APPENDIX 3.8-A **KNE GEOLOGY AND SOILS TECHNICAL REPORT**

Los Angeles County
Metropolitan Transportation Authority

GEOLOGY AND SOILS TECHNICAL REPORT

K LINE NORTHERN EXTENSION

Metro

JULY 2024

K LINE NORTHERN EXTENSION TRANSIT CORRIDOR PROJECT

Geology and Soils Technical Report

Prepared for:

Metro

Los Angeles County
Metropolitan Transportation Authority

Prepared by:

CONNECT
LOS ANGELES PARTNERS
Creating Connected Communities

515 S. Figueroa Street, Suite 1400
Los Angeles, California 90071

JULY 2024

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ABBREVIATIONS / ACRONYMS

ACRONYM	DEFINITION
AA	Alternatives Analysis
AASHTO	American Association of State Highway and Transportation Officials
Advanced AA	Advanced Alternatives Analysis
A-P	Alquist-Priolo
APEFZ	Alquist-Priolo Earthquake Fault Zones
bgs	below ground surface
BMPs	best management practices
Cal/OSHA	California Division of Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CBC	California Building Code
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CGS	California Geological Survey
Division 16	Division 16 Southwestern Maintenance Yard
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FPZ	Fault Precaution Zone
LADBS	Los Angeles Department of Buildings and Safety
LAMC	Los Angeles Municipal Code
LAX	Los Angeles International Airport
LRT	light rail transit
MDE	Maximum Design Earthquake
Metro	Los Angeles County Metropolitan Transportation Authority
MRDC	Metro Rail Design Criteria
MRZ	Mineral Resource Zones

ACRONYM	DEFINITION
MSF	Maintenance and Storage Facility
MUTCD	Manual of Uniform Traffic Control Devices
n.d.	no date
NIFZ	Newport-Inglewood Fault Zone
NPDES	National Pollutant Discharge Elimination System
ODE	Operating Design Earthquake
PRC	Public Resources Code
Project	K Line Northern Extension Project
PSHA	Probabilistic Seismic Hazard Analyses
RSA	Resource Study Area
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
SCAG	Southern California Association of Governments
SDC	Seismic Design Criteria
SEM	Sequential Excavation Method
SMARA	Surface Mining and Reclamation Act
SMGB	State Mining and Geology Board
SN	Safety and Noise
SWPPP	Storm Water Pollution Prevention Plan
TBM	tunnel boring machine
USDA	United States Department of Agriculture
USGS	United States Geological Survey

CHAPTER 1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Los Angeles County Metropolitan Transportation Authority (Metro) is preparing a Draft Environmental Impact Report (EIR) for the K Line Northern Extension Transit Corridor Project (the Project) (Figure 2-1). The Project would provide a northern extension of the Metro light rail transit (LRT) K Line from the Metro E Line (Expo) to the Metro D Line (Purple) and B Line (Red) heavy rail transit lines. The Project would serve as a critical regional connection, linking the South Bay, the Los Angeles International Airport (LAX) area, South Los Angeles, Inglewood, and Crenshaw corridor to Mid-City, Central Los Angeles, West Hollywood, and Hollywood, allowing for further connections to points north in the San Fernando Valley via the Metro B Line. The Project would also connect major activity centers and areas of high population and employment density within the Project area itself.

1.2 TECHNICAL REPORT SUMMARY

This technical report evaluates the Project's environmental impacts as they relate to geology, soils, seismicity, and mineral resources. It describes existing conditions, the current applicable regulatory setting, potential impacts from construction and operation of the alignment alternatives, stations, design option, and maintenance and storage facility (MSF), as well as mitigation measures where applicable. This technical report was conducted in compliance with the California Environmental Quality Act (CEQA) (Sections 21000 et seq.) and the CEQA Guidelines (Section 15000 et seq.), which require state and local agencies to identify the significant environmental impacts of their actions, including significant impacts associated with geologic, soil and mineral resources, and to avoid or mitigate those impacts, when feasible.

The technical report is organized into eight chapters:

- Chapter 1 – Introduction, provides an overview of the Project and a summary of the technical report's contents.
- Chapter 2 – Project Description, provides a description of the Project's alignment alternatives, stations, design option, and MSF. This section also describes the construction approach for the Project.
- Chapter 3 – Regulatory Framework, discusses applicable federal, state, and local regulatory requirements, including plans and policies relevant to Project jurisdictions.
- Chapter 4 – Methodology and Significance Thresholds, describes the analysis methodologies applied for this Project and provides a summary of CEQA significance thresholds adopted by state and local jurisdictions.
- Chapter 5 – Existing Setting, describes the existing conditions as relevant to the Project alignment alternatives, stations, design option, and MSF.
- Chapter 6 – Impacts and Mitigation Measures, discusses the impact analyses conducted for the Project's alignment alternatives, stations, design option, and MSF, and discusses

applicable mitigation measures. It also discusses any project measures that would be implemented as part of design and construction of the Project.

- Chapter 7 – Cumulative Impacts, discusses the cumulative impacts for the Project's alignment alternatives, stations, design option, and MSF.
- Chapter 8 – References, lists the references used to prepare this technical report.

CHAPTER 2 PROJECT DESCRIPTION

This section provides information pertinent to the components of the Project as evaluated in the technical report. The Project components for evaluation in this technical report include three light rail alignment alternatives with stations, one design option, and one MSF.

2.1 ALIGNMENT ALTERNATIVES

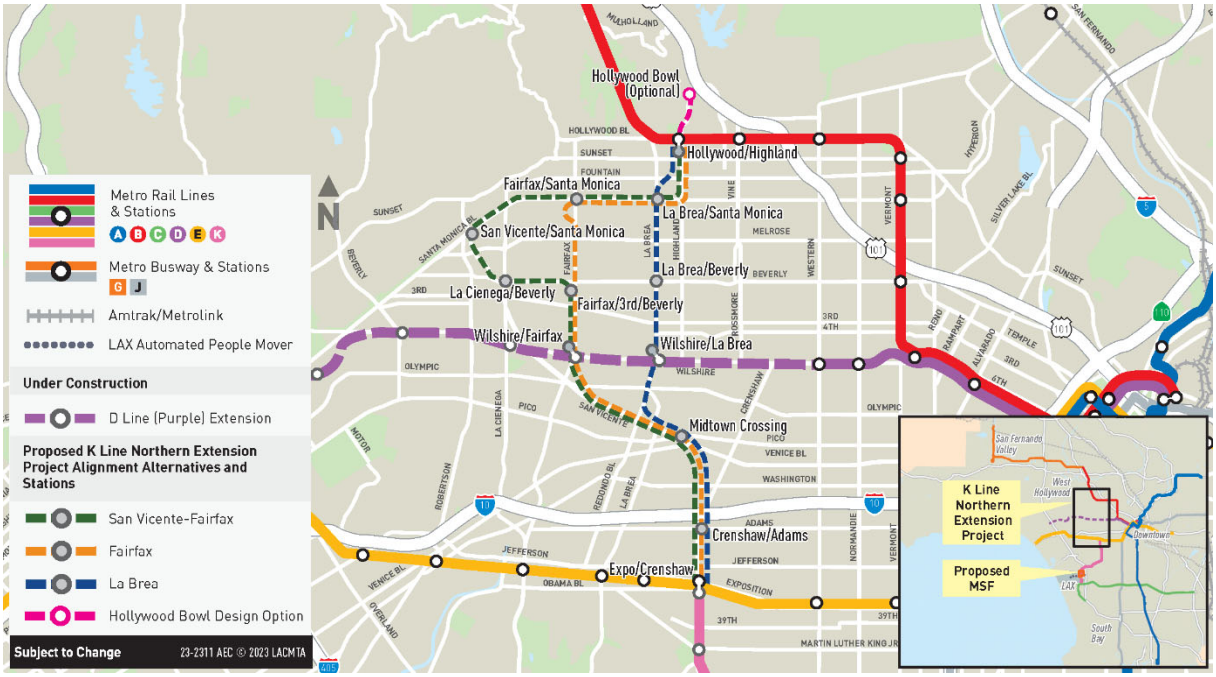
As shown in Figure 2-1, each of the three alignment alternatives would provide a northern extension of the Metro K Line from its current terminus at the Expo/Crenshaw Station to the Metro B Line Hollywood/Highland Station. All three alignment alternatives would operate entirely underground in parallel twin-bore tunnels with some station elements at the surface, including the station entrance and ventilation structures. Due to the project length and pending funding availability, the alignment alternatives would be constructed sequentially in sections.

The alignment alternatives are as follows:

- Alignment Alternative 1: San Vicente–Fairfax. This alignment alternative would travel north from the existing Metro K Line Expo/Crenshaw Station before heading northwest under San Vicente Boulevard, with a connection to the future Metro D Line Wilshire/Fairfax Station. It would continue north under Fairfax Avenue before turning west under Beverly Boulevard to rejoin San Vicente Boulevard. The alignment would then turn east under Santa Monica Boulevard, and then turn north just east of La Brea Avenue to follow Highland Avenue north to connect to the Metro B Line at the Hollywood/Highland Station.
- Alignment Alternative 2: Fairfax. This alignment alternative would travel north from the existing Metro K Line Expo/Crenshaw Station before heading northwest under San Vicente Boulevard and north under Fairfax Avenue, where it would connect with the future Metro D Line Wilshire/Fairfax Station. It would continue north under Fairfax Avenue and turn east under Santa Monica Boulevard. The alignment would then turn north just east of La Brea Avenue to follow Highland Avenue north to connect to the Metro B Line at the Hollywood/Highland Station.
- Alignment Alternative 3: La Brea. This alignment alternative would travel north from the existing Metro K Line Expo/Crenshaw Station before heading northwest under San Vicente Boulevard and north under La Brea Avenue, where it would connect with the future Metro D Line Wilshire/La Brea Station. From there, it would continue north under La Brea Avenue and turn northeast north of Fountain Avenue to follow Highland Avenue to connect with the Metro B Line at the Hollywood/Highland Station.

Table 2-1 provides a summary of the characteristics of each of the alignment alternatives and Table 2-2 identifies which stations would be constructed under each alignment alternative. In total, 12 station areas are identified, including the option to extend to the Hollywood Bowl.

FIGURE 2-1. K LINE NORTHERN EXTENSION ALIGNMENT ALTERNATIVES



Source: Connect Los Angeles Partners 2023

TABLE 2-1. CHARACTERISTICS OF THE ALIGNMENT ALTERNATIVES AND DESIGN OPTION

PROJECT COMPONENTS	ALIGNMENT ALTERNATIVES			DESIGN OPTION
	1. SAN VICENTE–FAIRFAX	2. FAIRFAX	3. LA BREA	HOLLYWOOD BOWL EXTENSION
Alignment Length	9.7 miles underground	7.9 miles underground	6.2 miles underground	+ 0.8 mile underground
Stations	9 underground	7 underground	6 underground	+1 underground
Travel time from Expo/Crenshaw to Hollywood/Highland	19 minutes	15 minutes	12 minutes	+2 minutes (from Hollywood/Highland)

Source: Connect Los Angeles Partners 2023

TABLE 2-2. STATIONS BY ALIGNMENT ALTERNATIVE

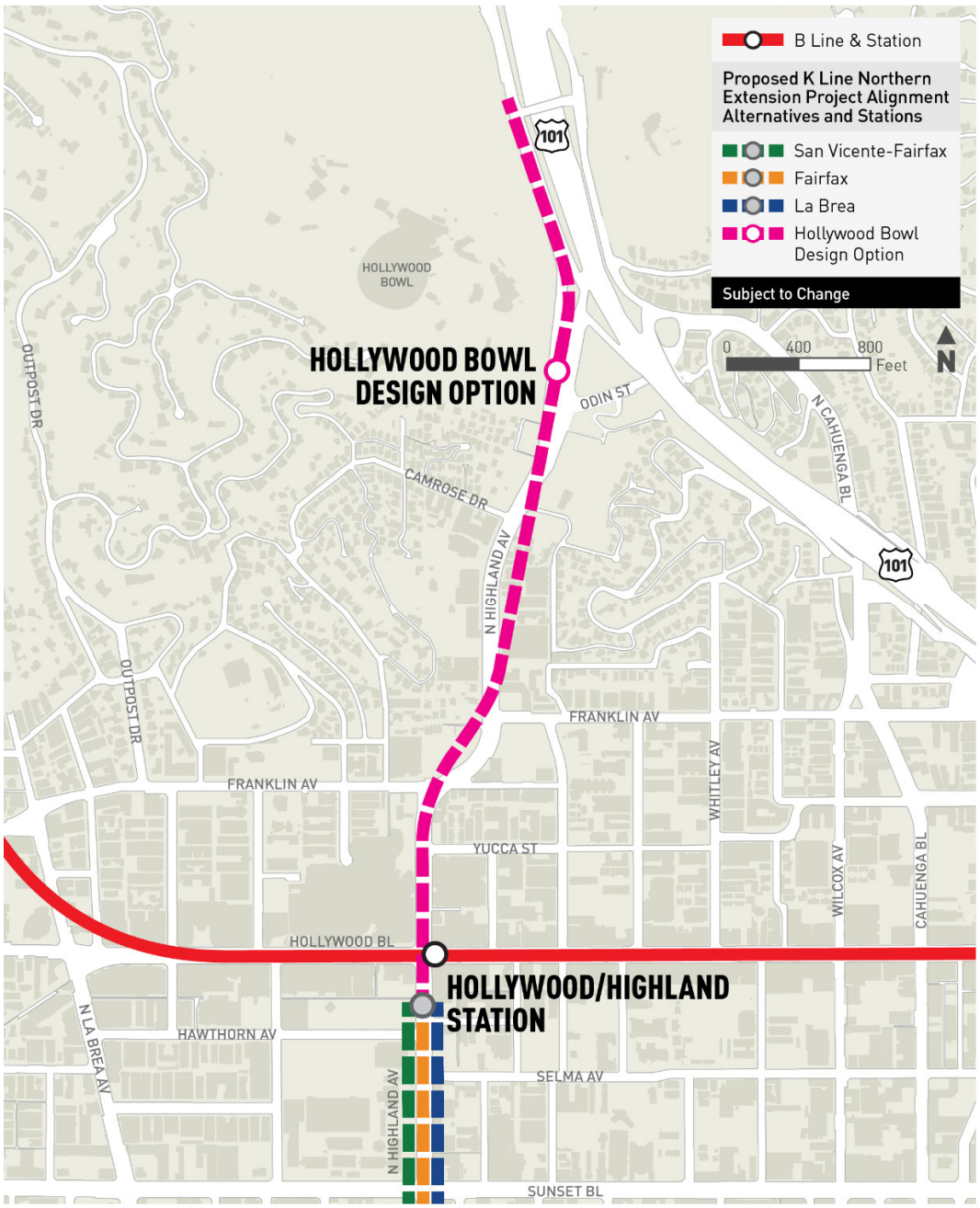
STATION	SAN VICENTE–FAIRFAX	FAIRFAX	LA BREA
Crenshaw/Adams (City of Los Angeles)	●	●	●
Midtown Crossing (City of Los Angeles)	●	●	●
Wilshire/Fairfax (City of Los Angeles)	●	●	
Fairfax/3rd (City of Los Angeles)	●	●	
La Cienega/Beverly (City of Los Angeles)	●		
San Vicente/Santa Monica (City of West Hollywood)	●		
Fairfax/Santa Monica (City of West Hollywood)	●	●	
La Brea/Santa Monica (City of West Hollywood)	●	●	●
Hollywood/Highland (City of Los Angeles)	●	●	●
Wilshire/La Brea (City of Los Angeles)			●
La Brea/Beverly (City of Los Angeles)			●
Hollywood Bowl (City of Los Angeles)	●	●	●

Source: Connect Los Angeles Partners 2023

2.2 HOLLYWOOD BOWL DESIGN OPTION

For every alignment alternative, there is one design option under consideration. The Hollywood Bowl Design Option includes an alternate terminus station at the Hollywood Bowl, north of the proposed Hollywood/Highland Station, as shown in Figure 2-2.

FIGURE 2-2. HOLLYWOOD BOWL DESIGN OPTION



Source: Connect Los Angeles Partners 2023

2.3 MAINTENANCE AND STORAGE FACILITY

An MSF would be constructed that would expand the Division 16 Maintenance Yard (Division 16), the existing MSF for the Metro K Line near LAX, as shown in Figure 2-3. The MSF would provide equipment and facilities to accommodate daily servicing and cleaning, inspection and repairs, and storage of light rail vehicles that are not in service. The MSF would be the primary physical employment center for rail operation employees, including train operators, maintenance workers, supervisors, administrators, security personnel, and other roles. If the Project is opened in sections, operation of the extended K Line from the Expo/Crenshaw Station to the Metro D Line could be accommodated within the existing Division 16 site with four new storage tracks.

FIGURE 2-3. MAINTENANCE AND STORAGE FACILITY

Source: Connect Los Angeles Partners 2023

2.4 CONSTRUCTION APPROACH

The Project would be constructed in sections that would be built sequentially, depending on available funding. The development of the Project would employ conventional construction methods, techniques, and equipment similar to other Metro projects that require underground tunneling. Detailed information on construction techniques can be found in the KNE Construction Approach Report. Major construction activities for the Project include surveys and preconstruction, which consist of local business surveys, building and utility assessments, and site preparations; right-of-way acquisition; tunnel construction, including tunnel boring machine (TBM) excavation and segmental lining and installation; utility relocation and installation work; station, crossover, and connection box construction; MSF construction, including site grading, maintenance building construction, and storage and access track construction; street restorations, including paving and sidewalks; ventilation and emergency egress construction; systems installation and facilities, including trackbed, rail, overhead contact system, conduit, electrical substation, and communications and signaling construction; and construction of other ancillary facilities.

The tunnels would be bored with TBMs, and the stations and track crossover boxes would be constructed via cut-and-cover methods, which entail excavating down from the ground surface and stabilizing the ground with an excavation support, then placing temporary decking surfaces above the excavation and conducting all excavation inside the supported area. The tunnel and station associated with the Hollywood Bowl Design Option would be constructed by sequential excavation method (SEM), which entails conventional mining techniques and equipment for hard rock excavation, which would reduce surface impacts.

Construction staging areas have been identified at each of the station locations, which are described and illustrated in Appendix A in the KNE Construction Approach Report. In order to construct a station, a minimum of one to two acres of construction staging sites would be needed for the duration of the station construction period. A larger construction staging site of three to four acres would be required if the site is also used to launch the TBMs and support tunneling activities. The TBM launch sites have been identified at the Midtown Crossing, San Vicente/Santa Monica, and La Brea/Santa Monica Stations. Temporary street, lane, sidewalk and bike lane closures as well as street reconfigurations will be part of construction activities. Construction and operational impacts on geology, soils, seismicity, and mineral resources are identified and discussed in this technical report.

CHAPTER 3 REGULATORY FRAMEWORK

3.1 FEDERAL REGULATIONS

There are no federal regulations applicable to this Project regarding geology, soils, seismicity, and mineral resources.

3.2 STATE REGULATIONS

3.2.1 ALQUIST-PRIOLO EARTHQUAKE FAULT ZONING ACT

The 1972 Alquist-Priolo Earthquake Fault Zoning Act (A-P Act) (Public Resources Code (PRC) 2621 et seq.) resulted from the consequences of the 1971 Sylmar-San Fernando earthquake and seeks to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault.

The A-P Act mandates that lead agencies (usually cities and counties) require that, within certain state-defined zones, geologic investigations must be performed to demonstrate that potential developments intended for human occupancy are not threatened by surface fault displacements from future earthquakes. A structure for human occupancy is defined as: “any structure used or intended for supporting or sheltering any use or occupancy, which is expected to have a human occupancy rate of more than 2,000 person-hours per year” (see CCR, Title 14, Division 2, Section 3601 (e)). To aid the various jurisdictions that function as lead agencies for project approvals in California, the California Geological Survey (CGS)[1] must delineate Alquist-Priolo Earthquake Fault Zones (APEFZ) on standard U.S. Geological Survey (USGS) topographic maps (one inch equals 2,000 feet scale) along faults that are "sufficiently active and well defined" as defined in the A-P Act. The A-P Act prohibits the location of structures for human occupancy across the active traces of faults in APEFZ and regulates construction in the corridors along active faults. Lead agencies are responsible for regulating most development projects within the APEFZ as described in the Act and may enact more stringent regulations. Certain smaller residential developments can be exempt.

3.2.2 SEISMIC HAZARDS MAPPING ACT OF 1990

The Seismic Hazards Mapping Act of 1990 (PRC, Chapter 7.8, Section 2690-2699.6) directs the CGS to identify and map areas prone to earthquake hazards of liquefaction, earthquake-induced landslides, and amplified ground shaking. The maps are adopted by the lead agencies (cities and counties) in their regulatory documents (safety elements and general plans) to reduce the potential impacts of such hazards to public safety and the built environment. Under the provisions of the Seismic Hazards Mapping Act, statewide regulatory zones (Zones of Required Investigations) identifying the Liquefaction and Landslide Hazard, are issued by CGS. In addition, CGS Special Publication 117A,

[1] CGS was formerly referred to as the California Division of Mines and Geology.

Guidelines for Evaluating and Mitigating Seismic Hazards in California (2008), provides guidance on geotechnical investigations for the evaluation of seismic hazard potential, presents methodologies for the quantification of the hazards, and discusses mitigating measures.

3.2.3 CALIFORNIA BUILDING CODE

The purpose of the California Building Code (CBC), Title 24, is to protect the public health, safety, and general welfare by establishing minimum requirements for the construction, alteration, maintenance, repair, and demolitions of buildings, their appurtenances, and relevant systems (e.g., egress facilities, lighting, ventilation, sanitation, energy conservation). The MRDC (see Section 3.3.1) requires compliance to the most current version of the Los Angeles County Building Code, which is based on the CBC, for the design of surface structures (other than bridges or guideways).

Several chapters of the CBC would be applicable for the Project's developments, including stations and buildings and surface facilities at the MSF site. Indicatively, Chapter 16 establishes the structural design requirements, including, but not limited to, loads and loading combinations to be accounted for (Section 1605 through 1617), strength, and serviceability requirements. Chapter 18 includes requirements for geotechnical investigations (Section 1803), excavation, grading and fill (Section 1804), presumptive load-bearing values of soils (Section 1806), retaining walls and embedded posts and poles (Section 1807), design of shallow and deep foundations (Sections 1808 through 1810), including, but not limited to, site requirements for protecting the foundations from problematic soil conditions (e.g., expansive soils, frost, water intrusion). Chapter 33 includes provisions to safeguard life and public and private property during construction activities, such as demolition (Section 3303) and site work for excavation and fill (Section 3304). Appendix J provides standards for grading, excavation and earthwork construction, design requirements for excavations (Section J106), fills (Section J107), setbacks (Section J108), drainage (Section J109), and erosion control (Section J110).

3.2.4 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

The National Pollutant Discharge Elimination System (NPDES) is a permit program created by the Clean Water Act of 1972 to address water pollution by regulating point sources that discharge pollutants to waterways. Under this act, the NPDES authorizes state governments to perform permitting, administrative, and enforcement aspects of the program. The California State Water Resources Control Board created and administers a Construction Stormwater General Permit (Order 2009-2009-DWQ with amendments 2010-0014-DWQ and 2012-0006-DWQ) as part of the NPDES program. The Water Resources Control Board recently adopted Order WQ 2022-0057-DWQ, which will go into effect on September 1, 2023. All construction activity that disturbs one or more acres of soil or less than one acre but part of a larger development plan must obtain a General Permit for Discharges of Storm Water Associated with Construction Activity. This permit covers construction activity, including clearing, grading, stockpiling, excavation. The permit requires development of a Storm Water Pollution Prevention Plan (SWPPP).

Metro would be responsible for compliance with this NPDES permit. Specific permit requirements will be determined once construction plans and phasing are finalized. NPDES permits and requirements are discussed in greater detail in the Project Hydrology and Water Quality Technical Report.

3.2.5 SURFACE MINING AND RECLAMATION ACT OF 1975

The Surface Mining and Reclamation Act (SMARA) of 1975 (PRC 2710 et seq.) regulates onshore surface mining in the State of California. Its primary purpose is to minimize the environmental impacts from surface mining operations and to protect the sites from activities resulting in mineral loss that might prevent their future use for mineral extraction. SMARA requires the State Mining and Geology Board (SMGB) to adopt state policy for the reclamation of mined lands and the conservation of mineral resources. In addition, SMGB is required to identify the mineral deposits statewide and map and classify the areas in Mineral Resource Zones (MRZ) as follows: (1) MRZ-1: areas where available data indicates that there is little or no likelihood for presence of significant mineral deposits, (2) MRZ-2: areas where significant mineral deposits are present based on the available data or there is high likelihood that such mineral deposits are present, (3) MRZ-3: areas containing mineral deposits the significance of which cannot be determined from available data, and (4) MRZ-4: areas of no known mineral occurrences, where available data does not exclude the presence or absence of significant mineral resources. The authority and requirement to establish specific plan procedures to guide mineral conservation and extraction are passed onto local jurisdictions.

3.2.6 CALIFORNIA DIVISION OF OCCUPATIONAL SAFETY AND HEALTH

All construction activities shall follow the California Division of Occupational Safety and Health Administration (Cal/OSHA) regulations (CCR, Title 8), including safety standards for excavation, trenches, shoring, and earthwork (Subchapter 4), as well as standards for underground construction (Subchapter 20), including ventilation and dust control requirements.

3.3 REGIONAL REGULATIONS

3.3.1 LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY

All Metro rail projects shall be designed in accordance with the most recent MRDC. As stated in MRDC Section 5 Structural/Geotechnical (Metro 2017), MRDC governs the design of Metro-owned facilities, including bridges; aerial guideways; cut-and-cover subway structures; tunnels, passenger stations; earth-retaining structures; surface buildings; miscellaneous structures, such as culverts, sound walls, and equipment enclosures; and other non-structural and operationally critical components and facilities supported on or inside Metro structures, as well as temporary structures. MRDC Section 5 Appendix – Metro Supplemental Seismic Design Criteria controls the seismic design of structures and addresses earthquake-related geohazards, such as fault rupture and earthquake-induced ground instabilities.

MRDC Section 5.6 outlines the requirements for geotechnical investigations (field and laboratory investigations) and reporting, discusses analyses methodologies, and establishes requirements for geotechnical design (reference codes and guidelines) as well as construction instrumentation and monitoring.

MRDC Section 5 Appendix – Metro Supplemental Seismic Design Criteria specify the performance criteria of Metro structures under seismic loading and earthquake-induced ground deformations for Metro-owned underground facilities, including structures and other non-structural components supported on or inside Metro underground structures. For structures, other than bridges and aerial structures, MRDC dictates that the seismic design should conform to the latest version of the Los Angeles County Building Code (based on the CBC). The seismic design for aerial bridges and aerial guideways should comply with the latest version of the California Department of Transportation (Caltrans) Bridge Design Specifications, Caltrans Seismic Design Criteria (SDC), American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design Bridge Design Specifications with Caltrans Amendments, or American Railway Engineering and Maintenance-of-Way Association guidelines, as applicable, depending on the location of the structure. Retaining walls subject to LRT loading would also be designed in compliance with the AASHTO with Caltrans Amendments. MRDC dictates that the seismic design of underground guideway and structures should conform to Metro design specifications, Metro structural standard drawings, and directive drawings. Surface facilities, not covered by Caltrans SDC, shall comply with the requirements of the Los Angeles County Building Code, which is based on the CBC.

MRDC adopts a two-level approach to seismic design for underground structures associated with the Maximum Design Earthquake (MDE) (4 percent probability of exceedance in 100 years) and Operating Design Earthquake (ODE) (50 percent probability of exceedance in 100 years). The Metro structures need to be designed to sustain repairable damage for the MDE level. For the ODE level, the Metro structures need to sustain none to minimal structural damage and need to remain in service for general use immediately after a post-earthquake inspection, including all systems. The methodology for development of site-specific seismic ground motion criteria for the design of Metro structures is also outlined in MRDC Section 5 -Appendix, Chapter 2 (Metro 2017), and is based on the 2014 USGS Probabilistic Seismic Hazard Analyses.

When requirements stipulated in any of the applicable documents are in conflict, the most stringent requirements shall be used.

3.4 LOCAL REGULATIONS

3.4.1 CITY OF LOS ANGELES

3.4.1.1 DEPARTMENT OF BUILDING AND SAFETY

Compliance with the Building Code is mandatory for all development in the City of Los Angeles. Chapter IX Article 1 sets forth for the specific requirements of the CBC. Department of Building and Safety (LADBS) engineers and inspectors confirm throughout the permitting, design, and construction

phases that the requirements of the CBC pertaining specifically to seismic and soil conditions are being implemented by project architects, engineers, and contractors.

3.4.1.2 ORDINANCE NO. 187, 709

Ordinance No. 187, 709 deems all existing drill sites and oil and gas wells a legally nonconforming land use. It also prohibits operators from drilling, redrilling, deepening, or performing any well maintenance, except if it is to prevent or respond to a threat to public health, safety, or the environment as determined by the Zoning Administrator. Even though the Conservation Element provides a map of the various oil fields in the City of Los Angeles and discusses petroleum as a resource, the city does not consider petroleum to be a mineral resource of local importance and considers the activities associated with its extraction to be detrimental to public health and safety and the environment.

3.4.1.3 MUNICIPAL CODE

LOS ANGELES MUNICIPAL CODE SECTION 62.70.040

Section 62.70.040 of the Los Angeles Municipal Code (LAMC), Chapter IX, Division 70 addresses on-site grading and site preparation. It requires that all construction and demolition sites must have a site plan approved by the Building and Safety Department, which must include provisions for grading and site preparation to prevent soil erosion and sediment runoff. The site plan must also include measures to control dust and debris during grading and site preparation. The code requires that contractors must comply with all relevant regulations and guidelines for site preparation and grading, including those established by the city, state, and federal governments.

LAMC SECTION 13.01

Section 13.01 of the LAMC identifies provisions for districts where the drilling of oil wells or the production from the wells of oil, gases, or other hydrocarbon substances is permitted. The Oil Drilling District procedures adopted in 1948 and amended in 1971, set forth provisions for monitoring and imposing mitigation measures to prevent significant subsidence relative to oil and gas extraction and mining activities. The districts are established as overlay zones and are administered by the City Planning Department with the assistance of other city agencies. The City Oil Administrator of the Office of the City Administrative Officer is responsible for monitoring oil extraction activities and has the authority to recommend additional mitigation measures to the Planning Commission after an Oil Drilling District is established. The Planning Department, Office of Zoning Administration issues and administers oil drilling permits and may impose additional mitigation measures, as deemed necessary, after a permit has been granted, such as measures to address subsidence.

3.4.1.4 CITY OF LOS ANGELES GENERAL PLAN

SAFETY ELEMENT

The Safety Element of the Los Angeles 2035 General Plan (2015) outlines the city's policies and programs to address seismic hazards and reduce the risk of damage and loss of life from earthquakes. It provides a comprehensive framework for managing seismic hazards and reducing the vulnerability of the city's built environment. The element includes provisions for:

- Seismic hazard mapping and assessment: Identification and mapping of the city's seismic hazard zones, including the likelihood and severity of earthquakes in each zone.
- Building and safety codes: Requirements for the design and construction of new buildings and structures that can resist earthquakes, including provisions for structural engineering, building materials, and construction methods.
- Retrofit of existing buildings: Requirements for retrofitting existing buildings to improve their resistance to earthquakes, including incentives for building owners and tenants.
- Emergency response and recovery planning: Development of plans for emergency response, evacuation, and recovery from earthquakes, including the training of emergency responders, the provision of emergency equipment, and the preparation of disaster recovery plans.
- Public education and outreach: Programs to educate the public about seismic hazards, emergency preparedness, and the importance of earthquake-resistant buildings and structures.

CONSERVATION ELEMENT

The Conservation Element of the City of Los Angeles General Plan guides the long-term conservation of natural resources and preservation of available open space areas. It outlines the various regulations and programs associated with the conservation, protection, development, utilization, and reclamation of natural resources, including mineral resources (sand and gravel) and fossil fuels (oil and gas). The Conservation Element, implementing SMARA, aims to protect access to state-identified zones of mineral resources by controlling the land uses and discouraging incompatible land uses, as well as guiding mineral conservation and extraction through the adoption of provisions that allow for environmentally safe extraction, thereby protecting the resources for the use of future generations. The City of Los Angeles has adopted the ‘G’ Surface Mining provisions (LAMC 13.03) for mineral resource management, since 1975. The local community plan elements (under the City of Los Angeles General Plan) also contain resource management provisions for the corresponding identified MRZ-2 sites. In addition, the City of Los Angeles issues mining permits and monitors site reclamation efforts. The City of Los Angeles has also adopted the ‘O’ Oil Drilling provisions (LAMC 13.01) since 1953, which control the surface activities associated with drilling and operating of oil wells and associated facilities. However, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits any new oil and gas extraction within the city’s limits, and deems existing extraction activities a legally nonconforming use across all zones.

3.4.2 CITY OF WEST HOLLYWOOD

3.4.2.1 GENERAL PLAN 2035 SAFETY AND NOISE ELEMENT

The Safety and Noise Element of the City of West Hollywood General Plan 2035 aims to reduce death, injuries, damages to property, and economic and social dislocation resulting from earthquakes and other geologic hazards. This document identifies several Safety and Noise (SN) policies and goals pertaining to ground motion, fault rupture, liquefaction, and emergency response:

- SN-1.1: Follow State guidelines regarding requiring upgrades or minimize the use of buildings and facilities that are vulnerable to natural or man-made hazards throughout the community through a program of orderly and effective identification of vulnerable buildings, outreach, education, support and enforcement.
- SN-1.2: Allow the consideration of potential natural or man-made hazards in project review and in City operations, considering best practices in hazard-avoidance and mitigation in the siting, structural engineering, maintenance, and building and landscape design for all development projects.
- SN-1.3: Require fault rupture hazard studies for sites located within the City-defined Fault Precaution Zone delineated around the Hollywood Fault Zone.
- SN-1.4: Maintain high standards for the seismic performance of buildings in all new development, through requirements for detailed geotechnical investigations following State guidelines and prompt adoption and careful enforcement of the best available standards for seismic design.
- SN-1.6: Utilize relevant data on natural hazards, including earthquakes, flooding, liquefaction, landslides, natural gas and subsurface methane gas, and apply this information for purposes of land use planning, including any permitting.

3.4.2.2 MUNICIPAL CODE

Chapter 19.32 of the City of West Hollywood Municipal Code establishes seismic safety standards. These standards are intended to protect development proposed in hazardous areas within dam failure inundation areas, fault precaution zones, and liquefaction susceptibility zones established by the General Plan.

The city has identified two fault precaution zones for consideration of future development. Fault Precaution Zone 1 (FPZ-1) consists of a region approximately 200 feet north and 500 feet south of the interpreted Hollywood Fault trace. New development in FPZ-1 requires a fault rupture evaluation by a California Certified Engineering Geologist to verify that the main trace or a recently active splay of the fault does not project through critical site structures or facilities. Fault Precaution Zone 2 (FPZ-2) consists of an area 200 feet south of FPZ-1. New development in FPZ-2 requires either a fault rupture evaluation or provisions for a strengthened foundation system capable of sustaining estimated ground displacements of 1 to 2 inches.

Within liquefaction susceptibility zones identified in the General Plan, a soils report is required that includes liquefaction potential studies and appropriate mitigation measures where liquefaction potential is identified.

CHAPTER 4 METHODOLOGY AND SIGNIFICANCE THRESHOLDS

4.1 METHODOLOGY

The purpose of this assessment is to evaluate the Project against thresholds of significance as the basis for determining the level of impacts related to geology, soils, seismicity, and mineral resources.

Documentation containing possible data within the vicinity of the Project was collected, reviewed, and evaluated from the following sources as part of preparation of this report. Available published and unpublished literature, as well as consultant reports within the region for known geologic hazards. Documents reviewed include:

- The safety elements of the General Plans for Los Angeles County and Cities of Los Angeles and West Hollywood.
- Geological reports and studies for previous Metro projects.
- Soil and geology reports from the Los Angeles Department of Public Works online database.
- The official APEFZ Maps; official Seismic Hazard Zone Maps, geologic and topographic maps, and other publications by the CGS, USGS, and California Division of Oil and Gas.
- Log of test borings and reports available from the Caltrans Digital Archive of Geotechnical Data.
- Borehole data from the CGS Borehole Database.
- Historical boring logs from the LADBS.
- Historical boring logs from the City of West Hollywood.
- Boring logs from Los Angeles City Planning.
- Geotechnical data from the GeoTracker database.

4.2 CEQA SIGNIFICANCE THRESHOLDS

In accordance with Appendix G of the 2022 State CEQA Guidelines, the Project would have a significant impact related to geology, soils, and seismicity if it would:

Impact GEO-1: Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

- Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42)
- Strong seismic ground shaking
- Seismic-related ground failure, including liquefaction
- Landslides

Impact GEO-2: Result in substantial soil erosion or the loss of topsoil.

Impact GEO-3: Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

Impact GEO-4: Be located on expansive soil, as defined in Section 1803.5.3 of the California Building Code (CBC), creating substantial direct or indirect risks to life or property.

Impact GEO-5:[2] Directly or indirectly destroy a unique geologic feature.

Appendix G of the State CEQA Guidelines also includes a significance threshold for impacts relating to the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater. The Project is located in an urban environment with an existing sewer system and no existing or proposed septic tanks are proposed as part of the Project; therefore, this threshold is considered not applicable.

Additionally, implementation of the Project would have a significant impact related to mineral resources if it would:

Impact MR-1: Result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state.

Impact MR-2: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

[2] Impact GEO-5 as stated in Appendix G of the State CEQA Guidelines also has a paleontological element that is being reviewed and evaluated in the Cultural and Paleontological Resources Technical Report as impact significance threshold CUL-4.

CHAPTER 5 EXISTING SETTING

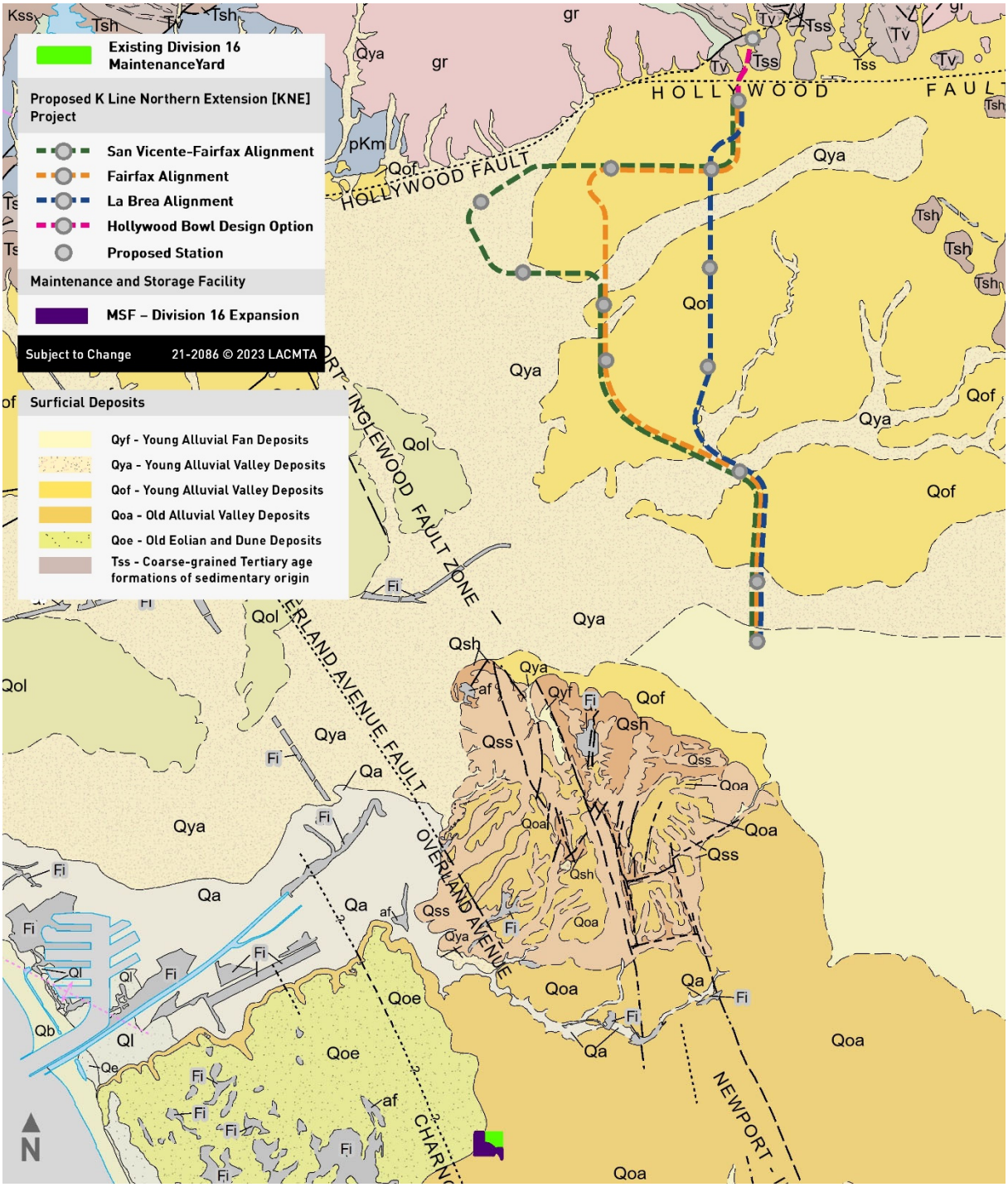
5.1 REGIONAL SETTING

5.1.1 REGIONAL GEOLOGIC SETTING

The Project is primarily located within the Los Angeles Basin, in the northern end of the Peninsular Ranges Geomorphic Province and near the southern boundary of the Transverse Ranges Geomorphic Province of California (CGS Note 36, based on Jennings, 1938). The dominant structural features of the Transverse Ranges are characterized by east-west trending mountain ranges, such as the Santa Monica Mountains that were uplifted during the Miocene and early Pliocene times. The Peninsular Ranges are characterized by northwesterly trending mountain ranges and intervening valleys extending from the Los Angeles Basin to the southern tip of the Baja California Peninsula. At the northern boundary of the Los Angeles Basin, the Transverse and Peninsular Ranges are bordered along the Santa Monica and Hollywood Faults.

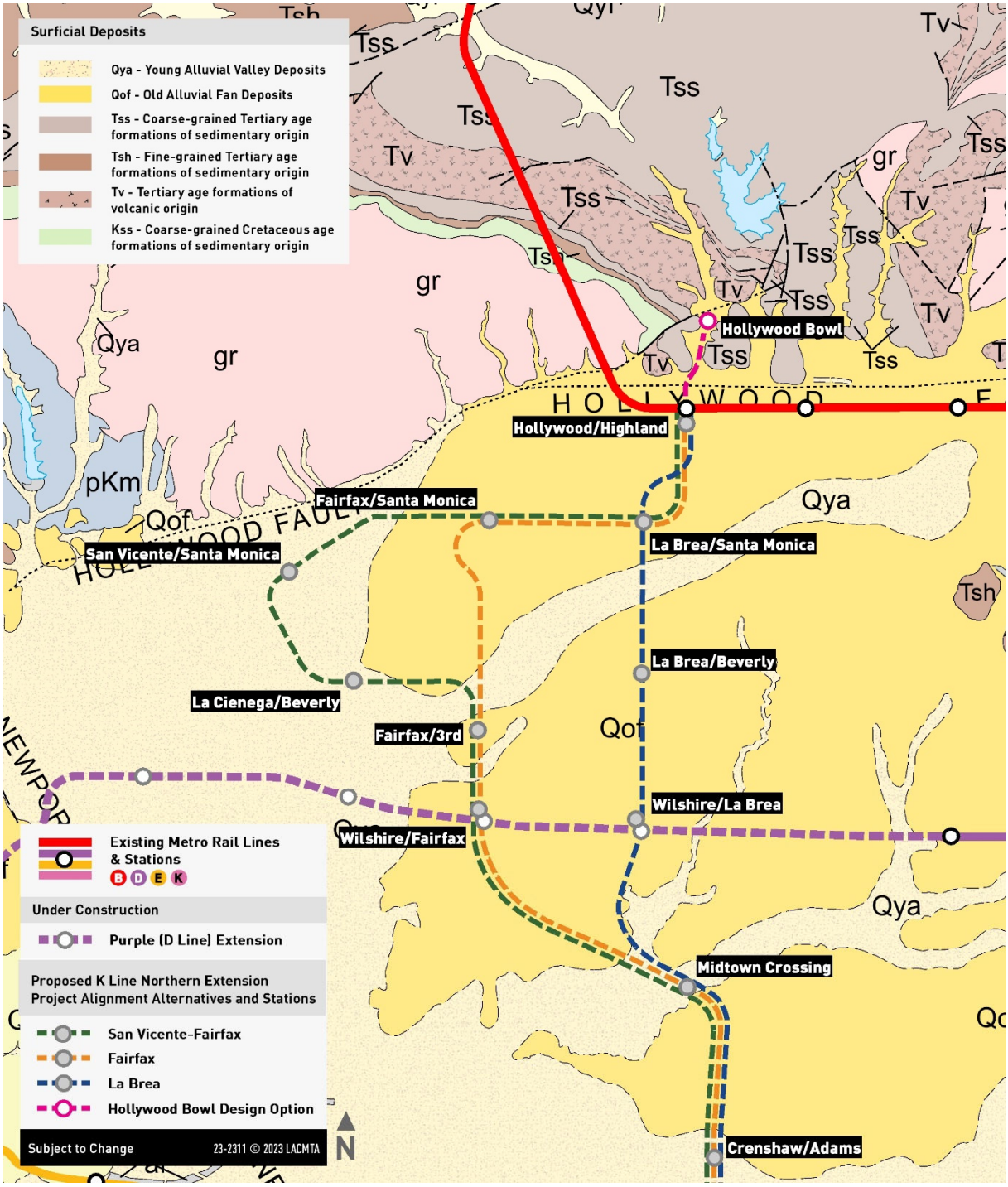
The Los Angeles Basin is a northwest-trending, sediment-filled structural trough that is approximately 31,000 feet deep at its deepest point, 50 miles long, and 20 miles wide. It is bounded on the north by the Santa Monica Mountains; on the east by the Elysian, Repetto, and Puente Hills; and on the southeast and south by the Santa Ana Mountains and the San Joaquin Hills (Yerkes et al. 1965). At the surface, the basin is an alluvial coastal plain of generally low relief that slopes gradually seaward toward the south, southwest, and west. The proposed MSF site is within the northern margin of the Torrance Plain physiographic feature of the Los Angeles Coastal Plain. The Torrance Plain is a Quaternary alluvial plain that drains on a gentle slope southward from the El Segundo Sand Dunes and Baldwin Hills to San Pedro Bay. The Project location with respect to the surficial deposits of the Los Angeles Basin is shown in Figure 5-1 (Bedrossian, et al., 2012). The geologic setting focused on the vicinity of the Hollywood Bowl Design Option is presented in Figure 5-2 (Campbell et al. 2014).

FIGURE 5-1. SURFICIAL DEPOSITS



Source: Bedrossian et al. 2012

FIGURE 5-2. SANTA MONICA MOUNTAINS GEOLOGIC SETTING



Source: Campbell et al. 2014

5.1.2 REGIONAL PHYSIOGRAPHY AND TOPOGRAPHY

The ground surface in the Project area is generally flat across the alignment alternatives, gently sloping to the south and west toward the coast. The design option extends into the foothills of the Santa Monica Mountains. Elevations along the Project area range from 100 feet at the MSF site, 110 feet at the southern end of the alignment alternatives near the Crenshaw/Adams Station, and 395 feet at the northern terminus of the alignment alternatives near the Hollywood/Highland Station. The design option reaches elevations up to 560 feet.

5.2 RESOURCE STUDY AREA

The resource study area (RSA) for this geology and soils assessment is delineated as a 300-foot radius around the alignment alternatives and stations, design option, and MSF. The geological units, faulting and seismicity, seismic hazards and non-seismic hazards sections below include separate section headings for each alignment alternative, design option, and MSF separately where there are substantial differences in the existing conditions; however, where the alternatives share resources, the discussion is grouped under a single heading.

5.2.1 RESOURCE STUDY AREA GEOLOGIC UNITS

This section summarizes the main geologic units in the RSA. The geologic units described below are based on a review of published geologic maps and literature. Surficial geology of the general Project area is shown in Figure 5-1. Relevant units for most of the alignment alternatives and the MSF include alluvium and sedimentary rock formation. Considering the great depths, bedrock is not anticipated along most of the Project area except near the northern end of the alignment alternatives and design option.

5.2.1.1 SURFICIAL DEPOSITS

The surficial geologic units are summarized in Table 5-1, including their locations along the alignments.

TABLE 5-1. SURFICIAL GEOLOGIC UNITS

SOIL MAP UNIT (MAP SYMBOL)	DESCRIPTION	PROJECT AREAS	ALTERNATIVES UNDERLAIN
Young Alluvial Valley Deposits	Unconsolidated to slightly consolidated, undissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers	Jefferson Blvd to I-10, Venice Blvd at Mid-City to S La Brea Ave along San Vicente Blvd, West Hollywood along Beverly Blvd west of Sweetzer Ave, San Vicente and Santa Monica west of Sweetzer Ave, as well as areas along Fairfax Avenue and La Brea Ave (between Melrose Ave and Willoughby Ave)	1, 2, 3
Young Alluvial Fan Deposits (Qyf)	Unconsolidated to slightly consolidated, undissected to slightly dissected boulder, cobble, gravel, sand, and silt deposits issued from a confined valley or canyon	Southern terminus to Jefferson Blvd	1, 2, 3
Old Alluvial Valley Deposits (Qoa)	Slightly to moderately consolidated, moderately dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of large rivers	West of I-405 and South of California State Highway 42	MSF
Old Eolian and Dune Deposits (Qoe)	Slightly to moderately consolidated, moderately dissected wind-blown sands	West of I-405 and South of California State Highway 42	MSF
Old Alluvial Fan Deposits (Qof)	Slightly to moderately consolidated, moderated dissected boulder, cobble, gravel, sand, and silt deposits issued from a confined alley or canyon	All Areas	1, 2, 3

Source: Connect Los Angeles Partners 2023
Note: MSF = maintenance and storage facility

FILL (Fi)

While not depicted on the geologic maps, fill is anticipated at each alignment alternative, the design option, and the MSF. Fill is typically composed of deposits resulting from human construction including engineered fill for buildings and roads. Historically, fill was placed during the construction of some past projects adjacent to proposed alignment to raise the grade at proposed site or to replace unsuitable foundation soil as ground improvement. The thickness and lateral extent of these fill soils depend on the original topography as well as intended development. Composition and compaction of fill soils are variable depending on the original source of the fill.

5.2.1.2 FORMATIONS

Beneath the fill and alluvium, several subsurface geologic units are anticipated across much of the alignment alternatives. Descriptions of the formations are summarized from the Westside Subway Extension Project, Section 1: Geotechnical Baseline Report (Metro 2014).

LAKEWOOD FORMATION (Qlw)

The Lakewood Formation is predominately interbedded yellow and brown to light- to medium-gray-colored silty sands, poorly graded sands, silts and clays with some clayey sand layers and some layers and zones of gravel and occasional cobbles.

SAN PEDRO FORMATION (Qsp)

The San Pedro Formation unconformably underlies the Lakewood Formation and Older Alluvium (meaning the San Pedro Formation is significantly older than and in contact with younger formations). Interbedded light to dark greenish-gray and bluish-gray, fine-grained micaceous sand and silty sand, with interbeds of medium- to coarse-grained sand and silt layers are present. Occasional cobbles, gravelly sand layers and shell fragments are also present. Local lenses and more continuous layers of hard to very hard concretionary deposits strongly cemented with calcium carbonate are present. Where tar sand is encountered along the alignment alternatives, it is usually found in this formation.

FERNANDO FORMATION (Tf)

The Fernando Formation unconformably underlies the San Pedro Formation. Predominantly massive siltstone, clayey siltstone, and claystone with few rare sandstone interbeds are present.

5.2.1.3 BEDROCK

The three alignment alternatives all connect at the northern end to the existing Metro B Line at the Hollywood/Highland Station, with an alternate terminus station farther north at the Hollywood Bowl. The design option crosses the Hollywood Fault and extends into the Santa Monica Mountains, which are an uplifted block comprised of Mesozoic age igneous and metamorphic rocks overlain by Tertiary sedimentary rocks along its flanks. On the north side of the Hollywood Fault, the design option would encounter bedrock of the Topanga Group (also referred to as Tertiary Units in Bedrossian 2012) based on the Preliminary Geologic Map of the Los Angeles 30’ x 60’ Quadrangle (Campbell et al. 2014), as shown in Figure 5-2.

TOPANGA GROUP SANDSTONE (Ttss)

Topanga Group Sandstone is typically medium- to coarse-grained, well-bedded, light brown and gray.

TOPANGA GROUP SILTSTONE (Ttsl)

Topanga Group Siltstone is typically well-bedded, medium to dark brown, with interbedded sandstone, shale, and chert.

INTRUSIVE AND EXTRUSIVE VOLCANIC ROCKS (Ttb)

Intrusive and Extrusive Volcanic Rocks are chiefly basaltic, interlayered with sandstone and shale assigned to the Topanga Group.

TOPANGA GROUP CONGLOMERATE (Ttcg)

Topanga Group Conglomerate is typically conglomerate, massive- to well-bedded, light brown, and includes basal breccia locally.

5.2.2 REGIONAL STRATIGRAPHY

5.2.2.1 ALIGNMENT ALTERNATIVES AND DESIGN OPTION

In general, the sequence of the geologic units underlying the alignment alternatives, from top to bottom, consists of fill, younger and older alluvium, and San Pedro and Fernando Formation bedrock. Topanga Group bedrock units are present near the northern end of the alignment alternatives.

The distribution of surficial geologic units is characterized by Quaternary alluvial sediments that were shed from the south flank of the Santa Monica Mountains and late Tertiary sedimentary rock, as shown in Figure 5-2. The Quaternary sediments and late Tertiary sedimentary rock within the RSA are summarized in Section 5.2.1 as per the CGS Special Report 217: Geologic Compilation of Quaternary Surficial Deposits in Southern California (Bedrossian et al. 2012).

5.2.2.2 MAINTENANCE AND STORAGE FACILITY

The geologic unit immediately underlying the MSF site consists of both Old Alluvial Valley deposits (Qoa) and Old Eolian and Dune deposits (Qoe) aged from Late to Middle Pleistocene (Roffers and Bedrossian 2010). The Torrance Plain is underlain by Late Pleistocene-age sediments of the Lakewood Formation, which generally consists of alternating layers of dense to very dense sand, clayey sand, silty sand, and very stiff to hard silty to sandy clay and clayey silt. The Lakewood Formation is underlain by the Pliocene age deposits of the Pico Formation. The Pico Formation is underlain by the Miocene age Monterey shale and Puente Formation.

5.2.3 GROUNDWATER

5.2.3.1 HYDROGEOLOGIC SETTING

The general hydrogeologic setting can be characterized by grouping it into two main aquifer systems: (1) the semi-perched aquifer systems of the Alluvium and the Lakewood Formations and (2) the saturated San Pedro and Fernando Formations.

The surficial alluvium deposits described in Section 5.2.1 is a semi-perched layer, meaning impermeable layers such as clayey sand and clay can exist locally and partially trap groundwater. Defining the groundwater levels in this layer is difficult because the layer is largely unsaturated, so measuring groundwater during drilling results in an inconsistent picture of the actual groundwater conditions. In some areas, the alluvium can be a non-perched, water-bearing aquifer. In other areas, semi-perched conditions and unsaturated conditions might exist.

Between the Expo/Crenshaw Station and the Midtown Crossing Station, the Lakewood Formation is relatively shallow. It has similar composition as the overlaying alluvial deposits and exhibits similar

semi-perched conditions with unsaturated zones. Tar-impacted soils found in the middle of the alignment alternatives near Wilshire Boulevard also act as a relatively impermeable layer, trapping groundwater in the overlaying Lakewood Formation.

In the northern part of the RSA, south of the Hollywood Fault, the Lakewood Formation becomes thicker. Along Santa Monica Boulevard between Crescent Heights Boulevard and Fuller Avenue, groundwater appears to be deeper than in the southern portion of the RSA because many of the boreholes drilled along Santa Monica Boulevard did not encounter groundwater.

The San Pedro and Fernando Formations are generally saturated. Semi-confined groundwater and artesian conditions may exist in the portions of the RSA around and south of Wilshire Boulevard.

The groundwater condition near the base of Santa Monica Mountains and near the Hollywood Fault is more complicated because the structural geology changes through alluvial sediments, fractured and sheared rocks, and less jointed rocks. Substantial fluctuations in hydraulic head are expected while crossing the Hollywood Fault. However, no groundwater data is available at the fault crossings. Groundwater pressure fluctuates depending on the saturation conditions of fractures and joints in the bedrock. Moving farther north from the Hollywood Fault toward the Santa Monica Mountains, the groundwater pressure is expected to lessen unless saturated joints are encountered.

5.2.3.2 HISTORICAL HIGH GROUNDWATER LEVELS

ALIGNMENT ALTERNATIVES AND DESIGN OPTION

The historical high groundwater levels reported in the CGS Seismic Hazard Report 023 and 026 for Beverly Hills and Hollywood 7.5-minute quadrangles (CGS 1998a, 1998b) are shown in Figure 5-3 in relationship to the alignment alternatives and design option. From the southern terminus of the alignment alternatives to Venice Boulevard, the depth to the highest groundwater level varies from 10 to 60 feet below ground surface (bgs). Between Venice Boulevard and 3rd Street, depth to groundwater is relatively flat and at about 10 to 20 feet bgs. Beyond this point to the northern end of the alignment alternatives, groundwater depth significantly varies between 10 to 100 feet bgs. This historical high groundwater map may differ from actual water table measured at particular times; the CGS uses the highest known groundwater levels to evaluate the liquefaction potential during an earthquake because the water levels cannot be anticipated due to the unpredictable fluctuations caused by natural processes and human activities. Groundwater levels at the site are subject to variations in groundwater basin management, seasonal variation, nearby construction, irrigation, and other artificial and natural influences.

FIGURE 5-3. HISTORICALLY HIGHEST MEASURED GROUNDWATER

Source: CGS 1998a; 1998b

MAINTENANCE AND STORAGE FACILITY

Based on the CGS Seismic Hazard Zone Report of Inglewood and Venice Quadrangle (CGS 1998c, 1998d), which are regional studies, the highest historical groundwater level in the MSF RSA is approximately 40 to 50 feet bgs. Inspection of groundwater records from historic soil borings and observation wells within 300 feet of the site shows that the depth to groundwater generally ranged from approximately 90 feet bgs near Arbor Vitae Street to approximately 115 feet bgs or more near Manchester Boulevard, except for a limited perched groundwater area that was observed south of Arbor Vitae Street to the east of the MSF. Localized perched water conditions, which is common in the alluvial deposits in the Los Angeles Basin, may be encountered at the site.

5.3 FAULTING AND SEISMICITY

5.3.1 GENERAL SETTING

Plate tectonics and the forces that affect the Earth's crust also affect Southern California geology and seismicity. Faults are formed at the plate boundaries and other stress points within tectonic plates. Faults adjacent to, within, and beneath the City of Los Angeles may be classified as inactive, potentially active, or active. An active fault is one that has had surface displacement within Holocene time (approximately the last 11,000 years). A potentially active fault is a fault that has demonstrated surface displacement of Quaternary age deposits (approximately the last 1.6 million years). Inactive faults have not moved in the last 1.6 million years. Figure 5-4 shows seismic hazards in the vicinity of the alternatives and identifies APEFZs, liquefaction zones, and earthquake-induced landslide zones mapped by the CGS. Seismic and other geologic hazards for the Project are discussed in the following sections.

5.3.2 ACTIVE FAULTS

5.3.2.1 ALIGNMENT ALTERNATIVES AND DESIGN OPTION

The active Hollywood Fault, identified as an APEFZ, runs roughly east-west along the base of the Santa Monica Mountains from Sunset Boulevard and Doheny Drive in the west to Franklin Avenue and Vine Street in the east. Other active faults that are identified as APEFZs and located within 5 miles of the RSA include the Santa Monica and Newport-Inglewood Faults. The Santa Monica Fault extends westward from Beverly Hills across West Los Angeles and Santa Monica to Pacific Palisades. The Santa Monica Fault has been interpreted to extend eastward as the Hollywood Fault. The Santa Monica and Hollywood Faults form the southern boundary of the Transverse Ranges that extends eastward for more than 150 miles through the northern part of the Los Angeles metropolitan region and to the west offshore and sit about 500 feet to a mile from the alignment alternatives.

FIGURE 5-4. SEISMIC HAZARDS

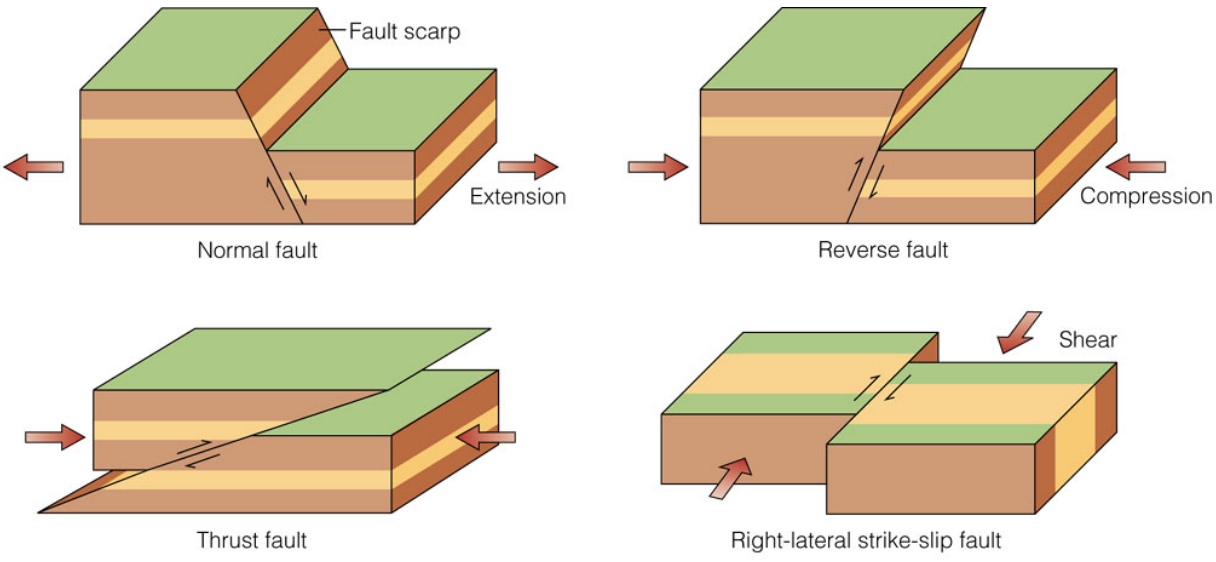
Source: CGS 1998a; 1998b; 1998c; 1998d

The Newport-Inglewood Fault is located about 1.5-miles west of the southern end of the Project alignment. The Newport-Inglewood Fault Zone is composed of a series of discontinuous northwest-trending parallel to sub-parallel faults extending from Ballona Gap southwestward to the area offshore from Newport Beach. This fault separates the central and southwestern blocks of the Los Angeles Basin (Reichard et al. 2003).

5.3.2.2 MAINTENANCE AND STORAGE FACILITY

The closest potentially active fault to the MSF is the Charnock Fault, located roughly 0.5 mile west of the proposed MSF site, as shown in Figure 5-5. The nature and existence of the Charnock Fault in the MSF vicinity is uncertain. Review of previous Earth/Geology Technical Reports for the LAX Master Plan EIS/EIR (Camp, Dresser, & McKee 2001) indicates the fault may extend toward and possibly beneath LAX in the vicinity of the east end of Runways 25R and 25L. The Charnock Fault was identified as a groundwater barrier. The fault appears to offset the eastern base of the lower Pleistocene San Pedro Formation by 140 feet. The fault fails to displace the "50-foot gravel" (pre-Holocene or earliest Holocene age) of the Ballona Gap but does appear to offset upper Pleistocene terrace deposits. The fault has apparently not been observed at the surface. Its attitude (orientation of the fault plane) is unknown, but it is presumed to have a near-vertical dip. By analogy with the nearby Newport-Inglewood Fault Zone (NIFZ), which has a similar orientation, the Charnock is typically considered to be a strike-slip fault (Figure 5-5). The eastside down displacement of the San Pedro Formation, however, indicates that the fault exhibits a significant vertical component of displacement in addition to strike-slip offset. Evidence exists for displacements on the Charnock Fault of approximately 140 feet in Late Pleistocene units, but no displacements in Holocene units have been reported. Because the Charnock Fault does not displace Holocene deposits, it is considered a low potential fault for fault rupture.

FIGURE 5-5. GEOLOGIC FAULT TYPES



Source: Monroe et al. 2006

Two other faults, the Overland Fault and the NIFZ, parallel the Charnock Fault to the southwest. The NIFZ is located about 2.3 to 2.9 miles to the northeast of the MSF and the Overland Fault is 1.3 to 1.8 miles to the north of the MSF site. The NIFZ is an uplifted anticlinal structure broken up by a series of offset, parallel faults. Movement along the NIFZ has resulted in formation of the string of low hills that extend from the Baldwin Hills southeastward to Newport Beach. The Overland Fault is considered potentially active.

5.4 SEISMIC HAZARDS

5.4.1 FAULT RUPTURE

Fault rupture is the result of fault movement that occurs either suddenly during earthquakes or slowly due to a process known as fault creep. It is the result of tectonic movement that originates deep in the Earth. The energy released during an earthquake is a direct result of fault rupture at depth, and when that rupture extends to the ground surface, it manifests as ground displacements expressed as fractures, fissures, offsets, and related tectonic deformations.

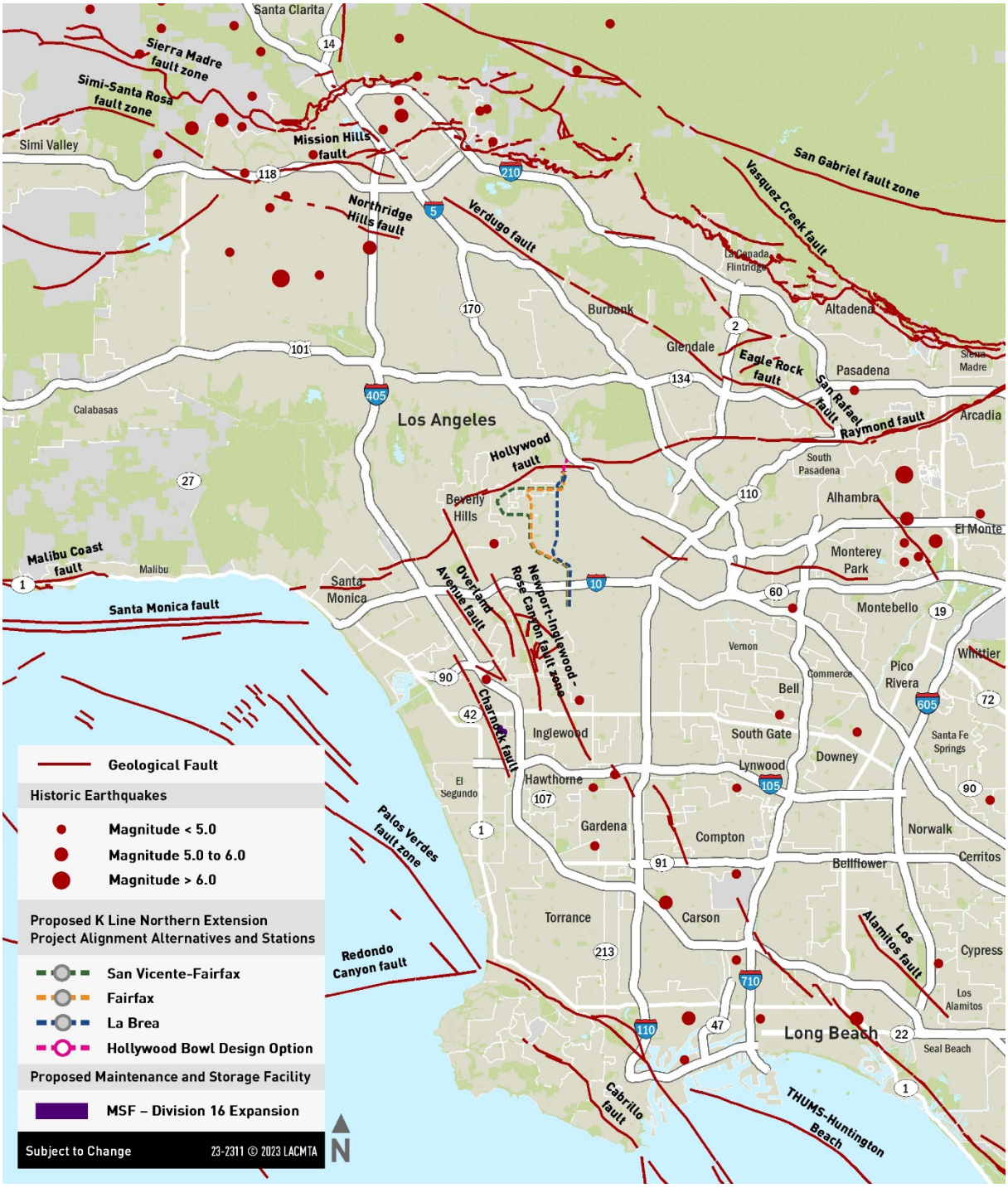
California state law prohibits the construction of structures for human occupancy in an APEFZ unless the absence of Holocene faulting can be demonstrated by geologic studies. Based on the current Project plans, the tail tracks of each alignment alternative at the Hollywood/Highland Station are in a portion of the APEFZ associated with the Hollywood Fault. The design option would traverse the Hollywood Fault zone in the vicinity of Franklin Avenue, a designated A-P Earthquake Fault Zone.

5.4.2 SEISMIC GROUND SHAKING

The Uniform California Earthquake Rupture Forecast, Version 3 (Field et al. 2013) provides authoritative estimates for magnitude, location, and time-averaged frequency of potentially damaging earthquakes in California. The magnitudes of recorded earthquakes (Branum et al. 2016) are shown on Figure 5-6. In accordance with MRDC Section 5 (Metro 2017), Metro Rail structures need to be designed to sustain seismic effects based on the 2,500-year criteria. The probabilistic MDE response spectrum should be 4 percent probability of exceedance in 100 years. A repairable damage level should be considered for the MDE level in lieu of “significant damage” sometimes used for other projects.

The probabilistic ODE response spectrum should be 50 percent probability of exceedance in 100 years. Designing for the lower-level ground motions reduces the likelihood of future repair and maintenance costs by minimizing damage during more frequently occurring earthquakes. The ODE service level damage is considered to be none to minimal.

FIGURE 5-6. HISTORIC SEISMICITY



Source: City of LA Geohub (accessed 2023)

5.4.3 LIQUEFACTION

Liquefaction occurs when saturated, low relative density materials are transformed from a solid to a near-liquid state. This phenomenon occurs when moderate to severe ground shaking causes pore-water pressure to increase. Site susceptibility to liquefaction is a function of the depth, density, soil type, and water content of coarse-grained sediments, along with the magnitude and frequency of earthquakes in the surrounding region. Saturated sands, silty sands, and unconsolidated silts within 50 feet of the ground surface are most susceptible to liquefaction. Liquefaction-related phenomena include lateral spreading, ground oscillation, flow failures, loss of bearing strength, subsidence, and buoyancy effects.

5.4.3.1 ALIGNMENTS AND STATIONS

The Seismic Hazard Zone Report 023 and 026 (CGS 1998a, 1998b) presents a study of potentially liquefiable zones in the Beverly Hills and Hollywood quadrangles. The findings are shown in Figure 5-4. All alignment alternatives are located in a mapped liquefaction zone from Exposition Boulevard and I-10. The San Vicente–Fairfax Alignment is located in a mapped liquefaction zone between the intersection of Fairfax Avenue and 1st Street and Croft Avenue and Santa Monica Boulevard. The Fairfax Alignment is located in a mapped liquefaction zone between 1st Avenue and Rosewood Avenue. The historic highest groundwater levels in the vicinity of the alignment alternatives range between 10 and 100 feet deep.

5.4.3.2 DESIGN OPTION

Using the same Seismic Hazard Zone Reports in Section 5.4.3.1, the design option is located in mapped liquefaction zones from Franklin Avenue to its alignment termini at the Hollywood Bowl. The historic highest groundwater levels in the vicinity of the design option is around 100 feet bgs.

5.4.3.3 MAINTENANCE AND STORAGE FACILITY

Based on the CGS Seismic Hazard Zones Official Maps (CGS 1998c, 1998d), the MSF site is not located in the mapped liquefaction hazard areas, as shown in Figure 5-4. Based on the highest historical groundwater contour map (CGS 1998c, 1998d) and a review of existing borings performed in 2004 near the potential MSF site location, groundwater is approximately 50 feet bgs or deeper. Therefore, the potential for liquefaction within the MSF site is considered low.

5.4.4 SEISMICALLY INDUCED SETTLEMENT

Seismically induced settlement typically occurs in loose, unsaturated granular soils. Fill above the groundwater table in the RSA could be considered loose and susceptible to seismic-induced settlement. Additionally, some alluvial soils in the RSA are anticipated to be loose to medium dense and susceptible to seismically induced settlement.

Settlement can also occur post-liquefaction when the excess pore-water pressure induced by the seismic shaking dissipates and the soil readjusts in a new equilibrium condition. This typically occurs

within a few seconds to minutes after the earthquake event. Post-liquefaction settlements can pose a significant hazard to structures founded on shallow foundations.

5.4.5 SEISMICALLY INDUCED LANDSLIDES

The Seismic Hazard Zone Report 023 and 026 identified earthquake-induced landslide potential zones (CGS 1998a, 1998b), as shown on Figure 5-4. The design option, north of the Hollywood/Highland Station, is in proximity to or within an identified zone. It should be noted that this study was based on the preliminary geologic map of the Hollywood 7.5' Quadrangle published by the USGS in 1997 (Yerkes 1997) and does not consider more recent work in this area. Neither the alignment alternatives nor the MSF site is located within or in proximity to mapped seismically induced landslide potential zones.

5.5 NON-SEISMIC HAZARDS

5.5.1 SLOPE STABILITY

An overlay of the alignment alternatives with the CGS Map Sheet 58, Susceptibility to Deep-Seated Landslides in California (Wills et al. 2011) shows that some parts of the alignment alternatives may be in areas with high landslide susceptibility. As shown in Figure 5-7, this map classifies landslide susceptibility by the steepness of a given slope and not necessarily an underlying instability. Weak, highly weathered rocks along steep slopes may be susceptible to landslides induced by extreme events such as heavy rainstorms or seismic shaking. This map shows only potential hazards and does not specify trigger events. The MSF site is not located in an area with potential landslide susceptibility.

5.5.2 EXPANSIVE SOILS

Expansive soils are clay-rich soil that have the potential to shrink and swell when they dry out or become saturated. The shrink-swell capacity of expansive soils can result in differential movement below or adjacent to a structure. This differential movement can result in significant damage to pavements, as well as foundations and associated structures. Clay-rich soils may exist locally within alluvial soils present in the RSA.

Information on the shrink-swell potential of some surficial soil units (upper 5 feet) within the RSA is available in the online United States Department of Agriculture (USDA) soil survey database (Table 5-2).

TABLE 5-2. EXPANSIVE POTENTIAL OF SOILS

SOIL MAP UNIT (MAP SYMBOL)	DESCRIPTION/ SOIL TEXTURE	LINEAR EXTENSIBILITY[1] (%)	SHRINK-SWELL POTENTIAL[1]
1161	Osito-Kawenga association, 20 to 65% slopes	1.0	Low
290	Topanga-Mipolomol-Sapwi association, 30 to 75% slopes	1.7	Low

Source: USDA Natural Resources Conservation Service National Soil Survey Handbook Part 618, 2022
[1] Linear extensibility percentage (LEP) can be used as a measure of shrink-swell potential. Soils with LEP lower than 3 typically exhibit low potential; soils with LEP between 3 and 5.9 typically exhibit moderate potential; soils with LEP between 6 and 8.9 exhibit high potential; and soils with LEP higher than 9 exhibit very high potential. Soils with moderate to very high potential can be detrimental to foundations, buildings, pavements, etc.

5.5.2.1 ALIGNMENT ALTERNATIVES

As discussed in Section 5.1.1 and 5.2.1, the alignment alternatives would be constructed within alluvial deposits, and more specifically, Qyf deposits, Qya deposits, and Qof deposits, as shown in Figure 5-1. Based on the soil matrix in these predominant geologic units (Bedrossian et al. 2012), clay-rich soils are most likely to be encountered within the alignment alternatives section underlain by Qya deposits; clay-rich soils may exist locally within alluvial deposits present within the RSA.

5.5.2.2 DESIGN OPTION

As discussed in Section 5.1.1 and 5.2.1 and shown in Figure 5-1 and Figure 5-2, the design option would encounter old alluvial fan deposits (Qof), as well as tertiary-age bedrock of Topanga Group (T_t). The Topanga Group may include sandstone, siltstone, shale, chert, basalt, conglomerate, and breccia (Campbell 2014). Based on the soil matrix in these predominant alluvial units (Bedrossian, et al. 2012), old alluvial fan deposits (Qof) are not expected to be clay-rich and therefore not expected to have high expansion potential. However, clay-rich soils may exist locally within alluvial soils. In addition, some of the tertiary-age bedrock units, such as shale, typically contain clay minerals and might exhibit expansive behavior.

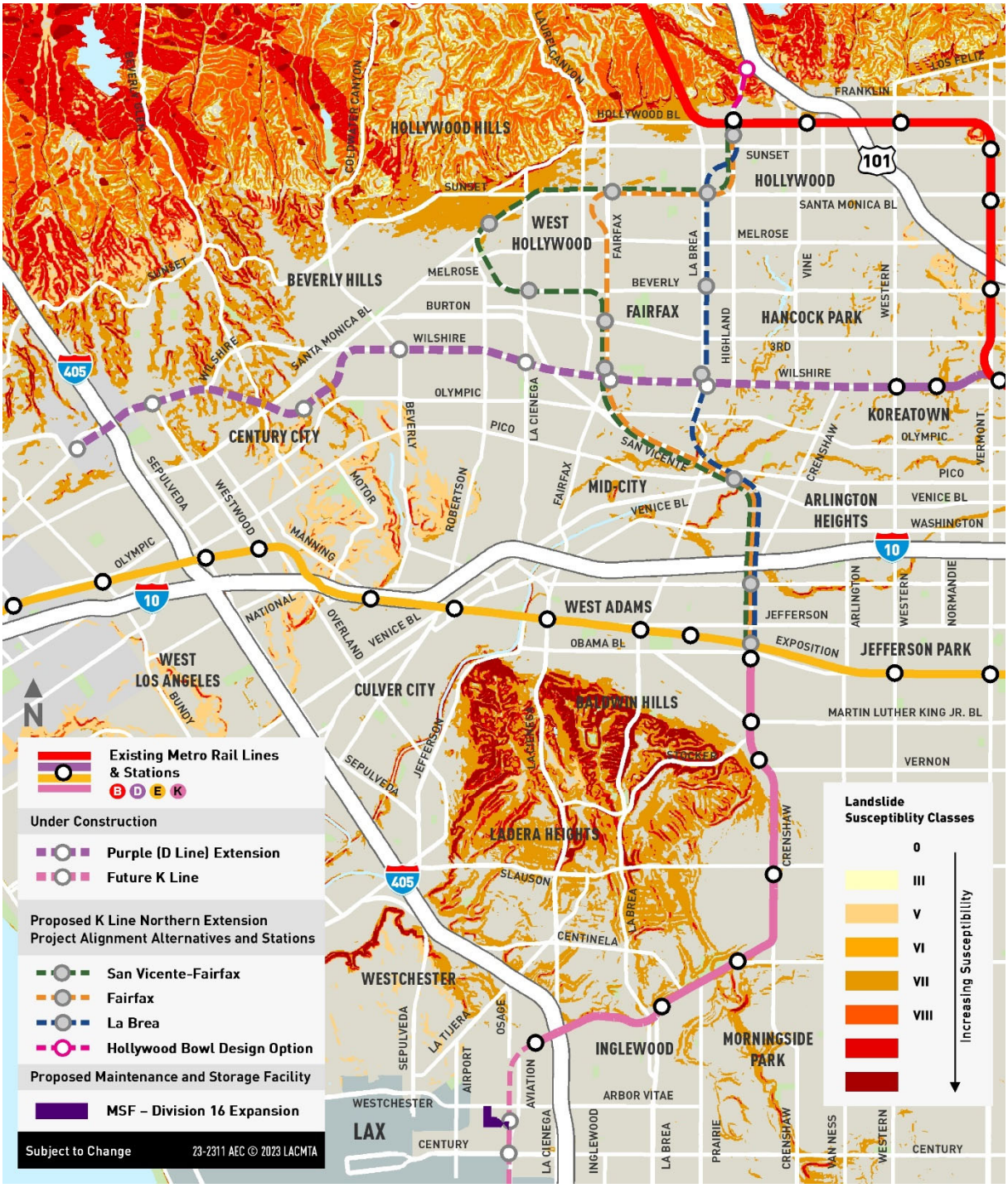
Available ratings for surficial soils along the design option indicate low shrink-swell potential. These surficial soils are reported along the eastern portion of the design option along Highland Avenue and Cahuenga Boulevard and the northwestern portion along Cahuenga Boulevard. This conclusion should be verified and updated through site-specific exploration in the subsequent design phases.

5.5.2.3 MAINTENANCE AND STORAGE FACILITY

As discussed in Section 5.1.1 and 5.2.1 and shown in Figure 5-1, the MSF site is underlain by Old Alluvial Valley deposits (Qoa) and old eolian and dune deposits (Qoe). Based on the soil matrix in this predominant geologic unit (Bedrossian et al. 2012), Qoa might contain clayey soils, while Qoe are expected to contain primarily sands and, therefore, are not expected to exhibit expansive behavior. However, Qoa might contain clayey soils. Overall, the MSF site might be subject to expansive soil behavior effects.

There is no available information in the USDA soil survey database on the shrink-swell potential of the surficial soils across the MSF site.

FIGURE 5-7. LANDSLIDE SUSCEPTIBILITY



Source: Wills et al. 2011

5.5.3 GROUND SETTLEMENT AND COLLAPSIBLE SOILS

Ground settlement occurs when new loading is applied to soil or soil support is removed. New loading can come in the form of structural loading or a reduction in the groundwater table elevation. In tunneling applications, ground settlement can occur from the relaxation due to excavation of material at the tunnel face. Deep excavations can cause settlement of retained soil if excavation support is not rigid.

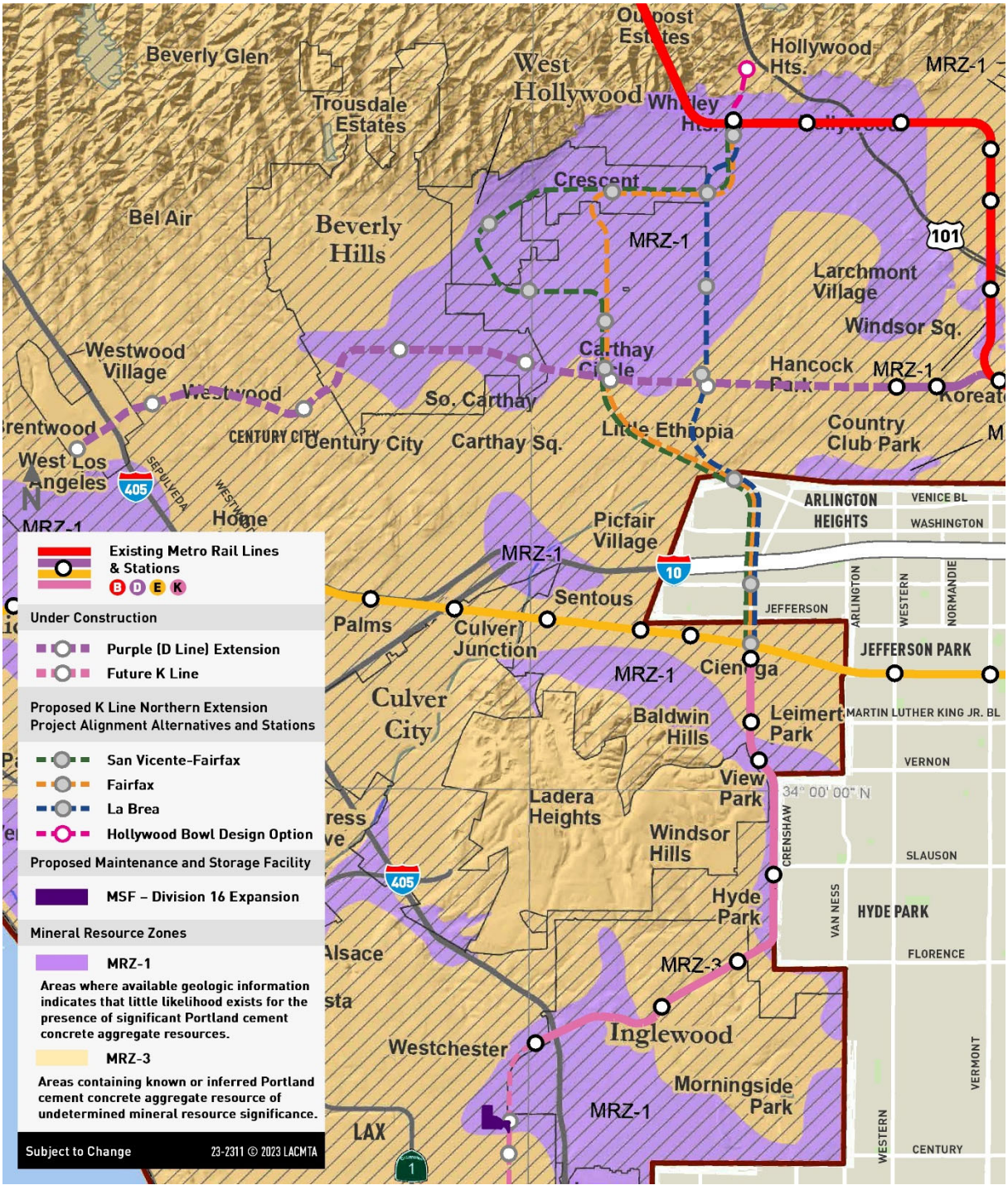
Collapsible soil is typically a loose, porous, dry natural soil deposit that undergoes a drastic rearrangement of particles upon wetting or loading that causes a significant decrease in volume. Based on review of the available data, there are no known collapsible soils in the RSA. This conclusion should be verified through site-specific field investigation in the subsequent design phase.

5.5.3.1 NON-FUEL RESOURCES

As stated in the Los Angeles County General Plan 2035, mineral resources are commercially viable aggregate or mineral deposits, such as sand, gravel, and other construction aggregate. California constitutes a major consumer and producer of aggregates, with the Los Angeles metropolitan area consuming the largest quantities of construction aggregates in the country. Los Angeles County relies on CGS to identify and map significant mineral deposits. As discussed in Section 3.2.5, CGS, implementing SMARA of 1975, uses available data to classify the areas in MRZs based on the presence and significance of mineral resources. The areas where geologic information indicates the presence of significant mineral resources are designated as MRZ-2. As shown in Figure 5-8, there are no major MRZ-2 areas identified within the RSA (Los Angeles County 2022). Los Angeles County regulations protect MRZ-2s and access to MRZ-2s from development and discourage incompatible land uses that could compromise accessibility for future extraction.

Parts of the Project within the City of Los Angeles fall within areas designated as MRZ-3 (i.e., areas containing known or inferred resources of undetermined mineral resource significance) (CGS 2021; CGS 2010; CGS 1994). The portion of the RSA within the City of West Hollywood lies in an area designated as MRZ-1 (i.e., areas where available information indicates that little likelihood exists for the presence of significant mineral resources), with the exception of the westernmost curve of the San Vicente–Fairfax Alignment Alternative, which lies or borders an MRZ-3 zone. It should be noted that the alignment alternatives and stations, design option, and MSF are within an urbanized area that has been previously disturbed by development. Therefore, these areas are essentially unavailable for future mineral extraction.

FIGURE 5-8. MINERAL RESOURCE ZONES



Source: CGS 2021

5.5.3.2 OIL AND GAS

Extensive oil and gas exploration and petroleum extraction (pumping) from proven reserves have occurred within the RSA. According to the Wildcat Maps and the digital well database of the California Geologic Energy Management Division (WellSTAR) (formerly the California Department of Conservation Division of Oil, Gas, and Geothermal Resources), most wells within the RSA and vicinity are idle, abandoned, or dry. An idle well is a well that has not been in operation for two years or more and has not yet been properly plugged or abandoned. The approximate locations of wells and oil/gas fields, as well as status (active/idle/plugged) relative to the alignment alternatives and stations, design option, and MSF site, are shown on Figure 5-9 (City of Los Angeles 2020).

The San Vicente–Fairfax Alignment Alternative transverses the Las Cienegas, Salt Lake (South), Salt Lake, Beverly Hills, and Sherman (Abandoned) oil/gas fields. This Alignment Alternative is located along Beverly Boulevard, passing next to the Beverly Center, the site of active oil wells.

The Fairfax Alignment Alternative crosses the Las Cienegas, Salt Lake (South), Salt Lake, and Beverly Hills oil/gas fields. Based on available data, no active wells are in the vicinity of the Fairfax Alignment Alternative. The La Brea Alignment Alternative transverses the Las Cienegas and Salt Lake oil/gas fields and is not near any active wells. No known active wells or oil/gas fields are documented near the design option. Also, no known active wells or oil/gas fields are documented within the footprint of or within 0.5 mile of the MSF site.

FIGURE 5-9. OIL AND GAS WELLS

Sources: City of Los Angeles 2020

CHAPTER 6 IMPACTS AND MITIGATION MEASURES

6.1 IMPACT ANALYSIS

This section presents the evaluation of impacts related to *geology*, soils, seismicity, and mineral resources discussed in Chapter 5, as well as the corresponding mitigation measures, wherever applicable. Both construction and operational impacts are evaluated. Table 6-1 *in* Section 6.1.9 provides a summary of the impact conclusions.

Project measures are design features, best management practices, or other commitments that Metro implements as part of all alignment alternatives and stations, the design option, and the MSF to reduce or avoid environmental effects associated with the Project. Project measures are not the same as mitigation measures, which are used to reduce an environmental impact's significance level. Where applicable, project measures are identified here as part of the evaluation of environmental impacts in this chapter.

6.1.1 PM GEO-1: DESIGN AND CONSTRUCT PROJECT PER THE METRO RAIL DESIGN CRITERIA (MRDC)

The MRDC incorporates various design specifications from the Federal Highway Administration, Caltrans, the State of California, Los Angeles County, and other sources by reference. Key compliance sections of the MRDC relative to geology and soils are presented in Section 5.3, Section 5.4, Section 5.6, and the MRDC Section 5 Appendix: Metro Supplemental Seismic Design Criteria (Metro 2017). Section 5.6 of the MRDC provides detailed requirements for planning and conducting a geotechnical investigation, geotechnical design methodologies, and reporting. In addition, Caltrans and the Los Angeles County Building Code (based on the CBC) have independent design criteria for building structures (Los Angeles County) that are required. In accordance with the MRDC, geotechnical report recommendations shall be incorporated into project plans and specifications. These recommendations shall be a product of final design and shall address potential subsurface hazards. Without these report recommendations, the Project plans and specifications shall not be approved, and the Project will not be allowed to advance into the final design stage or into construction.

6.1.2 IMPACT GEO-1: EXPOSURE TO SEISMIC HAZARDS

Impact GEO-1: Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

- Rupture of a known earthquake fault, as delineated on the most recent APEFZ Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42)?
- Strong seismic ground shaking?
- Seismic-related ground failure, including liquefaction?
- Landslides?

As discussed in Section 5.3 and Figure 5-4, the Project is located within a seismically active area of Southern California. Strong to moderate ground shaking is a common hazard for every project in the area. Therefore, all alignment alternatives, design option, and MSF would be subject to the impacts of seismic shaking during construction and normal operating conditions. Potential impacts include, but are not limited to, human loss, injury, or death, as well as structural damage and disruption of normal operation.

Potential impacts of rupture of a known earthquake fault, strong seismic ground shaking, seismic ground failure, including liquefaction, and seismically induced landslides are discussed in the following sections.

6.1.2.1 ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX

RUPTURE OF A KNOWN EARTHQUAKE FAULT

The rupture of a known earthquake fault impact applies to both the construction and operational impacts. As discussed in Section 5.3 and 5.4 and shown in Figure 5-4, the only known active fault with surface rupture potential in the RSA of the San Vicente–Fairfax Alignment Alternative is the Hollywood Fault, located near the Hollywood/ Highland Station. The alignment section along Highland Avenue, between Yucca Street and Franklin Avenue, lies within an established APEFZ associated with the Hollywood Fault. Therefore, the San Vicente–Fairfax Alignment Alternative would be subject to the impacts of a potential ground rupture. While it is possible that an unmapped fault crosses the Project, based on the available data, the probability of a surface fault rupture along the remaining portion of the San Vicente–Fairfax Alignment Alternative is low.

SEISMIC-RELATED GROUND FAILURE, LIQUEFACTION, AND LANDSLIDES

Seismic-related ground failures include liquefaction, post-liquefaction settlements, and landslides, and apply to construction and operational impacts. As stated in Section 5.4.3 and shown in Figure 5-4, portions of the San Vicente–Fairfax Alignment Alternative lie within a mapped CGS liquefaction zone. More specifically, the areas within the liquefaction potential zones include a section between the southern terminus of the Project (connection with the existing Metro K Line at Expo/Crenshaw Station at Exposition Boulevard) and I-10, and a section between the intersection of Fairfax Avenue and 1st Street and Croft Avenue and Santa Monica Boulevard. The former area is primarily underlain by Qyf and Qya deposits, and the historical high groundwater in this area is reported to be relatively shallow by CGS (10 to 20 feet bgs), as shown in Figure 5-3. The latter area is also underlain by Qya deposits, as well as Qof deposits along Beverly Boulevard, with a shallow historical high groundwater table reported at about 10 feet bgs (CGS 1998b). Preliminarily, it can be concluded that the San Vicente–Fairfax Alignment Alternative would be subject to adverse effects of liquefaction and liquefaction-induced settlements in these areas. Additionally, the San Vicente–Fairfax Alignment Alternative could be subject to post-seismic settlement due to densification of loose, unsaturated alluvial soils, if present.

The San Vicente–Fairfax Alignment Alternative is not located within a mapped earthquake-induced landslide zone, as shown in Figure 5-4. Therefore, it is not subject to impacts related to earthquake-induced landslides.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction of the San Vicente–Fairfax Alignment Alternative would involve several components, including, but not limited to, tunnels, stations and entrances, crossovers, shafts, connection box at the Expo/Crenshaw Station, cross passages, ancillary structures, trackwork, and installation of electrical, mechanical, lighting, fire protection, and communication systems. Tunneling construction would involve the use of TBM excavation with segmental lining in soft ground conditions and conventional mining in rock with cast-in-place lining. At each TBM launching site, pits would be excavated and construction staging areas would be set up. All stations and crossovers, as well as the connection box and TBM extraction sites, would be excavated with the cut-and-cover technique. Installation of temporary excavation support, roadway decking, mass excavation, and earthwork would occur at the cut-and-cover locations. Cross passages would be excavated, typically by SEM, following tunnel construction. These construction activities might be subject to seismic hazards during a significant earthquake event that may result in potential human loss or injury for workers, as well as damage to the structures.

The potential impacts of ground rupture, seismic ground shaking, and earthquake-induced ground instabilities on the construction of the San Vicente - Fairfax Alignment Alternative would be addressed with the implementation of project measure PM GEO-1 and conformance with the applicable regulatory framework. The regulatory framework includes MRDC, the most recent version of the CBC, Metro's standard specifications, Cal/OSHA, and industry standards (see Chapter 3). All underground design and construction would be reviewed by the Metro Tunnel Advisory Panel and the Metro Fire Life Safety Committee. When necessary, traffic and pedestrian control during construction activities shall comply with the local jurisdiction guidelines and the Manual of Uniform Traffic Control Devices (MUTCD) standards. Strict compliance with health and safety regulations will lower the risks to construction personnel. In addition, as part of final design, geotechnical construction recommendations and instrumentation and monitoring plans will be developed by a qualified engineer. These recommendations will be documented in the geotechnical design reports and will be incorporated in structural design and construction drawings, as required per MRDC. Adherence and implementation of the recommendations that typically address temporary conditions during construction will reduce the potential impacts of seismic hazards to humans and structures.

For the reasons described above, the San Vicente–Fairfax Alignment Alternative would not directly or indirectly cause potential substantial adverse effects related to rupture of a known earthquake fault, strong seismic ground shaking, seismic ground failure, including liquefaction, or landslides. Therefore, the potential impacts of seismically induced hazards on the construction of the San Vicente–Fairfax Alignment Alternative would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. In the event of a significant earthquake, there is risk for human loss, injury, or death of commuters and damage to structures due to potential ground rupture, ground shaking, or seismically induced ground instability, with subsequent disruptions in the regular operating schedules while damage is repaired. In addition, the Project components might experience permanent deformation after a significant seismic event.

Implementation of project measure PM GEO-1 would address the potential impacts of ground rupture on the San Vicente–Fairfax Alignment Alternative. The MRDC states that a detailed fault study should be performed to determine the location and extents of the fault zones, fault activity, and fault rupture characteristics (e.g., amount of displacement, distribution of slip across the zone, vertical and horizontal displacement components). This is in accordance with the requirements set by CGS Special Publication 42 (CGS 2018c) for structures lying within an established APEFZ. The primary purpose of the CGS Special Publication is to detect potentially active faults in the vicinity of the mapped faults and to assess the recency of their activity. The evaluation of the surface rupture hazard may include available data collection, surficial field investigations (e.g., remote sensing, Lidar-imagery, field-based observations), subsurface site-specific investigations (e.g., trenching, boring and sampling, cone penetration tests, geophysical techniques), and age-dating methods. The San Vicente–Fairfax Alignment Alternative in the vicinity of the Hollywood Fault would be designed and constructed in compliance with the MRDC and all additional regulatory requirements, as discussed in Section 1.1 and identified in Chapter 3. The required site-specific investigations would assist in the determination of the level of ground rupture hazard, including the extents of the fault zone and magnitude of anticipated fault displacement to be accommodated by the components of the San Vicente–Fairfax Alignment Alternative. The performance-based requirements set by MRDC Section 5 Appendix – Metro Supplemental Seismic Design Criteria, Rev. 12 (Metro 2017) would be satisfied.

The San Vicente–Fairfax Alignment Alternative is located within the seismically active Southern California area, and therefore the Project components and commuters may be subject to ground shaking that could lead to human injury or death, as well as damage to structures, along with major disruptions in Project operations. In order to address the impact from seismic ground motion, the San Vicente–Fairfax Alignment Alternative will be designed and constructed in conformance with MRDC and CBC requirements, which are incorporated into project measure PM GEO-1.

The Project structures associated with the San Vicente–Fairfax Alignment Alternative shall be designed per MRDC and shall account for the earthquake-induced ground instability, liquefaction potential, and anticipated total and differential deformations. The implementation of a comprehensive geotechnical exploration program, as required per MRDC, will provide information about the subsurface conditions, including groundwater level and the depths and extents of the soils susceptible to liquefaction, and will assist in the determination of the liquefaction and lateral spreading potential, as well as estimation of the seismically induced settlements. If the estimated seismically induced settlements cannot be accommodated by the structures, ground improvement may be implemented to mitigate the impacts of the liquefaction-induced settlements to the Project structures. Ground improvement methods may include, but are not limited to, compaction grouting, compensation grouting, jet grouting, dynamic

compaction, and stone columns. The selection of the appropriate method for each critical section will be made on the basis of subsurface conditions, site accessibility and space limitations, performance requirements, and cost effectiveness.

Conformance with design requirements would lower the risk of human loss, injury, or death, and reduce the potential for structural damage to the Project structures and for interruptions in the normal operating conditions in the event of ground rupture or an earthquake event. Therefore, the potential impacts of seismically induced hazards on operation of the San Vicente–Fairfax Alignment Alternative would be less than significant.

6.1.2.2 ALIGNMENT ALTERNATIVE 2: FAIRFAX

RUPTURE OF A KNOWN EARTHQUAKE FAULT

The rupture of a known earthquake fault impact applies to both the construction and operational impacts. As discussed in Section 5.3 and 5.4 and shown in Figure 5-4, the only known active fault with surface rupture potential in the RSA of the Fairfax Alignment Alternative is the Hollywood Fault, located near the Hollywood/Highland Station. The alignment section along Highland Avenue, between Yucca Street and Franklin Avenue, lies within an established APEFZ associated with the Hollywood Fault. Therefore, the Fairfax Alignment Alternative would be subject to the impacts of a potential ground rupture. While it is possible that an unmapped fault crosses the Project, based on the available data, the probability of a surface fault rupture along the remaining portion of the Fairfax Alignment Alternative is low.

SEISMIC-RELATED GROUND FAILURE, LIQUEFACTION, AND LANDSLIDES

Seismic-related ground failures include liquefaction, post-liquefaction settlements, and landslides, and apply to the construction and operational impacts. As stated in Section 5.4.3 and shown in Figure 5-4, portions of the Fairfax Alignment Alternative lie within the mapped CGS liquefaction zone. More specifically, the areas within the liquefaction potential zones include a section between the southern terminus of the Project (connection with the existing Metro K Line at Expo/Crenshaw Station at Exposition Boulevard) and I-10, and a section along Fairfax Avenue between 1st Street and Rosewood Avenue. The former area is primarily underlain by young alluvial fan and valley deposits (Qyf and Qya, respectively), and the historically highest groundwater in this area is reported to be relatively shallow by CGS (10 to 20 feet bgs), as shown in Figure 5-3. The latter area is underlain by younger alluvial valley deposits (Qya) as well as old alluvial fan deposits (Qof), with a shallow historically highest groundwater table reported generally between 10 and 30 feet bgs (CGS 1998b). Preliminarily, it can be concluded that the Fairfax Alignment Alternative would be subject to the adverse effects of liquefaction and liquefaction-induced settlements in these areas. Additionally, the Fairfax Alignment Alternative would be subject to post-seismic settlement due to densification of loose, unsaturated alluvial soils, if present.

The Fairfax Alignment Alternative is not located within a mapped earthquake-induced landslide zone, as shown in Figure 5-4, and therefore it is not subject to impacts related to earthquake-induced landslides.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction of the Fairfax Alignment Alternative would involve several components, including, but not limited to, tunnels, stations and entrances, crossovers, shafts, connection box at the Expo/Crenshaw Station, cross passages, TBM extraction sites, ancillary structures, trackwork, and installation of electrical, mechanical, lighting, fire protection, and communication systems. Tunneling construction would involve the use of TBM excavation with segmental lining in soft ground conditions and conventional mining in rock with cast-in-place lining. At each TBM launching site, pits would be excavated and construction staging areas would be set up. All stations, crossovers, as well as the connection box, of the Fairfax Alignment Alternative would be excavated with the cut-and-cover technique. Installation of temporary excavation support, roadway decking, mass excavation, and earthwork would occur at the cut-and-cover locations. Cross passages would be excavated typically by SEM, following tunnel construction. These construction activities might be subject to seismic hazards during a significant earthquake event that may result in potential human loss or injury for workers, as well as damage to the structures.

The potential impacts of ground rupture, seismic ground shaking, and earthquake-induced ground instabilities on the construction of the Fairfax Alignment Alternative would be addressed with the implementation of project measure PM GEO-1 and conformance with the applicable regulatory framework. The regulatory framework includes MRDC, the most recent version of the CBC, Metro's standard specifications, Cal/OSHA, and industry standards (see Chapter 3). All underground design and construction would be reviewed by the Metro Tunnel Advisory Panel and the Metro Fire Life Safety Committee. When necessary, traffic and pedestrian control during construction activities shall comply with the local jurisdiction guidelines and the MUTCD standards. Strict compliance with health and safety regulations will lower the risks to construction personnel. In addition, as part of final design, geotechnical construction recommendations and instrumentation and monitoring plans will be developed by a qualified geotechnical engineer. These recommendations will be documented in the geotechnical design reports and will be incorporated in structural design and construction drawings, as required per MRDC. Adherence and implementation of the recommendations that typically address temporary conditions during construction will reduce the potential impacts of seismic hazards to humans and structures.

For the reasons described above, the Fairfax Alignment Alternative would not directly or indirectly cause potential substantial adverse effects related to rupture of a known earthquake fault, strong seismic ground shaking, seismic ground failure, including liquefaction, or landslides. Therefore, the potential impacts of seismically induced hazards on the construction of the Fairfax Alignment Alternative would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. In the event of a significant earthquake, there is risk for human loss, injury, or death of commuters and damage to structures due to potential ground rupture, ground shaking, or seismically induced ground instability, with subsequent disruptions in the regular operating

schedules while damage is repaired. In addition, the Project components might experience permanent deformation after a significant seismic event.

Implementation of project measure PM GEO-1 would address the potential impacts of ground rupture on the Fairfax Alignment Alternative. The MRDC states that a detailed fault study should be performed to determine the location and extents of the fault zones, fault activity, and fault rupture characteristics (e.g., amount of displacement, distribution of slip across the zone, vertical and horizontal displacement components). This is in accordance with the requirements set by CGS Special Publication 42 (CGS 2018c) for structures lying within an established APEFZ. The primary purpose of the CGS Special Publication is to detect potentially active faults in the vicinity of the mapped faults and to assess the recency of their activity. The evaluation of the surface rupture hazard may include available data collection, surficial field investigations (e.g., remote sensing, Lidar-imagery, field-based observations), subsurface site-specific investigations (e.g., trenching, boring and sampling, cone penetration tests, geophysical techniques), and age-dating methods. The Fairfax Alignment Alternative in the vicinity of the Hollywood Fault would be designed and constructed in compliance with the MRDC and all additional regulatory requirements, as discussed in Section 1.1 and identified in Chapter 3. The required site-specific investigations would assist in the determination of the level of ground rupture hazard, including the extents of the fault zone and magnitude of anticipated fault displacement to be accommodated by the components of the Fairfax Alignment Alternative. The performance-based requirements set by MRDC Section 5 Appendix – Metro Supplemental Seismic Design Criteria, Rev. 12 (Metro 2017), should be satisfied.

The Fairfax Alignment Alternative is located within the seismically active Southern California area, and therefore the Project components and commuters may be subject to ground shaking that could lead to human injury or death, as well as damage to structures, along with major disruptions in Project operations. In order to address the impact from seismic ground motion, the Fairfax Alignment Alternative will be designed and constructed in conformance with MRDC and CBC requirements, which are incorporated into project measure PM GEO-1.

The Project structures associated with the Fairfax Alignment Alternative shall be designed per MRDC and shall account for the earthquake-induced ground instability, liquefaction potential, and anticipated total and differential deformations. The implementation of a comprehensive geotechnical exploration program, as required per MRDC, will provide information about the subsurface conditions, including groundwater level and the depths and extents of the soils susceptible to liquefaction, and will assist in the determination of the liquefaction and lateral spreading potential, as well as estimation of the seismically induced settlements. If the estimated seismically induced settlements cannot be accommodated by the structures, ground improvement may be implemented to mitigate the impacts of the liquefaction-induced settlements to the Project structures. Ground improvement methods may include, but are not limited to, compaction grouting, compensation grouting, jet grouting, dynamic compaction, and stone columns. The selection of the appropriate method for each critical section will be made on the basis of subsurface conditions, site accessibility and space limitations, performance requirements, and cost effectiveness.

Conformance with design requirements would lower the risk of human loss, injury, or death, and reduce the potential for structural damage to the Project structures and for interruptions in the normal operating conditions in the event of ground rupture or an earthquake event. Therefore, the potential impacts of seismically induced hazards on operation of the Fairfax Alignment Alternative would be less than significant.

6.1.2.3 ALIGNMENT ALTERNATIVE 3: LA BREA

RUPTURE OF A KNOWN EARTHQUAKE FAULT

The rupture of a known earthquake fault impact applies to both the construction and operational impacts. As discussed in Section 5.3 and 5.4 and shown in Figure 5-4, the only known active fault with surface rupture potential in the RSA of the La Brea Alignment Alternative is the Hollywood Fault, located near the Hollywood/Highland Station of all three alignment alternatives. The alignment section along Highland Avenue, between Yucca Street and Franklin Avenue, lies within the established APEFZ associated with the Hollywood Fault. Therefore, the La Brea Alignment Alternative would be subject to the impacts of a potential ground rupture. While it is possible that an unmapped fault crosses the Project, based on the available data, the probability of a surface fault rupture along the remaining portion of the La Brea Alignment Alternative is low.

SEISMIC-RELATED GROUND FAILURE, LIQUEFACTION, AND LANDSLIDES

Seismic-related ground failures include liquefaction, post-liquefaction settlements, and landslides, and apply to the construction and operational impacts. As stated in Section 5.4.3 and shown in Figure 5-4, portions of the La Brea Alignment Alternative lie within the mapped CGS liquefaction zone. More specifically, the area within the liquefaction potential zones includes the section between the southern terminus of the Project (connection with the existing Metro K Line at Expo/Crenshaw Station at Exposition Boulevard) and I-10. This section is primarily underlain by young alluvial fan and valley deposits (Qyf and Qya, respectively), and the historically highest groundwater in this area is reported to be relatively shallow by CGS (10 to 20 feet bgs) (CGS 1998b). Preliminarily, it can be concluded that the La Brea Alignment Alternative would be subject to the adverse effects of liquefaction and liquefaction-induced settlements in this area. Additionally, the La Brea Alignment Alternative would be subject to post-seismic settlement due to densification of loose, unsaturated alluvial soils, if present.

The La Brea Alignment Alternative is not located within a mapped earthquake-induced landslide zone, as shown in Figure 5-4, and therefore it is not subject to impacts related to earthquake-induced landslides.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction of the La Brea Alignment Alternative would involve several components, including, but not limited to, tunnels, stations and entrances, crossovers, shafts, connection box at the Expo/Crenshaw Station, cross passages, ancillary structures, trackwork, and installation of electrical, mechanical, lighting, fire protection, and communication systems. Tunneling construction would involve the use of TBM excavation with segmental lining in soft ground conditions

and conventional mining in rock with cast-in-place lining. At each TBM launching site, pits would be excavated and construction staging areas would be set up. All stations, crossovers, as well as the connection box, of the La Brea Alignment Alternative would be excavated with the cut-and-cover technique. Installation of temporary excavation support, roadway decking, mass excavation, and earthwork would occur at the cut-and-cover locations. Cross passages would be excavated typically by SEM, following tunnel construction. These construction activities might be subject to seismic hazards during a significant earthquake event that may result in potential human loss or injury for workers, as well as damage to the structures.

The potential impacts of ground rupture, seismic ground shaking, and earthquake-induced ground instabilities on the construction of the La Brea Alignment Alternative would be addressed with the implementation of project measure PM GEO-1 and conformance with the applicable regulatory framework. The regulatory framework includes MRDC, the most recent version of the CBC, Metro's standard specifications, Cal/OSHA, and industry standards (see Chapter 3). All underground design and construction would be reviewed by the Metro Tunnel Advisory Panel and the Metro Fire Life Safety Committee. When necessary, traffic and pedestrian control during construction activities shall comply with the local jurisdiction guidelines and the MUTCD standards. Strict compliance with health and safety regulations will lower the risks to construction personnel. In addition, as part of final design, geotechnical construction recommendations and instrumentation and monitoring plans will be developed by a qualified geotechnical engineer. These recommendations will be documented in the geotechnical design reports and will be incorporated in structural design and construction drawings, as required per MRDC. Adherence and implementation of the recommendations that typically address temporary conditions during construction will reduce the potential impacts of seismic hazards to humans and structures.

For the reasons described above, the La Brea Alignment Alternative would not directly or indirectly cause potential substantial adverse effects related to rupture of a known earthquake fault, strong seismic ground shaking, seismic ground failure, including liquefaction, or landslides. Therefore, the potential impacts of seismically induced hazards on the construction of the La Brea Alignment Alternative would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. In the event of a significant earthquake, there is risk for human loss, injury, or death of commuters and damage to structures due to potential ground rupture, ground shaking, or seismically induced ground instability, with subsequent disruptions in the regular operating schedules while damage is repaired. In addition, the Project components might experience permanent deformation after a significant seismic event.

Implementation of project measure PM GEO-1 would address the potential impacts of ground rupture on the La Brea Alignment Alternative. MRDC states that a detailed fault study should be performed to determine the location and extents of the fault zones, fault activity, and fault rupture characteristics (e.g., amount of displacement, distribution of slip across the zone, vertical and horizontal displacement components). This is in accordance with the requirements set by the CGS Special

Publication 42 (CGS 2018c) for structures lying within an established APEFZ. The primary purpose of the CGS Special Publication is to detect potentially active faults in the vicinity of the mapped faults and to assess the recency of their activity. The evaluation of the surface rupture hazard may include available data collection, surficial field investigations (e.g., remote sensing, Lidar-imagery, field-based observations), subsurface site-specific investigations (e.g., trenching, boring and sampling, cone penetration tests, geophysical techniques), and age-dating methods. The La Brea Alignment Alternative in the vicinity of the Hollywood Fault would be designed and constructed in compliance with the MRDC and all additional regulatory requirements, as discussed in Section 1.1 and identified in Chapter 3. The required site-specific investigations would assist in the determination of the level of ground rupture hazard, including the extents of the fault zone and magnitude of anticipated fault displacement to be accommodated by the components of the La Brea Alignment Alternative. The performance-based requirements set by MRDC Section 5 Appendix – Metro Supplemental Seismic Design Criteria, Rev. 12 (Metro 2017), should be satisfied.

The La Brea Alignment Alternative is located within the seismically active Southern California area, and therefore the Project components and commuters may be subject to ground shaking that could lead to human injury or death, as well as damage to structures, along with major disruptions in Project operations. In order to address the impact from seismic ground motion, the La Brea Alignment Alternative will be designed and constructed in conformance with MRDC and CBC requirements, which are incorporated into project measure PM GEO-1.

The Project structures associated with the La Brea Alignment Alternative shall be designed per MRDC and shall account for the earthquake-induced ground instability, liquefaction potential, and anticipated total and differential deformations. The implementation of a comprehensive geotechnical exploration program, as required per MRDC, will provide information about the subsurface conditions, including groundwater level and the depths and extents of the soils susceptible to liquefaction, and will assist in the determination of the liquefaction and lateral spreading potential, as well as estimation of the seismically induced settlements. If the estimated seismically induced settlements cannot be accommodated by the structures, ground improvement may be implemented to mitigate the impacts of the liquefaction-induced settlements to the Project structures. Ground improvement methods may include, but are not limited to, compaction grouting, compensation grouting, jet grouting, dynamic compaction, and stone columns. The selection of the appropriate method for each critical section will be made on the basis of subsurface conditions, site accessibility and space limitations, performance requirements, and cost effectiveness.

Conformance with design requirements would lower the risk of human loss, injury, or death, and reduce the potential for structural damage to the Project structures and for interruptions in the normal operating conditions in the event of ground rupture or an earthquake event. Therefore, the potential impacts of seismically induced hazards on operation of the La Brea Alignment Alternative would be less than significant.

6.1.2.4 HOLLYWOOD BOWL DESIGN OPTION

RUPTURE OF A KNOWN EARTHQUAKE FAULT

The rupture of a known earthquake fault impact applies to both the construction and operational impacts. As discussed in Section 5.3 and 5.4 and shown in Figure 5-4, the only known active fault with the design option RSA with surface rupture potential that crosses the design option alignment is the Hollywood Fault. Based on the available data, the known Hollywood Fault trace of Latest Quaternary era crosses the design option near Franklin Avenue. In addition, the section of the design option between Yucca Street and north of the western projection of Bonair Place lies within the established APEFZ associated with the Hollywood Fault. Therefore, the Hollywood Bowl Design Option would be subject to the impacts of a potential ground rupture at this location. While it is possible that an unmapped fault crosses the design option, based on the available data, the probability of a surface fault rupture along the remaining portion of the design option is low.

SEISMIC-RELATED GROUND FAILURE, LIQUEFACTION, AND LANDSLIDES

Seismic-related ground failures include liquefaction, post-liquefaction settlements, and landslides and apply to construction and operational impacts. As stated in Section 5.4.3 and shown in Figure 5-4, the portion of the Hollywood Bowl Design Option north of Franklin Avenue to the Hollywood Bowl Station lies within the mapped CGS liquefaction zone. The design option is expected to encounter primarily old alluvial fan deposits (Qof) and tertiary-age Topanga Formation (Tt). Historical groundwater data in this area indicate that south of Franklin Avenue the highest groundwater level ranges between 80 and 100 feet bgs (CGS 1998b), while there is limited groundwater data availability for the highest groundwater level north of this area. Preliminarily, it can be concluded that the design option would be subject to the adverse effects of liquefaction and liquefaction-induced settlements, pending results of site-specific investigations. Additionally, the design option is not expected to be subject to post-seismic settlement due to densification of loose, unsaturated alluvial soils, because it is underlain primarily by older alluvial soils.

In addition, the design option north of Hollywood/Highland Station would be close to or within a mapped earthquake-induced landslide zone, as shown in Figure 5-4 and therefore would be subject to impacts related to earthquake-induced landslides.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction of the Hollywood Bowl Design Option would involve several components, including, but not limited to, tunnels, a station and its entrance, crossovers, shafts, cross passages, ancillary structures, trackwork, installation of electrical, mechanical, lighting, fire protection, and communication systems. The extension to Hollywood Bowl would include a station with entrance structures, two crossovers, guideway tunnels, and two emergency ventilation/egress shafts. The station and its crossovers would be constructed utilizing conventional mining techniques and equipment via SEM and hard rock excavation. Controlled blasting would be used locally if strong rocks are encountered. Installation of temporary excavation support, roadway decking, mass excavation, and earthwork would occur at the cut-and-cover locations. These construction activities might be

subject to seismic hazards during a significant earthquake event that could result in potential human loss or injury for workers, as well as damage to the structures.

The potential impacts of ground rupture, seismic ground shaking, and earthquake-induced ground instabilities on the construction of the design option would be addressed with the implementation of project measure PM GEO-1 and conformance with the applicable regulatory framework. The regulatory framework includes MRDC, the most recent version of the CBC, Metro's standard specifications, Cal/OSHA, and industry standards (see Chapter 3). All underground design and construction would be reviewed by the Metro Tunnel Advisory Panel and the Metro Fire-Life Safety Committee. When necessary, traffic and pedestrian control during construction activities shall comply with the local jurisdiction guidelines and the MUTCD standards. Strict compliance with health and safety regulations will lower the risks to construction personnel. In addition, as part of final design, geotechnical construction recommendations and instrumentation and monitoring plans will be developed by a qualified engineer. These recommendations will be documented in the geotechnical design reports and will be incorporated in structural design and construction drawings, as required per MRDC. Adherence and implementation of the recommendations that typically address temporary conditions during construction will reduce the potential impacts of seismic hazards to humans and structures.

For the reasons described above, the Hollywood Bowl Design Option would not directly or indirectly cause potential substantial adverse effects related to rupture of a known earthquake fault, strong seismic ground shaking, seismic ground failure, including liquefaction, or landslides. Therefore, the potential impacts of seismically induced hazards on the construction of the design option would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. In the event of a significant earthquake, there is risk for human loss, injury, or death of commuters and damage to structures due to potential ground rupture, ground shaking, or seismically induced ground instability, with subsequent disruptions in the regular operating schedules while damage is repaired. In addition, the Project components might experience permanent deformation after a significant seismic event.

Implementation of project measure PM GEO-1 will address the potential impacts of ground rupture on the design option. The MRDC states that a detailed fault study should be performed to determine the location and extents of the fault zones, fault activity, and fault rupture characteristics (e.g., amount of displacement, distribution of slip across the zone, vertical and horizontal displacement components). This is in accordance with the requirements set by CGS Special Publication 42 (CGS 2018c) for structures lying within an established APEFZ. The primary purpose of the CGS Special Publication is to detect potentially active faults in the vicinity of the mapped faults and to assess the recency of their activity. The evaluation of the surface rupture hazard may include available data collection, surficial field investigations (e.g., remote sensing, Lidar-imagery, field-based observations), subsurface site-specific investigations (e.g., trenching, boring and sampling, cone penetration tests, geophysical techniques), and age-dating methods. The design option in the vicinity of the Hollywood Fault would

be designed and constructed in compliance with the MRDC and all additional regulatory requirements, as identified in Chapter 3. The required site-specific investigations would assist in the determination of the level of ground rupture hazard, including the extents of the fault zone and magnitude of anticipated fault displacement to be accommodated by the components of the San Vicente–Fairfax Alignment Alternative. The performance-based requirements set by MRDC Section 5 Appendix – Metro Supplemental Seismic Design Criteria, Rev. 12 (Metro 2017), should be satisfied. Additionally, for the tunnel sections of the design option crossing the Hollywood Fault, special design will likely be required. More specifically, the MRDC recognizes that at fault crossings, should the maximum design earthquake-induced displacement occur, the tunnel should still be of "sufficient diameter to fulfill its function after repairs."

"Overboring" the tunnel through the fault zone with transition zones narrowing to the regular tunnel diameter and backfilling with easily re-minable and crushable material (such as "cellular" concrete) is a widely accepted approach and was used previously in the Metro B Line Segment 3 Hollywood Fault crossing. Using ductile lining is another approach that allows for the accommodation of the fault ruptured-induced deformations. Furthermore, the MRDC provides guidance for the determination of the displacement demand and analytical procedures for the evaluation of fault displacement impacts to Metro structures.

The design option is located within the seismically active Southern California area, and therefore the Project components and commuters may be subject to ground shaking that could lead to human injury or death, as well as damage to structures, along with major disruptions in Project operations. In order to address the impact from seismic ground motion, the design option will be designed and constructed in conformance with MRDC and CBC requirements, which are incorporated into project measure PM GEO-1.

The Project structures associated with the design option shall be designed per MRDC and shall account for the earthquake-induced ground instability, liquefaction potential, anticipated total and differential deformations, as well as earthquake-induced landslide potential. The implementation of a comprehensive geotechnical exploration program, as required per MRDC, will provide information about the subsurface conditions, including groundwater level and the depths and extents of the soils susceptible to liquefaction, and will assist in the determination of the liquefaction and lateral spreading potential, as well as estimation of the seismically induced settlements. If the estimated seismically induced settlements cannot be accommodated by the structures, ground improvement may be implemented to mitigate the impacts of the liquefaction-induced settlements to the Project structures. Ground improvement methods may include, but are not limited to, compaction grouting, compensation grouting, jet grouting, dynamic compaction, and stone columns. The selection of the appropriate method for each critical section will be made on the basis of subsurface conditions, site accessibility and space limitations, performance requirements, and cost effectiveness.

Conformance with the design requirements would lower the risk for human loss, injury, or death, and reduce the potential of structural damage to the Project structures and interruptions in the normal operating conditions in the event of ground rupture, ground shaking, and/or earthquake-induced

ground instability. Therefore, the potential impacts of seismically induced hazards on operation of the Hollywood Bowl Design Option would be less than significant.

6.1.2.5 MAINTENANCE AND STORAGE FACILITY

RUPTURE OF A KNOWN EARTHQUAKE FAULT

As shown in Figure 5-4, no known active faults cross the MSF site. The nearest mapped fault is the Charnock Fault, which is of Late Quaternary age and is located at an approximate minimum distance of 0.5 mile west of the MSF RSA. In addition, according to the mapped APEFZ, the Overland Fault is approximately 1.3 miles north of the MSF site and the Newport-Inglewood-Rose Canyon Fault Zone is approximately 1.8 miles northeast of the site; both have surface rupture potential. While it is possible that an unmapped fault crosses the MSF, based on the available data, the probability of surface fault rupture within the MSF site is low. Therefore, the MSF is not expected to be subject to ground rupture impacts.

SEISMIC-RELATED GROUND FAILURE, LIQUEFACTION, AND LANDSLIDES

Seismic-related ground failures include liquefaction, post-liquefaction settlements, and landslides, and apply to construction and operational impacts. As stated in Section 5.4.3 and shown in Figure 5-4, the MSF RSA is within the mapped CGS liquefaction zone. The historic highest groundwater level data in the vicinity of the site indicate groundwater levels on the order of 40 to 50 feet bgs (CGS 1998c; 1998d). Preliminarily, it can be concluded that the MSF would not be subject to the adverse effects of liquefaction and liquefaction-induced settlements, pending results of a site-specific investigation. The MSF is not expected to be subject to post-seismic settlements due to densification of loose, unsaturated alluvial soils because the site is underlain by older alluvial deposits.

In addition, the MSF site is not within a mapped earthquake-induced landslide zone, as shown in Figure 5-4 and, therefore, it would not be subject to impacts related to earthquake-induced landslides.

CONSTRUCTION IMPACTS

Less than Significant Impact. The MSF would use conventional methods for the construction of trackwork and buildings for maintenance and storage of light rail vehicles. Construction activities may also include, but are not limited to, demolition of existing facilities, site preparation, grading, utility installation, fencing installation, paving, and landscaping. These construction activities might be subject to seismic hazards during a significant earthquake event that could result in potential human loss or injury for workers, as well as damage to structures.

The potential impacts of seismic ground shaking on construction of the MSF would be addressed with implementation of project measure PM GEO-1 and conformance with the applicable regulatory framework. Therefore, the potential impacts of seismically induced hazards on the construction of the MSF would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. No known active faults with surface rupture potential cross the MSF site. In addition, the site is not located within a liquefaction or landslide zone. Therefore, the MSF would not be subject to the adverse effects of a seismically induced ground instability or surface rupture during normal operating conditions.

As discussed in Section 5.3, the Project is located within the seismically active Southern California area, and therefore the MSF components and workers would be subject to ground shaking that could lead to human injury or death, as well as damage to structures, along with major disruptions in operations. Implementation of project measure PM GEO-1 would address the impacts of ground shaking on the MSF. For the design of surface structures, MRDC Section 5.5 requires compliance with the CBC, CCR, Title 24, Part 2. In addition, MRDC Section 5.5.3 indicates that buildings and their components should comply with the Metro Supplemental Seismic Design Criteria and the applicable sections of the CBC. The MRDC Section 5 Appendix – Metro Supplemental Seismic Design Criteria, Rev. 12 (Metro 2017) adopts a two-level performance-based seismic design, associated with the MDE (4 percent probability of exceedance in 100 years) and ODE (50 percent probability of exceedance in 100 years). Metro structures, including buildings, need to be designed to sustain repairable damage for the MDE. For the ODE, Metro structures need to sustain none to minimal structural damage and need to remain in service for general use immediately after a post-earthquake inspection, including all systems (mechanical, electrical, plumbing, and fire life safety systems). MRDC Section 5.5.3 requires site-specific recommendations for the seismic design parameters needed per the CBC to be included in the geotechnical reports.

Conformance with design requirements would lower the risk of human loss, injury, or death, and reduce the potential of structural damage to Project structures and for interruptions in the normal operating conditions in the event of ground rupture or an earthquake event. Therefore, the potential impacts of seismically induced hazards on operation of the MSF would be less than significant.

6.1.3 IMPACT GEO-2: SOIL EROSION

Impact GEO-2: Would the Project result in substantial soil erosion or the loss of topsoil?

6.1.3.1 ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX

The San Vicente–Fairfax Alignment Alternative is contained within an urban setting and the topsoil in the RSA has been previously disturbed or concealed by human activities. The only exposed topsoil is typically in landscaped medians, planters, setbacks, or residential yards.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction activities would temporarily expose surficial soils to erosion by eolian[3] and hydraulic forces, increasing the potential for erosion and topsoil loss when compared to existing conditions. Additionally, a rainstorm event concurrent with construction activities could accelerate the rate of erosion and topsoil loss. The increase in erosion potential for the San Vicente–Fairfax Alignment Alternative would primarily be limited to the construction of shafts, stations, and cut-and-cover excavations. Underground construction activities related to tunnel excavation and construction would not affect erosion potential or topsoil loss.

Existing regulatory requirements limit erosion and topsoil loss during construction activities. These requirements include the implementation of best management practices (BMPs), SWPPPs, and erosion and sedimentation control measures that would ensure excavation, grading, and other earth-moving activities would not have a significant impact. Erosion control BMPs might include the implementation and use of detention ponds or infiltration pits to collect and reduce erosion, using barriers to slow the rate of runoff, or controlling the use of water irrigation. BMPs are discussed in the K Line Northern Extension Transit Corridor Project Hydrology and Water Quality Technical Report. An erosion and sedimentation control plan will be prepared by the contractor in compliance with applicable NPDES permits, as discussed in Section 3.2.4.

All earthwork and grading activities require grading permits from the LADBS that include requirements and standards designed to limit potential impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70 of the LAMC, which addresses grading, excavations, and fill placement. It also requires the preparation of a site-specific geotechnical report to evaluate soils issues. The City of West Hollywood also requires a grading permit and plan check prior to commencement of grading activities. All grading and excavation shall be performed in accordance with the CBC Section 1804 as adopted and amended by the City of West Hollywood.

Upon completion of construction activities, it is anticipated that surficial soil previously concealed by pavements and structures will be restored to an impervious condition. The potential for erosion and topsoil loss would be temporary, and while the potential would increase during construction, compliance with regulatory requirements would keep that potential at a minimum.

For the reasons described above, the impact of construction on erosion and topsoil loss would be minimal. Therefore, the San Vicente–Fairfax Alignment Alternative would have a less than significant impact during construction.

OPERATIONAL IMPACTS

Less than Significant Impact. Operation of the San Vicente–Fairfax Alignment Alternative would not result in ground disturbance or in increase of the exposed area of soils when compared to existing conditions. The San Vicente–Fairfax Alignment Alternative would comply with applicable post-

[3] Eolian refers to erosion by wind.

construction NPDES permits and any permit requirements of the Cities of Los Angeles and West Hollywood, which minimize erosion impacts from development projects. NPDES permits are discussed in more detail in the K Line Northern Extension Transit Corridor Project Hydrology and Water Quality Technical Report. Therefore, operation of the San Vicente–Fairfax Alignment Alternative would not result in substantial soil erosion or the loss of topsoil, and impacts would be less than significant.

6.1.3.2 ALIGNMENT ALTERNATIVE 2: FAIRFAX

The Fairfax Alignment Alternative is contained within an urban setting and the topsoil in the RSA has been previously disturbed or concealed by human activities. The only exposed topsoil is typically in landscaped medians, planters, setbacks, or residential yards.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction activities would temporarily expose surficial soils to erosion by eolian and hydraulic forces, increasing the potential for erosion and topsoil loss when compared to existing conditions. Additionally, a rainstorm event concurrent with construction activities could accelerate the rate of erosion and topsoil loss. The increase in erosion potential for the Fairfax Alignment Alternative would primarily be limited to the construction of shafts, stations, and cut-and-cover excavations. Underground construction activities related to tunnel excavation and construction would not affect erosion potential or topsoil loss.

Existing regulatory requirements limit erosion and topsoil loss during construction activities. These requirements include the implementation of BMPs, SWPPPs, and erosion and sedimentation control measures that would ensure excavation, grading, and other earth-moving activities would not have a significant impact. Erosion control BMPs might include the implementation and use of detention ponds or infiltration pits to collect and reduce erosion, using barriers to slow the rate of runoff, or controlling the use of water irrigation. BMPs are discussed in the K Line Northern Extension Transit Corridor Project Hydrology and Water Quality Technical Report. An erosion and sedimentation control plan will be prepared by the contractor in compliance with applicable NPDES permits, as discussed in Section 3.2.4.

All earthwork and grading activities required grading permits from the LADBS that include requirements and standards designed to limit potential impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70 of the LAMC, which addresses grading, excavations, and fill placement. It also requires the preparation of a site-specific geotechnical report to evaluate soils issues. The City of West Hollywood also requires a grading permit and plan check prior to commencement of grading activities. All grading and excavation shall be performed in accordance with the CBC Section 1804 as adopted and amended by the City of West Hollywood.

Upon completion of construction activities, it is anticipated that surficial soil previously concealed by pavements and structures will be restored to an impervious condition. The potential for erosion and topsoil loss would be temporary, and while the potential would increase during construction, compliance with regulatory requirements would keep that potential at a minimum.

For the reasons described above, the impact of construction on erosion and topsoil loss would be minimal. Therefore, the Fairfax Alignment Alternative would have a less than significant impact during construction.

OPERATIONAL IMPACTS

Less than Significant Impact. Operation of the Fairfax Alignment Alternative would not result in ground disturbance or in increase of the exposed area of soils when compared to existing conditions. The Fairfax Alignment Alternative would comply with applicable post-construction NPDES permits and any permit requirements of the Cities of Los Angeles and West Hollywood, which minimize erosion impacts from development projects. NPDES permits are discussed in more detail in the K Line Northern Extension Transit Corridor Project Hydrology and Water Quality Technical Report. Therefore, operation of the Fairfax Alignment Alternative would not result in substantial soil erosion or the loss of topsoil, and impacts would be less than significant.

6.1.3.3 ALIGNMENT ALTERNATIVE 3: LA BREA

The La Brea Alignment Alternative is contained within an urban setting and the topsoil in the RSA has been previously disturbed or concealed by human activities. The only exposed topsoil is typically in landscaped medians, planters, setbacks, or residential yards.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction activities would temporarily expose surficial soils to erosion by eolian and hydraulic forces, increasing the potential for erosion and topsoil loss when compared to existing conditions. Additionally, a rainstorm event concurrent with construction activities could accelerate the rate of erosion and topsoil loss. The increase in erosion potential for the La Brea Alignment Alternative would primarily be limited to the construction of shafts, stations, and cut-and-cover excavations. Underground construction activities related to tunnel excavation and construction would not affect erosion potential or topsoil loss.

Existing regulatory requirements limit erosion and topsoil loss during construction activities. These requirements include the implementation of BMPs, SWPPPs, and erosion and sedimentation control measures that would ensure excavation, grading, and other earth-moving activities would not have a significant impact. Erosion control BMPs might include the implementation and use of detention ponds or infiltration pits to collect and reduce erosion, using barriers to slow the rate of runoff, or controlling the use of water irrigation. BMPs are discussed in the K Line Northern Extension Transit Corridor Project Hydrology and Water Quality Technical Report. An erosion and sedimentation control plan will be prepared by the contractor in compliance with applicable NPDES permits, as discussed in Section 3.2.4.

All earthwork and grading activities required grading permits from the LADBS that include requirements and standards designed to limit potential impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70 of the LAMC, which addresses grading, excavations, and fill placement. It also requires the preparation of a

site-specific geotechnical report to evaluate soils issues. The City of West Hollywood also requires a grading permit and plan check prior to commencement of grading activities. All grading and excavation shall be performed in accordance with the CBC Section 1804 as adopted and amended by the City of West Hollywood.

Upon completion of construction activities, it is anticipated that surficial soil previously concealed by pavements and structures will be restored to an impervious condition. The potential for erosion and topsoil loss would be temporary, and while the potential would increase during construction, compliance with regulatory requirements would keep that potential at a minimum.

For the reasons described above, the impact of construction on erosion and topsoil loss would be minimal. Therefore, the La Brea Alignment Alternative would have a less than significant impact during construction.

OPERATIONAL IMPACTS

Less than Significant Impact. Operation of the La Brea Alignment Alternative would not result in ground disturbance or in increase of the exposed area of soils when compared to existing conditions. The La Brea Alignment Alternative would comply with applicable post-construction NPDES permits and any permit requirements of the Cities of Los Angeles and West Hollywood, which aim to minimize erosion impacts from development projects. NPDES permits are discussed in more detail in the Project's Hydrology and Water Quality Technical Report. Therefore, operation of the La Brea Alignment Alternative would not result in substantial soil erosion or the loss of topsoil, and impacts would be less than significant.

6.1.3.4 HOLLYWOOD BOWL DESIGN OPTION

The Hollywood Bowl Design Option is contained within an urban setting, and the topsoil in the RSA has been previously disturbed or concealed by human activities. The only exposed topsoil is typically in landscaped medians, planters, setbacks, or residential yards.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction activities would temporarily expose surficial soils to erosion by eolian and hydraulic forces, increasing the potential for erosion and topsoil loss when compared to existing conditions. Additionally, a rainstorm event concurrent with construction activities could accelerate the rate of erosion and topsoil loss. The increase in erosion potential for the design option would primarily be limited to the construction of shafts, stations, cut-and-cover excavations, and hillside grading. The tail tracks at the terminus of the design option north of the Pilgrimage Bridge would require grading of the hillside west of Cahuenga Boulevard. The topsoil of the hillside is largely undisturbed by human activity. Underground construction activities related to tunnel excavation and construction would not affect erosion potential or topsoil loss.

Existing regulatory requirements limit erosion and topsoil loss during construction activities. These requirements include the implementation of BMPs, SWPPPs, and erosion and sedimentation control measures that would ensure excavation, grading, and other earth-moving activities would not have a

significant impact. Erosion control BMPs might include the implementation and use of detention ponds or infiltration pits to collect and reduce erosion, using barriers to slow the rate of runoff, or controlling the use of water irrigation. BMPs are discussed in the Project's Hydrology and Water Quality Technical Report. An erosion and sedimentation control plan will be prepared by the contractor in compliance with applicable NPDES permits, as discussed in Section 3.2.4.

All earthwork and grading activities required grading permits from the LADBS that include requirements and standards designed to limit potential impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70 of the LAMC, which addresses grading, excavations, and fill placement. It also requires the preparation of a site-specific geotechnical report to evaluate soils issues. The grading required for the design option is in a designated hillside area; therefore, the grading would be considered engineered grading per LAMC Section 91.7004 and would require a grading permit and grading design to be performed by a licensed civil engineer. The designated hillside areas generally contribute to greater erosion and require additional sedimentation controls. The City of West Hollywood also requires a grading permit and plan check prior to commencement of grading activities. All grading and excavation shall be performed in accordance with the CBC Section 1804 as adopted and amended by the City of West Hollywood.

Upon completion of construction activities, it is anticipated that surficial soil previously concealed by pavements and structures will be restored to an impervious condition. The potential for erosion and topsoil loss would be temporary, and while the potential would increase during construction, compliance with regulatory requirements would keep that potential at a minimum.

For the reasons described above, the impact of construction on erosion and topsoil loss would be minimal. Therefore, the Hollywood Bowl Design Option would have a less than significant impact during construction

OPERATIONAL IMPACTS

Less than Significant Impact. Operation of the Hollywood Bowl Design Option would not result in ground disturbance or in increase of the exposed area of soils when compared to existing conditions. The design option would comply with applicable post-construction NPDES permits and any standards required by the Cities of Los Angeles and West Hollywood, which minimize erosion impacts from development projects. NPDES permits are discussed in the Project's Hydrology and Water Quality Technical Report. Therefore, operation of the design option would not result in substantial soil erosion or the loss of topsoil and impacts would be less than significant.

6.1.3.5 MAINTENANCE AND STORAGE FACILITY

The proposed MSF is in an urban setting and the topsoil in the RSA has been previously disturbed or concealed by human activities. The only exposed topsoil is typically in landscaped medians, planters, setbacks, or residential yards.

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction activities would temporarily expose surficial soils to erosion by eolian and hydraulic forces, increasing the potential for erosion and topsoil loss when compared to existing conditions. Additionally, a rainstorm event concurrent with construction activities could accelerate the rate of erosion and topsoil loss. The increase in erosion potential for the MSF would primarily be limited to the construction of shafts, stations, and cut-and-cover excavations. Underground construction activities related to tunnel excavation and construction would not affect erosion potential or topsoil loss.

Existing regulatory requirements limit erosion and topsoil loss during construction activities. These requirements include the implementation of BMPs, SWPPPs, and erosion and sedimentation control measures that would ensure excavation, grading, and other earth-moving activities would not have a significant impact. Erosion control BMPs might include the implementation and use of detention ponds or infiltration pits to collect and reduce erosion, using barriers to slow the rate of runoff, or controlling the use of water irrigation. BMPs are discussed in the K Line Northern Extension Transit Corridor Project Hydrology and Water Quality Technical Report. An erosion and sedimentation control plan will be prepared by the contractor in compliance with applicable NPDES permits, as discussed in Section 3.2.4.

All earthwork and grading activities required grading permits from the LADBS that include requirements and standards designed to limit potential impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70 of the LAMC, which addresses grading, excavations, and fill placement. It also requires the preparation of a site-specific geotechnical report to evaluate soils issues.

Upon completion of construction activities, it is anticipated that surficial soil previously concealed by pavements and structures will be restored to an impervious condition. The potential for erosion and topsoil loss would be temporary, and while the potential would increase during construction, compliance with regulatory requirements would keep that potential at a minimum.

For the reasons described above, the impact of construction on erosion and topsoil loss would be minimal. Therefore, the MSF would have a less than significant impact during construction.

OPERATIONAL IMPACTS

Less than Significant Impact. Operation of the MSF would not result in ground disturbance or in increase of the exposed area of soils when compared to existing conditions. The MSF would comply with applicable post-construction NPDES permits and any permit requirements of the City of Los Angeles, which minimize erosion impacts from development projects. NPDES permits are discussed in more detail in the K Line Northern Extension Transit Corridor Project Hydrology and Water Quality Technical Report. Therefore, operation of the MSF would not result in substantial soil erosion or the loss of topsoil and the impact would be less than significant.

6.1.4 IMPACT GEO-3: SOIL STABILITY

Impact GEO-3: Would the Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence,[4] liquefaction, or collapse[5]?

6.1.4.1 ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction of the San Vicente–Fairfax Alignment Alternative would involve excavation for shafts and stations, temporary excavation support, tunneling, and dewatering that could affect soil stability and lead to ground movements (lateral or vertical) and subsidence. Dewatering to provide dry working conditions could affect soil stability by changing the in situ soil stresses that can propagate to the surface and could manifest as surface settlement. Excavation for shafts and stations could negatively impact soil stability by reducing the self-support capacity of the retained soil and subsequently increasing the loading demands on the temporary shoring. Furthermore, movement of temporary shoring could result in surface settlement and soil collapse. Tunneling with a TBM could cause volume loss through over excavation and cause settlement or sinkholes at the surface.

However, the Project will comply with the regulatory and design requirements identified in Section 6.1.2.1 and as described in PM. GEO-1. Therefore, construction will not result in loss of soil stability and will have a less than significant impact.

OPERATIONAL IMPACTS

Less than Significant Impact. The San Vicente–Fairfax Alignment Alternative RSA is located on relatively level or gently sloping ground. There are no mapped landslide-susceptible areas in the San Vicente–Fairfax Alignment Alternative RSA, as shown in Figure 5-7.

As shown in Figure 5-4, part of the San Vicente–Fairfax Alignment Alternative is in a mapped liquefaction zone. Areas of historically high, shallow groundwater and loose, coarse-grained alluvial soils could cause seismic-induced liquefaction and settlement, including lateral spreading. Lateral spreading is a phenomenon were large blocks of intact soil move downslope in a rapid fluid-like movement as a result of liquefaction. The mass moves toward an unconfined area or free-face, such as a descending slope or stream-cut bluff and can move on slope gradients as gentle as one degree. While the conditions for liquefaction potential are present in the San Vicente–Fairfax Alignment Alternative RSA, the free-face condition required for inducement of lateral spreading is not present.

[4] Land subsidence is the progressive settling of the ground surface due to several sources, such as extraction of oil, groundwater, or gas.

[5] Collapse is an abrupt depression of ground surface and can also be caused by extraction of subsurface fluids or mining.

Subsidence or settlement could be caused by ongoing oil and gas extraction near the San Vicente–Fairfax Alignment. Within the RSA, there are active oil wells at the Beverly Center at the corner of San Vicente Boulevard and Beverly Boulevard, which are estimated to be approximately 300 feet from the alignment. While subsidence in the vicinity of the wells due to hydrocarbon extraction is a possibility, LAMC Section 13.01 contains provisions for subsidence monitoring and mitigation of permitted hydrocarbon extraction and it is assumed that any active well will comply with the regulations. Furthermore, the San Vicente–Fairfax Alignment Alternative is not in an area of known land subsidence mapped by USGS Areas of Land Subsidence in California (USGS n.d.).

Operation of the San Vicente–Fairfax Alignment Alternative would not exacerbate or cause conditions leading to landslides, liquefaction, lateral spreading, subsidence, or collapse. Implementation of project measure PM GEO-1 during design and construction would include design measures to stabilize soils, such as compaction grouting, compensation grouting, jet grouting, dynamic compaction, and stone columns. Therefore, there would be a less than significant impact related to soil stability during operation of the San Vicente–Fairfax Alignment Alternative.

6.1.4.2 ALIGNMENT ALTERNATIVE 2: FAIRFAX

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction of the Fairfax Alignment Alternative would involve excavation for shafts and stations, temporary excavation support, tunneling, and dewatering that could affect soil stability and lead to ground movements (lateral or vertical) and subsidence. Dewatering to provide dry working conditions could affect soil stability by changing the in situ soil stresses that can propagate to the surface and could manifest as surface settlement. Excavation for shafts and stations could negatively impact soil stability by reducing the self-support capacity of the retained soil and subsequently increasing the loading demands on the temporary shoring. Furthermore, movement of temporary shoring could result in surface settlement and soil collapse. Tunneling with a TBM could cause volume loss through over excavation and cause settlement or sinkholes at the surface.

However, the Project will comply with the regulatory and design requirements identified in Section 6.1.2.1 and as described in project measure PM GEO-1. Therefore, construction will not result in loss of soil stability and will have a less than significant impact.

OPERATIONAL IMPACTS

Less than Significant Impact. The Fairfax Alignment Alternative RSA is on relatively level or gently sloping ground, and there are no mapped landslide-susceptible areas in the Fairfax Alignment Alternative RSA, as shown in Figure 5-7. Therefore, the Fairfax Alignment Alternative would have no impact to the potential for on- or off-site landslides.

There are no known active or abandoned oil and gas wells along the Fairfax Alignment Alternative RSA, and the alignment alternative is not in an area of known land subsidence mapped by USGS Areas of

Land Subsidence in California (USGS n.d.). Therefore, the effect of subsidence on the Fairfax Alignment Alternative would be less than significant.

As shown in Figure 5-4, part of the Fairfax Alignment Alternative is in a mapped liquefaction zone. Areas of historically high, shallow groundwater and loose, coarse-grained alluvial soils could cause seismic-induced liquefaction and settlement, including lateral spreading. Lateral spreading is a phenomenon were large blocks of intact soil move downslope in a rapid fluid-like movement as a result of liquefaction. The mass moves toward an unconfined area or free-face, such as a descending slope or stream-cut bluff and can move on slope gradients as gentle as one degree. While the conditions for liquefaction potential are present in the Fairfax Alignment Alternative RSA, the free-face condition required for inducement of lateral spreading is not present.

Operation of the Fairfax Alignment Alternative would not exacerbate or cause conditions leading to landslides, liquefaction, lateral spreading, subsidence, or collapse. Implementation of project measure PM GEO-1 during design and construction would include design measures to stabilize soils, such as compaction grouting, compensation grouting, jet grouting, dynamic compaction, and stone columns. Therefore, there would be a less than significant impact related to soil stability during operation of the Fairfax Alignment Alternative.

6.1.4.3 ALIGNMENT ALTERNATIVE 3: LA BREA

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction of the La Brea Alignment Alternative would involve excavation for shafts and stations, temporary excavation support, tunneling, and dewatering that could affect soil stability and lead to ground movements (lateral or vertical) and subsidence. Dewatering to provide dry working conditions could affect soil stability by changing the in situ soil stresses that can propagate to the surface and could manifest as surface settlement. Excavation for shafts and stations could negatively impact soil stability by reducing the self-support capacity of the retained soil and subsequently increasing the loading demands on the temporary shoring. Furthermore, movement of temporary shoring could result in surface settlement and soil collapse. Tunneling with a TBM could cause volume loss through over excavation and cause settlement or sinkholes at the surface.

However, the Project will comply with the regulatory and design requirements identified in Section 6.1.2.1 and as described in project measure PM GEO-1. Therefore, construction will not result in loss of soil stability and will have a less than significant impact.

OPERATIONAL IMPACTS

Less than Significant Impact. The La Brea Alignment Alternative RSA is on relatively level or gently sloping ground, and there are no mapped landslide-susceptible areas in the La Brea Alignment Alternative RSA, as shown in Figure 5-7. Therefore, the La Brea Alignment Alternative would have no impact to the potential for on- or off-site landslides.

As discussed in Section 6.1.2.1, part of the La Brea Alignment Alternative is in a mapped liquefaction zone. Areas of historically high, shallow groundwater and loose, coarse-grained alluvial soils areas could cause seismic-induced liquefaction and settlement, including lateral spreading. Lateral spreading is a phenomenon were large blocks of intact soil move downslope in a rapid fluid-like movement because of liquefaction. The mass moves toward an unconfined area or free-face, such as a descending slope or stream-cut bluff and can move on slope gradients as gentle as one degree. While the conditions for liquefaction potential are present in the La Brea Alignment Alternative RSA, the free-face condition required for inducement of lateral spreading is not present.

There are no known active or abandoned oil and gas wells along the La Brea Alignment Alternative RSA. Furthermore, the La Brea Alignment Alternative is not in an area of known land subsidence mapped by USGS Areas of Land Subsidence in California (USGS n.d.). Therefore, the effect of subsidence on the La Brea Alignment Alternative would be low.

Operation of the La Brea Alignment Alternative would not exacerbate or cause conditions leading to landslides, liquefaction, lateral spreading, subsidence, or collapse. Implementation of project measure PM GEO-1 during design and construction would include design measures to stabilize soils, such as compaction grouting, compensation grouting, jet grouting, dynamic compaction, and stone columns. Therefore, there would be a less than significant impact related to soil stability during operation of the La Brea Alignment Alternative.

6.1.4.4 HOLLYWOOD BOWL DESIGN OPTION

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction activities for the Hollywood Bowl Design Option would include excavation for shafts and stations, temporary excavation support, tunneling, and dewatering, activities which could affect soil stability and lead to ground movements (lateral or vertical) and subsidence. Dewatering is not anticipated because the depth of groundwater is below proposed excavation depths. Excavation for shafts and stations could negatively impact soil stability by reducing the self-support capacity of the retained soil and subsequently increasing the loading demands on the temporary shoring. Furthermore, movement of temporary shoring could result in surface settlement and soil collapse. Tunneling with a TBM could cause volume loss through over excavation and cause settlement or sinkholes at the surface.

As discussed in Section 6.1.2.1, parts of the design option are located in a mapped liquefaction zone. Areas of historically high, shallow groundwater and loose, coarse-grained alluvial soils areas could cause seismic-induced liquefaction and settlement, including lateral spreading. Lateral spreading is a phenomenon were large blocks of intact soil move downslope in a rapid fluid-like movement as a result of liquefaction. The mass moves toward and unconfined area or free-face, such as a descending slope or stream-cut bluff and can move on slope gradients as gentle as one degree. While the conditions for liquefaction potential are present in the design option RSA, the free-face condition required for inducement of lateral spreading is not present.

The design option would include altering the slope for construction of a staging area and ventilation shafts. Excavation into the slope could cause landslides on-site and off-site. However, all earthwork and grading activities require grading permits from the LADBS that include requirements and standards designed to limit potential impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70 of the LAMC, which addresses grading, excavations, and fill, and the recommendations of a site-specific geotechnical report. The City of Los Angeles requires the preparation of a site-specific geotechnical report to evaluate soils issues. Furthermore, as part of project measure PM GEO-1, a geotechnical site investigation will be conducted at the site and recommendations given for support of the slope, which will minimize the potential for landslides on- or off-site.

There are no known active or abandoned oil and gas wells in the vicinity of the design option RSA. Furthermore, the design option is not in an area of known land subsidence mapped by USGS Areas of Land Subsidence in California (USGS n.d.). Therefore, the effect of subsidence on the design option would be low.

The Project will comply with the regulatory and design requirements identified in Section 6.1.2.1 and as described in project measure PM GEO-1. Therefore, construction would not result in loss of soil stability and would have a less than significant impact.

OPERATIONAL IMPACTS

Less than Significant Impact. Operation of the Hollywood Bowl Design Option would not exacerbate or cause conditions leading to landslides, liquefaction, lateral spreading, subsidence, or collapse. In addition, implementation of project measure PM GEO-1 during design and construction would include stabilizing the soils. Therefore, there would be a less than significant impact related to soil stability during operation of the design option.

6.1.4.5 MAINTENANCE AND STORAGE FACILITY

CONSTRUCTION IMPACTS

Less than Significant Impact. Construction activities for the MSF would include excavation and grading for foundations and associated utilities that could affect soil stability and lead to ground movements (lateral or vertical). Without compliance with regulatory and design requirements, these activities could result in loss of soil stability.

The MSF site is not in an area of mapped liquefaction or seismic landslide hazards. Furthermore, historically high groundwater elevations were 40 to 50 feet bgs, and the old alluvial deposits underlying the site are relatively dense, further reducing the potential for liquefaction.

The MSF site is on relatively level or gently sloping ground. There is no potential for landslides on or off-site.

There are no known active or abandoned oil and gas wells within the MSF RSA. Furthermore, the RSA is not in an area of known land subsidence mapped by USGS Areas of Land Subsidence in California (USGS n.d.).

For the reasons described above, the overall impact associated with soil stability that could result in landslides, lateral spreading, subsidence, liquefaction, or collapse would be minimal. Therefore, soil stability impacts associated with construction of the MSF would be less than significant.

OPERATIONAL IMPACTS

No Impact. Operation of the MSF would not exacerbate or cause conditions leading to the occurrence of landslides, liquefaction, lateral spreading, subsidence, or collapse. In addition, implementation of project measure PM GEO-1 during design and construction would include stabilizing the soils. Therefore, landslides, lateral spreading, subsidence, liquefaction, or collapse would result in no impacts for the MSF.

6.1.5 IMPACT GEO-4: EXPANSIVE SOILS

Impact GEO-4: Would the Project be located on expansive soil, as defined in Section 1803.5.3 of the CBC, creating substantial direct or indirect risks to life or property?

As discussed in Section 5.5.2, expansive soils are materials that undergo significant volume changes in response to relative changes in water content (wetting and drying). Expansive soils have a significant amount of clay particles, which can absorb, release, and hold water. The magnitude of volumetric changes depends on the amount of expansive minerals in the soil. The shrinking and swelling may result in the tilting of structures and differential settlements, as well as exert stresses and damages (e.g., cracking) to pavements, underground utilities, and shallow foundations.

6.1.5.1 ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX

CONSTRUCTION IMPACTS

Less than Significant Impact. As discussed in Section 5.5.2.1, the San Vicente–Fairfax Alignment Alternative would be constructed within alluvial deposits that might contain expansive soil. Additionally, bedrock units underlying alluvial deposits, such as the Fernando Formation, that contain claystone could exhibit expansive behavior if present in the shallow subsurface. Expansive soils and bedrock, if encountered within the shallow subsurface, could affect components of the San Vicente–Fairfax Alignment Alternative, primarily stations and other ancillary structures.

The San Vicente–Fairfax Alignment Alternative would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, prior to construction, a comprehensive subsurface field and laboratory investigation program would be required to establish the subsurface conditions and geotechnical design parameters for final design and recommendations for construction. As part of the geotechnical explorations for final design, the presence, depths, and the extents of expansive soils will be determined, and their expansive potential will be characterized. Therefore, there is the potential

that expansive soils will be identified in the shallow subsurface, which could affect construction. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements will be implemented.

Design and construction recommendations to address potential impacts, if needed, would be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations would ensure that expansive soil behavior does not pose a substantial direct or indirect risk to life or property during construction of the San Vicente–Fairfax Alignment Alternative. Therefore, the impact of expansive soils on the construction of the San Vicente–Fairfax Alignment Alternative would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. As described above for construction impacts, the proposed San Vicente–Fairfax Alignment Alternative is located within alluvial deposits that might contain expansive soil. Additionally, bedrock units underlying alluvial deposits, such as the Fernando Formation, that contain claystone could exhibit expansive behavior if present in the shallow subsurface. Expansive soils and bedrock, if encountered within the shallow subsurface, could affect components of the San Vicente–Fairfax Alignment Alternative, primarily stations and other ancillary structures.

The San Vicente–Fairfax Alignment Alternative would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, a comprehensive subsurface field and laboratory investigation program will be required, as described above. There is the potential that expansive soils could be identified in the shallow subsurface that could affect operation of the San Vicente–Fairfax Alignment Alternative. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements will be implemented.

As stated above, design and construction recommendations to address potential impacts, if needed, will be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations will ensure that expansive soil behavior will not pose a substantial direct or indirect risk to life or property during operation of the San Vicente–Fairfax Alignment Alternative. Therefore, the impact of expansive soils on operation of the San Vicente–Fairfax Alignment Alternative would be less than significant.

6.1.5.2 ALIGNMENT ALTERNATIVE 2: FAIRFAX

CONSTRUCTION IMPACTS

Less than Significant Impact. As discussed in Section5.5.2.1, the Fairfax Alignment Alternative would be constructed within alluvial deposits that might contain expansive soil. Additionally, bedrock units underlying alluvial deposits, such as the Fernando Formation, that contain claystone could exhibit expansive behavior if present in the shallow subsurface. Expansive soils and bedrock, if encountered

within the shallow subsurface, could affect components of the Fairfax Alignment Alternative, primarily stations and other ancillary structures.

The Fairfax Alignment Alternative would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, prior to construction, a comprehensive subsurface field and laboratory investigation program would be required to establish the subsurface conditions and geotechnical design parameters for final design and recommendations for construction. As part of the geotechnical explorations for final design, the presence, depths, and the extents of expansive soils will be determined, and their expansive potential will be characterized. Therefore, there is the potential that expansive soils will be identified in the shallow subsurface, which could affect construction. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements will be implemented.

Design and construction recommendations to address potential impacts, if needed, would be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations would ensure that expansive soil behavior does not pose a substantial direct or indirect risk to life or property during construction of the Fairfax Alignment Alternative. Therefore, the impact of expansive soils on the construction of the Fairfax Alignment Alternative would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. As described above for operational impacts, the proposed Fairfax Alignment Alternative is located within alluvial deposits that might contain expansive soil. Additionally, bedrock units underlying alluvial deposits, such as the Fernando Formation, that contain claystone could exhibit expansive behavior if present in the shallow subsurface. Expansive soils and bedrock, if encountered within the shallow subsurface, could affect components of the Fairfax Alignment Alternative, primarily stations and other ancillary structures.

The Fairfax Alignment Alternative would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, a comprehensive subsurface field and laboratory investigation program will be required, as described above. There is the potential that expansive soils could be identified in the shallow subsurface that could affect operation of the Fairfax Alignment Alternative. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements will be implemented.

As stated above, design and construction recommendations to address potential impacts, if needed, will be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations will ensure that expansive soil behavior will not pose a substantial direct or indirect risk to life or property during operation of the Fairfax Alignment Alternative. Therefore, the impact of expansive soils on operation of the Fairfax Alignment Alternative would be less than significant.

6.1.5.3 ALIGNMENT ALTERNATIVE 3: LA BREA

CONSTRUCTION IMPACTS

Less than Significant Impact. As discussed in Section 5.5.2.1, the La Brea Alignment Alternative would be constructed within alluvial deposits that might contain expansive soil. Additionally, bedrock units underlying alluvial deposits, such as the Fernando Formation, that contain claystone could exhibit expansive behavior if present in the shallow subsurface. Expansive soils and bedrock, if encountered within the shallow subsurface, could affect components of the La Brea Alignment Alternative, primarily stations and other ancillary structures.

The La Brea Alignment Alternative would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, prior to construction, a comprehensive subsurface field and laboratory investigation program would be required to establish the subsurface conditions and geotechnical design parameters for final design and recommendations for construction. As part of the geotechnical explorations for final design, the presence, depths, and the extents of expansive soils will be determined, and their expansive potential will be characterized. Therefore, there is the potential that expansive soils will be identified in the shallow subsurface, which could affect construction. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements will be implemented.

Design and construction recommendations to address potential impacts, if needed, would be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations would ensure that expansive soil behavior does not pose a substantial direct or indirect risk to life or property during construction of the La Brea Alignment Alternative. Therefore, the impact of expansive soils on the construction of the La Brea Alignment Alternative would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. As described above for construction impacts, the proposed La Brea Alignment Alternative is located within alluvial deposits that might contain expansive soil. Additionally, bedrock units underlying alluvial deposits, such as the Fernando Formation, that contain claystone could exhibit expansive behavior if present in the shallow subsurface. Expansive soils and bedrock, if encountered within the shallow subsurface, could affect components of the La Brea Alignment Alternative, primarily stations and other ancillary structures.

The La Brea Alignment Alternative would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, a comprehensive subsurface field and laboratory investigation program will be required, as described above. There is the potential that expansive soils could be identified in the shallow subsurface that could affect operation of the La Brea Alignment Alternative. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements would be implemented.

As stated above, design and construction recommendations to address potential impacts, if needed, will be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations will ensure that expansive soil behavior will not pose a substantial direct or indirect risk to life or property during operation of the La Brea Alignment Alternative. Therefore, the impact of expansive soils on operation of the La Brea Alignment Alternative would be less than significant.

6.1.5.4 HOLLYWOOD BOWL DESIGN OPTION

CONSTRUCTION IMPACTS

Less than Significant Impact. As discussed in Section5.5.2.2, construction activities associated with the Hollywood Bowl Design Option would occur on old alluvial fan deposits (Qof), as well as tertiary-age bedrock of Topanga Group (Tt) and might be subjected to expansive soil behavior. Based on USDA rating (see Section 5.5.2.2), the surficial soils (top 5 feet) along the eastern portion of the design option along Highland Avenue and Cahuenga Boulevard are classified as having low shrink-swell potential. However, this should be verified through site-specific exploration in subsequent design phases. At this preliminary stage, it is assumed that the design option would be subject to the effects of expansive soil behavior.

The design option would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2, which is included in project measure PM GEO-1, a comprehensive subsurface field and laboratory investigation program would be required to establish the subsurface conditions and geotechnical design parameters for final design and recommendations for construction. As part of the geotechnical explorations for final design, the presence, depths, and the extents of expansive soils, as well as rock composition, will be determined, and their expansive potential will be characterized. Therefore, there is the potential that expansive soils will be identified in the shallow subsurface, which could affect construction. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements will be implemented.

Design and construction recommendations to address potential impacts, if needed, would be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations would ensure that expansive soil behavior does not pose a substantial direct or indirect risk to life or property during construction of the design option. Therefore, the impact of expansive soils on the construction of the design option would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. As described above for construction impacts, the Hollywood Bowl Design Option would be located on old alluvial fan deposits (Qof), as well as tertiary-age bedrock of the Topanga Group (Tt) and might be subjected to expansive soil behavior. Based on the USDA rating (see Section 5.5.2.2), the surficial soils (top 5 feet) along the eastern portion of the design option along Highland Avenue and Cahuenga Boulevard are classified as having low shrink-swell potential.

However, this should be verified through site-specific exploration in subsequent design phases. At this preliminary stage, it is assumed that operation of the design option would be subject to the effects of expansive soil behavior.

The design option would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2, which is included in project measure PM GEO-1, a comprehensive subsurface field and laboratory investigation program would be required to establish the subsurface conditions and geotechnical design parameters for final design and recommendations for construction, as described in the construction impacts section. Although, the potential exists that expansive soils will be identified in the shallow subsurface, which could affect operations, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements would be implemented.

Design and construction recommendations to address potential impacts, if needed, would be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations would ensure that expansive soil behavior does not pose a substantial direct or indirect risk to life or property during operation of the design option. Therefore, the impact of expansive soils on operation of the design option would be less than significant.

6.1.5.5 MAINTENANCE AND STORAGE FACILITY

CONSTRUCTION IMPACTS

Less than Significant Impact. As discussed in Section 5.5.2.3, the MSF would be constructed on alluvial deposits that might contain expansive soil. Expansive soils, if present within the shallow subsurface, could affect construction of the MSF.

The MSF would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, a comprehensive subsurface field and laboratory investigation program would be required to establish the subsurface conditions and geotechnical design parameters for final design and recommendations for construction. As part of the geotechnical explorations for final design, the presence, depths, and the extents of expansive soils, would be determined, and their expansive potential would be characterized. Therefore, there is the potential that expansive soils would be identified in the shallow subsurface, which could affect construction. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements would be implemented.

Design and construction recommendations to address potential impacts, if needed, would be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations would ensure that expansive soil behavior does not pose a substantial direct or indirect risk to life or property during construction of the MSF. Therefore, the impact of expansive soils on the construction of the MSF would be less than significant.

OPERATIONAL IMPACTS

Less than Significant Impact. As discussed in Section 5.5.2.3, the MSF would be located on an area of alluvial deposits that might contain expansive soil. Expansive soils, if present within the shallow subsurface, could affect several components of the MSF, such as buildings, newly installed utilities, trackwork, and other ancillary facilities.

The MSF would be designed in conformance with the MRDC, CBC, and other applicable regulations and design standards (see Chapter 3). In accordance with MRDC Section 5.6.2 and project measure PM GEO-1, a comprehensive subsurface field and laboratory investigation program would be required to establish the subsurface conditions and geotechnical design parameters for final design and recommendations for construction. As part of the geotechnical explorations for final design, the presence, depths, and extents of expansive soils would be determined and their expansive potential would be characterized. Therefore, the potential exists that expansive soils would be identified in the shallow subsurface, which could affect operation. However, per applicable regulations and design standards, soil remediation measures such as soil removal and replacement, chemical treatment, or structural enhancements would be implemented.

Design and construction recommendations to address potential impacts, if needed, would be incorporated into the geotechnical design reports, as required by the MRDC. Compliance with such recommendations would ensure that expansive soil behavior does not pose a substantial direct or indirect risk to life or property during operation of the MSF. Therefore, the impact of expansive soils on operation of the MSF would be less than significant.

6.1.6 IMPACT GEO-5: GEOLOGIC FEATURES

Impact GEO-5: Would the Project directly or indirectly destroy a unique geologic feature?

6.1.6.1 ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX

CONSTRUCTION IMPACTS

No Impact. The proposed San Vicente–Fairfax Alignment Alternative is in a relatively flat, developed urban area and therefore not anticipated to destroy, permanently cover, or adversely alter any unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands. Therefore, construction of the San Vicente–Fairfax Alignment Alternative would have no impact on unique geologic features.

OPERATIONAL IMPACTS

No Impact. The proposed San Vicente–Fairfax Alignment Alternative is in a relatively flat, developed urban area and therefore not anticipated to destroy, permanently cover, or adversely alter any unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands. Therefore, operation of the San Vicente–Fairfax Alignment Alternative would have no impact on unique geologic features.

6.1.6.2 ALIGNMENT ALTERNATIVE 2: FAIRFAX

CONSTRUCTION IMPACTS

No Impact. The proposed Fairfax Alignment Alternative is in a relatively flat, developed urban area and therefore not anticipated to destroy, permanently cover, or adversely alter any unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands. Therefore, construction of the Fairfax Alignment Alternative would have no impact on unique geologic features.

OPERATIONAL IMPACTS

No Impact. The proposed Fairfax Alignment Alternative is in a relatively flat, developed urban area and therefore not anticipated to destroy, permanently cover, or adversely alter any unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands. Therefore, operation of the Fairfax Alignment Alternative would have no impact on unique geologic features.

6.1.6.3 ALIGNMENT ALTERNATIVE 3: LA BREA

CONSTRUCTION IMPACTS

No Impact. The proposed La Brea Alignment Alternative is in a relatively flat, developed urban area and therefore not anticipated to destroy, permanently cover, or adversely alter any unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands. Therefore, construction of the La Brea Alignment Alternative would have no impact on unique geologic features.

OPERATIONAL IMPACTS

No Impact. The proposed La Brea Alignment Alternative is in a relatively flat, developed urban area and therefore not anticipated to destroy, permanently cover, or adversely alter any unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands. Therefore, operation of the San Vicente–Fairfax Alignment Alternative would have no impact on unique geologic features.

6.1.6.4 HOLLYWOOD BOWL DESIGN OPTION

CONSTRUCTION IMPACTS

Less than Significant Impact. The Hollywood Bowl Design Option would alter a hillslope for construction of a ventilation shaft and construction staging area. However, the hillslope has been previously altered as part of construction of Cahuenga Boulevard and no rock outcrops are visible on the slope. The area of grading would be approximately 60 feet by 105 feet within a much larger hillslope. Therefore, construction of the design option would have a less than significant impact on unique geologic features.

OPERATIONAL IMPACT

Less than Significant Impact. During operations, the Hollywood Bowl Design Option would alter a hillslope to install a ventilation shaft. However, the hillslope has been previously altered as part of construction of Cahuenga Boulevard and no rock outcrops are visible on the slope. The area of grading would be approximately 60 feet by 105 feet within a much larger hillslope. Therefore, operation of the design option would have a less than significant impact on unique geologic features.

6.1.6.5 MAINTENANCE AND STORAGE FACILITY

CONSTRUCTION IMPACT

No Impact. The MSF site is in a relatively flat, developed urban area without unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands, that could be destroyed, permanently covered, or adversely altered by construction. Therefore, construction of the MSF would have no impact on unique geologic features.

OPERATIONAL IMPACT

No Impact. The MSF site is in a relatively flat, developed urban area without unique or prominent geologic or topographic features, such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands, that could be destroyed, permanently covered, or adversely altered by operational activities. Therefore, operations of the MSF would have no impact on unique geologic features.

6.1.7 IMPACT MR-1: MINERAL RESOURCES

Impact MR-1: Would the Project result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state?

6.1.7.1 ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX

CONSTRUCTION IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The San Vicente–Fairfax Alignment Alternative lies within a highly urbanized area of Los Angeles County within the Cities of Los Angeles and West Hollywood. The general location of the alignment alternative with respect to the identified MRZ areas per the 2035 Los Angeles County General Plan (Los Angeles County 2022) is shown in Figure 5-8. The portion of the San Vicente–Fairfax Alignment Alternative between its southern terminus at the existing Metro K Line Expo/Crenshaw Station and approximately the intersection of Fairfax Avenue with West 5th Street is within an area classified as MRZ-3, while the section north of this location to its northern terminus (Hollywood/Highland Station) lies within an area classified as MRZ-1 (CGS 2021, 1994).

The westernmost curve of the San Vicente–Fairfax Alignment Alternative (approximately between the Pacific Design Center at San Vicente Boulevard and the intersection of San Vicente Boulevard and Santa Monica Boulevard) appears to border or lie within a designated MRZ-3 area as well. Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the San Vicente–Fairfax Alignment Alternative consists of urbanized areas including commercial, residential, open spaces, public facilities, and light manufacturing land uses, which are unavailable for future mineral extraction. Based on the MRZ classification, construction of the San Vicente–Fairfax Alignment Alternative would not directly or indirectly have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

Less than Significant Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, the San Vicente–Fairfax Alignment Alternative would traverse the Las Cienegas, Salt Lake (South), Salt Lake, Beverly Hills, and Sherman (Abandoned) oil fields. As shown in Figure 5-9, although there are several idle/plugged/dry wells within 300 feet of the San Vicente–Fairfax Alignment Alternative, the only documented active wells are located at Beverly Center, near the intersection of Beverly Boulevard and La Cienega Boulevard. LAMC 3.01 lays out the regulatory framework for oil drilling within the City of Los Angeles. Due to technological advancements in drilling and extraction techniques, oil wells do not need to be placed directly over the oil field. Construction of the San Vicente–Fairfax Alignment Alternative is not proposed to be at depths capable of disrupting the extraction activities of any active well; therefore, construction of the San Vicente–Fairfax Alignment Alternative would have a less than significant impact on an existing oil resource.

MINERAL RESOURCES CONSTRUCTION IMPACT CONCLUSION

Less than Significant Impact. Based on the impact evaluation described above for non-fuel and oil resources, while the construction of the San Vicente–Fairfax Alignment Alternative would have no impact on non-fuel mineral resources, it would have a less than significant impact on an existing oil resource. Therefore, construction of the San Vicente–Fairfax Alignment Alternative would result in a less than significant impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

OPERATIONAL IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The San Vicente–Fairfax Alignment Alternative lies within a highly urbanized area of Los Angeles County within the Cities of Los Angeles and West Hollywood, as described for construction impacts. The general location of the alignment alternative with respect to the identified MRZ areas per the 2035 Los Angeles County General Plan (Los Angeles County 2022) is shown in Figure 5-8. The portion of the San Vicente–Fairfax Alignment Alternative between its southern terminus at the existing Metro K Line Expo/Crenshaw Station and approximately the intersection of Fairfax Avenue with West 5th Street is within an area classified as MRZ-3.

The section north of this location to its northern terminus (Hollywood/Highland Station) lies within an area classified as MRZ-1 (CGS 2021, 1994). The westernmost curve of the San Vicente–Fairfax Alignment Alternative (approximately between the Pacific Design Center at San Vicente Boulevard and the intersection of San Vicente Boulevard and Santa Monica Boulevard) appears to border or lie within a designated MRZ-3 area as well. Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the San Vicente–Fairfax Alignment Alternative consists of urbanized areas, including commercial, residential, open spaces, public facilities, and light manufacturing land uses, which are unavailable for future mineral extraction. Based on the MRZ classifications, operation of the San Vicente–Fairfax Alignment Alternative would not directly or indirectly have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

Less than Significant Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, the San Vicente–Fairfax Alignment Alternative would traverse the Las Cienegas, Salt Lake (South), Salt Lake, Beverly Hills, and Sherman (Abandoned) oil fields. As shown in Figure 5-9, although there are several idle/plugged/dry wells within 300 feet of the San Vicente–Fairfax Alignment Alternative, the only documented active wells are located at Beverly Center, near the intersection of Beverly Boulevard and La Cienega Boulevard. LAMC 3.01 lays out the regulatory framework for oil drilling within the City of Los Angeles. Due to technological advancements in drilling and extraction techniques, oil wells do not need to be placed directly over the oil field. There are no operational activities associated with the San Vicente–Fairfax Alignment Alternative that would be at depths capable of disrupting the extraction activities of any active well; therefore, operation of the San Vicente–Fairfax Alignment Alternative would have a less than significant impact on an existing oil resource.

MINERAL RESOURCES OPERATIONAL IMPACT CONCLUSION

Less than Significant Impact. Based on the impact evaluation described above for non-fuel and oil resources, while operation of the San Vicente–Fairfax Alignment Alternative would have no impact on non-fuel mineral resources, it would have a less than significant impact on an existing oil resource. Therefore, operation of the San Vicente–Fairfax Alignment Alternative would result in a less than significant impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

6.1.7.2 ALIGNMENT ALTERNATIVE 2: FAIRFAX

CONSTRUCTION IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The Fairfax Alignment Alternative lies within a highly urbanized area of Los Angeles County within the Cities of Los Angeles and West Hollywood. The general location of the alignment alternative with respect to the identified MRZ areas per the 2035 Los Angeles County General Plan (Los Angeles

County 2022) is shown in Figure 5-8. The portion of the Fairfax Alignment Alternative between its southern terminus at the existing Metro K Line Expo/Crenshaw Station and approximately the intersection of Fairfax Avenue with 5th Street is within an area classified as MRZ-3, while the section north of this location to its northern terminus (Hollywood/Highland Station) lies within an area classified as MRZ-1 (CGS 2021). Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the Fairfax Alignment Alternative is in an urbanized area including commercial, residential, open spaces, public facilities areas, and light manufacturing, which are unavailable for future mineral extraction. Based on the MRZ classification, construction of the Fairfax Alignment Alternative would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, the Fairfax Alignment Alternative traverses the Las Cienegas, Salt Lake (South), Salt Lake, and Beverly Hills oil fields. As shown in Figure 5-9, there are several idle/plugged/dry wells within 300 feet of the Fairfax Alignment Alternative, but no active wells. LAMC 3.01 lays out the regulatory framework for oil drilling within the City of Los Angeles. Due to technological advancements in drilling and extraction techniques, oil wells do not need to be placed directly over the oil field. Therefore, construction of the Fairfax Alignment Alternative would have no impact on an existing oil resource.

MINERAL RESOURCES CONSTRUCTION IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, construction of the Fairfax Alignment Alternative would result in no impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

OPERATIONAL IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The Fairfax Alignment Alternative lies within a highly urbanized area of Los Angeles County within the Cities of Los Angeles and West Hollywood. The general location of the alignment alternative with respect to the identified MRZ areas per the 2035 Los Angeles County General Plan (Los Angeles County 2022) is shown in Figure 5-8. The portion of the Fairfax Alignment Alternative between its southern terminus at the existing Metro K Line Expo/Crenshaw Station and approximately the intersection of Fairfax Avenue with 5th Street is within an area classified as MRZ-3, while the section north of this location to its northern terminus (Hollywood/Highland Station) lies within an area classified as MRZ-1 (CGS 2021). Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the Fairfax Alignment Alternative is in an urbanized area, including commercial, residential, open spaces, public facilities areas, and light manufacturing, which are unavailable for future mineral extraction. Based on the MRZ classification, operation of the Fairfax

Alignment Alternative would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, the Fairfax Alignment Alternative traverses the Las Cienegas, Salt Lake (South), Salt Lake, and Beverly Hills oil fields. As shown in Figure 5-9, several idle/plugged/dry wells are within 300 feet of the Fairfax Alignment Alternative, but no active wells. LAMC 3.01 lays out the regulatory framework for oil drilling within the City of Los Angeles. Due to technological advancements in drilling and extraction techniques, oil wells do not need to be placed directly over the oil field. Therefore, operation of the Fairfax Alignment Alternative would have no impact on an existing oil resource.

MINERAL RESOURCES OPERATIONAL IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, operation of the Fairfax Alignment Alternative would result in no impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

6.1.7.3 ALIGNMENT ALTERNATIVE 3: LA BREA

CONSTRUCTION IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The La Brea Alignment Alternative lies within a highly urbanized area of Los Angeles County within the Cities of Los Angeles and West Hollywood. The general location of the alignment alternative with respect to the identified MRZ areas per the 2035 Los Angeles County General Plan (Los Angeles County 2022) is shown in Figure 5-8. The portion of the La Brea Alignment Alternative between its southern terminus at the existing Metro K Line Expo/Crenshaw Station and approximately the intersection of La Brea Avenue with 4th Street is within an area classified as MRZ-3, while the section north of this location to its northern terminus (Hollywood/Highland Station) lies within an area classified as MRZ-1 (CGS 2021). Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the La Brea Alignment Alternative is in an urbanized area including commercial, residential, open spaces, public facilities areas, and light manufacturing, which are unavailable for future mineral extraction. Based on the MRZ classification, construction of the La Brea Alignment Alternative would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, the La Brea Alignment Alternative traverses the Las Cienegas and Salt Lake oil fields. As shown in Figure 5-9, there are several

idle/plugged/dry wells within 300 feet of the La Brea Alignment Alternative, but no active wells. LAMC 3.01 lays out the regulatory framework for oil drilling within the City of Los Angeles. Due to technological advancements in drilling and extraction techniques, oil wells do not need to be placed directly over the oil field. Therefore, construction of the La Brea Alignment Alternative would have no impact on an existing oil resource.

MINERAL RESOURCES CONSTRUCTION IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, construction of the La Brea Alignment Alternative would result in no impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

OPERATIONAL IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The La Brea Alignment Alternative lies within a highly urbanized area of Los Angeles County within the Cities of Los Angeles and West Hollywood. The general location of the alignment alternative with respect to the identified MRZ areas per the 2035 Los Angeles County General Plan (Los Angeles County 2022) is shown in Figure 5-8. The portion of the La Brea Alignment Alternative between its southern terminus at the existing Metro K Line Expo/Crenshaw Station and approximately the intersection of La Brea Avenue with 4th Street is within an area classified as MRZ-3, while the section north of this location to its northern terminus (Hollywood/Highland Station) lies within an area classified as MRZ-1 (CGS 2021). Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the La Brea Alignment Alternative is in an urbanized area including commercial, residential, open spaces, public facilities areas, and light manufacturing, which are unavailable for future mineral extraction. Based on the MRZ classification, operation of the La Brea Alignment Alternative would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, the La Brea Alignment Alternative traverses the Las Cienegas and Salt Lake oil fields. As shown in Figure 5-9, there are several idle/plugged/dry wells within 300 feet of the La Brea Alignment Alternative, but no active wells. LAMC 3.01 lays out the regulatory framework for oil drilling within the City of Los Angeles. Due to technological advancements in drilling and extraction techniques, oil wells do not need to be placed directly over the oil field. Therefore, operation of the La Brea Alignment Alternative would have no impact on an existing oil resource.

MINERAL RESOURCES OPERATIONAL IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, operation of the La Brea Alignment Alternative would result in no impact overall related to the loss of availability of a known mineral resource that would be a value to the region and the residents of the state.

6.1.7.4 HOLLYWOOD BOWL DESIGN OPTION

CONSTRUCTION IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. As shown in Figure 5-8, the Hollywood Bowl Design Option lies within an area classified as MRZ-1 south of the intersection of Highland Avenue with Milner Road and Camrose Drive, and an area classified as MRZ-3 north of this location to the Hollywood Bowl Station (CGS 2021, 1994). Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the design option is in an urbanized area that includes commercial, residential, open spaces, and public facilities areas, which are unavailable for future mineral extraction. Based on this MRZ classification, construction of the design option would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, there are no known oil fields or active, plugged, or idle oil/gas wells in the RSA of the Hollywood Bowl Design Option. Therefore, based on the available data, the construction of the design option would not have an impact to a known oil resource.

MINERAL RESOURCES CONSTRUCTION IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, construction of the Hollywood Bowl Design Option would result in no impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

OPERATIONAL IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. As shown in Figure 5-8, the Hollywood Bowl Design Option lies within an area classified as MRZ-1 south of the intersection of Highland Avenue with Milner Road and Camrose Drive, and an area classified as MRZ-3 north of this location to the Hollywood Bowl Station (CGS 2021, 1994). Areas classified as MRZ-1 have little or no likelihood for the presence of significant mineral resources. Areas classified as MRZ-3 contain known mineral occurrences of undetermined significance. In addition, the

design option is in an urbanized area that includes commercial, residential, open spaces, and public facilities areas, which are unavailable for future mineral extraction. Based on this MRZ classification, operation of the design option would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, there are no known oil fields or active, plugged, or idle oil/gas wells in the RSA of the Hollywood Bowl Design Option. Therefore, based on the available data, operation of the design option would not have an impact to a known oil resource.

MINERAL RESOURCES OPERATIONAL IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, operation of the Hollywood Bowl Design Option would result in no impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

6.1.7.5 MAINTENANCE AND STORAGE FACILITY

CONSTRUCTION IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The general location of the MSF site with respect to the identified MRZ areas is shown in Figure 5-8. The MSF site is within an area classified as MRZ-1 (CGS 2021, 1994) that has little or no likelihood for the presence of significant mineral resources. No sand or gravel mines have been identified within the MSF RSA within the City of Los Angeles. In addition, the MSF site is within an urbanized area with light industrial land use. Based on this MRZ classification, construction of the MSF would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, there are no known oil fields or active, plugged, or idle oil/gas wells in the MSF RSA. Based on the available data, the construction of the MSF would not have an impact to a known oil resource.

MINERAL RESOURCES CONSTRUCTION IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, construction of the MSF would result in no impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

OPERATIONAL IMPACTS

NON-FUEL MINERAL RESOURCES

No Impact. The general location of the MSF site with respect to the identified MRZ areas is shown in Figure 5-8. The MSF site is within an area classified as MRZ-1 (CGS 2021, 1994) that has little or no likelihood for the presence of significant mineral resources. No sand or gravel mines have been identified within the MSF RSA within the City of Los Angeles. In addition, the MSF site is within an urbanized area with light industrial land use. Based on this MRZ classification, operation of the MSF would not have an impact to a known non-fuel mineral resource that is of value to the region and the residents of the state.

OIL RESOURCES

No Impact. As discussed in Section 5.5.3 and shown in Figure 5-9, there are no known oil fields or active, plugged, or idle oil/gas wells in the MSF RSA. Based on the available data, operation of the MSF would not have an impact to a known oil resource.

MINERAL RESOURCES OPERATIONAL IMPACT CONCLUSION

No Impact. Based on the impact evaluation described above for non-fuel mineral resources and oil resources, operation of the MSF would result in no impact overall related to the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

6.1.8 IMPACT MR-2: MINERAL RESOURCE RECOVERY SITES

Impact MR-2: Would the Project result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

6.1.8.1 ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX

CONSTRUCTION IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the San Vicente–Fairfax Alignment Alternative. The area is highly urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plans (West Adams-Baldwin Hills-Leimert Community Plan, Wilshire Community Plan, Hollywood Community Plan), City of Los Angeles General Plan, City of West Hollywood General Plan, Los Angeles County General Plan, or other specific plan. Therefore, construction of the San Vicente–Fairfax Alignment Alternative would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The San Vicente–Fairfax Alignment Alternative lies within the highly urbanized areas of the Cities of Los Angeles and West Hollywood. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all zones. In addition, the ordinance states that the

City of Los Angeles does not consider petroleum to be a mineral source of local importance. The City of West Hollywood General Plan Final EIR states that no state-designated or locally designated MRZs exist in the city. The construction of the San Vicente–Fairfax Alignment Alternative would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, construction of the San Vicente–Fairfax Alignment Alternative would have no impact on mineral resource recovery sites.

OPERATIONAL IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the San Vicente–Fairfax Alignment Alternative. The area is highly urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plans (West Adams-Baldwin Hills-Leimert Community Plan, Wilshire Community Plan, Hollywood Community Plan), City of Los Angeles General Plan, City of West Hollywood General Plan, Los Angeles County General Plan, or other specific plan. Therefore, operation of the San Vicente–Fairfax Alignment Alternative would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The San Vicente–Fairfax Alignment Alternative lies within the highly urbanized areas of the Cities of Los Angeles and West Hollywood. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. The City of West Hollywood General Plan Final EIR states that no state-designated or locally designated MRZs exist in the city. Operation of the San Vicente–Fairfax Alignment Alternative would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, operation of the San Vicente–Fairfax Alignment Alternative would have no impact on mineral resource recovery sites.

6.1.8.2 ALIGNMENT ALTERNATIVE 2: FAIRFAX

CONSTRUCTION IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the Fairfax Alignment Alternative. The area is highly urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plans (West Adams-Baldwin Hills-Leimert Community Plan, Wilshire Community Plan, Hollywood Community Plan), City of Los Angeles General Plan, City of West Hollywood General Plan, Los Angeles County General Plan, or other specific plan. Therefore, construction of the Fairfax Alignment Alternative would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The Fairfax Alignment Alternative lies within the highly urbanized areas of the Cities of Los Angeles and West Hollywood. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction

activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. The City of West Hollywood General Plan Final EIR states that no state-designated or locally designated MRZs exist in the city. The construction of the Fairfax Alignment Alternative would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, construction of the Fairfax Alignment Alternative would have no impact on mineral resource recovery sites.

OPERATIONAL IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the Fairfax Alignment Alternative. The area is highly urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plans (West Adams-Baldwin Hills-Leimert Community Plan, Wilshire Community Plan, Hollywood Community Plan), City of Los Angeles General Plan, City of West Hollywood General Plan, Los Angeles County General Plan, or other specific plan. Therefore, operation of the Fairfax Alignment Alternative would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The Fairfax Alignment Alternative lies within the highly urbanized areas of the Cities of Los Angeles and West Hollywood. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. The City of West Hollywood General Plan Final EIR states that no state-designated or locally designated MRZs exist in the city. Operation of the Fairfax Alignment Alternative would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, operation of the Fairfax Alignment Alternative would have no impact on mineral resource recovery sites.

6.1.8.3 ALIGNMENT ALTERNATIVE 3: LA BREA

CONSTRUCTION IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the La Brea Alignment Alternative. The area is highly urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plans (West Adams-Baldwin Hills-Leimert Community Plan, Wilshire Community Plan, Hollywood Community Plan), City of Los Angeles General Plan, City of West Hollywood General Plan, Los Angeles County General Plan, or other specific plan. Therefore, construction of the La Brea Alignment Alternative would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The La Brea Alignment Alternative lies within the highly urbanized areas of the Cities of Los Angeles and West Hollywood. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction

activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. The City of West Hollywood General Plan Final EIR states that no state-designated or locally designated MRZs exist in the city. The construction of the La Brea Alignment Alternative would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, construction of the La Brea Alignment Alternative would have no impact on mineral resource recovery sites.

OPERATIONAL IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the La Brea Alignment Alternative. The area is highly urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plans (West Adams-Baldwin Hills-Leimert Community Plan, Wilshire Community Plan, Hollywood Community Plan), City of Los Angeles General Plan, City of West Hollywood General Plan, Los Angeles County General Plan, or other specific plan. Therefore, operation of the La Brea Alignment Alternative would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The La Brea Alignment Alternative lies within the highly urbanized areas of the Cities of Los Angeles and West Hollywood. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. The City of West Hollywood General Plan Final EIR states that no state-designated or locally designated MRZs exist in the city. Operation of the La Brea Alignment Alternative would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, operation of the La Brea Alignment Alternative would have no impact on mineral resource recovery sites.

6.1.8.4 HOLLYWOOD BOWL DESIGN OPTION

CONSTRUCTION IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the Hollywood Bowl Design Option. The area is urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plan (Hollywood Community Plan), City of Los Angeles General Plan, Los Angeles County General Plan, or other specific plan. In addition, no changes in the land use designations for this area are planned. Therefore, the construction of the design option would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The design option would be within the urbanized area of the City of Los Angeles. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all

zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. The construction of the design option would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, construction of the Hollywood Bowl Design Option would have no impact on mineral resource recovery sites.

OPERATIONAL IMPACTS

No Impact. No known mineral resource recovery sites are identified in the RSA of the Hollywood Bowl Design Option. The area is urbanized and consequently unavailable for future mineral extraction. There are no mineral resource recovery sites delineated in the local general plan (Hollywood Community Plan), City of Los Angeles General Plan, Los Angeles County General Plan, or other specific plan. In addition, no changes in the land use designations for this area are planned. Therefore, operation of the design option would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The design option would be within the urbanized area of the City of Los Angeles. In addition, the City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. Operation of the design option would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, operation of the Hollywood Bowl Design Option would have no impact on mineral resource recovery sites.

6.1.8.5 MAINTENANCE AND STORAGE FACILITY

CONSTRUCTION IMPACTS

No Impact. No know mineral resource recovery sites are identified within the MSF RSA. There are no mineral resource recovery sites delineated in the local general plan (Westchester-Playa Del Rey Community Plan), City of Los Angeles General Plan, Los Angeles County General Plan, or other specific plan. Therefore, the construction of the MSF would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The MSF site is located within the City of Los Angeles. The City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. The construction of the MSF would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, construction of the MSF would have no impact on mineral resource recovery sites.

OPERATIONAL IMPACTS

No Impact. No know mineral resource recovery sites are identified within the MSF RSA. There are no mineral resource recovery sites delineated in the local general plan (Westchester-Playa Del Rey Community Plan), City of Los Angeles General Plan, Los Angeles County General Plan, or other specific plan. Therefore, operation of the MSF would not result in the loss of availability of or access to a locally important mineral resource recovery site.

The MSF site is located within the City of Los Angeles. The City of Los Angeles Oil and Gas Drilling Ordinance, which became effective on January 18, 2023, prohibits new oil and gas extraction, and deems existing extraction activities a nonconforming use across all zones. In addition, the ordinance states that the City of Los Angeles does not consider petroleum to be a mineral source of local importance. Operation of the MSF would not result in the loss of availability of a locally important oil resource recovery site.

For the reasons described above, construction of the MSF would have no impact on mineral resource recovery sites.

6.1.9 SUMMARY OF IMPACT CONCLUSIONS

Table 6-1 provides a summary of the impact conclusions discussed in this section.

TABLE 6-1. IMPACT CONCLUSION SUMMARY TABLE

IMPACT SIGNIFICANCE THRESHOLD	IMPACT CONCLUSION				
	ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX	ALIGNMENT ALTERNATIVE 2: FAIRFAX	ALIGNMENT ALTERNATIVE 3: LA BREA	HOLLYWOOD BOWL DESIGN OPTION	MAINTENANCE AND STORAGE FACILITY
Impact GEO-1: Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: ■ Rupture of a known earthquake fault, as delineated on the most recent APEFZ Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42)? ■ Strong seismic ground shaking? ■ Seismic-related ground failure, including liquefaction? ■ Landslides?	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact

IMPACT SIGNIFICANCE THRESHOLD	IMPACT CONCLUSION				
	ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX	ALIGNMENT ALTERNATIVE 2: FAIRFAX	ALIGNMENT ALTERNATIVE 3: LA BREA	HOLLYWOOD BOWL DESIGN OPTION	MAINTENANCE AND STORAGE FACILITY
Impact GEO-2: Would the Project result in substantial soil erosion or the loss of topsoil?	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact
Impact GEO-3: Would the Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: No Impact
Impact GEO-4: Would the Project be located on expansive soil, as defined in Section 1803.5.3 of the CBC, creating substantial direct or indirect risks to life or property?	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact
Impact GEO-5: Would the Project directly or indirectly destroy a unique geologic feature?	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: No Impact Operation: No Impact

IMPACT SIGNIFICANCE THRESHOLD	IMPACT CONCLUSION				
	ALIGNMENT ALTERNATIVE 1: SAN VICENTE–FAIRFAX	ALIGNMENT ALTERNATIVE 2: FAIRFAX	ALIGNMENT ALTERNATIVE 3: LA BREA	HOLLYWOOD BOWL DESIGN OPTION	MAINTENANCE AND STORAGE FACILITY
Impact MR-1: Would the Project result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state?	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: Less than Significant Impact Operation: Less than Significant Impact	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact
Impact MR-2: Would the Project result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact	Construction: No Impact Operation: No Impact

Source: Connect Los Angeles Partners 2023

6.2 MITIGATION MEASURES

As the impact analysis in Section 6.1 demonstrates, construction and operation of any of the Project alignment alternatives and stations, design option, and MSF would result in either no impact or a less than significant impact related to geology, soils, seismicity, or mineral resources. Therefore, no mitigation is required under CEQA.

CHAPTER 7 CUMULATIVE IMPACTS

7.1 INTRODUCTION

Under the state CEQA Guidelines, cumulative impacts are defined as two or more individual impacts that, when considered together, are considerable or would compound and increase other environmental impacts (Section 15355). These cumulative impacts must be discussed in an EIR when the project's incremental effect is "cumulatively considerable" (Section 15130). "Cumulatively considerable" is defined as when the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (Section 15065(a)(3)).

CEQA Guidelines Section 15130(b)(1) includes two methodology approaches for assessing cumulative impacts. One approach is a "list of past, present, and probable future projects producing related or cumulative impacts" (CEQA Guidelines Section 15130(b)(1)(A)). The other approach is a "summary of projections contained in an adopted local, regional, or statewide plan, or related document, that describes or evaluates conditions contributing to the cumulative effect" (CEQA Guidelines Section 15030 (b)(1)(B)). For the purposes of this analysis, the latter approach is used due to the long Project implementation time. The forecasted Project completion timeframe is in the mid- to late-2040s based on Metro Measure M funding. Due to the long-term nature of the Project's implementation, a list of land use and transportation projects is insufficient for the cumulative analysis since the currently known projects would be completed and operational by the Project's forecasted completion. In addition, it is highly likely many additional projects will be proposed and constructed between now and project implementation in 20 years; therefore, any project list developed now would be incomplete and incorrect.

The SCAG 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) Plan is the adopted long-range forecast for population, households, and employment within the six-county Southern California region, which includes all Project elements. The Project is also included in the SCAG 2020 RTP/SCS Plan, as well as Metro's 2020 Long Range Transportation Plan. The RTP/SCS was adopted in 2020 and proposes land use and transportation strategies to improve mobility options and achieve a more sustainable growth pattern (SCAG 2020). SCAG worked in close coordination with decision-makers and the public across multiple jurisdictions throughout the SCAG region to create the plan. The population, household, and employment growth projections from this plan are used to assess regional growth and its cumulative impact in the vicinity of the Project.

For the cumulative analysis, the RSA is defined as a half-mile radius from the stations, the design option, and the MSF. The half-mile radius is used for all resources to ensure consistency in evaluating cumulative effects. Table 7-1shows the projected net growth in population, households, and employment between 2019 and 2045 for a half-mile radius from all Project stations, the design option, and the MSF. The data in the table were calculated by merging the SCAG 2020 RTP/SCS growth projections with the SCAG Tier 2 Transportation Analysis Zone boundaries for Los Angeles County, then assessed for a half-mile radius around the stations, the design option, and the MSF. The data show the projected growth from transportation and development projects, as well as associated infrastructure, that when combined with the Project's construction and operation, could result in cumulative effects.

TABLE 7-1. SCAG PROJECTED PERCENT GROWTH FOR HALF-MILE BUFFER AREAS, 2019-2045

HALF-MILE BUFFER AREA	POPULATION % GROWTH	HOUSEHOLD % GROWTH	EMPLOYMENT % GROWTH
STATIONS			
Expo/Crenshaw	46.0	65.9	26.4
Crenshaw/Adams	35.6	56.3	19.6
Midtown Crossing	20.2	33.1	21.1
Wilshire/Fairfax	19.8	21.2	6.2
Fairfax/3rd	21.9	23.1	6.5
La Cienega/Beverly	30.7	31.3	6.1
San Vicente/Santa Monica	11.5	11.4	46.2
Fairfax/Santa Monica	7.2	7.7	49.5
La Brea/Santa Monica	16.0	17.2	42.6
Hollywood/Highland	16.2	15.0	3.0
Wilshire/La Brea	22.8	24.3	9.4
La Brea/Beverly	17.9	24.5	14.5
DESIGN OPTION			
Hollywood Bowl Design Option	30.4	29.0	17.4
MAINTENANCE AND STORAGE FACILITY			
MSF	14.0	15.9	9.9

Source: SCAG 2020 RTP/SCS Growth Forecast
Note: MSF = Maintenance and Storage Facility

7.2 CUMULATIVE IMPACTS

The evaluation of geology, soils, and seismicity and of mineral resources is site-specific to individual projects, and the resulting adverse effects are largely localized. During both construction and operation, the proposed alignment alternatives and stations, design option, and MSF would not expose people or structures to adverse impacts, including the risk of loss, injury, or death involving fault rupture or seismic hazards, including liquefaction or landslides. The Project would not result in impacts related to soil erosion, unstable or expansive soils, or loss of access to mineral resources and recovery sites. The alignment alternatives, design option, and MSF would implement project measure PM GEO-1 and would comply with all applicable state and local guidelines and mandatory design requirements related to geologic, subsurface, and seismic hazards. Therefore, no adverse impacts would occur related to geologic, subsurface, and seismic hazards due to operation and construction of the Project. Projected future projects from the SCAG 2020 RTP/SCS would also be required to comply with all applicable standards, requirements, and guidance hazards, and to implement mitigation measures to reduce any significant impacts to a less than significant level. Therefore, the Project would not contribute to cumulative effects, and there would be no cumulative impact to geologic, subsurface, and seismic hazards or to mineral resources.

7.3 CUMULATIVE MITIGATION MEASURES

The Project's effects related to geology, soils, seismicity and mineral resources for the alignment alternatives and stations, design option, and MSF would not be cumulatively considerable. Therefore, no mitigation is required under CEQA.

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