in California.

The California Geological Survey identified ultramafic rocks in California to be the source of NOA, and in August 2000, the California Department of Conservation, Division of Mines and Geology published a report, *A General Location Guide for Ultramafic Rocks in California Areas More Likely to Contain Naturally Occurring Asbestos* (2000). This study was used to determine if NOA would be located within the project vicinity.

6.8 Greenhouse Gas Emission Sources

As discussed in Section 6.2, the project section would reduce long-distance, city-to-city travel along freeways and highways throughout the state, as well as long-distance, city-to-city aircraft takeoffs and landings. The project section would also affect electricity demand throughout the state. These elements would affect GHG emissions in both the statewide and regional study areas. The methodology for estimating GHG emissions associated with operations of the project section is discussed below.

6.8.1 On-Road Vehicle Emissions

Analysts conducted the on-road vehicle GHG emission analysis using the same methods and RSAs as described for air quality emission calculations in Section 6.2.1, On-Road Vehicles.

6.8.2 Aircraft Emissions

Analysts calculated aircraft emissions by using the fuel consumption factors and emission factors from CARB's 2000–2014 *Greenhouse Gas Emissions Inventory Technical Support Document* and the accompanying technical support document. The emission factor includes both landing and takeoff and cruise operations (formula: aircraft emissions per flight = fuel consumption × emission factor; aircraft emissions = flights removed × aircraft emissions per flight). Analysts calculated average aircraft GHG emissions based on the profile of intrastate aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the project section through the travel demand modeling analysis conducted for the project section, based on the ridership estimates presented in the Authority's *Business Plan* (Authority 2016).

6.8.3 Power Plant Emissions

The electrical demands due to propulsion of the trains, stations, and storage depots were calculated as part of the statewide HSR project design. The average GHG emission factors for each kilowatt-hour required were derived from USEPA eGRID2012 electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR Build Alternative include the use of regenerative brake power.

In addition, because of the state requirement that an increasing fraction (50 percent by 2030) of electricity generated for the state's power portfolio must come from renewable energy sources, the emissions generated for the HSR Build Alternative are expected to be lower in the future when compared to emissions estimated for this analysis.

6.9 Construction Emission Sources

Construction phase emissions were quantitatively estimated for the earthwork and major civil construction activity during construction of the following components of the proposed project:

- At-grade rail segments
- Below-grade rail segments
- Roadway and rail bridges
- Retained fill rail segments
- HSR stations
- Roadways and roadway overcrossings and undercrossings

These major construction activities would account for the vast majority of earthwork, the largest amount of diesel-powered off-road construction equipment, and the majority of material to be hauled along public streets compared with the other minor construction activities of the project. Therefore, the regional emissions and localized emissions from these major activities would account for the vast majority of construction emissions that would be generated by construction of the proposed project. Regional and localized emissions from minor construction activities, such as mobilization and demobilization, were quantified and would contribute to fewer emissions than the major construction activities listed above. The estimated construction emissions from these major as well as minor activities were used to evaluate the regional and localized air quality effects during the construction phase. Project-specific information was analyzed when available. Default emission rates for activities, such as architectural coating, were used if project-specific information was not available. Project information used for the construction emission estimates and details of the construction emission calculations are provided in Appendix A.

6.9.1 Models Used for Construction Emissions

Criteria pollutant and GHG emissions from regional building demolition and construction of the at-grade rail segments, roadway and rail bridges, retained-fill rail segments, and HSR stations, including parking areas and platform facilities, were calculated using CalEEMod, which uses emission factors from the OFFROAD 2011 model. The OFFROAD 2011 model provides the latest emission factors for construction off-road equipment, and accounts for lower fleet population and growth factors as a result of the economic recession and updated load factors based on feedback from engine manufacturers. For emission rates not available in OFFROAD 2011, rates from OFFROAD2007 were conservatively applied. The use of emission rates from the OFFROAD models reflects the recommendation of CARB to capture the latest off-road construction assumptions. OFFROAD 2011 default load factors (the ratio of average equipment horsepower utilized to maximum equipment horsepower) and useful life parameters were used for emission estimates. Mobile source emission burdens from worker vehicle trips and truck trips were calculated using VMT estimates and appropriate emission factors from EMFAC2014. Fugitive dust emissions from dirt and aggregate handling were calculated using emission factors derived from equations from the USEPA's AP-42 (USEPA 2006).

Construction exhaust emissions from equipment, fugitive dust emissions from earthmoving activities, and emissions from worker vehicle trips, deliveries, and material hauling were calculated and compiled in a spreadsheet tool specific to the HSR project for each year of construction. Project-specific data, including construction equipment lists and the construction schedule, were used for construction associated with the alignment.

Mobile source emission burdens from worker trips and truck trips were calculated using VMT estimates and appropriate emission factors from EMFAC2014.

6.9.2 General Assumptions for Methodologies

6.9.2.1 Assumptions and Methodologies

Project-specific data, including construction equipment lists and the construction schedule, were used for construction associated with the alignment. Calculations were performed for each year of construction.

Major activities were grouped into the following categories by the HSR engineering design team:

- Land Clearing
- Land Clearing Haul Roads
- Earthmoving
- Tunneling Cut-and-Cover
- Materials Handling
- Laying Track At Grade
- System Facilities
- Buildings Demolition
- Bridge Demolition
- Elevated Structures Roads
- Elevated Structures Rail
- Roadway Construction
- Burbank Airport Station Construction
- Maintenance Station Facilities
- LAUS Platform Construction

These major construction activities are used in the construction emission estimates. Construction exhaust emissions were modeled using Tier 4 construction equipment emission rates (AQ-IAMF#4) from CalEEMod. Fugitive dust reductions from earthmoving best management practices were applied in CalEEMod (AQ-IAMF#1)[9]. PM exhaust and GHG emission reductions (30 percent and 99.1 percent, respectively) would occur from use of renewable diesel (AQ-IAMF#3) in all off-road diesel-powered engines (not applied in CalEEMod, instead applied by manual calculations in the tables). Mobile-source emission burdens from worker trips and truck trips were calculated using VMT estimates and appropriate emission factors from EMFAC2014. Model year 2010 or newer on-road engines in heavy-duty, diesel-powered truck emissions (AQ-IAMF#5) were calculated using emission rates derived from the CalEEMod. Mobile-source emission burdens from worker trips and truck trips were calculated using VMT estimates and appropriate emission factors from EMFAC2014. Model year 2010 or newer on-road engines in heavy-duty, diesel powered truck emissions (AQ-IAMF#5) were modeled using emission rates derived from CalEEMod. Section 6.9.3 provides details of the construction emission calculations.

[9] The IAMF requires watering on all unpaved surfaces, which would achieve additional reductions (up to 61 percent).

6.9.2.2 Statewide Environmental Impact Report/Environmental Impact Statement Programmatic Control Measures

The project design incorporates the following design elements from the 2005 Statewide Program EIR/EIS mitigation strategies to reduce air quality effects associated with construction and operation of the California HSR System. Because the 2005 Statewide Program EIR/EIS includes these measures, they are not considered mitigation but are calculated as part of the project construction emissions before mitigation. The effectiveness of these measures was not included in the mitigated emissions calculations but was included in the unmitigated emission estimates. The programmatic measures and their corresponding emissions reductions include the following:

- Replacing ground cover in disturbed areas (PM, 5 percent)
- Watering exposed surfaces three times daily (PM, 61 percent)
- Watering unpaved access roads three times daily (PM, 61 percent)
- Reducing speed on unpaved roads to 15 mph (PM, 45 percent)
- Ensuring that trucks hauling loose materials would be covered (PM, 69 percent)
- Use of low-VOC paint (VOC, 10 percent)
- Washing all trucks and equipment before exiting construction sites
- Suspending dust-generating activities when wind speeds are above 25 mph

6.9.2.3 Regulatory Control Measures

Many of the control measures required by the SCAQMD Rule 403 Fugitive Dust are the same or similar to the control measures listed in the 2005 Statewide Program EIR/EIS. Compliance with Rule 403 requirements is mandatory but compliance could be achieved through a variety of dust prevention and suppression measures. Because the 2005 Statewide Program EIR/EIS includes these measures, they are not considered mitigation but are calculated as part of the project construction emissions before mitigation. The measures were included in the unmitigated emission estimates. The programmatic measures and their corresponding emissions reductions include the following:

- Replacing ground cover in disturbed areas (PM, 5 percent)
- Watering exposed surfaces three times daily (PM, 61 percent)
- Watering unpaved access roads three times daily (PM, 61 percent)
- Reducing speed on unpaved roads to 15 mph (PM, 45 percent)
- Ensuring that trucks hauling loose materials would be covered (PM, 69 percent)
- Use of low-VOC paint (VOC, 10 percent)
- Suspending dust-generating activities when wind speeds are above 25 mph

Dust emissions and dirt track-out would be minimized through compliance with SCAQMD Rule 403. The proposed project is required to follow all of the best available control measures described in Rule 403. Several of the key measures applicable to this project are as follows:

- For cut and fill at large sites, pre-water with sprinklers or water trucks and allow time for penetration.
- Track-out shall not extend 25 feet or more in cumulative length from the point of origin from an active operation. All track-out from an active operation shall be removed at the conclusion of each workday or evening shift.

If the disturbed surface area is 5 acres or more, or if the daily import or export of bulk material is 100 cubic yards or more, then at least one of the following precautions must also be taken:

- Install a pad consisting of washed gravel (minimum-size: 1 inch) maintained in a clean condition to a depth of at least six inches and extending at least 30 feet wide and at least 50 feet long.
- Pave the surface extending at least 100 feet and at least 20 feet wide.

- Use a wheel shaker/wheel spreading device consisting of raised divides at least 24 feet long and 10 feet wide to remove bulk material from tires and vehicle undercarriages before vehicles exit the site.
- Install and use a wheel washing system to remove bulk material from tires and vehicle undercarriages before vehicles exit the site.

6.9.3 Construction Activities

6.9.3.1 Site Preparation

Demolition

For purposes of this air quality analysis, demolition of existing structures along the HSR alignment and HSR stations would occur from December 2020 through October 2021. Demolition emissions were calculated using CalEEMod using the project specific equipment list. In addition to the fugitive dust emissions resulting from the destruction of existing buildings, emissions were estimated for worker trips, construction equipment exhaust, and truck-hauling exhaust.

Land Clearing/Grubbing

Land grubbing refers to the site preparation activities for the HSR alignment construction. Emissions from land grubbing were estimated using the OFFROAD 2011 emission factors as well as a site-specific equipment list. For purposes of this air quality analysis, land clearing and grubbing was assumed to take place along the route ahead of earthmoving and to construct haul roads from January 2020 to July 2025. Fugitive dust from land-grubbing activities includes that from worker trips, construction equipment exhaust, and truck-hauling exhaust.

6.9.3.2 Earthmoving

The earthmoving activities include grading, trenching, and cut/fill activities for the alignment construction. For purposes of this air quality analysis, earthmoving would take place from January 2020 to January 2025. The emissions associated with the earthmoving activities were estimated using CalEEMod with OFFROAD 2011 emission factors, in conjunction with the site-specific equipment list. Fugitive dust from earthmoving activities includes that from worker trips, construction equipment exhaust, and truck-hauling exhaust.

6.9.3.3 Trenching/Tunneling

The trenching and tunneling activities include excavation, cut/fill activities, and concrete installation for the below-grade portion of the HSR alignment. Cut-and-cover equipment would be used to cut through the ground, progressively installing concrete linings to support the excavated trench. The excavated material would be transported through the machine to the surface for removal by trucks. For purposes of this air quality analysis, the sequential excavation method and cut-and-cover activities would take place from January 2020 to January 2026. The emissions associated with the cut-and-cover activities were estimated using CalEEMod with OFFROAD 2011 emission factors, in conjunction with the site-specific equipment list. Fugitive dust includes that from worker trips, construction equipment exhaust, and truck-hauling exhaust.

6.9.3.4 High-Speed Rail Alignment Construction

For purposes of this air quality analysis, the HSR alignment construction is expected to take place from January 2020 to January 2027, and includes the following construction phases:

- Constructing roadway and rail bridges
- Laying cut-and-cover rail, retained-fill rail and at-grade rail

Emissions from construction of the track were calculated using CalEEMod. Equipment counts, horsepower, hours of operation, and load factors used in CalEEMod are included in Appendix A.

Material Hauling

Emissions from the exhaust of trucks used to haul material (including concrete slabs and ballast materials) to the construction site were calculated using heavy-duty truck emission factors from EMFAC2014 and anticipated travel distances of haul trucks within the Basin.

Quarries with 200 or more acres of permitted area are considered to be of sufficient size to effectively serve the demand (URS et al. 2011). At least three quarries in the vicinity of the project met this criterion; however, it was assumed that the smallest number of quarries would be used for efficiency. Therefore, one quarry with the largest acreage nearest to the project vicinity was selected for this analysis. Ballast hauling activities would take place with the use of locomotives. Locomotive activity would take place in two working days.

System Facilities

For purposes of this air quality analysis, the system facilities construction is expected to occur from January 2022 to July 2028.

6.9.3.5 Station Construction

Emissions from Burbank Airport Station construction would be a result of mass site grading and excavation, underground and aboveground facilities construction (i.e., train boarding platforms, the station building, pick-up/drop-off facilities for private autos, and the transit center for buses and shuttles), asphalt paving activates for surface roadways and parking areas, and architectural coatings. Emissions from LAUS would be a result of construction activities for raising the existing platforms and installation of the overhead catenary system. Where applicable, emissions resulting from worker trips, vendor trips, and construction equipment exhaust were included. CalEEMod was used to estimate emissions from the construction phases of the HSR stations.

6.9.3.6 Roadway Crossing Construction

The HSR Build Alternative would include the relocation and expansion of local roads and roadway undercrossings and overcrossings, and reconstruction of several intersections to provide grade separations between roads and railways. Roadway demolition emissions are included in the CalEEMod analysis using the project-specific equipment list. Roadway project construction would begin in July 2021 and be completed by January 2027. Based on project-specific data, a simplified construction schedule was used to estimate construction emissions.

6.9.3.7 Early Action Projects Construction

Early action projects would include four roadway undercrossing grade separations (i.e., Sonora Avenue, Grandview Avenue, Flower Street, and Goodwin Avenue/Chevy Chase Drive), one roadway overcrossing grade separation (i.e., Main Street) and improvements at a regional passenger rail station (Burbank Metrolink Station) (the projects are described in more detail in Chapter 2, Alternatives in the Draft EIR/EIS).

Construction emissions include exhaust emissions from heavy equipment used during the construction phase of each of the project components. The bulk of the construction activities would occur simultaneously and were broken down on a project-by-project component basis to evaluate the construction activities that would occur at a particular location during a peak day and average calendar year period. The construction schedule analysis was used to identify the type and number of equipment that would operate on a typical workday during the period of maximum construction activity. The number of each type of equipment was entered into a spreadsheet. Emission factors from the ARB's OFFROAD2011, EMFAC2014, and HSR inventory of air emissions were identified for each type of equipment and for heavy-duty trucks. Peak day and annual average emissions then were determined by summing emissions from overlapping construction activities as indicated in the proposed construction schedule.

6.9.3.8 Localized Modeling for Construction Health Risks and Localized Effects

According to the OEHHA guidance, cancer risk is defined as the predicted risk of cancer (unitless) over a lifetime based on a long-term (70-year) continuous exposure, and is usually expressed as chances per million persons exposed (OEHHA 2015). The construction of the Burbank to Los Angeles Project Section of the HSR project has the potential to exceed or contribute to exceedances of the ambient air quality standards and to cause adverse health effects on nearby sensitive receptors. Construction of the HSR alignment and HSR stations would take place over several years, and sensitive receptors at schools, child care centers, health care facilities, and residences could potentially be exposed to cancer risks. A detailed air dispersion modeling analysis and a health risk assessment were conducted to determine if these effects would be significant.

An air dispersion modeling analysis using the USEPA's AERMOD (Version 19191) was conducted to simulate physical conditions and predict pollutant concentrations at locations near the fence line of construction sites. Construction sites for the alignment and HSR stations were each evaluated for potential localized air quality effects. For these construction sites, representative construction work areas were modeled, as it is not practical to model the entire length of the alignment or all possible construction alternatives, configurations, and locations for these project components. Pollutant concentrations were estimated near the site boundary and surrounding area. Regulatory default options and the urban dispersion algorithm of AERMOD were used in the analysis. All sources were modeled with urban effects using the population of the Los Angeles County where the project is located. The modeled concentrations were compared with the applicable NAAQS, CAAQS, and health-related guidelines to determine the level of effects.

Local meteorological data were used in the air dispersion modeling analysis. For the analysis of HSR station construction, the nearest available meteorological data set was used. Five years of meteorological data from 2012 through 2016 for the Burbank area and data from 2010 through 2011 and 2014 through 2016 for the Central Los Angeles area were used for the Burbank Airport Station and LAUS, respectively.

TAC concentrations at the maximally exposed individual sensitive receptor location were used to estimate cancer risks and the overall noncancer chronic and acute hazard index associated with construction emissions, using procedures developed by OEHHA (OEHHA 2015). Individual cancer risk is directly proportional to the frequency and duration of exposure to TACs, modified by age sensitivity factors. The age sensitivity factors multiply the risk by 10 for third-trimester fetuses to age 2 (labeled by OEHHA as "0 < 2"), by 3 for children age 2 to 16 ("2 < 16"), and by 1 for persons age 16 and older.

It was necessary to subdivide the exposure durations into smaller time periods (subperiods) and calculate the health risk separately for each subperiod. These subperiods correspond to the years when the modeled receptor's age falls within the ranges defined by the age sensitivity factors (0 < 2, 2 < 16, and ≥ 16). For residential exposures, the range 0 < 2 also includes the third trimester before birth.

For each receptor type, the youngest expected age range was modeled in the Health Risk Assessment to produce the most conservative (highest) risk result. For example, the calculation of residential cancer risk assumes that the exposed person is in the third trimester before birth at the beginning of the exposure period. This assumption maximizes the use of the childhood age sensitivity factors in the cancer risk calculation. Moreover, the calculated cancer risk is increased even further during childhood years by using higher breathing rates per body weight than adults.

For each subperiod calculated in the Health Risk Assessment Technical Report (Appendix G), the average annual construction emissions that would occur during that subperiod were used. The cancer risk results for each subperiod were then summed to obtain the cancer risk for the four-year construction exposure duration. For example, the residential cancer risk for the proposed project was determined by calculating once for each of the three subperiods. The first subperiod represents a receptor age of 0 < 2, assumes an exposure duration of two years, and uses construction emissions averaged over the nine-year construction period. The second subperiod represents a receptor age of 2 < 16 and assumes an exposure duration of nine years (i.e., the maximum construction duration period). The third subperiod represents a receptor age of 16 < 30 and assumes an exposure duration of nine years. The cancer risks calculated for these three subperiods were then summed to obtain the total cancer risks for the nine-year construction exposure duration.

Details of the risk analysis are in Appendix G. The analysis of these localized effects from construction activities include both qualitative and quantitative information on potential localized effects from construction emissions to provide the public with additional information about the potential project effects.

6.9.4 Construction Emission Analysis

Air quality effects of project construction were evaluated under NEPA and CEQA contexts. Although the following criteria are discussed for construction impact analysis, the same criteria also apply to operational impact analysis.

6.9.4.1 Federal

Pursuant to NEPA regulations (40 C.F.R. 1500–1508), project effects are evaluated based on the criteria of context and intensity. Context means the affected environment in which a proposed project occurs. Intensity refers to the severity of the effect, which is examined in terms of the type, quality, and sensitivity of the resource involved, the location and extent of the effect, the duration of the effect (short or long term), and other considerations of context. Beneficial effects are identified and described. When there is no measurable effect, adverse effect is found not to occur. The intensity of the adverse effects is summarized as the degree or magnitude of a potential adverse effect, where the adverse effect is thus determined to be negligible, moderate, or substantial. It is possible that a significant adverse effect may still exist when, on balance, the impact is negligible or even beneficial.

Project emissions of criteria pollutants are compared with the general conformity *de minimis* levels on a calendar-year basis for both construction and operation emissions. If the general conformity levels are exceeded for any calendar year in which emissions occur, a general conformity determination is required. In addition, project emissions may not cause new violations or exacerbate an existing violation of NAAQS. Table 6-1 presents the general conformity *de minimis* levels applicable to the project. In summary, the annual general conformity *de minimis* levels are 10 tons of VOCs and NO_X, 70 tons of $PM_{2.5}$, and 100 tons of CO and PM_{10}. Effects related to GHG emissions are evaluated based on conformity with established statewide GHG reduction goals, including the goals set forth in AB 32 and SB 32.

Table 6-1 General Conformity *De Minimis* Levels

Pollutant	Federal Attainment Status	*De Minimis* Levels (tons/yr)
Ozone (VOC or NO_X)	Extreme nonattainment	10
CO, SO_2, and NO_2	All nonattainment and maintenance	100
$PM_{2.5}$ direct emissions, SO_2, NO_X (unless determined not to be a significant precursor), VOC or ammonia (if determined to be significant precursors	All nonattainment and maintenance	70
PM_{10}	Attainment/Maintenance	100

Source: U.S. Environmental Protection Agency, 2013
Thresholds from Code of Federal Regulations Title 40, Parts 51 and 93.
CO = carbon monoxide
NO_2 = nitrogen dioxide
NO_X = nitrogen oxides
Pb = lead
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
tons/yr = tons per year
VOC = volatile organic compound

Criteria pollutant emissions are measured in mass (i.e., by weight in which the unit of measures are in pounds per day or tons per year) and/or in concentration (i.e., by volume of air in which the unit of measures are in parts per million or micrograms per cubic meter). The results of the air quality analysis would occur in one of the following three intensity levels of impacts. If the project pollutant mass emissions are below the corresponding general conformity *de minimis* levels and are expected to cause pollutant emissions that do not exceed other applicable emission concentration levels, ambient air quality standards, or health risk thresholds (e.g., those in SCAQMD CEQA guidelines), the intensity of the impact is considered negligible. Air quality effects of moderate intensity are defined as pollutant emissions below corresponding general conformity *de minimis* levels, but having the potential to exceed other applicable emission concentration levels, ambient air quality standards, or health risk thresholds. Effects of substantial intensity are defined as pollutant emissions that are greater than the corresponding general conformity *de minimis* levels and have the potential to exceed other applicable emissions, air quality, or health risk thresholds.

6.9.4.2 State

Based on the CEQA Guidelines, the project would have a significant impact if it would:

- Conflict with or obstruct implementation of the applicable air quality plan
- Result in a 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
- Expose sensitive receptors to substantial pollutant concentrations
- Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people
- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs

Quantitative emission thresholds that can be used to evaluate the significance level of impacts have been developed by SCAQMD and are discussed in the following section.

6.9.4.3 Local

SCAQMD's *CEQA Air Quality Handbook* (SCAQMD 1993) contains the guidelines and emissions thresholds used to evaluate the significance of a project's emissions with regard to air quality standards. Emission thresholds were established based on the attainment status of the Basin with regard to air quality standards for specific criteria pollutants. The attainment concentration standards were set at a level that protects public health with an adequate margin of safety. Therefore, the emission thresholds are regarded as conservative in determining an individual project's contribution to health risks.

The air quality impacts analysis follows the guidance and methodologies recommended in SCAQMD's *CEQA Air Quality Handbook* and the significance thresholds on the SCAQMD website (SCAQMD 2015). CEQA allows the significance criteria established by the applicable air quality management or air pollution control district to be used to assess the impacts of a project on air quality.

SCAQMD has adopted regional construction and operational emissions thresholds to determine a project's cumulative impact on air quality in the Basin. Specifically, these thresholds gauge whether a project would significantly contribute to a nonattainment designation based on the mass emissions generated. Table 6-2 lists SCAQMD's regional significance thresholds.

Table 6-2 South Coast Air Quality Management District Thresholds

Pollutant	Construction Phase	Operational Phase
ROCs	75 lbs/day	55 lbs/day
CO	550 lbs/day	550 lbs/day
NO_X	100 lbs/day	55 lbs/day
SO_X	150 lbs/day	150 lbs/day
PM_{10}	150 lbs/day	150 lbs/day
$PM_{2.5}$	55 lbs/day	55 lbs/day

Source: South Coast Air Quality Management District, 2015
CO = carbon monoxide
lbs/day = pounds per day
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROC = reactive organic compound
SO_X = sulfur oxides

7 EFFECT ANALYSIS

7.1 Introduction

Using the methodologies described in Section 6, the effects of the proposed project were evaluated and are discussed in the following subsections. Section 7 provides analysis of existing conditions with the project as well as future year 2029 and 2040 conditions. The analysis includes an evaluation of the HSR Build Alternative under the two ridership scenarios, based on a medium ridership forecast scenario (46.8 million) and a high ridership forecast scenario (56.8 million).

The ridership forecasts were presented for two scenarios based on probability of occurrence. The "medium" scenario is the forecast with a 50 percent probability of occurring; the "high" scenario is the forecast with a 75 percent probability of occurring. For the year 2040, which corresponds to the horizon year used in the impacts analysis in this document, the forecasts projected 42.8 million passengers under the medium scenario and 56.8 million passengers under the high scenario.

This range of ridership forecasts reflects the development of certain aspects of the HSR system's design and certain portions of the environmental analysis, as described in more detail below. Because the ultimate ridership of the HSR system will depend on many uncertain factors, such as the price of gasoline or population growth, the HSR system described in this document has been designed to accommodate the broad range of ridership assumptions expected over the coming decades.

Since the 2016 Business Plan forecasts were developed, the Authority has adopted its 2018 Business Plan, which was accompanied by updated forecasts (Authority 2016c; Authority 2018b). The 2016 and 2018 Business Plan ridership forecasts were developed using the same travel forecasting model; the forecasts differ due to changes in the model's inputs, including the HSR service plan, demographic forecasts, estimates of automobile operating costs and travel times, and airfares. The "medium" ridership forecast for 2040 decreased by 6.5 percent, from 42.8 to 40 million, and the "high" ridership forecast decreased by 10.1 percent, from 56.8 to 51.6 million. In addition, the 2018 Business Plan assumes an opening year of 2033 rather than 2029 for the full Phase 1 system (Authority 2016c; Authority 2018b).

The Authority released a Draft 2020 Business Plan in February 2020 for public review and comment. The plan's final adoption is expected at the April 2020 Board meeting for submittal to the Legislature by May 1, 2020. The 2020 Business Plan forecasts were developed using the same travel forecasting model as the 2016 and 2018 Business Plans, updated for population and employment forecasts. The Phase 1 medium ridership forecast for 2040 is 38.6 million, and the high is 50.0 million.

To the extent that the lower ridership levels projected in the 2018 Business Plan result in fewer trains operating in 2040, the impacts associated with the train operations in 2040 would be somewhat less than the impacts presented in this report, and the benefits accruing to the project (e.g., reduced VMT, GHG emissions, and energy consumption) also would be less than the benefits presented in this report. As with the impacts, the benefits would continue to build and accrue over time and would eventually reach the levels discussed in this report for the Phase 1 system.

7.2 General Plans and Policies Consistency Analysis

CEQ and FRA regulations require the discussion of any inconsistency or conflict of a proposed action with regional or local plans and laws. Where inconsistencies or conflicts exist, CEQ and FRA require a description of the extent of reconciliation and the reason for proceeding if full reconciliation is not feasible (40 C.F.R. Part 1506.2(d) and 64 Fed. Reg. 28545, 14(n)(15)). The CEQA Guidelines also require that an EIR discuss the inconsistencies between the project and applicable general plans, specific plans, and regional plans (CEQA Guidelines, Section 15125(d)).

The 2016–2040 SCAG RTP/SCS discussed many long-term needs for the South Coast region's transportation system. As part of SCAG's plan, it will continue ongoing work with railroads, air quality management agencies, and other stakeholders to reach the goal of a zero-emissions rail system. The Cities of Burbank, Glendale, and Los Angeles General Plans and their Air Quality Elements contain a number of goals, objectives, and policies aimed at improving air quality within the cities. Table 7-1 presents an evaluation of General Plan air quality element plans and policies adopted for the purpose of reducing criteria pollutants and GHG emissions. The table describes whether or not the plans, policies and regulations are applicable on a city-specific basis and, therefore, applicable to the project. Other regional plans would include the Amtrak Sustainability Policy, the Metrolink Fuel Conservation Plan, and the Union Pacific Railroad Fuel Efficiency Plan. Table 7-1 shows that the proposed HSR Build Alternative would not conflict with any of the plans, policies, or regulations that apply to the project.

Table 7-1 Consistency Analysis with Regional and Local Plans and Policies

Policy Title	Summary	Evaluation
Southern California Association of Governments 2016-2040 Regional Transportation Plan/Sustainable Community Strategies		
Strategic Plan **Goal 1:** California High Speed Rail	• **2016 Strategic Plan:** The California High-Speed Train will be electrified and will therefore produce no emissions along its operating corridors. Furthermore, the California High-Speed Rail Authority (Authority) has committed to using 100 percent renewable energy to power its trains. Because of the expected reduction in air and auto travel, the Authority estimates its service will save 2.0 million to 3.2 million barrels of oil annually, beginning in 2030.	The proposed HSR Build Alternative is consistent with the identified SCAG RTP/SCS Strategic Plan because it would implement project features that would utilize electric HSR in the region.
Goal 2: Emission Reduction Targets	• The 2016-2040 RTP/SCS includes a strong commitment to reduce emissions from transportation sources to comply with SB 375, improve public health, and meet the NAAQS as set forth by the CAA.	The proposed HSR Build Alternative is consistent with the identified SCAG RTP/SCS because it would implement project features that would utilize zero-emission HSR locomotives.

Policy Title	Summary	Evaluation
City of Burbank 2035 General Plan		
General Plan Air Quality and Climate Change Element (Adopted in 2013) **Goal 1:** Reduction of Air Pollution	• **Policy 1.1:** Coordinate air quality planning efforts with local, regional, state, and federal agencies, and evaluate the air quality effects of proposed plans and development projects. • **Policy 1.2:** Seek to attain or exceed the more stringent of federal or state ambient air quality standards for each criteria air pollutant. • **Policy 1.3:** Continue to participate in the Cities for Climate Protection Program, South Coast Air Quality Management District's (SCAQMD's) Flag Program, SCAQMD's Transportation Programs (i.e., Rule 2202, Employee Rideshare Program), and applicable state and federal air quality and climate change programs. • **Policy 1.5:** Require projects that generate potentially significant levels of air pollutants, such as large construction projects, to incorporate best available air quality and greenhouse gas mitigation in project design. • **Policy 1.6:** Require measures to control air pollutant emissions at construction sites and during soil- disturbing or dust-generating activities (i.e., tilling, landscaping) for projects requiring such activities.	The adoption of the City's General Plan Air Quality Element serves to aid the South Coast region in attaining the state and federal ambient air quality standards at the earliest feasible date, while still maintaining economic growth and improving the quality of life. The City's Air Quality Element acknowledges the inter-relationship between transportation and land use planning in meeting the City's mobility and clean air goals. The Proposed HSR Build Alternative is consistent with the identified policies of the City of Burbank Air Quality Element because it would implement project features that would reduce and control construction emissions, would reduce vehicular trips, would reduce vehicle miles traveled (VMT), and would encourage the use of alternative modes of transportation.
Goal 2: Sensitive Receptors	• **Policy 2.2** Separate sensitive uses such as residences, schools, parks, and day care facilities from sources of air pollution and toxic chemicals. Provide proper site planning and design features to buffer and protect when physical separation of these uses is not feasible. • **Policy 2.3** Require businesses that cause air pollution to provide pollution control measures. • **Policy 2.4** Reduce the effects of air pollution, poor ambient air quality, and urban heat island effect with increased tree planting in public and private spaces. • **Policy 2.5** Require the use of recommendations from the California Air Resources Board's Air Quality and Land Use Handbook to guide decisions regarding location of sensitive land uses.	The Proposed HSR Build Alternative is consistent with the identified sensitive receptor policies of the City of Burbank Air Quality Element because it would implement project features that would reduce and control air pollution and toxic chemicals, provide pollution control measures, and maintain safe buffer distance during construction.
Goal 3: Reduction of Greenhouse Gas Emissions	• **Policy 3.4** Reduce greenhouse gas emissions by promoting development that is pedestrian-friendly and transit-oriented; and promoting energy-efficient building design and site planning.	The proposed HSR Build Alternative is consistent with the identified greenhouse gas (GHG) policies because it would implement project features that would utilize electric rail locomotive technology, would promote pedestrian-friendly and transit-oriented facilities, and would promote energy-efficient building design.

Policy Title	Summary	Evaluation
City of Glendale		
General Plan Air Quality Element (Adopted in 1992) **Goal 1:** Air Quality will be healthful for all residents	• **Policy Objective 1:** Reduce Glendale's contribution to regional emissions in a manner both efficient and equitable to residents and businesses, since emissions generated within Glendale affect regional air quality. • **Policy Objective 2:** Comply with the AQMP prepared by the SCAQMD and the Southern California Association of Governments.	The adoption of the City's General Plan Air Quality Element serves to aid the South Coast region in attaining state and federal ambient air quality standards at the earliest feasible date, while still maintaining economic growth and improving the quality of life. The City's Air Quality Element acknowledges the inter-relationship between transportation and land use planning in meeting the City's mobility and clean air goals. The proposed HSR Build Alternative is consistent with the identified policies of the City of Glendale Air Quality Element because it would implement project features that would reduce and control construction emissions, would reduce vehicular trips, would reduce VMT, and encourage use of alternative modes of transportation.
Greener Glendale Sustainability Plan (Adopted in 2012)	One of the goals of the Sustainability Plan is to facilitate the provision of alternative transportation infrastructure for residents and patrons in the Glendale community. • **Policy T1-G:** Connect Glendale to the regional lightrail network and high speed rail, should it be developed.	The proposed HSR Build Alternative is consistent with the identified policies of the City of Glendale Sustainability Plan because it would implement project features that would connect Glendale to the high- speed rail system.
City of Los Angeles		
General Plan Land Use Element (Adopted in 1992) **Goal 1:** Good air quality and mobility	• **Objective1.3:** Reduce particulate air pollutants emanating from construction sites. – **Policy 1.3.1:** Minimize particulate emission from construction sites.	The 1992 revision to the City's General Plan Air Quality Element serves to aid the greater Los Angeles region in attaining the state and federal ambient air quality standards at the earliest feasible date, while still maintaining economic growth and improving the quality of life. The City's Air Quality Element and the accompanying Clean Air Program acknowledge the inter-relationship between transportation and land use planning in meeting the City's mobility and clean air goals. The proposed HSR Build Alternative is consistent with the identified policies of the City of Los Angeles Air Quality Element because it would implement project features that would reduce and control construction emissions, and would reduce particulate emissions with the implementation of IAMFs and CEQA mitigation measures.

Policy Title	Summary	Evaluation
Goal 3: Efficient management of transportation facilities and system infrastructure	• **Objective 3.1:** It is the objective to the City to increase the portion of work trips made by transit to levels that are consistent with the goals of the AQMP. – **Policy 3.1.1:** Implement programs to finance and improve public transit facilities and service. – **Policy 3.1.2:** Address public safety concerns as part of transit improvement programs in order to increase transit ridership. – **Policy 3.1.2:** Cooperate with regional transportation agencies in expediting the development and implementation of regional transit system.	The proposed HSR Build Alternative is consistent with the identified policies of the City of Los Angeles Air Quality Element because it would implement project features that would reduce vehicular trips, would reduce VMT, and would encourage the use of alternative modes of transportation.
Goal 4: Minimal impact of existing land use patterns and future land use development on air quality	• **Objective 4.1:** It is the objective of the City to include the regional attainment of ambient air quality standards as a primary consideration in land use planning. – **Policy 4.1.1:** Coordinate with all appropriate regional agencies the implementation of strategies for the integration of land use, transportation, and air quality policies.	The proposed HSR Build Alternative is consistent with the identified policies of the City of Los Angeles Air Quality Element because it would implement project features that would encourage the HSR Authority to continue with the coordination between transportation and land use planning with the City and the community.
Green LA Plan (adopted in 2007)	• **Transportation Goal:** Focus on Mobility for People, Not Cars – **Objective:** Expand the regional rail network.	The proposed HSR Build Alternative is consistent with the identified policies of the City of Glendale sustainability Green LA Plan because it would implement project features that would connect Los Angeles to the high-speed rail system.
Amtrak		
Amtrak Sustainability Policy & Program	• **Goal:** Environmental Compliance – **Objective:** Comply with the Clean Air Act, and state and local air quality and greenhouse gas emission requirements. ▪ **Policy:** Implement fuel conservation efforts by encouraging efficient train handling and reducing locomotive idling wherever possible.	The proposed HSR Build Alternative is consistent with the identified Amtrak policies because it would implement project features that would utilize electric rail locomotive technology, and would comply with the Clean Air Act and state and local air quality and greenhouse gas emission requirements.
Metrolink		
Metro Link Fuel Conservation Program	• **Goal:** Environmental Compliance – **Objective:** Comply with the Clean Air Act, and state and local air quality and greenhouse gas emission requirements. ▪ **Policy:** Implement fuel conservation efforts by encouraging efficient train handling and reducing locomotive idling wherever possible.	The proposed HSR Build Alternative is consistent with the identified Metro policies because it would implement project features that would utilize electric rail locomotive technology, and would comply with the Clean Air Act and state and local air quality and greenhouse gas emission requirements.

Policy Title	Summary	Evaluation
Metro Link Plug-In Program	• **Goal:** Add more plug-in stations – **Policy:** Implement plug-in stations that supply electric ground power to rail cars during testing and inspection at CMF.	The proposed HSR Build Alternative is consistent with the identified Metro policy because it would implement project features that would utilize electric rail locomotive technology.

AQMP = air quality management plan
CEQA = California Environmental Quality Act
HSR = high-speed rail
IAMF = impact avoidance and minimization feature
Metro = Los Angeles County Metropolitan Transportation Authority

7.3 No Project Alternative

For comparison purposes, the air quality analysis was conducted for conditions without the project for the existing conditions, the opening year (2029), and the horizon year (2040). Statewide and regional emissions without the project for each ridership scenario are shown for each of these years in Table 7-2, Table 7-3 (2015); Table 7-4, and Table 7-5 (2029); and Table 7-6, and Table 7-7 (2040).

Table 7-2 2015 Statewide No Project Emissions (Medium Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	7,785	10,506	323,019	33,326	816	22,977	6,238
Planes	338	341	2,888	2,779	299	84	84
Energy (power plants)	1,646	16,458	29,616	15,531	2,303	2,953	2,683
Total	**9,768**	**27,305**	**355,523**	**51,636**	**3,418**	**23,061**	**9,004**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-3 2015 Statewide No Project Emissions (High Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	7,746	10,454	321,414	33,161	812	22,862	6,207
Planes	315	318	2,692	2,589	279	78	78
Energy (power plants)	1,646	16,458	29,616	15,531	2,303	2,953	2,683
Total	**9,707**	**27,229**	**353,722**	**51,281**	**3,394**	**25,894**	**8,968**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-4 2029 Statewide No Project Emissions (Medium Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	1,615	2,353	119,273	9,279	543	25,805	6,784
Planes	411	415	3,445	3,391	367	103	102
Energy (power plants)	1,977	18,965	39,934	19,081	2,879	3,606	3,275
Total	**4,004**	**21,733**	**162,651**	**31,751**	**3,789**	**29,514**	**10,161**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-5 2029 Statewide No Project Emissions (High Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	1,627	2,370	120,369	9,467	555	26,370	6,929
Planes	341	344	2,856	2,811	304	85	85
Energy (power plants)	1,977	18,965	39,934	19,081	2,879	3,606	3,275
Total	**3,946**	**21,679**	**163,158**	**31,360**	**3,738**	**30,061**	**10,289**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-6 2040 Statewide No Project Emissions (Medium Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	996	1,451	86,627	6,312	489	27,540	7,091
Planes	474	479	3,968	3,908	423	118	118
Energy (power plants)	2,205	20,757	45,146	20,858	3,177	3,921	3,564
Total	**3,675**	**22,686**	**135,741**	**31,077**	**4,089**	**31,580**	**10,773**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-7 2040 Statewide No Project Emissions (High Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	1,029	1,498	89,456	6,518	505	28,439	7,323
Planes	520	525	4,348	4,282	464	129	129
Energy (power plants)	2,205	20,757	45,146	20,858	3,177	3,921	3,564
Total	**3,753**	**22,779**	**138,950**	**31,658**	**4,145**	**32,490**	**11,016**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-8 summarizes the statewide GHG emissions (expressed in terms of CO_2e) that would result from implementation of the No Project Alternative for the three ridership scenarios. The baseline GHG emissions for these three scenarios are shown for the existing condition (2015), opening year (2029), and horizon year (2040).

Table 7-8 Estimated Statewide Greenhouse Gas Emissions for the No Project Alternative Under the Silicon Valley to Central Valley Medium, Silicon Valley to Central Valley Medium Extension, and Silicon Valley to Central Valley High Scenarios

Project Element	GHG Emissions for the No Project Alternative (MMT CO_2e/yr)	
	Med Ridership Scenario	High Ridership Scenario
Year 2015		
Roadways	64.0	63.7
Planes	2.3	2.2
Energy (power plants)	N/A	N/A
Total	**66.3**	**65.8**
Year 2029		
Roadways	45.9	46.5
Planes	2.9	2.4
Energy (power plants)	N/A	N/A
Total	48.7	48.9
Year 2040		
Roadways	41.9	43.3
Planes	3.3	3.6
Energy (power plants)	N/A	N/A
Total	**45.2**	**46.9**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
High V2V = Silicon Valley to Central Valley High
Med V2V = Silicon Valley to Central Valley Medium
Med V2V Ext = Silicon Valley to Central Valley Medium Extension
MMT = million metric tons
MMT CO_2e/yr = million metric tons per year of carbon dioxide equivalent
N/A = not available

7.4 Statewide and Regional Operational Emissions Analysis

Table 7-9 and Table 7-10 summarize estimated statewide emission burden changes resulting from the project in the year 2015. Table 7-11 and Table 7-12 summarize estimated statewide emission burden changes resulting from the project in the year 2029. Table 7-13 and Table 7-14 summarize estimated statewide emission burden changes resulting from the project in the year 2040. As shown, the larger reductions in roadway and plane emissions and the larger increases in energy emissions occur with the High Ridership scenario (i.e., when more riders would use the HSR). The project is predicted to have a beneficial effect on (i.e., reduce) statewide emissions of applicable pollutants, with the exception of TOG emissions in the opening year (2029), which would increase with the project due to increased power requirements. The analysis estimated the emission changes due to projected reductions of on-road VMT and intrastate air travel, and increases in electrical demand (required to power the HSR project).

Table 7-9 2015 Estimated Statewide Emissions Burden Changes Due to the High-Speed Rail Project vs. No Project (Medium Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	-130	-176	-5,406	-558	-14	-385	-104
Planes	-101	-102	-862	-829	-89	-25	-25
Energy (power plants)	12	124	207	105	17	23	21
Total	**-219**	**-153**	**-6,061**	**-1,281**	**-86**	**-387**	**-108**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-10 2015 Estimated Statewide Emission Burden Changes Due to the High-Speed Rail Project vs. No Project (High Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	-179	-242	-7,432	-767	-19	-529	-144
Planes	-97	-98	-829	-798	-86	-24	-24
Energy (power plants)	14	137	227	116	19	25	23
Total	**-262**	**-203**	**-8,034**	**-1,448**	**-86**	**-528**	**-145**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-11 2029 Estimated Statewide Emissions Burden Changes Due to the High-Speed Rail Project vs. No Project (Medium Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	-15	-22	-1,124	-87	-5	-243	-64
Planes	-65	-66	-545	-536	-58	-16	-16
Energy (power plants)	11	106	176	90	14	20	18
Total	**-70**	**18**	**-1,493**	**-534**	**-49**	**-240**	**-62**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-12 2029 Estimated Statewide Emission Burden Changes Due to the High-Speed Rail Project vs. No Project (High Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	3	4	-20	-105	-7	-332	-84
Planes	-72	-73	-602	-593	-64	-18	-18
Energy (power plants)	12	117	194	99	16	21	20
Total	-58	48	-428	-599	-55	-328	-82

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-13 2040 Estimated Statewide Emission Burden Changes Due to the High-Speed Rail Project vs. No Project (Medium Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	-7	-10	-564	-109	-9	-500	-127
Planes	-139	-140	-1,162	-1,145	-124	-35	-35
Energy (power plants)	12	124	207	105	17	23	21
Total	**-133**	**-25**	**-1,520**	**-1,148**	**-116**	**-512**	**-141**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

Table 7-14 2040 Estimated Statewide Emission Burden Changes Due to the High-Speed Rail Project vs. No Project (High Ridership Scenario)

Project Element	ROG (tons/yr)	TOG (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Roadways	-25	-36	-2,174	-158	-12	-691	-178
Planes	-134	-135	-1,118	-1,101	-119	-33	-33
Energy (power plants)	14	137	227	116	19	25	23
Total	**-145**	**-34**	**-3,065**	**-1,144**	**-113**	**-699**	**-188**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = oxides of sulfur
TOG = total organic gas
tons/yr = tons per year

7.4.1 On-Road Vehicles Operational Emissions

The HSR project is predicted to reduce daily roadway VMT by more than 4 billion due to travelers using the HSR rather than driving. The on-road vehicle emissions analysis is based on VMT changes and associated average daily speed estimates, calculated for each affected county. Emission factors were obtained from EMFAC2014, using parameters set within the program for each individual county to reflect travel within each county and statewide parameter to reflect travel through each county. As shown in Table 7-15, Table 7-16, Table 7-17,Table 7-18, Table 7-19, and Table 7-20, the proposed project is predicted to have either no measureable effect or to slightly reduce regional emissions, as compared to the No Project Alternative.

Table 7-15 2015 On-Road Vehicle Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

County	No Project VMT Total Traffic	Project VMT Total Traffic	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Los Angeles	73,394,193,078	72,724,087,184	-27	-36	-1,087	-109	-3	-76	-21
Ventura	5,892,874,243	5,859,075,240	-1	-2	-53	-5	0	-4	-1
Orange	23,850,547,795	23,717,213,976	-5	-7	-212	-22	-1	-15	-4
Riverside	17,712,108,321	17,633,058,738	-3	-4	-122	-13	0	-9	-2
San Bernardino	12,725,201,965	12,665,228,642	-2	-3	-92	-10	0	-7	-2
Santa Barbara	864,545,016	840,246,898	-1	-1	-34	-4	0	-3	-1
Regional Total	*134,439,470,419*	*133,438,910,677*	*-39*	*-53*	*-1,601*	*-163*	*-4*	*-113*	*-31*
Statewide Total	**205,015,920,154**	**201,584,933,649**	**-130**	**-176**	**-5,406**	**-558**	**-14**	**-385**	**-104**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-16 2015 On-Road Vehicle Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

County	No Project VMT Total Traffic	Project VMT Total Traffic	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Los Angeles	73,236,845,700	72,310,888,632	-37	-50	-1,502	-151	-4	-105	-28
Ventura	5,871,995,391	5,823,357,866	-2	-3	-77	-8	0	-6	-1
Orange	23,786,461,969	23,598,774,570	-7	-10	-299	-31	-1	-21	-6
Riverside	17,638,349,903	17,527,712,591	-4	-6	-171	-18	0	-13	-3
San Bernardino	12,686,260,346	12,601,481,161	-3	-4	-130	-14	0	-10	-3
Santa Barbara	849,400,023	814,378,660	-1	-2	-49	-6	0	-4	-1
Regional Total	*134,069,313,333*	*132,676,593,479*	*-55*	*-74*	*-2,229*	*-227*	*-6*	*-158*	*-43*
Statewide Total	**203,997,417,634**	**199,280,213,986**	**-179**	**-242**	**-7,432**	**-767**	**-19**	**-529**	**-144**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-17 2029 On-Road Vehicle Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

County	No Project VMT Total Traffic	Project VMT Total Traffic	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Los Angeles	83,292,097,055	82,912,308,772	-3	-4	-193	-15	-1	-41	-11
Ventura	6,958,738,851	6,938,712,330	0	0	-10	-1	0	-2	-1
Orange	26,850,572,843	26,781,493,981	0	-1	-34	-3	0	-7	-2
Riverside	23,854,538,076	23,813,465,919	0	0	-20	-2	0	-4	-1
San Bernardino	15,485,020,177	15,451,893,425	0	0	-16	-1	0	-4	-1
Santa Barbara	981,913,675	965,944,500	0	0	-7	-1	0	-2	0
Regional Total	*157,422,880,677*	*156,863,818,928*	*-4*	*-6*	*-279*	*-22*	*-1*	*-61*	*-16*
Statewide Total	**240,475,748,703**	**238,209,151,397**	**-15**	**-22**	**-1,124**	**-87**	**-5**	**-243**	**-64**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-18 2029 On-Road Vehicle Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

County	No Project VMT Total Traffic	Project VMT Total Traffic	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Los Angeles	84,124,984,453	83,596,457,306	-4	-5	-269	-21	-1	-57	-15
Ventura	7,053,048,744	7,024,064,519	0	0	-14	-1	0	-3	-1
Orange	27,146,429,700	27,049,528,730	-1	-1	-47	-4	0	-11	-3
Riverside	24,151,608,458	24,094,387,910	0	-1	-27	-2	0	-6	-2
San Bernardino	15,653,692,190	15,606,876,889	0	0	-22	-2	0	-5	-1
Santa Barbara	1,054,058,771	1,030,577,339	0	0	-10	-1	0	-3	-1
Regional Total	*159,183,822,315*	*158,401,892,692*	*-5*	*-8*	*-390*	*-30*	*-2*	*-85*	*-22*
Statewide Total	**245,782,498,313**	**242,644,922,069**	**3**	**4**	**-20**	**-105**	**-7**	**-332**	**-84**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-19 2040 On-Road Vehicle Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

County	No Project VMT Total Traffic	Project VMT Total Traffic	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Los Angeles	86,055,909,405	85,124,593,011	-4	-5	-316	-23	-2	-99	-25
Ventura	7,085,588,919	7,038,614,902	0	0	-16	-1	0	-5	-1
Orange	27,531,689,116	27,346,381,133	-1	-1	-61	-4	0	-20	-5
Riverside	28,519,428,527	28,409,565,036	0	-1	-36	-3	0	-12	-3
San Bernardino	18,495,252,023	18,411,900,811	0	0	-27	-2	0	-9	-2
Santa Barbara	1,038,912,666	1,005,143,024	0	0	-9	-1	0	-4	-1
Regional Total	*168,726,780,657*	*167,336,197,916*	*-5*	*-8*	*-464*	*-34*	*-3*	*-149*	*-38*
Statewide Total	**261,252,464,970**	**256,484,063,423**	**-7**	**-10**	**-564**	**-109**	**-9**	**-500**	**-127**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-20 2040 On-Road Vehicle Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

County	No Project VMT Total Traffic	Project VMT Total Traffic	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Los Angeles	87,075,870,799	85,788,971,213	-5	-7	-437	-31	-2	-137	-35
Ventura	7,181,701,297	7,114,104,631	0	0	6	-1	0	-7	-2
Orange	27,846,004,312	27,585,155,461	-1	-1	-85	-6	0	-28	-7
Riverside	29,009,461,048	28,855,696,779	-1	-1	-49	-4	0	-16	-4
San Bernardino	18,770,247,920	18,652,421,401	0	-1	-38	-3	0	-13	-3
Santa Barbara	1,117,778,105	1,069,105,246	0	0	-14	-1	0	-5	-1
Regional Total	*171,001,063,481*	*169,065,454,730*	*-7*	*-10*	*-617*	*-47*	*-4*	*-207*	*-53*
Statewide Total	**269,784,125,131**	**263,228,132,814**	**-25**	**-36**	**-2,174**	**-158**	**-12**	**-691**	**-178**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Based on the traffic analysis, the HSR Build Alternative evaluated would have the same regional VMT and the same regional emissions. Under the HSR Build Alternative horizon year, the regional VMT would decrease by about 0.5 to 1.5 percent compared to the No Project Alternative for Los Angeles County. These reductions would result in lower pollutant emissions. The benefits presented depend on ridership. Therefore, lower ridership than those assumed in the design and planning values would result in fewer benefits, while higher ridership would result in more benefits.

7.4.2 Train Movement Operational Emissions

The HSR project would use electric multiple unit trains, with the power distributed through the overhead contact system. Combustion of fossil fuels and associated emissions from the HSR project would not occur. However, trains traveling at high velocities, such as those associated with the proposed HSR, create sideways turbulence and rear wake, which would resuspend particulates from the surface around the track, resulting in fugitive dust emissions. The trapezoidal rule for numerical integration is used to estimate the results for the particulate emission factor for a passing high-speed train moving at between speeds of 20 to 140 mph. Different portions of the project section would be travelling at different speeds. For the proposed Burbank to Los Angeles HSR segment, the PM_{10} fugitive dust entrainment from wind induced by the high-speed train is 0.15 ton per year, and the $PM_{2.5}$ fugitive dust is 0.02 ton per year. Details of these calculations are included in Appendix D.

Los Angeles County has high rates of asthma in adults and children. Because the HSR is electrically powered, it is not expected to generate direct combustion emissions along its route that would cause substantial health concerns, such as asthma or other respiratory diseases. In addition, a detailed analysis of wind-induced fugitive dust emissions from HSR travel is discussed in Appendix D. Based on this analysis, fugitive dust emissions from HSR travel are not expected to result in substantial amounts of dust to cause health concerns.

7.4.3 Airport Operational Emissions

The HSR project could affect travel at regional airports and airports supporting intrastate travel. The Statewide Program EIR/EIS (Authority and FRA 2005) demonstrated that the long-distance, city-to-city aircraft takeoffs and landings within the Burbank to Los Angeles Project Section would be reduced with the project, which would reduce regional airport-related emissions of CO,

NO_X, and VOCs relative to the No Project Alternative and existing conditions. As shown in Table 7-19, the HSR project is predicted to reduce the number of plane flights because travelers would use HSR rather than fly to their destination, which would reduce emissions associated with the operations phase of the project.

As shown in Table 7-21, Table 7-22, Table 7-23, Table 7-24, Table 7-25, and Table 7-26, the proposed project is predicted either to have no measurable effect or to slightly reduce regional emissions in 2040 and 2029 when compared with the No Project Alternative for each of the three ridership scenarios.

Table 7-21 2015 Aircraft Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

County	No Project Number of Flights	Project Number of Flights	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Southern California	107,915	73,378	-43	-44	-371	-357	-38	-11	-11
Statewide	268,567	188,430	-101	-102	-862	-829	-89	-25	-25

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
$S5O_2$ = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-22 2015 Aircraft Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

County	No Project Number of Flights	Project Number of Flights	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Southern California	100,674	68,130	-41	-41	-350	-337	-36	-10	-10
Statewide	250,276	173,177	-97	-98	-829	-798	-86	-24	-24

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-23 2029 Aircraft Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

County	No Project Number of Flights	Project Number of Flights	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Southern California	130,344	107,802	-28	-28	-236	-232	-25	-7	-7
Statewide	329,614	277,475	-65	-66	-545	-536	-58	-16	-16

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-24 2029 Aircraft Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

County	No Project Number of Flights	Project Number of Flights	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Southern California	107,443	82,707	-31	-31	-259	-254	-28	-8	-8
Statewide	273,240	215,599	-72	-73	-602	-593	-64	-18	-18

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-25 2040 Aircraft Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

County	No Project Number of Flights	Project Number of Flights	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Southern California	149,961	101,962	-60	-60	-501	-493	-53	-15	-15
Statewide	380,189	268,814	-139	-140	-1,162	-1,145	-124	-35	-35

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-26 2040 Aircraft Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

County	No Project Number of Flights	Project Number of Flights	Change in Emissions with HSR (tons/yr)						
			ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Southern California	162,667	117,437	-56	-57	-472	-465	-50	-14	-14
Statewide	416,659	309,505	-134	-135	-1,118	-1,101	-119	-33	-33

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

7.4.4 Indirect Power Plant Operational Emissions

The California HSR Project is expected to increase electrical requirements when compared with the No Project Alternative and existing conditions. The electrical demands due to propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities were calculated as part of the project design. Average emission factors for each kilowatt-hour required were derived from CARB statewide emission inventories of electrical and cogeneration facilities.[10] To derive the portion of electricity usage required by the Burbank to Los Angeles Project Section, a percentage was applied to each project section based upon the alignment distance for that segment, as compared to the entire HSR project. Accordingly, the Burbank to Los Angeles Project Section is assumed to account for approximately 1 percent of the statewide electricity usage of the HSR. As shown in Table 7-27, Table 7-28, Table 7-29, Table 7-30, Table 7-31, and Table 7-32, the project is expected to result in an increase in energy emissions for all three ridership scenarios and build years.

Table 7-27 2015 Power Plant Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

Project Section	Change in Emissions with HSR (tons/yr)						
	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Burbank to Los Angeles	0	1	2	1	0	0	0
Statewide	12	124	207	105	17	23	21

Source: California High-Speed Rail Authority, 2017
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

[10] California Air Resources Board. www.arb.ca.gov/app/emsinv/fcemssumcat2013.php.

Table 7-28 2015 Power Plant Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

Project Section	Change in Emissions with HSR (tons/yr)						
	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Burbank to Los Angeles	0	1	2	1	0	0	0
Statewide	14	137	227	116	19	25	23

Source: California High-Speed Rail Authority, 2017
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-29 2029 Power Plant Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

Project Section	Change in Emissions with HSR (tons/yr)						
	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Burbank to Los Angeles	0	1	2	1	0	0	0
Statewide	11	106	176	90	14	19	18

Source: California High-Speed Rail Authority, 2017
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-30 2029 Power Plant Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

Project Section	Change in Emissions with HSR (tons/yr)						
	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Burbank to Los Angeles	0	1	2	1	0	0	0
Statewide	12	117	194	99	16	21	20

Source: California High-Speed Rail Authority, 2017
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-31 2040 Power Plant Emission Changes Due to the High-Speed Rail Project (Medium Ridership Scenario)

Project Section	Change in Emissions with HSR (tons/yr)						
	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Burbank to Los Angeles	0	1	2	1	0	0	0
Statewide	12	124	207	105	17	23	21

Source: California High-Speed Rail Authority, 2017
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

Table 7-32 2040 Power Plant Emission Changes Due to the High-Speed Rail Project (High Ridership Scenario)

Project Section	Change in Emissions with HSR (tons/yr)						
	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Burbank to Los Angeles	0	1	2	1	0	0	0
Statewide	14	137	227	116	19	25	23

Source: California High-Speed Rail Authority, 2017
CO = carbon monoxide
HSR = high-speed rail
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year

The HSR system would be powered by the state's electrical grid and, therefore, no single generation source for the electrical power requirements can be positively identified. Emission changes from power generation can, therefore, be predicted on a statewide level only. The estimated emission changes are considered to be conservative, because they are based on the state's current electrical profile. The State of California is requiring an increasing fraction (33 percent by 2020 and 50 percent by 2030) of electricity generated for the state's power portfolio to come from renewable energy sources. As such, the emissions generated for powering the HSR system are expected to be lower in the future when compared with emission estimates used in this analysis based on the existing state power portfolio. In addition, the Authority has adopted a goal to purchase the HSR system's power from renewable energy sources, which would further reduce the emissions compared to the existing estimates.

7.5 Local Operation Emission Sources

Operation of the Burbank and Los Angeles HSR stations would produce criteria pollutant and GHG emissions. The operation of the traction power substations would not result in appreciable quantities of air pollutants because site visits would be infrequent and power usage would be limited. Therefore, emissions from the traction power substations were not quantified.

7.5.1 Station Sites

Emissions associated with the operation of the HSR stations are expected as a result of combustion sources used primarily for space heating and facility landscaping (backup emergency generators), energy consumption for facility lighting, minor solvent and paint usage, and employee and passenger traffic. CalEEMod was used to estimate these emissions from those portions of the Burbank and Los Angeles HSR stations that service the HSR, based on the square footage of the new station platforms and parking spaces, if applicable. EMFAC2014 was used to estimate emissions from mobile sources. The unmitigated criteria pollutant and GHG emissions for the HSR stations were estimated for the years 2029 and 2040 and are included in Table 7-33 and Table 7-34, respectively.

Table 7-33 High-Speed Rail Station Operational Emissions (Tons per Year)

Project Component	Emissions (tons/yr)					
	VOCs	CO[1]	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Operational Year 2029						
Burbank Airport Station	0	5	2	0	1	0
LAUS	1	32	2	0	23	6
Total	**1**	**37**	**4**	**0**	**24**	**6**
Operational Year 2040						
Burbank Airport Station	0	3	2	0	1	0
LAUS	1	34	2	0	37	10
Total	**1**	**37**	**4**	**0**	**38**	**10**

Source: California High-Speed Rail Authority, 2016

CO = carbon monoxide
CO_2 = carbon dioxide
HSR = high-speed rail
LAUS = Los Angeles Union Station
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
SO_2 = sulfur dioxide
tons/yr = tons per year
VOC = volatile organic compound

Table 7-34 High-Speed Rail Station Operational Emissions (Pounds per Day)

Project Component	Emissions (lbs/day)					
	VOCs	CO[1]	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Operational Year 2029						
Burbank Airport Station	4	37	15	0	9	3
LAUS	6	196	12	1	126	34
Total	**10**	**233**	**27**	**1**	**135**	**37**
Operational Year 2040						
Burbank Airport Station	3	27	15	0	9	3
LAUS	5	205	11	1	206	55
Total	**8**	**232**	**26**	**1**	**215**	**58**

Source: California High-Speed Rail Authority, 2016

CO = carbon monoxide
CO_2 = carbon dioxide
HSR = high-speed rail
LAUS = Los Angeles Union Station
lbs/day = pounds per day
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
SO_2 = sulfur dioxide
VOC = volatile organic compound

7.6 Total Operational Emissions

Table 7-35, Table 7-36, Table 7-37, Table 7-38, Table 7-39, and Table 7-40 summarize the total emission changes due to HSR operation for the Medium and High Ridership scenarios, including the indirect emissions from regional vehicle travel, aircraft, and power plants, and direct project operational emissions from HSR stations and train movements for the years 2015, 2029, and 2040. The project would result in a net regional decrease in emissions of criteria pollutants. These decreases would be beneficial to the Basin and help the Basin meet its attainment goals for O_3 and particulates (PM_{10} and $PM_{2.5}$). However, although lower ridership would result in fewer regional benefits, there would be a net benefit in the reduction in emissions when indirect and direct emissions are accounted for.

Table 7-35 2015 Regional Emissions Changes Due to High-Speed Rail Operations (Tons per Year) (Medium Ridership Scenario)

Activities	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Indirect Emissions							
Changes in VMT Emissions	-39	-53	-1,601	-163	-4	-113	-31
Changes in Airplane Emissions	-43	-44	-371	-357	-38	-11	-11
Changes in Power Plant Emissions	0	1	2	1	0	0	0
Direct Emissions							
HSR Station Operations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fugitive Dust from Train Operations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total[1]	**-83**	**-96**	**-1,971**	**-520**	**-42**	**-124**	**-41**

Source: California High-Speed Rail Authority, 2017
[1] The total includes the indirect and direct emissions.
CO = carbon monoxide
HSR = high-speed rail
N/A = not available
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-36 2015 Regional Emissions Changes Due to High-Speed Rail Operations (Tons per Year) (High Ridership Scenario)

Activities	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Indirect Emissions							
Changes in VMT Emissions	-55	-74	-2,229	-227	-6	-158	-43
Changes in Airplane Emissions	-41	-41	-350	-337	-36	-10	-10
Changes in Power Plant Emissions	0	1	2	1	0	0	0
Direct Emissions							
HSR Station Operations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fugitive Dust from Train Operations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total[1]	**-96**	**-114**	**-2,577**	**-563**	**-42**	**-167**	**-53**

Source: California High-Speed Rail Authority, 2017
[1] The total includes the indirect and direct emissions.
CO = carbon monoxide
HSR = high-speed rail
N/A = not available
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-37 2029 Regional Emissions Changes Due to High-Speed Rail Operations (Tons per Year) (Medium Ridership Scenario)

Activities	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Indirect Emissions							
Changes in VMT Emissions	-4	-6	-279	-22	-1	-61	-16
Changes in Airplane Emissions	-28	-28	-236	-232	-25	-7	-7
Changes in Power Plant Emissions	0	1	2	1	0	0	0
Direct Emissions							
HSR Station Operations	1	1	37	4	0	24	6
Fugitive Dust from Train Operations	N/A	N/A	N/A	N/A	N/A	0	0
Total[1]	**-31**	**-32**	**-476**	**-249**	**-26**	**-44**	**-17**

Source: California High-Speed Rail Authority, 2017
[1] The total includes the indirect and direct emissions.
CO = carbon monoxide
HSR = high-speed rail
N/A = not available
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-38 2029 Regional Emissions Changes Due to High-Speed Rail Operations (Tons per Year) (High Ridership Scenario)

Activities	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Indirect Emissions							
Changes in VMT Emissions	-5	-8	-390	-30	-2	-85	-22
Changes in Airplane Emissions	-31	-31	-259	-254	-28	-8	-8
Changes in Power Plant Emissions	0	1	2	1	0	0	0
Direct Emissions							
HSR Station Operations	1	1	37	4	0	24	6
Fugitive Dust from Train Operations	N/A	N/A	N/A	N/A	N/A	0	0
Total[1]	**-35**	**-37**	**-610**	**-279**	**-30**	**-69**	**-24**

Source: California High-Speed Rail Authority, 2017
[1] The total includes the indirect and direct emissions.
CO = carbon monoxide
HSR = high-speed rail
N/A = not available
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-39 2040 Regional Emissions Changes Due to High-Speed Rail Operations (Tons per Year) (Medium Ridership Scenario)

Activities	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Indirect Emissions							
Changes in VMT Emissions	-5	-8	-464	-34	-3	-149	-38
Changes in Airplane Emissions	-60	-60	-501	-493	-53	-15	-15
Changes in Power Plant Emissions	0	1	2	1	0	0	0
Direct Emissions							
HSR Station Operations	1	1	37	4	0	38	10
Fugitive Dust from Train Operations	N/A	N/A	N/A	N/A	N/A	0	0
Total[1]	**-64**	**-66**	**-926**	**-522**	**-56**	**-126**	**-43**

Source: California High-Speed Rail Authority, 2017
[1] The total includes the indirect and direct emissions.
CO = carbon monoxide
HSR = high-speed rail
N/A = not available
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

Table 7-40 2040 Regional Emissions Changes Due to High-Speed Rail Operations (Tons per Year) (High Ridership Scenario)

Activities	ROG	TOG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Indirect Emissions							
Changes in VMT Emissions	-7	-10	-617	-47	-4	-207	-53
Changes in Airplane Emissions	-56	-57	-472	-465	-50	-14	-14
Changes in Power Plant Emissions	0	1	2	1	0	0	0
Direct Emissions							
HSR Station Operations	1	1	37	4	0	38	10
Fugitive Dust from Train Operations	N/A	N/A	N/A	N/A	N/A	0	0
Total[1]	**-62**	**-65**	**-1,050**	**-507**	**-54**	**-183**	**-57**

Source: California High-Speed Rail Authority, 2017
[1] The total includes the indirect and direct emissions.
CO = carbon monoxide
HSR = high-speed rail
N/A = not available
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than 10 microns in size
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in size
ROG = reactive organic gas
SO_2 = sulfur dioxide
TOG = total organic gas
tons/yr = tons per year
VMT = vehicle miles traveled

7.7 Microscale Carbon Monoxide Analysis

A CO hot-spot analysis was performed for intersections that could potentially cause a localized CO hot-spot. The modeled CO concentrations were combined with CO background concentrations and compared with the air quality standards.

7.7.1 Intersections

The project would not worsen traffic conditions at intersections along the alignment because existing at-grade crossings would be grade-separated. Therefore, the CO analysis did not consider intersections along the alignment; instead, the analysis focused on locations near the HSR stations and on locations that would experience a change in roadway structure or traffic conditions. CO concentrations were modeled at five intersections near the proposed Burbank and Los Angeles HSR stations for existing conditions (2015) and for the proposed project conditions in 2029 and 2040. The intersections were selected based on those projected to have the greatest effect on LOS and/or traffic volumes as a result of the project and thus the worst-case scenario for CO emissions.

The results presented in Table 7-41 and Table 7-42 summarize the CO hot-spot analysis results at the Burbank Airport Station and LAUS, respectively, and include the HSR project as well as the natural growth in traffic and implementation of other transportation improvement projects in the region.

Table 7-41 Maximum Modeled Carbon Monoxide Concentrations at Intersections near the Burbank Airport Station

Intersection[1]	Existing Conditions[2]		Existing Plus Project[2]	
	Max 1-Hour CO Concentration (ppm)	Max 8-Hour CO Concentration (ppm)[3]	Max 1-Hour CO Concentration (ppm)	Max 8-Hour CO Concentration (ppm)[3]
Year 2015				
Laurel Canyon Blvd / Sherman Way	4.8	4.0	4.8	4.0
Hollywood Way / I-5 SB Ramps	4.7	3.9	4.8	4.0
Buena Vista St / Winona Ave	4.3	3.6	4.3	3.6
I-5 NB Ramps / San Fernando Rd	4.2	3.6	4.2	3.6
SR 170 SB Ramps / Victory Blvd	5.2	4.3	5.2	4.3
Year 2029				
Laurel Canyon Blvd / Sherman Way	4.1	3.5	4.1	3.5
Hollywood Way / I-5 SB Ramps	4.1	3.5	4.1	3.5
Buena Vista St / Winona Ave	3.8	3.3	3.8	3.3
I-5 NB Ramps / San Fernando Rd	4.0	3.4	4.0	3.4
SR 170 SB Ramps / Victory Blvd	4.4	3.7	4.4	3.7
Year 2040				
Laurel Canyon Blvd / Sherman Way	4.0	3.4	4.0	3.4
Hollywood Way / I-5 SB Ramps	4.0	3.4	4.0	3.4
Buena Vista St / Winona Ave	3.8	3.3	3.8	3.3
I-5 NB Ramps / San Fernando Rd	3.9	3.4	3.9	3.4
SR 170 SB Ramps / Victory Blvd	4.2	3.6	4.2	3.6

Source: California High-Speed Rail Authority, 2017
[1] All proposed grade crossing configurations are pending California Public Utilities Commission approval.
[2] Concentrations include a predicted 1-hour background concentration of 3.4 ppm and an 8-hour background concentration of 3.0 ppm, representing the second-highest measured CO concentrations in years 2014–2016 at the 228 N Palm Avenue, Burbank, California, air monitoring station.
[3] A persistence factor of 0.7 was used to estimate the 8-hour CO concentrations based on the generalized persistence factor for urban locations in the CO Protocol (Caltrans 1997).
Caltrans = California Department of Transportation
CO = carbon monoxide
I = Interstate
NB = northbound
ppm = parts per million
SB = southbound
SR = State Route

Table 7-42 Maximum Modeled Carbon Monoxide Concentrations at Intersections near Los Angeles Union Station

Intersection[1]	Existing Conditions[2]		Existing Plus Project[2]	
	Max 1-Hour CO Concentration (ppm)	Max 8-Hour CO Concentration (ppm)[3]	Max 1-Hour CO Concentration (ppm)	Max 8-Hour CO Concentration (ppm)[3]
Year 2015				
Broadway / E Cesar E. Chavez Ave	3.7	2.8	3.7	2.8
Alameda St / Aliso St – Commercial St	3.4	2.6	3.4	2.6
Garey St–US-101 SB On-/Off-Ramps / Commercial St	3.1	2.4	3.1	2.4
Center St / Commercial St	3.0	2.4	3.0	2.4
Mission Rd / E Cesar E. Chavez Ave	3.5	2.7	3.5	2.7
Year 2029				
Broadway / E Cesar E. Chavez Ave	3.1	2.4	3.1	2.4
Alameda St / Aliso St – Commercial St	2.9	2.3	2.9	2.3
Garey St–US-101 SB On-/Off-Ramps / Commercial St	2.8	2.2	2.8	2.2
Center St / Commercial St	2.7	2.1	2.7	2.1
Mission Rd / E Cesar E. Chavez Ave	3.0	2.4	3.0	2.4
Year 2040				
Broadway / E Cesar E. Chavez Ave	3.0	2.4	3.1	2.4
Alameda St / Aliso St – Commercial St	2.9	2.3	3.0	2.4
Garey St–US-101 SB On-/Off-Ramps / Commercial St	2.7	2.1	2.7	2.1
Center St / Commercial St	2.7	2.1	2.7	2.1
Mission Rd / E Cesar E. Chavez Ave	3.0	2.4	3.1	2.4

Source: California High-Speed Rail Authority, 2017

[1] All proposed grade crossing configurations are pending California Public Utilities Commission approval.

[2] Concentrations include a predicted 1-hour background concentration of 2.5 ppm and an 8-hour background concentration of 2.0 ppm, representing the second-highest measured CO concentrations in years 2014–2016 at the 1630 N Main St, Los Angeles, California, air monitoring station.

[3] A persistence factor of 0.7 was used to estimate the 8-hour CO concentrations based on the generalized persistence factor for urban locations in the CO Protocol (Caltrans 1997).

Caltrans = California Department of Transportation
CO = carbon monoxide
EB = eastbound
I = Interstate
Max = maximum
ppm = parts per million
SB = southbound
SR = State Route
US = United States Route

7.8 Particulate Matter Analysis

Based on the PM qualitative analysis performed, and as discussed below, the project would provide regional benefits by reducing the regional VMT compared to the No Project Alternative and existing conditions, which would reduce PM_{10} and $PM_{2.5}$ emissions from regional vehicle travel. The project area location is designated nonattainment for $PM_{2.5}$ and attainment/maintenance for PM_{10}.

The USEPA specifies in 40 C.F.R. Part 93.123(b)(1) that only projects of air quality concern are required to undergo a $PM_{2.5}$ and PM_{10} hot-spot analysis. The USEPA defines projects of air quality concern as certain highway and transit projects that involve significant levels of diesel traffic or any other project identified by the $PM_{2.5}$ SIP as a localized air quality concern. Projects of air quality concern, as defined by 40 C.F.R. Part 93.123(b)(1), include the following:

(i) New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles;

(ii) Projects affecting intersections that are at Level-of-Service D, E, or F with a significant number of diesel vehicles, or those that will change to Level-of-Service D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project;

(iii) New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;

(iv) Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and

(v) Projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ or PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

The proposed project is not a new highway project, nor would it expand an existing highway beyond its current capacity. The HSR vehicles would be electrically powered. While the project would affect traffic conditions on roadways near the stations, it should not measurably affect truck volumes on the affected roadways. Most vehicle trips entering and leaving the station locations would be passenger vehicles, which are typically not diesel-powered, with the exception of delivery truck trips to support station activities. Furthermore, the HSR project would improve regional traffic conditions by reducing traffic congestion, increasing vehicle speeds, and reducing regional VMT within the project vicinity.

Generally, the HSR project would not change the existing traffic mix at signalized intersections. In some cases, the LOS of intersections near the HSR stations would change from LOS D/E under the No Project Alternative to LOS F under the HSR Build Alternative. However, the traffic volume increases at the affected intersections would be primarily from passenger cars and transit buses used for transporting people to or from the stations. Passenger cars would be gasoline-powered and consequently would not add to the number of diesel-fueled vehicles.

BurbankBus is the transit operator in Burbank, and currently operates clean-burning natural gas buses (BurbankBus 2009). Metro is the transit operator in Los Angeles County, with service also in Burbank and Glendale, and it currently operates a fleet of all natural gas buses (Metro 2011). The City of Los Angeles Department of Transportation (LADOT) also provides bus service through DASH and Commuter Express in Los Angeles. LADOT offers clean air alternatives with new compressed natural gas or propane powered buses (LADOT 2016). Therefore, the HSR Build Alternative would not measurably increase the number of diesel vehicles at these intersections used by project-related traffic.

The project would not have new or expanded bus or rail terminals or transfer points that significantly increase the number of diesel vehicles congregating at a single location. Although the project would include passenger rail terminals, there would not be a significant number of diesel vehicles congregating at a single location. Improved bus service is not part of the HSR project. If the local bus service were to be improved to better serve the HSR stations, it would be subject to the local transit authority’s environmental review.

In summary, the trains used for the project would be electric-multiple-unit trains, powered by electricity, not diesel fuel. Most vehicle trips entering and leaving the station would be passenger vehicles, which are not typically diesel-powered. Therefore, the project is not expected to result in an increase in PM_{10} and $PM_{2.5}$ emissions.

7.9 Odors

7.9.1 General Operations

No potentially odorous emissions would be associated with the train operation because the trains would be powered from the regional electrical grid. There would also be some area source emissions associated with station operation, such as natural-gas combustion for space and water heating, landscaping equipment emissions, and minor solvent and paint use. The solvent and paint use would have the potential to be odorous sources to sensitive receptors in areas where the stations are located.

7.10 Mobile-Source Air Toxics Analysis

In accordance with FHWA's *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents,* released October 18, 2016 (FHWA 2016)*,* the qualitative assessment presented below is derived, in part, from a study conducted by FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives* (FHWA 2012). It is provided as a basis for identifying and comparing the potential differences in MSAT emissions, if any, among the HSR Build Alternative, existing conditions, and the No Project Alternative.

7.10.1 Regional Mobile-Source Air Toxics Effects

Under the HSR Build Alternative, the proposed HSR would use electric multiple units, with the power distributed to each train car via the overhead contact system. Operation of the electric-multiple-unit trains would not generate combustion emissions; therefore, no toxic emissions would be expected from operation of the HSR.

The HSR Build Alternative would decrease regional VMT and MSAT emissions compared to the existing conditions and No Project Alternative. The use of the HSR over other modes of travel would reduce the number of individual vehicle trips on a regional basis. Because the HSR Build Alternative would not substantially change the regional traffic mix, the amount of MSATs emitted from highways and other roadways within the study area would be proportional to the VMT. Because the regional VMT estimated for the HSR Build Alternative would be less than the existing conditions and No Action Alternative in 2040, MSAT emissions from regional vehicle traffic would be less for the HSR Build Alternative compared to the existing conditions in 2015 and the No Project Alternative in 2040.

The HSR Build Alternative would also result in lower traffic volumes and increased vehicle speed when compared to the No Project Alternative because people would use the HSR instead of driving. Fewer automobiles on public roadways would lessen traffic volume conditions during peak traffic periods. According to the USEPA's MOVES2010b model, emissions of all priority MSATs, except for DPM, decrease as speed increases (USEPA 2009). Therefore, the HSR Build Alternative would result in further decreased MSAT emissions due to the decline in vehicular traffic volumes and increases in the use of cleaner fuel technology in vehicles.

Based on an FHWA analysis using EPA's MOVES2010b model, emissions will likely be lower than present levels in 2040 regardless of the HSR Build Alternative as a result of the USEPA's national control programs. These control programs are projected to reduce annual MSAT emissions by 83 percent for the same time period. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

7.10.2 Local Mobile-Source Air Toxics Effects

The potential MSAT emission sources directly related to project operation would be from passenger vehicles traveling to and from the HSR stations. Localized emissions related to the stations would be substantially reduced due to implementation of the USEPA's vehicle and fuel regulations. The HSR Build Alternative would decrease regional MSAT emissions compared with the No Project Alternative.

7.10.3 Uncertainties of Mobile-Source Air Toxics Analysis

Because of the lack of a national consensus on an acceptable level of risk, uncertainties about other air quality criteria assumed to protect the public health and welfare, and uncertainties about the reliability of available technical tools, the project-specific health effects of the emission changes associated with the alternative evaluated in this assessment cannot be predicted with confidence. The outcome of such an assessment would be influenced more by the uncertainty introduced into the process by the assumptions made than insight into the actual health effects from MSAT exposure directly attributable to the proposed action. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 C.F.R. 1502.22[b]) regarding incomplete or unavailable information.

In FHWA's view, information is incomplete or unavailable to predict the project-specific health effects due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumptions and speculation rather than by insight into the actual health effects directly attributable to MSAT exposure associated with the proposed action.

The USEPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. It is the lead authority for administering the CAA and its amendments and has specific statutory obligations with respect to hazardous air pollutant and MSATs. The USEPA continues to assess human health effects, exposures, and risks posed by air pollutants. The USEPA maintains the Integrated Risk Information System, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (USEPA 2011b). Each report contains assessments of noncancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures, with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in researching and analyzing the human health effects of MSATs, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents* (FHWA 2012). Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious are the adverse human health effects of MSAT compounds at current environmental concentrations[11] or in the future as vehicle emissions substantially decrease[12]

The methodologies for forecasting health effects include emissions modeling, dispersion modeling, exposure modeling, and final determination of health effects—each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health effects among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70-year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affect emissions rates) over that time frame inasmuch as such information is unavailable. The results produced by the USEPA's MOBILE6.2 model, California EPA's EMFAC model, and the USEPA's MOVES2010b model in forecasting MSAT emissions are inconsistent. For example, indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates DPM emissions and significantly overestimates benzene emissions.

[11] HEI. 2007. http://pubs.healtheffects.org/view.php?id=282.

[12] HEI. 2010. https://www.healtheffects.org/publication/traffic-related-air-pollution-critical-review-literature-emissions-exposure-and-health.

Regarding air-dispersion modeling, an extensive evaluation of the USEPA's guideline CAL3QHC model was conducted in a National Cooperative Highway Research Program (NCHRP) study (NCHRP 2015), which documents poor model performance at 10 sites across the country: three where intensive monitoring was conducted, and seven where less-intensive monitoring was conducted. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections. Such poor model performance is less difficult to manage for demonstrating compliance with NAAQS for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given the fact that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to reliably forecast MSAT exposure near roadways and to determine the portion of time that people are actually exposed at a specific location.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT compounds, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (HEI 2007). As a result, no national consensus exists on the air dose-response values assumed to protect the public health and welfare for MSAT compounds, particularly for DPM. The USEPA[13] has not established a basis for quantitative risk assessment of DPM in ambient settings.

There is also a lack of a national consensus on an acceptable level of risk. The current context is the process used by the USEPA, as provided by the CAA, to determine whether more-stringent controls are required to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect from industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires the USEPA to determine a "safe" or "acceptable" level of risk from emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million from source emissions. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could indicate maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld the USEPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest highway projects would result in levels of risk greater than are deemed to be safe or acceptable.

Because of the limitations in the methodologies for forecasting health effects described above, any predicted difference in health effects among alternatives is likely to be much smaller than the uncertainties associated with predicting the effects. Consequently, the results of such assessments would not be useful to decision-makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities and improving access for emergency response, which are better suited for quantitative analysis.

7.11 Asbestos Emission Analysis

Los Angeles County is designated by the California Department of Conservation, Department of Mines and Geology, as an area not likely to contain ultramafic rocks in outcrops ("Reported Historic Asbestos Mines, Historic Asbestos Prospects, and Other Natural Occurrences of Asbestos in California (U.S. Geological Survey 2011). As such, NOA is not anticipated to be present within the project section.

[13] USEPA (www.epa.gov/risk/basicinformation.htm#g) and HEI (http://pubs.healtheffects.org/getfile.php?u=395).

7.12 Greenhouse Gas Emission Analysis

Guidance for the analysis of GHG emissions is provided at the state, regional, and local levels. This guidance provides a comprehensive and complementary approach for the analysis of the potential effects of GHG emissions. Due to the global nature of GHG emissions and the nature of the electrical grid system, GHGs are examined on a statewide level. However, regional and local guidance will be considered as a component of the overall statewide goal to reduce GHG emissions.

The HSR project, which is included in the AB 32 Scoping Plan as Measure #T-9, would help the state to meet its GHG emissions reduction goals (CARB 2008). As shown below, the project operation overall would result in a net reduction in GHG emissions.

Table 7-43 reports the statewide GHG emissions (expressed in terms of CO_2e) that would result from the Build Alternative for the two potential ridership scenarios (Medium and High Ridership) under the existing baseline condition (2015), the opening year condition (2029), and the horizon year condition (2040).

Table 7-43 Estimated Statewide Greenhouse Gas Emissions for the High-Speed Rail Build Alternative Under the Medium and High Ridership Scenarios

Project Element	CO_2e Emissions Due to HSR (MMT/yr)	
	Medium Ridership Scenario	High Ridership Scenario
Year 2015		
Roadways	62.9	62.2
Planes	1.6	1.5
Energy (power plants)	N/A	N/A
Total	**64.5**	**63.7**
Year 2029		
Roadways	45.4	46.3
Planes	2.4	1.9
Energy (power plants)	N/A	N/A
Total	**47.8**	**48.2**
Year 2040		
Roadways	41.5	42.2
Planes	2.3	2.7
Energy (power plants)	N/A	N/A
Total	**43.8**	**44.9**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
High V2V = Silicon Valley to Central Valley High
HSR = high-speed rail
Med V2V = Silicon Valley to Central Valley Medium
Med V2V Ext = Silicon Valley to Central Valley Medium Extension
MMT/yr = million metric tons per year
N/A = not available

Table 7-43 summarizes the statewide GHG emission changes (expressed in terms of CO_2e) that would result from the project for the two potential scenarios (Medium and High Ridership Scenarios) under the existing year (2015), opening year condition (2029), and the horizon year condition (2040), compared to No Project baseline conditions. The No Project baseline GHG emissions for the two scenarios and the three baseline years are described above in Section 7.3. As shown, the project is predicted to result in a net reduction in statewide GHG emissions under the existing and future conditions (opening year and horizon year).

Despite increases in power plant emissions from the project section plus all other statewide activity between 2015 and 2040, total statewide GHG emissions in 2040 would be less than the level of GHG emissions in 2015. As shown in Table 7-44, the primary factor for the net decrease in emissions is from decreases in on-road vehicle emissions related to advancements in vehicle emissions technology and the retirement of older, higher-emitting vehicles. Aircraft emissions would increase slightly with or without the project section because of growth in the state. Therefore, the project section's effect on GHG emissions would be beneficial with respect to both the 2015 existing baseline and the 2040 no project baseline.

Table 7-44 Estimated Statewide Greenhouse Gas Emission Changes Due to the High-Speed Rail Project Under the Medium and High Ridership Scenarios

Project Element	Change in CO_2e Emissions Due to HSR (MMT/yr)	
	Medium Ridership	High Ridership
Year 2015		
Roadways	-1.1	-1.5
Planes	-0.7	-0.7
Energy (power plants)	0.5	0.5
Total	**-1.3**	**-1.6**
Year 2029		
Roadways	-0.4	-0.3
Planes	-0.5	-0.5
Energy (power plants)	0.4	0.4
Total	**-0.5**	**-0.3**
Year 2040		
Roadways	-0.5	-1.1
Planes	-1.0	-0.9
Energy (power plants)	0.5	0.5
Total	**-1.0**	**-1.5**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT = million metric tons

7.12.1 On-Road Vehicles Emissions

The HSR Build Alternative would reduce daily roadway VMT because some travelers would use the HSR for intercity, regional, and statewide travel over other modes of travel. The on-road vehicle emission analysis is based on projected VMT changes and associated average daily speed estimates, calculated for each affected county as part of the project's transportation analysis. GHG emission factors were obtained from EMFAC2014, using statewide parameters. As shown in Table 7-45, the proposed project is predicted to have no measurable change or reduce GHG emissions when compared with the No Project Alternative. This is demonstrated on both a county and statewide level.

Table 7-45 On-Road Vehicle Greenhouse Gas Emission Changes

Area	No Project Annual VMT Total Traffic		HSR Build Alternative Annual VMT Total Traffic		Change in CO_2e Emissions Due to HSR (MMT/yr)	
	Medium Ridership	High Ridership	Medium Ridership	High Ridership	Medium Ridership	High Ridership
Year 2015						
Los Angeles	73,394,193,078	73,236,845,700	72,724,087,184	72,310,888,632	-0.2	-0.3
Regional Total	134,439,470,419	134,069,313,333	133,438,910,677	132,676,593,479	-0.3	-0.4
Statewide Total	**205,015,920,154**	**203,997,417,634**	**201,584,933,649**	**199,280,213,986**	**-1.1**	**-1.5**
Year 2029						
Los Angeles	83,292,097,055	84,124,984,453	82,912,308,772	83,596,457,306	-0.1	-0.1
Regional Total	157,422,880,677	159,183,822,315	156,863,818,928	158,401,892,692	-0.1	-0.2
Statewide Total	**240,475,748,703**	**245,782,498,313**	**238,209,151,397**	**242,644,922,069**	**-0.4**	**-0.3**
Year 2040						
Los Angeles	86,055,909,405	87,075,870,799	85,124,593,011	85,788,971,213	-0.2	-0.2
Regional Total	168,726,780,657	171,001,063,481	167,336,197,916	169,065,454,730	-0.2	-0.3
Statewide Total	**261,252,464,970**	**269,784,125,131**	**256,484,063,423**	**263,228,132,814**	**-0.5**	**-1.1**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CA = California
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT/yr = million metric tons per year
VMT = vehicle miles traveled

7.12.2 Airport Emissions

As shown in Table 7-46, the HSR is predicted to reduce the number of plane flights because travelers would use the HSR rather than fly to their destination. Therefore, the proposed project would either have no measurable effect or may reduce regional emissions due to the HSR compared with the No Project Alternative.

Table 7-46 Aircraft Greenhouse Gas Emission Changes Due to the High-Speed Rail Project Under the Medium and High Ridership Scenarios

Area	Total No Project Number of Flights (per year)		Build Alternative Number of Flights (per year)		Change in CO_2e Emissions Due to HSR (MMT/yr)	
	Medium Ridership	High Ridership	Medium Ridership	High Ridership	Medium Ridership	High Ridership
Year 2015						
Southern CA	107,915	100,674	73,378	68,130	-0.3	-0.3
Statewide Total	**268,567**	**250,276**	**188,430**	**173,177**	**-0.7**	**-0.7**
Year 2029						
Southern CA	130,344	107,443	107,802	82,707	-0.2	-0.2
Statewide Total	**329,614**	**273,240**	**277,475**	**215,599**	**-0.5**	**-0.5**
Year 2040						
Southern CA	149,961	162,667	101,962	117,437	-0.4	-0.4
Statewide Total	**380,189**	**416,659**	**268,814**	**309,505**	**-1.0**	**-0.9**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CA = California
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT/yr = million metric tons per year

As shown in Table 7-47, the proposed project is predicted either to have no measurable effect or to slightly reduce regional emissions due to the HSR, when compared to the No Project Alternative, under both future conditions (opening year and horizon year).

7.12.3 Power Plant Emissions

The HSR project would increase electrical requirements when compared to the No Project Alternative. The electrical demands due to propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities were calculated as part of the statewide HSR project design. Average GHG emission factors for each kilowatt-hour required were derived from USEPA eGRID electrical generation data. As shown in Table 7-47, the project's electrical requirements would increase statewide and regional indirect GHG emissions.

Table 7-47 Power Plant Greenhouse Gas Emission Changes Due to the High-Speed Rail Project Under the Medium and High Ridership Scenarios

Area	Change in CO_2e Emissions Due to HSR (MMT/yr)	
	Medium Ridership	High Ridership
Year 2015		
Burbank to Los Angeles	0.0	0.0
Statewide Total	**0.5**	**0.5**
Year 2029		
Burbank to Los Angeles	0.0	0.0
Statewide Total	**0.4**	**0.4**
Year 2040		
Burbank to Los Angeles	0.0	0.0
Statewide Total	**0.5**	**0.5**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMBTU = million British thermal units
MMT/yr = million metric tons per year

To derive the portion of electricity usage required by the Burbank to Los Angeles Project Section, a percentage was applied to each HSR project section based on the alignment distance for that project section, compared to the length of the entire HSR system. Accordingly, the Burbank to Los Angeles Project Section is assumed to account for approximately 1 percent of the statewide electricity usage of the HSR system. The state's electrical grid would power the HSR system; therefore, no single generation source for the electrical power requirements can be identified. As previously discussed, the state requires an increasing fraction (33 percent by 2020 and 50 percent by 2030) of electricity generated for the state's power portfolio to come from renewable energy sources, and the Authority has a policy goal to use 100 percent renewable energy to power the HSR system. As such, the GHG emissions generated for powering the HSR system are expected to be lower in the future compared to emission estimates used in this analysis.

7.12.4 Regional Greenhouse Gas Emission from Operations

A summary of the project's effects on regional GHG emissions, which include the emissions from vehicles, aircraft, and power plants, is shown in Table 7-48. As shown, the proposed project would reduce regional GHG emissions compared with the No Project Alternative.

7.13 Construction Emission Analysis

7.13.1 Regional Construction Emission Analysis

7.13.1.1 Construction Emissions

Construction activities associated with the HSR Build Alternative would result in criteria pollutant and GHG emissions. Construction emissions for the Build Alternative are quantified and analyzed in this section. Project construction activities expected to occur during the same calendar year were summarized according to the construction schedule presented in Appendix A. The summary of the HSR construction emissions for the Burbank to Los Angeles Project Section over the entire construction period are shown in Table 7-49. The project emissions were also calculated on an annual basis, with units in tons per year and the daily maximum basis expressed in pounds per day, and are shown in Table 7-49.

Table 7-48 Regional Greenhouse Gas Changes Due to the High-Speed Rail Project Under the Medium and High Ridership Scenarios

Emission Sources	Change in CO_2e Emissions Due to HSR (MMT/yr)	
	Medium Ridership	High Ridership
2015		
Regional VMT	-0.3	-0.4
Regional Airports	-0.3	-0.3
Indirect Regional Power	0.0	0.0
Net Regional Difference	**-0.6**	**-0.7**
2029		
Regional VMT	-0.1	-0.2
Regional Airports	-0.2	-0.2
Indirect Regional Power	0.0	0.0
Net Regional Difference	**-0.3**	**-0.4**
2040		
Regional VMT	-0.2	-0.3
Regional Airports	-0.4	-0.4
Indirect Regional Power	0.0	0.0
Net Regional Difference	**-0.6**	**-0.7**

Source: California High-Speed Rail Authority, 2017
Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT/yr = million metric tons per year
VMT = vehicle miles traveled

Table 7-49 Burbank to Los Angeles Project Section Construction Emissions

Emission Measurement	Emissions[1]					
	VOCs	CO	NO_X	SO_2	PM_{10}[2]	$PM_{2.5}$[2]
Maximum Daily (lbs/day)	45.99	708.97	482.11	1.69	80.45	28.00
Maximum Annual (tons/year)	3.09	71.92	22.07	0.18	15.93	2.94
Total (tons/construction duration)	**13.18**	**313.51**	**92.64**	**0.76**	**78.13**	**14.26**

Source: California High-Speed Rail Authority, 2019
[1] Emissions include HSR construction as well as roadway projects that are not included in RTPs.
[2] The PM_{10} and $PM_{2.5}$ emissions consist of the exhaust and fugitive dust emissions.
CO = carbon monoxide
HSR = high-speed rail
lbs/day = pounds per day
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
RTP = Regional Transportation Plan
SO_2 = sulfur dioxide
VOC = volatile organic compound

7.13.1.2 Construction Emission Analysis Summary

The predominant pollutants associated with construction of the alignment and stations would be fugitive dust (PM_{10} and $PM_{2.5}$) from earthmoving and disturbed earth surfaces and from combustion pollutants, particularly O_3 precursors (NO_X and VOCs), from heavy equipment and trucks. Emissions would be released within the Basin. Details of emissions from the HSR Build Alternative from all construction phases of the HSR are presented in the following section and in Table 7-50. Details are provided in Appendix A.

Table 7-50 High-Speed Rail Build Alternative Programmatic Construction Emissions

Activities	VOC	CO	NO_X	SO_X	PM_{10}[1]	$PM_{2.5}$[1]
SCAQMD annual CEQA significance thresholds (pounds per day)	75	550	100	150	150	55
Annual general conformity *de minimis* levels (tons/yr)[2]	10	100	10	N/A	100	70
Year 2020						
Emissions (lbs/day)	16.28	360.00	**172.93**	0.98	64.23	15.82
Exceeds SCAQMD CEQA thresholds?	No	No	**Yes**	No	No	No
Emissions (tons/yr)	1.21	28.95	**11.88**	0.07	9.56	1.66
Exceeds *de minimis* levels?	No	No	**Yes**	N/A	No	No
Year 2021						
Emissions (lbs/day)	41.42	**644.93**	**482.11**	1.45	80.45	28.00
Exceeds SCAQMD CEQA thresholds?	No	**Yes**	**Yes**	No	No	No
Emissions (tons/yr)	2.55	57.32	**22.07**	0.15	13.01	2.50
Exceeds *de minimis* levels?	No	No	**Yes**	N/A	No	No
Year 2022						
Emissions (lbs/day)	45.99	**552.30**	**171.07**	1.37	65.39	17.14
Exceeds SCAQMD CEQA thresholds?	No	**Yes**	**Yes**	No	No	No
Emissions (tons/yr)	3.09	65.21	**20.88**	0.16	13.65	2.68
Exceeds *de minimis* levels?	No	No	**Yes**	N/A	No	No
Year 2023						
Emissions (lbs/day)	23.29	545.91	**134.54**	1.36	65.29	16.79
Exceeds SCAQMD CEQA thresholds?	No	No	**Yes**	No	No	No
Emissions (tons/yr)	2.57	63.16	**16.49**	0.16	13.51	2.62
Exceeds *de minimis* levels?	No	No	**Yes**	N/A	No	No
Year 2024						
Emissions (lbs/day)	29.23	**708.97**	**180.65**	1.69	75.75	18.67
Exceeds SCAQMD CEQA thresholds?	No	**Yes**	**Yes**	No	No	No
Emissions (tons/yr)	2.87	71.92	**20.45**	0.18	15.93	2.94
Exceeds *de minimis* levels?	No	No	**Yes**	N/A	No	No
Year 2025						
Emissions (lbs/day)	22.41	**567.33**	**150.98**	1.37	58.04	12.99
Exceeds SCAQMD CEQA thresholds?	No	**Yes**	**Yes**	No	No	No
Emissions (tons/yr)	2.24	61.73	**13.21**	0.14	14.47	2.60
Exceeds *de minimis* levels?	No	No	**Yes**	N/A	No	No
Year 2026						
Emissions (lbs/day)	17.48	456.58	98.42	1.01	64.07	11.61
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	1.41	34.81	7.51	0.08	10.49	1.77
Exceeds *de minimis* levels?	No	No	No	N/A	No	No

Activities	VOC	CO	NO_X	SO_X	PM_{10}[1]	$PM_{2.5}$[1]
Year 2027						
Emissions (lbs/day)	9.94	218.82	51.19	0.49	18.46	2.23
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.08	1.76	0.36	0.00	3.37	0.41
Exceeds *de minimis* levels?	No	No	No	N/A	No	No
Year 2028						
Emissions (lbs/day)	0.43	8.66	0.94	0.02	1.04	0.30
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.03	0.57	0.06	0.00	0.07	0.02
Exceeds *de minimis* levels?	No	No	No	N/A	No	No

Source: California High Speed Rail Authority, 2019

[1] The PM_{10} and $PM_{2.5}$ emissions consist of exhaust and fugitive dust emissions.

[2] Pursuant to NEPA, effects on air quality would be considered an adverse effect if the HSR Build Alternative criteria pollutant emissions would exceed the general conformity *de minimis* levels in a nonattainment or maintenance area. It is currently assumed that general conformity will apply only to construction of the HSR Build Alternative, because operation of the HSR Build Alternative is expected to decrease regional emissions of criteria pollutants.

CEQA = California Environmental Quality Act
CO = carbon monoxide
HSR = high-speed rail
lbs/day = pounds per day
NEPA = National Environmental Policy Act
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SCAQMD = South Coast Air Quality Management District
SO_X = sulfur oxides
tons/yr = tons per year
VOC = volatile organic compound

During construction, programmatic emission reduction measures would be applied such as AQ-IAMF #1, including watering exposed surfaces twice daily, watering unpaved roads three times daily, reducing vehicle speeds on unpaved roads to 15 mph, and ensuring that haul trucks are covered. However, construction emissions would exceed the daily emission SCAQMD CEQA thresholds for CO and NO_X in some construction years.

7.13.2 Early Action Projects Construction Emission Analysis

Construction emissions have the potential to cause elevated criteria pollutant emissions to the local communities. These elevated emission levels may cause or contribute to exceedances of the general conformity *de minimis* emission thresholds and/or SCAQMD significance thresholds. Construction emissions associated with several early action projects would occur from the construction equipment and truck activity at four roadway undercrossing grade separations (i.e., Sonora Avenue, Grandview Avenue, Flower Street, and Goodwin Avenue/Chevy Chase Drive), one roadway overcrossing grade separation (i.e., Main Street), and improvements at a regional passenger rail station (Burbank Metrolink Station).

Table 7-51 presents the criteria pollutant emissions during construction of these project components.

Table 7-51 Early Action Projects Construction Emissions

Activities	VOC	CO	NO_X	SO_X	PM_{10}[1]	$PM_{2.5}$[1]
SCAQMD Daily CEQA significance thresholds (lbs per day)	75	550	100	150	150	55
Annual general conformity *de minimis* levels (tons/yr)[2]	10	100	10	N/A	100	70
Burbank Metrolink Station Improvements						
Emissions (lbs/day)	0.60	6.25	0.68	0.02	1.58	0.43
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.07	0.83	0.09	0.00	0.20	0.05
Exceeds *de minimis* levels?	No	No	No	N/A	No	No
Sonora Avenue Roadway Undercrossing						
Emissions (lbs/day)	6.64	119.21	28.00	0.29	13.29	3.80
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.40	7.79	1.83	0.02	0.85	0.25
Exceeds *de minimis* levels?	No	No	No	N/A	No	No
Grandview Avenue Roadway Undercrossing						
Emissions (lbs/day)	6.37	119.21	28.00	0.29	13.29	3.80
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.53	10.57	2.44	0.03	1.19	0.34
Exceeds *de minimis* levels?	No	No	No	N/A	No	No
Flower Street Roadway Undercrossing						
Emissions (lbs/day)	5.76	111.89	25.32	0.26	10.87	3.67
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.47	9.95	2.21	0.02	0.98	0.28
Exceeds *de minimis* levels?	No	No	No	N/A	No	No
Goodwin Avenue Roadway Undercrossing						
Emissions (lbs/day)	3.54	92.83	25.58	0.21	7.05	3.67
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.22	6.03	1.67	0.01	0.27	0.09
Exceeds *de minimis* levels?	No	No	No	N/A	No	No
Main Street Roadway Overcrossing						
Emissions (lbs/day)	8.50	134.26	33.78	0.34	18.79	5.28
Exceeds SCAQMD CEQA thresholds?	No	No	No	No	No	No
Emissions (tons/yr)	0.93	16.37	4.08	0.04	2.30	0.65
Exceeds *de minimis* levels?	No	No	No	N/A	No	No

Source: California High Speed Rail (2018)

[1] The PM_{10} and $PM_{2.5}$ emissions consist of exhaust and fugitive dust emissions.

[2] Pursuant to NEPA, effects on air quality would be considered an adverse effect if the HSR Build Alternative criteria pollutant emissions would exceed the general conformity *de minimis* levels in a nonattainment or maintenance area. It is currently assumed that general conformity will apply only to construction of the HSR Build Alternative, because operation of the HSR Build Alternative is expected to decrease regional emissions of criteria pollutants.

CEQA = California Environmental Quality Act
CO = carbon monoxide
lbs/day = pounds per day
NEPA = National Environmental Policy Act
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SCAQMD = South Coast Air Quality Management District
SO_X = sulfur oxides
tons/yr = tons per year
VOC = volatile organic compound

7.13.3 Other Localized Construction Emission Analysis

Construction emissions have the potential to cause elevated criteria pollutant concentrations. As shown in Table 7-50, the construction-related daily CO and NO_x emissions exceeded the CEQA significance thresholds, and the annual NOx emission exceeded the general conformity *de minimis* level. These elevated CO and NO_2 concentrations may cause or contribute to exceedances of the NAAQS and the CAAQS, which are established concentrations of criteria pollutants that provide public health protection. Sensitive receptors (such as schools, residences, and health care facilities) are located near the construction areas throughout the project section.

For the purposes of the dispersion modeling analysis and health risk assessment, the following six construction areas were evaluated for the potential to cause localized air quality effects:

- Burbank sequential excavation method Tunneling and Cut and Cover Construction Area
  - Construction of a 1.8-mile segment of the below-grade alignment south of Burbank Airport Station under the Hollywood Burbank Airport Runway 8-26, Taxiway D, the proposed extended Taxiway C, and critical airport safety zones and then via cut-and-cover method from south of the runway/taxiways to Victory Place
- Burbank Boulevard Overcrossing Construction Area
  - Construction of a grade separation of Burbank Boulevard over new rail tracks along with the demolition of several buildings, construction of at-grade tracks south to Alameda Avenue, and a rail bridge over Alameda Avenue
- Glendale 2-Mile Rail Segment
  - Construction of a 2-mile segment of the at-grade alignment between SR 134 and Los Feliz Boulevard
- Metrolink CMF Rail Track Reconfiguration Area
  - Construction of at-grade rail tracks from SR-2 to SR-110
  - Reconfiguration of the Metrolink CMF
- Main Street Grade Separation Construction Area
  - Construction of grade separation areas (Main Street)
  - Construction of the at-grade rail track alignment
- LAUS Platform Construction
  - Construction of the LAUS platforms

Figure 7-1, Figure 7-2, Figure 7-3, Figure 7-4, Figure 7-5, and Figure 7-6 presents the six construction areas for the dispersion modeling analysis and health risk assessment. The construction emissions are associated with several different phases, such as mobilization, demolition, earthmoving, land clearing, station construction, track construction, and roadway and rail bridges construction.

Thresholds for CO, and NO_2 are absolute thresholds based on the ambient air quality standards. This means that the highest modeled project concentrations must be added to the monitored ambient background concentrations to yield total concentrations for comparison to the ambient air quality standard thresholds.

As described in Section 8, below, AQ-IAMF#1 (Fugitive Dust Emissions), and AQ-IAMF#2 (Selection of Coatings), AQ-IAMF#4 Reduce Criteria Exhaust Emissions from Construction Equipment, AQ-IAMF#5 (Reduce Criteria Exhaust Emissions from On-Road Construction Equipment) and AQ-IAMF#6 (Reduce the Potential Impact of Concrete Batch Plants) are included as part of the HSR Build Alternative and would be implemented to avoid or minimize effects.

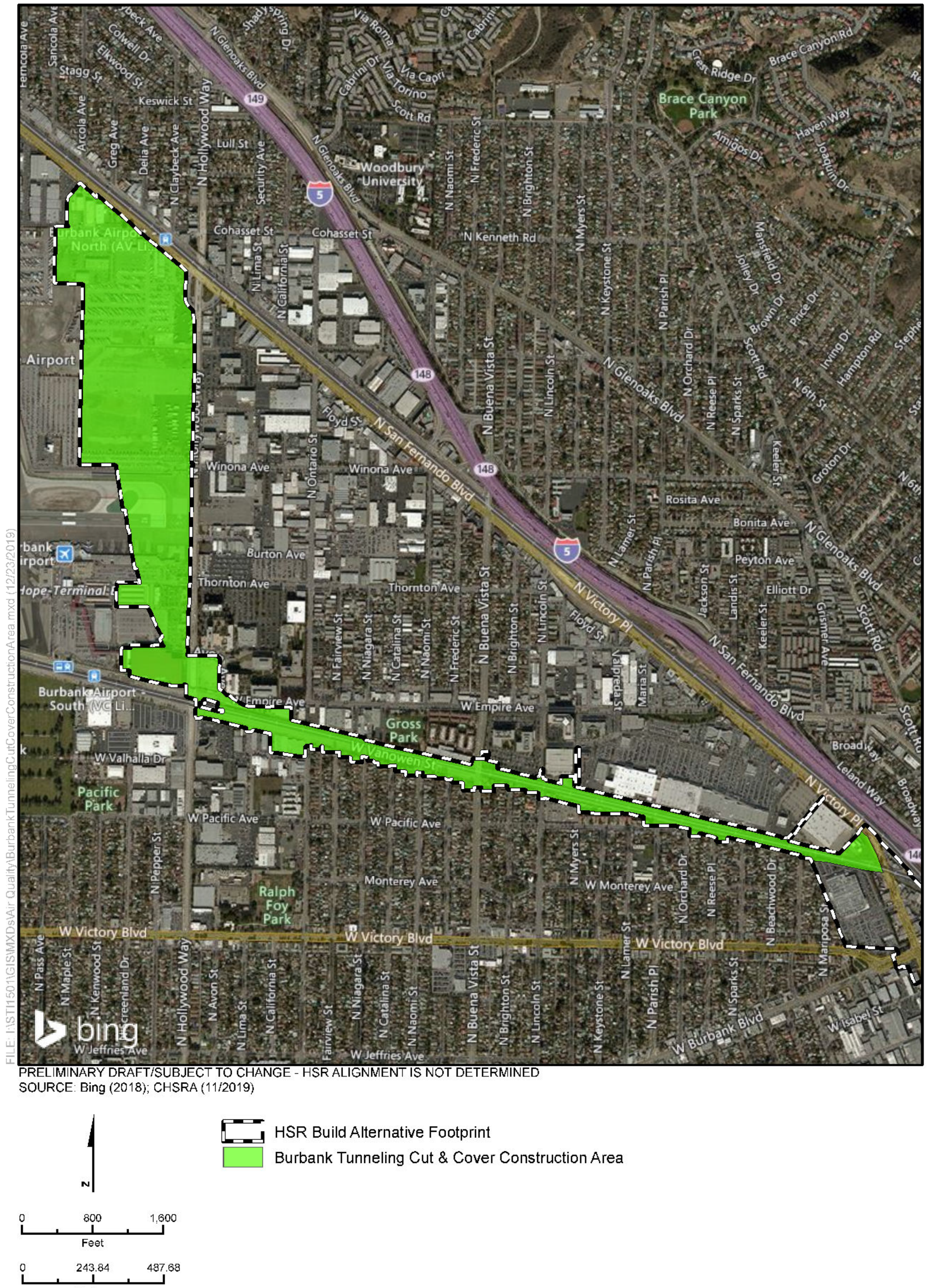
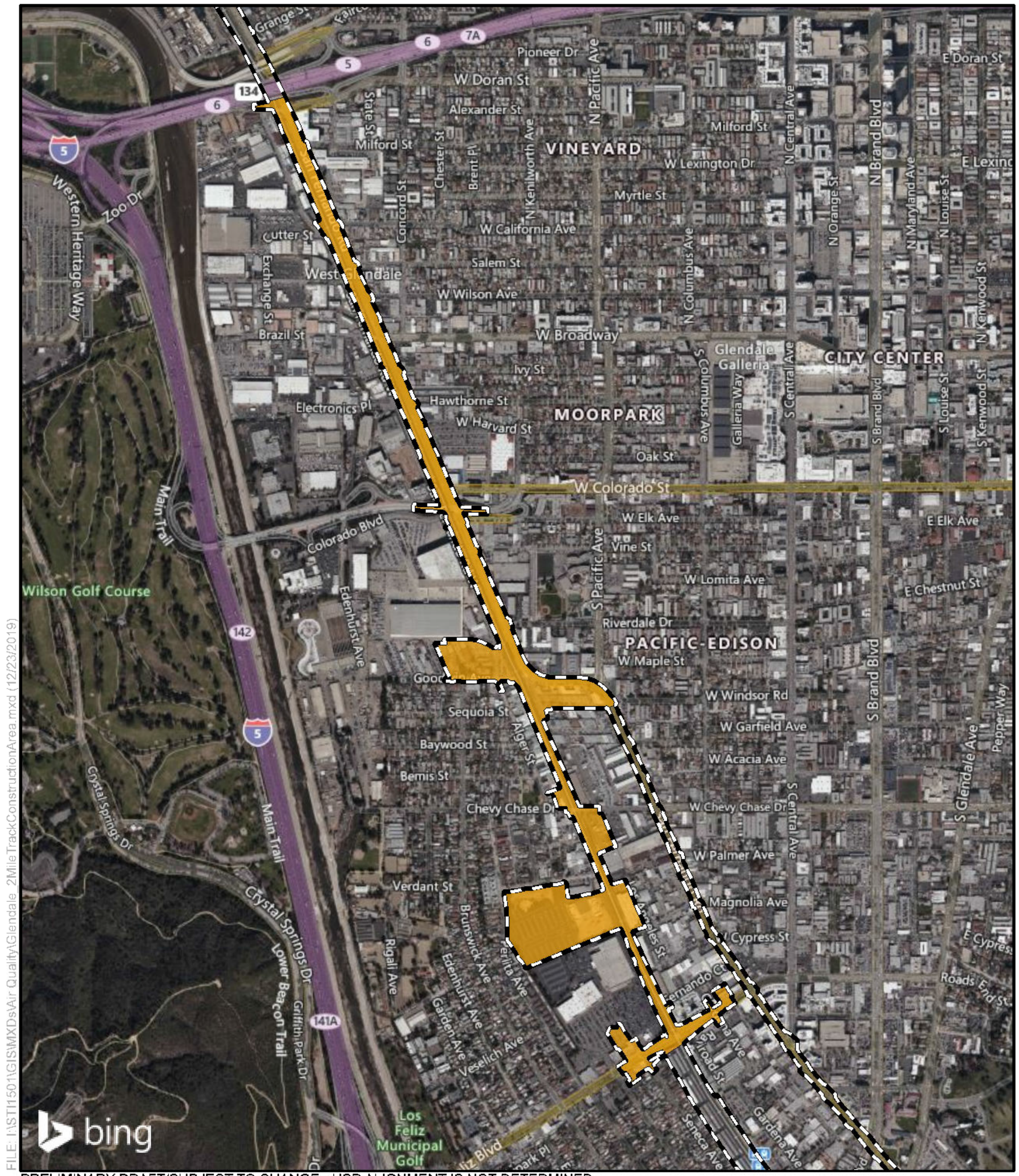
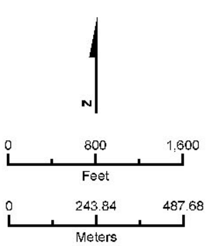


Figure 7-1 Burbank Sequential Excavation Method Tunneling and Cut-and-Cover Modeled Construction Area

Figure 7-2 Burbank Boulevard Overcrossing Modeled Construction Area



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HSR ALIGNMENT IS NOT DETERMINED
SOURCE: Bing (2018); CHSRA (11/2019)



HSR Build Alternative Footprint
Glendale 2-Miles Track Segment Construction Area

Figure 7-3 Glendale 2-Mile Rail Segment Modeled Construction Area

Figure 7-4 Metrolink CMF Rail Track Reconfiguration Modeled Construction Area

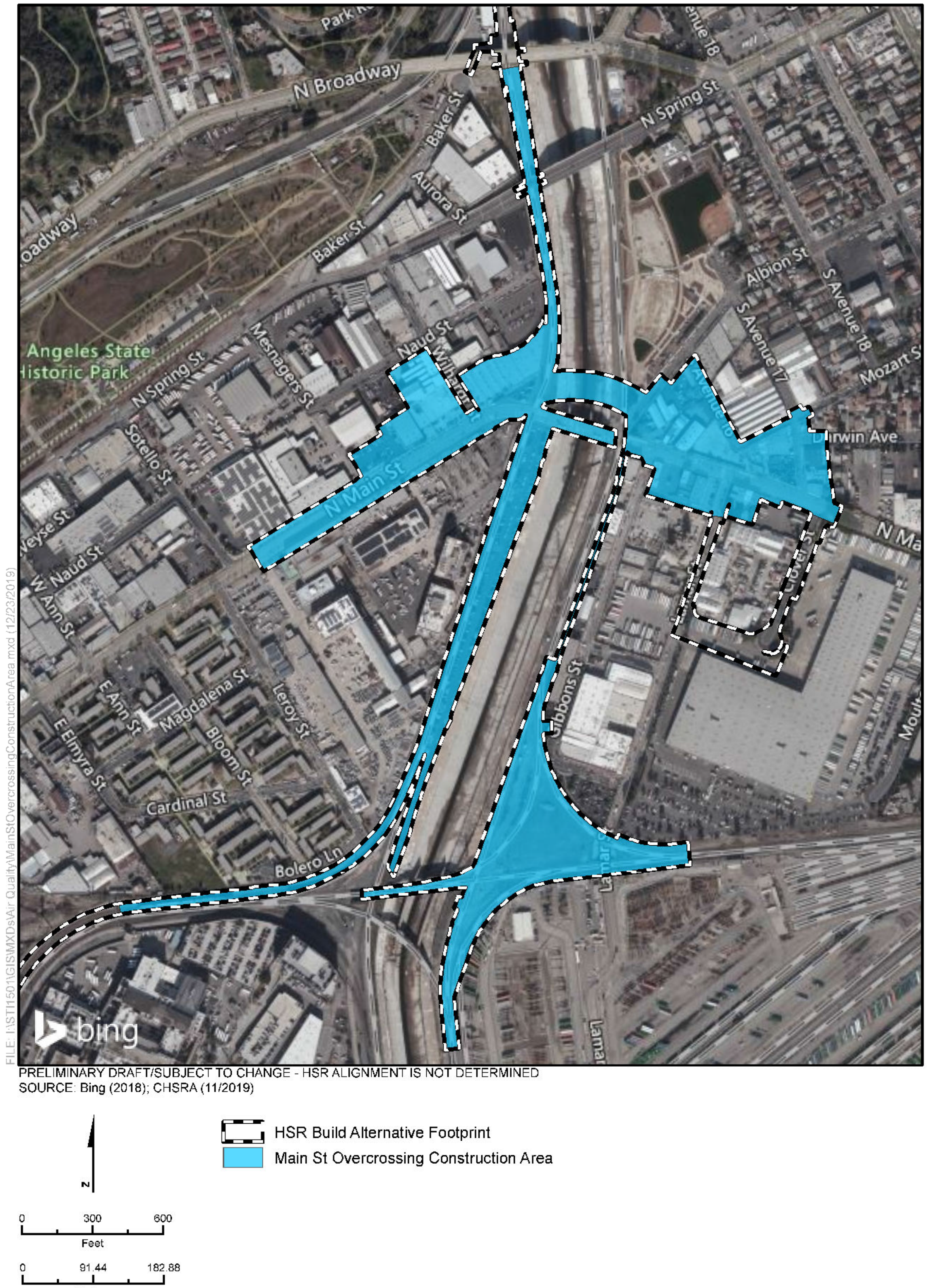
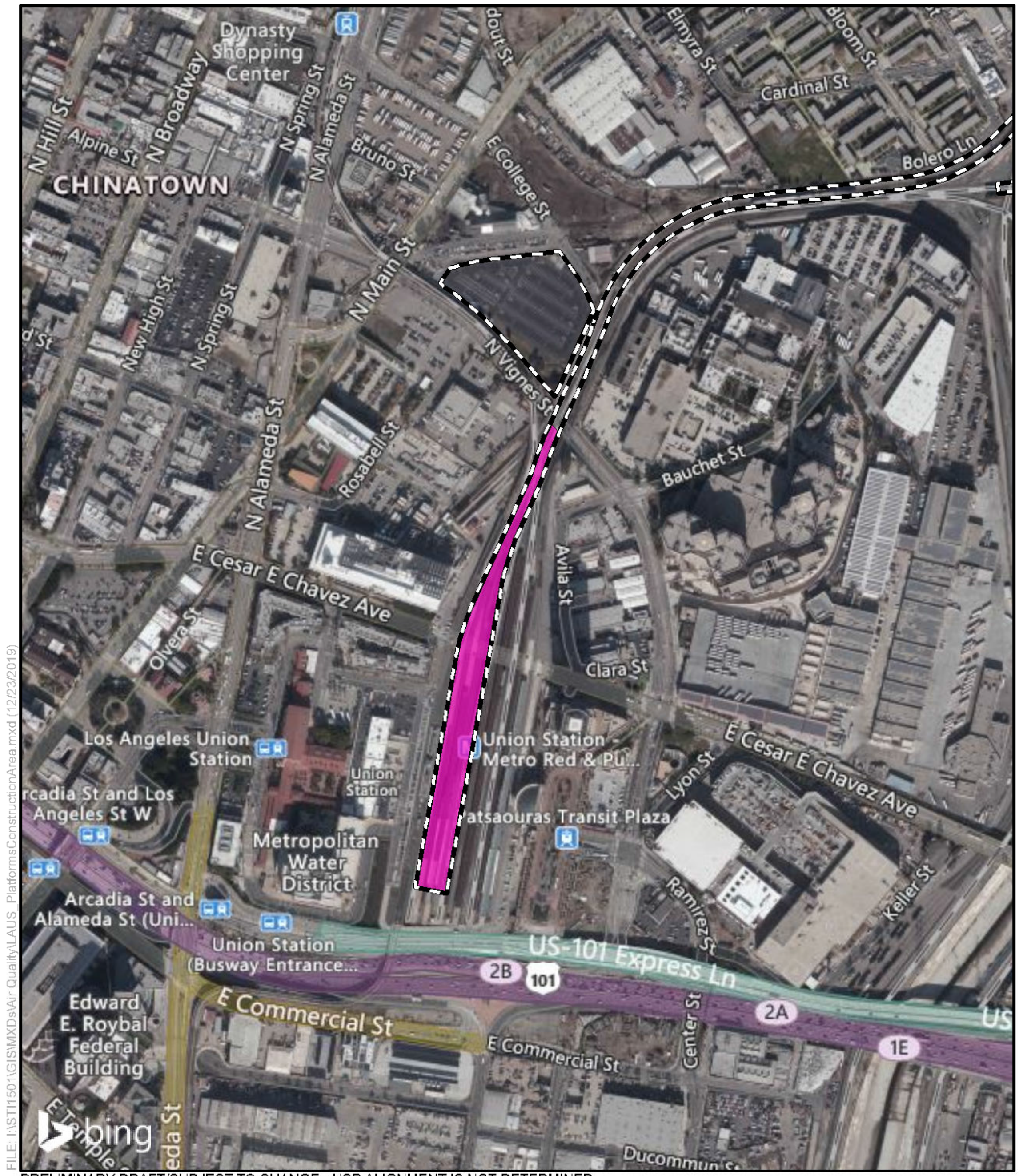


Figure 7-5 Main Street Grade Separation Modeled Construction Area



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HSR ALIGNMENT IS NOT DETERMINED
SOURCE: Bing (2018); CHSRA (11/2019)

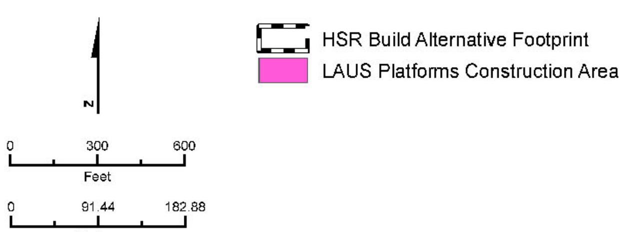


Figure 7-6 LAUS Platform Modeled Construction Area

These IAMFs would reduce potential adverse effects resulting from factors related to criteria pollutants during construction.

[It should be noted that the emission reduction data for each construction equipment using the renewable diesel fuel (as implemented under IAMF#3) is not available in the CARB's OFFROAD emission factor data file at this time. Therefore, the quantification of the emission reductions from the use of renewable diesel in the diesel-powered equipment and vehicles were applied to CARB-approved factors of 99.1 percent reduction in CO_2e construction exhaust emissions for the HSR Build Alternative (Authority and FRA 2018).

Table 7-52, and Table 7-53 show the estimated CO and NO_2 ambient air concentrations, respectively, for each of the construction work areas. The predicted 1-hour NO_2 ambient effects for the Burbank Airport Station to Alameda Avenue below-grade rail alignment and the Main Street grade separation would exceed the 1-hour NO_2 NAAQS and CAAQS standards. The predicted annual NO_2, and 1- and 8-hour CO, ambient effects for all of the work areas would be below the NAAQS and CAAQS.

Table 7-52 Carbon Monoxide Concentrations from Construction Emissions

Construction Area	Maximum Incremental Off-Site Average CO Concentration ($\mu g/m^3$) Unmitigated		Background CO Concentration ($\mu g/m^3$)[1]		Total Off-Site CO Concentration ($\mu g/m^3$)		NAAQS ($\mu g/m^3$ equivalent)		CAAQS ($\mu g/m^3$ equivalent)	
	1-hour	8-hour	1-hour[1]	8-hour[2]	1-hour	8-hour	1-hour	8-hour	1-hour	8-hour
Burbank Tunneling Cut and Cover 1.8-Mile Segment (between Burbank Airport Station and Victory Place	3,161	1,060	2,514	2,000	5,675	3,060	40,000	10,000	23,000	10,000
Burbank Boulevard Overcrossing Area	3,160	1,060	2,514	2,000	5,674	3,060	40,000	10,000	23,000	10,000
Glendale 2-Mile Segment (between SR 134 and Los Feliz Boulevard)	903	277	2,514	2,000	3,417	2,277	40,000	10,000	23,000	10,000
Metrolink CMF Area	519	144	2,514	2,000	3,033	2,144	40,000	10,000	23,000	10,000
Main Street Grade Separation	2,182	782	2,514	2,000	4,696	2,782	40,000	10,000	23,000	10,000
LAUS Platforms	1,785	603	2,514	2,000	4,299	2,603	40,000	10,000	23,000	10,000

Sources: California High Speed Rail Authority, 2019; South Coast Air Quality Management District, n.d.; California Air Resources Board, n.d.

1 The highest monitored 1-hour value from the Pasadena station or Central Los Angeles station was used as the background concentration.

2 The highest monitored 8-hour value from the Pasadena station or Central Los Angeles station was used as the background concentration.

$\mu g/m^3$ = micrograms per cubic meter
CAAQS = California Ambient Air Quality Standards
CMF = Central Maintenance Facility
CO = carbon monoxide
LAUS = Los Angeles Union Station
N/A = not applicable
NAAQS = National Ambient Air Quality Standards
SR = State Route
TBP = to be provided

Table 7-53 Nitrogen Dioxide Concentrations from Construction Emissions

Construction Area	Maximum Incremental Off-Site Average NO_2 Concentration ($\mu g/m^3$)		Background Concentration ($\mu g/m^3$)[1]		Total Off-Site 1-hour NO_2 Concentration ($\mu g/m^3$)		NAAQS		CAAQS	
	1-hour	Annual	1-hour	Annual	1-hour	Annual	1-hour	Annual	1-hour	Annual
Burbank Tunneling Cut & Cover 1.8-Mile Segment (between Burbank Airport Station and Victory Place	438	20.3	152	39.6	**590***	**59.9**	188	100	339	57
Burbank Boulevard Overcrossing Area	294	2.4			**446***	42.0				
Glendale 2-Mile Segment (between SR 134 and Los Feliz Boulevard)	146	10.9			**298***	50.5				
Metrolink CMF Area	109	5.7			**261***	45.3				
Main Street Grade Separation	491	37.7			**643***	**77.3***				
LAUS Platforms	131	10.2			**283***	49.8				

Sources: California High Speed Rail Authority, 2019; South Coast Air Quality Management District, n.d.; California Air Resources Board, n.d.

1 The highest monitored 1-hour value from the Pasadena station or Central Los Angeles station was used as the background concentration.

2 The highest monitored annual value from the Pasadena station or Central Los Angeles station was used as the background concentration.

3 Exceedances of the LSTs are shown in **bold with asterisks**.

$\mu g/m^3$ = micrograms per cubic meter
CAAQS = California Ambient Air Quality Standards
CMF = Central Maintenance Facility
LAUS = Los Angeles Union Station
LST = localized significance threshold
NAAQS = National Ambient Air Quality Standards
NO_2 = nitrogen dioxide
SR = State Route
TBP = to be provided

7.13.3.1 Health Risk Assessment

During construction, sensitive receptors would be exposed to increased concentrations of TACs (e.g., DPM), which may present cancer risks. According to the OEHHA guidance, cancer risk is defined as the predicted risk of cancer (unit less) over a lifetime based on a long-term (70-year) continuous exposure, and is usually expressed as chances per million persons exposed (OEHHA 2015).

DPM is the primary TAC released from construction activities. The modeled DPM concentrations were used in determining the total exposure dose and associated health effect. Specific details of the air dispersion modeling and health risk assessment are provided in Appendix G.

Because the HSR Build Alternative is 14 miles long, it would not be practical to analyze the entire construction phase as a whole. Therefore, six discrete construction modeling areas were chosen to represent the worst-case scenarios for construction-related air quality and health risk impacts to the maximum number of sensitive receptors along the Burbank to Los Angeles alignment. Each selected construction area encompasses a discrete area that includes all elements of the project section Build Alternative passing through that area, including construction features with their emissions profile, meteorology, topography, and sensitive receptors.

These discrete construction areas were designed to represent the "worst-case" in terms of construction-related air quality and health risk impacts, typically those that have a large amount of construction activity with exhaust vented to the air near sensitive receptors along the Burbank to Los Angeles alignment. For cancer impacts, a threshold of 10 excess cancers in a million is used. For chronic and acute hazard index, a threshold of 1.0 is used. In all six cases, the maximally exposed individual location is the individual resident receptor immediately adjacent to the perimeter of the facility.

According to the construction localized effect air dispersion modeling, construction activities along the alignment (including roadway modifications or grade separations) would present an incremental increase in DPM emissions from construction equipment exhaust that would generate an incremental cancer risk of 2.97 in 1 million. Table 7-54 indicates that incremental residential cancer risk would not exceed the applicable SCAQMD thresholds for all construction areas. None of the construction areas would result in exceedances of applicable thresholds for noncancer chronic hazard indices.

Table 7-54 Diesel Particulate Matter Cancer Risk Associated with Construction Emissions

Highest Risk, by Risk Type and Receptor Type	Sensitive Receptor Type		
	Residential [1]	Recreational	School
Burbank SEM Tunneling (Burbank Airport runway) and Cut and Cover Segment (between Burbank Airport Station and Victory Place)			
Cancer Risk (per Million)	1.11	0.52	0.56
Noncancer Chronic Hazard Index	0.005	0.001	0.001
Burbank Boulevard Grade Separation Area			
Cancer Risk (per Million)	2.64	0.34	0.42
Noncancer Chronic Hazard Index	0.013	0.001	0.001
Glendale 2-Mile Segment (between SR 134 and Los Feliz Boulevard)			
Cancer Risk (per Million)	2.97	1.00	0.39
Noncancer Chronic Hazard Index	0.014	0.010	0.001
Metrolink CMF Area			
Cancer Risk (per Million)	1.10	1.42	1.12
Noncancer Chronic Hazard Index	0.005	0.005	0.005
Main Street Grade Separation			
Cancer Risk (per Million)	1.09	0.08	1.27
Noncancer Chronic Hazard Index	0.005	0.001	0.005
LAUS Platforms			
Cancer Risk (per Million)	2.14	N/A	N/A
Noncancer Chronic Hazard Index	0.010	N/A	N/A

Source: California High Speed Rail Authority, 2019

[1] The 30-year residential health risk was estimated based on the projected ambient air concentrations estimated from air dispersion modeling along with exposure factors and cancer potency factors.

CMF = Central Maintenance Facility
LAUS = Los Angeles Union Station
SEM = sequential excavation method
SR = State Route

7.13.4 Asbestos and Lead-Based Paint Emission Analysis

The demolition of asbestos-containing materials is subject to the limitations of the National Emission Standards for Hazardous Air Pollutants regulations and would require an asbestos inspection. The Compliance Division of the SCAQMD would be consulted before demolition begins. Strict compliance with existing asbestos regulations would prevent asbestos from being a significant adverse effect.

The project RSA is not located in an area with reported NOA based on the "Reported Historic Asbestos Mines, Historic Asbestos Prospects, and Other Natural Occurrences of Asbestos in California (U.S. Geological Survey 2011).

Buildings in the study area might be contaminated with residual Pb, which was used as a pigment and drying agent in oil-based paint until the Lead-Based Paint Poisoning Prevention Act of 1971 prohibited such use. If encountered during structure demolitions and relocations, Pb-based paint and asbestos will be handled and disposed of in accordance with applicable standards.

7.13.5 Greenhouse Gas Construction Emission Analysis

7.13.5.1 Construction Effects Within the Air Quality District

GHG emissions generated from construction of the project would be short term. However, because the time that CO_2 remains in the atmosphere cannot be definitively quantified due to the wide range of time scales in which carbon reservoirs exchange CO_2 with the atmosphere, there is no single value for the half-life of CO_2 in the atmosphere (IPCC 1997). Therefore, the duration that CO_2 emissions from a short-term project would remain in the atmosphere is unknown.

The emissions for this impact assume implementation of **AQ-IAMF#1, AQ-IAMF#2, AQ-IAMF#3, AQ-IAMF#4, AQ-IAMF#5,** and **AQ-IAMF#6.** The GHG emissions reductions from the use of Renewable Diesel Fuel (AQ-IAMF#3) in all off-road diesel-powered engines. The GHG construction emissions for the Burbank to Los Angeles Project Section of the HSR project would total 770 MT CO_2e and would represent 0.003 percent of the most recently reported total annual statewide GHG emissions (CARB 2018). The most recent available GHG emission inventory for California was released in July 2019 and shows that total annual GHG emissions for California in 2017 were 424.1 MMT CO_2e.

Table 7-55 shows the amortized GHG emissions during construction of the Burbank to Los Angeles Project Section. The half-life of CO_2 is not defined, and other GHG pollutants such as N_2O can remain in the atmosphere for 120 years (IPCC 1997). According to SCAQMD guidelines, a project's construction emissions should be amortized over the life of the project (defined as 30 years, unless the project is a temporary project which would operate for less than 30 years). The amortized GHG construction emissions for the Burbank to Los Angeles Project Section would be approximately 1,203 MT CO_2e per year, as shown in Table 7-55.

Table 7-55 Burbank to Los Angeles Carbon Dioxide Equivalent Construction Emissions and Payback Periods

Year	CO_2e Emissions (MT/yr)
2020	3,096
2021	6,474
2022	6,846
2023	6,494
2024	6,681
2025	3,994
2026	2,338
2027	132
2028	47
Total	**36,102**
Amortized GHG Emissions (averaged over 30 years)[1]	
CO_2e per year	1,203
Payback of GHG Emissions (day)[2]	
Payback period (Medium Ridership)	13
Payback period (High Ridership)	8

Source: California High-Speed Rail Authority, 2019
Emission factors for CO_2 assume the use of AQ-IAMF#3 – Renewable Diesel Fuel.
[1] Project life assumed to be 30 years according to SCAQMD guidance.
[2] Payback periods were estimated by dividing the GHG emissions during construction years by the annual GHG emission reduction during project operation. See Table 7-4444 for operational GHG emission reduction data. The data range represents the emission changes based on the three ridership scenarios (Medium and High) for the Horizon year (2040).
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
MT/yr = metric tons per year

The increase in GHG emissions generated during construction would be offset by the net GHG reductions in operation (because of car and plane trips removed) in less than 1 day.

7.13.5.2 Early Action Project Construction GHG Emissions

Table 7-56 presents GHG emissions generated from early action project construction activities.

Table 7-56 Early Action Project Carbon Dioxide Equivalent Construction Emissions

Early Action Projects	Total CO_2e Emissions (MT/yr) per component at full construction duration
Burbank Metrolink Platform	439
Sonora Avenue Roadway Undercrossing	1,533
Grandview Avenue Roadway Undercrossing	2,089
Flower Street Roadway Undercrossing	1,713
Goodwin Avenue Roadway Undercrossing	681
Main Street Roadway Overcrossing	3,621

Source: California High-Speed Rail Authority, 2019
Emission factors for CO_2 assume the use of AQ-IAMF#3 – Renewable Diesel Fuel.
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
MT/yr = metric tons per year
SCAQMD = South Coast Air Quality Maintenance District

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8 IMPACT AVOIDANCE AND MINIMIZATION FEATURES

The HSR Build Alternative incorporates standardized HSR features to avoid and minimize impacts. These features are referred to as IAMFs. The Authority would implement these measures during project design and construction to avoid or reduce impacts.

The following IAMFs would be implemented to avoid and/or minimize adverse effects on air quality.

AQ-IAMF#1: Fugitive Dust Emissions

During construction, the Contractor shall employ the following measures to minimize and control fugitive dust emissions. The Contractor shall prepare a fugitive dust control plan for each distinct construction segment. At a minimum, the plan shall describe how each measure would be employed and identify an individual responsible for ensuring implementation. At a minimum, the plan shall address the following components unless alternative measures are approved by the applicable air quality management district.

- Cover all vehicle loads transported on public roads to limit visible dust emissions, and maintain at least 6 inches of freeboard space from the top of the container or truck bed.
- Clean all trucks and equipment before exiting the construction site using an appropriate cleaning station that does not allow runoff to leave the site or mud to be carried on tires off the site.
- Water exposed surfaces and unpaved roads at a minimum three times daily with adequate volume to result in wetting of the top 1 inch of soil but avoiding overland flow. Rain events may result in adequate wetting of top 1 inch of soil thereby alleviating the need to manually apply water.
- Limit vehicle travel speed on unpaved roads to 15 miles per hour (mph).
- Suspend any dust-generating activities when average wind speed exceeds 25 mph.
- Stabilize all disturbed areas, including storage piles that are not being used on a daily basis for construction purposes, by using water, a chemical stabilizer/suppressant, hydro mulch or by covering with a tarp or other suitable cover or vegetative ground cover, to control fugitive dust emissions effectively. In areas adjacent to organic farms, the Authority would use non-chemical means of dust suppression.
- Stabilize all on-site unpaved roads and off-site unpaved access roads, using water or a chemical stabilizer/suppressant, to effectively control fugitive dust emissions. In areas adjacent to organic farms, the Authority would use non-chemical means of dust suppression.
- Carry out watering or presoaking for all land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities.
- For buildings up to six stories in height, wet all exterior surfaces of buildings during demolition.
- Limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets a minimum of once per day, using a vacuum type sweeper.
- After the addition of materials to or the removal of materials from surface or outdoor storage piles, apply sufficient water or a chemical stabilizer/suppressant.

AQ-IAMF#2: Selection of Coatings

During construction, the Contractor shall use:

- Low-volatile organic compound (VOC) paint that contains less than 10 percent of VOC contents (VOC, 10 percent).
- Super-compliant or Clean Air paint that has a lower VOC content than that required by South Coast Air Quality Management District Rule 1113, when available. If not available, the Contractor shall document the lack of availability, recommend alternative measure(s) to

comply with Rule 1113 or disclose absence of measure(s) for full compliance and obtain concurrence from the Authority.

AQ-IAMF#3: Renewable Diesel

During construction, the Contractor would use renewable diesel fuel to minimize and control exhaust emissions from all heavy-duty diesel-fueled construction diesel equipment and on-road diesel trucks. Renewable diesel must meet the most recent ASTM D975 specification for Ultra Low Sulfur Diesel and have a carbon intensity no greater than 50% of diesel with the lowest carbon intensity among petroleum fuels sold in California. The Contractor would provide the Authority with monthly and annual reports, through the Environmental Mitigation Management and Application (EMMA) system, of renewable diesel purchase records and equipment and vehicle fuel consumption. Exemptions to use traditional diesel can be made where renewable diesel is not available from suppliers within 200 miles of the project site. The construction contract must identify the quantity of traditional diesel purchased and fully document the availability and price of renewable diesel to meet project demand.

AQ-IAMF#4: Reduce Criteria Exhaust Emissions from Construction Equipment

Prior to issuance of construction contracts, the Authority and/or contract administrator would incorporate the following construction equipment exhaust emissions requirements into the contract specifications:

1. All heavy-duty off-road construction diesel equipment used during the construction phase would meet Tier 4 engine requirements.
2. A copy of each unit's certified tier specification and any required CARB or air pollution control district operating permit would be made available to the Authority at the time of mobilization of each piece of equipment.
3. The contractor would keep a written record (supported by equipment-hour meters where available) of equipment usage during project construction for each piece of equipment.
4. The contractor would provide the Authority with monthly reports of equipment operating hours (through the Environmental Mitigation Management and Assessment [EMMA] system) and annual reports documenting compliance.

AQ-IAMF#5: Reduce Criteria Exhaust Emissions from On-Road Construction Equipment

Prior to issuance of construction contracts, the Authority would incorporate the following material-hauling truck fleet mix requirements into the contract specifications:

1. All on-road trucks used to haul construction materials, including fill, ballast, rail ties, and steel, would consist of an average fleet mix of equipment model year 2010 or newer, but no less than the average fleet mix for the current calendar year as set forth in the CARB's EMFAC 2014 database.
2. The contractor would provide documentation to the Authority of efforts to secure such a fleet mix.
3. The contractor would keep a written record of equipment usage during project construction for each piece of equipment and provide the Authority with monthly reports of VMT (through EMMA) and annual reports documenting compliance.

AQ-IAMF#6: Reduce the Potential Impact of Concrete Batch Plants

Prior to construction of any concrete batch plant, the contractor shall provide the Authority with a technical memorandum documenting consistency with the Authority's concrete batch plant siting criteria and utilization of typical control measures. Concrete batch plants would be sited at least 1,000 feet from sensitive receptors, including places such as daycare centers, hospitals, senior care facilities, residences, parks, and other areas where people may congregate. The concrete batch plant would implement typical control measures to reduce fugitive dust such as water sprays, enclosures, hoods, curtains, shrouds, movable and telescoping chutes, central dust collection systems, and other suitable technology, to reduce emissions to be equivalent to the USEPA AP-42 controlled emission factors for concrete batch plants. The contractor would provide to the Authority documentation that each batch plant meets this standard during operation.

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9.2 Persons and Agencies Consulted

No persons or agencies outside of the HSR team were consulted.

10 PREPARER QUALIFICATIONS

The following individuals have made significant contributions to the development of this technical report.

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APPENDIX A: CONSTRUCTION EMISSIONS

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APPENDIX B: OPERATIONAL EMISSIONS

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APPENDIX C: MICROSCALE CARBON MONOXIDE ANALYSIS

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APPENDIX D: POTENTIAL IMPACT FROM INDUCED WINDS

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APPENDIX E: EXISTING CONDITIONS—2015

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APPENDIX F: QUARRY AND BALLAST MEMORANDA

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APPENDIX G: HEALTH RISK ASSESSMENT TECHNICAL REPORT

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