3.6 Geology, Soils, Seismicity, and Paleontological Resources

This section is based on the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Resources Technical Report*, incorporated into this DEIR as Appendix K.

3.6.1 Regulatory and Policy Framework

3.6.1.1 Federal

United States Code Title 42

The federal Earthquake Hazard Reduction Act of 1977 (United States [U.S.] Code Title 42, Chapter 86) was enacted to reduce the risks to life and property from earthquakes in the U.S. through the establishment and maintenance of an effective earthquake hazards reduction program. Implementation of these program requirements is regulated, monitored, and enforced at the state and local level.

United States Code of Federal Regulations Title 29 Part 1926.650

The Occupational Safety and Health Administration's (OSHA) Excavation and Trenching standard, outlined in Title 29 Code of Federal Regulations (CFR) Part 1926.650, establishes essential safety requirements to protect workers involved in excavation and trenching operations, which are among the most hazardous construction activities. This standard mandates that all excavations five feet or deeper must have protective systems unless made entirely of stable rock. Employers are responsible for implementing protective measures, such as sloping, shoring, or using trench boxes, to prevent cave-ins and ensure safe egress through ladders or ramps. The standard also includes requirements for inspections by a competent person to assess soil stability and recognize potential hazards, including water accumulation or nearby structures that could increase risk. Compliance with these regulations aims to prevent accidents, injuries, and fatalities commonly associated with excavation and trenching work.

National Earthquake Hazards Reduction Program

The National Earthquake Hazards Reduction Program (NEHRP) was established in 1977 and is a joint effort involving multiple federal agencies, including the Federal Emergency Management Agency, the National Institute of Standards and Technology, the National Science Foundation, and the United States Geological Survey (USGS). These agencies collaborate to advance the understanding of earthquake hazards, develop earthquake-resistant design and construction standards, and promote public education on earthquake preparedness. The program's primary objective is to improve the nation's earthquake resilience through extensive research and development, as well as implementation of risk reduction measures.

NEHRP provides scientific and engineering information necessary for developing building codes and standards that ensure the safety and resilience of structures in earthquake-prone areas. The program supports research on the causes and effects of earthquakes, which informs the creation of technical guidance and best practices for seismic design and construction. Additionally, NEHRP's efforts in public education and outreach help communities understand and mitigate earthquake risks, thereby enhancing overall public safety and reducing economic losses from seismic events.

National Engineering Handbook

The National Engineering Handbook (NEH) serves as a comprehensive guide for the planning, design, and implementation of engineering practices that support conservation efforts. Specifically, Section 8 of the NEH emphasizes the importance of understanding geologic, hydrogeologic, and geomorphic processes, conditions, and hazards. These guidelines help identify and mitigate potential geologic hazards, ensuring that engineering projects do not adversely impact the environment. The NEH supports the classification and designation of significant geological features. Additionally, this section ensures that the physical and engineering properties of earth materials are properly characterized to protect public health, safety, welfare, and the environment. The NEH outlines responsibilities for geologists and engineers, detailing the necessary qualifications and procedures for conducting geologic investigations. This includes adherence to standards set by recognized entities such as the American Geological Institute.

3.6.1.2 State

Alquist-Priolo Earthquake Fault Zoning Act

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act of 1972 is "to regulate development near active faults so as to mitigate the hazard of surface fault rupture." This state law was passed in response to the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. At the directive of the Alquist-Priolo Earthquake Fault Zoning Act, in 1972 the state geologist began delineating earthquake fault zones (called special studies zones prior to 1994) around active and potentially active faults to reduce fault-rupture risks to structures for human occupancy (California Public Resources Code [PRC] Division 2, Chapter 7.5, Sections 2621 through 2630). The Alquist-Priolo Earthquake Fault Zoning Act provides for special seismic design considerations if developments are planned in areas that are adjacent to active or potentially active faults. Cities and counties affected by the zones must regulate certain development within the zones. The cities and counties must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. Typically, structures for human occupancy are not allowed within generally 50 feet of the trace of an active fault.

California Building Code

California Code of Regulations (CCR), Title 24, Part 2, the California Building Code (CBC), provides minimum standards for building design in California. The 2022 CBC, effective on January 1, 2023, is based on the current (2021) International Building Code that is published by the International Code Council (California Building Standards Commission, 2022). Each jurisdiction in California may adopt its own building code based on the 2022 CBC. Local codes are permitted to be more stringent than the 2022 CBC, but at a minimum, the codes are required to meet all state standards and enforce the regulations of the 2022 CBC beginning on January 1, 2023.

Chapter 16 – Structural Design

This chapter establishes minimum design requirements so that the structural components of buildings are proportioned to resist the loads that are likely to be encountered. In addition, this chapter assigns buildings and structures to risk categories that are indicative of their intended use for buildings and structures, including guidelines for loads (e.g., live, dead, wind, snow, and earthquake loads). It includes design standards to ensure structural integrity, safety, and stability under various stressors, tailored for California's seismic activity and other regional factors.

Related to geohazards, Chapter 16 of the CBC deals with structural design requirements governing seismically resistant construction (Section 1604) and includes (but is not limited to) factors and coefficients that are used to establish the seismic site class and seismic occupancy category for the soil(s) or rock(s) at the building location and the proposed building design.

Chapter 18 – Soils and Foundations

This chapter provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads imposed by the structure above. It addresses issues like bearing capacity, soil classification, load-bearing values, and foundation types. Requirements are set to mitigate risks from soil instability, expansive soils, and seismic activity, crucial in California's diverse geology.

Chapter 18 includes (but is not limited to) the requirements for foundation and soil investigations (Section 1803); excavation, grading, and fill (Section 1804); allowable load-bearing values of soils (Section 1806); and the design of footings, foundations, and slope clearances (Sections 1808 and 1809), retaining walls (Section 1807), and pier, pile, driven, and cast-in-place (CIP) foundation support systems (Section 1810).

Chapter 33 – Safeguards During Construction

Chapter 33 covers safety protocols to protect public health and property during construction activities. It includes regulations on temporary structures, demolition, excavations, and ensuring safe access around construction sites. This chapter aims to minimize risks associated with construction hazards.

Chapter 33 includes (but is not limited to) requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes (Section 3304).

Appendix J – Grading

Appendix J offers guidelines for grading, which includes excavation, filling, and earthwork. It defines grading permit requirements, inspections, and standards to control erosion, manage stormwater, and ensure site stability. This appendix is essential for managing the environmental and safety impacts of grading, especially in areas prone to landslides or erosion.

Appendix J includes (but is not limited to) grading requirements for the design of excavations and fills (Sections J106 and J107) and for erosion control (Section J110).

Construction activities are subject to occupational safety standards for excavation, shoring, and trenching, as specified in California Division of Occupational Safety and Health (Cal/OSHA) regulations (CCR Title 8).

California Department of Transportation Seismic Design Criteria (2019)

The *California Department of Transportation (Caltrans) Seismic Design Criteria (SDC) Version 2.0*, last updated in 2019, sets comprehensive seismic design requirements to ensure the resilience and safety of bridges and other structures within Caltrans' right-of-way (ROW). These criteria apply specifically to new bridges on the California State Highway System, aiming to withstand California's high seismic activity. The SDC synthesizes and organizes critical seismic design guidelines from Caltrans' Division of Engineering Services (DES) publications, addressing aspects like structural response, ductility, displacement, and load resistance during earthquakes.

Key features of the SDC include provisions for soil-structure interaction, pier and abutment design, and foundation requirements to mitigate seismic forces. The SDC allows for various construction methods, such as CIP and precast construction, including Accelerated Bridge Construction (ABC) techniques to speed up project timelines while maintaining structural integrity. The SDC also emphasizes "no-collapse" requirements, ensuring that bridges maintain at least minimal functionality immediately after seismic events to facilitate emergency response and traffic flow. Furthermore, the SDC mandates rigorous testing and analysis for performance-based design, requiring detailed evaluations of seismic risk factors for specific bridge sites, such as proximity to fault lines and soil composition, to tailor seismic resistance measures.

ABC refers to innovative construction techniques and project management strategies aimed at reducing the time needed to construct or replace bridges. ABC involves the use of prefabricated bridge components (such as beams, decks, and abutments), advanced construction materials, and sometimes entirely modular bridge systems that can be quickly assembled on-site. By preparing components off-site and then transporting and installing them in a short period, ABC significantly minimizes disruption to traffic, enhances safety for workers and travelers, and can lower overall project costs.

California Division of Occupational Safety and Health

Cal/OSHA enforces safety and health regulations for construction activities under Title 8 of the CCR, aiming to protect workers from hazards on construction sites. Title 8 covers a wide range of safety requirements, including rules for scaffolding, electrical safety, fall protection, confined spaces, excavation, shoring, trenching, and hazardous materials. These tasks require stringent protective measures to prevent cave-ins, equipment accidents, and exposure to hazardous materials. Cal/OSHA's Title 8 standards encompass requirements for scaffolding, electrical safety, fall protection, confined spaces, and handling hazardous substances, ensuring robust safeguards for construction workers. The agency inspects job sites, investigates accidents, and issues citations for non-compliance, with particular emphasis on tasks like fall prevention and trench safety. Additionally, Cal/OSHA provides training, outreach, and educational resources, and often exceeds federal OSHA standards.

Public Resources Code Section 5097.5 and Section 30244

PRC Sections 5097.5 and 30244 prohibit the removal of any paleontological site or feature from public lands without permission of the jurisdiction agency, define the removal of paleontological sites or features as a misdemeanor, and require reasonable mitigation of adverse impacts to paleontological resources from development on public (state, county, city, district) lands.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act became effective in 1990 to identify and map seismic hazard zones for the purpose of assisting cities and counties in preparing the safety elements of their general plans and to encourage land use management policies and regulations that reduce seismic hazards. This act protects the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. In addition, California Geological Survey (CGS) Special Publication 117A, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, provides guidance for the evaluation and mitigation of earthquake-related hazards for projects in designated zones of required investigations (CGS, 2008).

State of California National Pollutant Discharge Elimination System

In accordance with Clean Water Act (CWA) Section 402(p), which regulates municipal and industrial stormwater discharges under the National Pollutant Discharge Elimination System (NPDES) program, State Water Resources Control Board (SWRCB) adopted an Industrial General Permit (IGP) and Construction General Permit (CGP), which are detailed in this section. The Los Angeles County Metropolitan Transportation Authority (Metro) would be responsible for compliance with both of these NPDES permits.

Amendments made to the CWA in 1987 require that stormwater associated with industrial activities that discharge either directly to surface waters or indirectly through municipal storm sewers must be regulated by an NPDES permit (Water Quality Order No. 2014-0057-DWQ, and amendments 2015-0122-

DWQ and 2018-0028-DWQ [SWRCB Division of Water Quality]) (SWRCB, 2014). In order to obtain authorization for stormwater discharges associated with industrial activities under this permit, the facility operator must submit a Notice of Intent. The Project would be subject to the regulations of this NPDES permit under category 8 of the categories that require coverage under the IGP. Category 8 includes "vehicle maintenance shops, equipment cleaning operations, or airport deicing operations." Only those portions of the facility involved in vehicle maintenance (including vehicle, rehabilitation, mechanical repairs, painting, fueling, and lubrication) would be covered under this permit.

As with the IGP, the SWRCB administers the CGP, which is applicable to all stormwater discharges associated with construction activity. In addition, the CGP includes requirements on dewatering discharge. The NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (the CGP) was adopted on September 8, 2022. The provisions of the new CGP (Order No. 2022-0057-DWQ, NPDES No. CAS000002 [SWRCB Division of Water Quality]) (SWRCB, 2022a) became effective September 1, 2023. Order No. 2022-0057-DWQ supersedes the previous CGP (Order No. 2009-0009-DWQ).

The main objectives of the CGP are to:

- Reduce erosion from construction projects or activities
- Minimize or eliminate sediment in stormwater discharges from construction projects
- Prevent materials used at a construction site from contacting stormwater
- Implement a sampling and analysis program to monitor construction site runoff
- Eliminate unauthorized non-stormwater discharges from the construction sites
- Implement appropriate measures to reduce potential impacts on waterways both during and after construction projects
- Establish maintenance commitments on post-construction pollution control measures

The CGP requirements apply to any construction project that either result in the disturbance of at least one acre of land or is part of a larger common development plan. Additionally, the CGP is required for related construction or demolition activities, including clearing, grading, grubbing, or excavation, or any other activity that results in greater than one acre of land disturbance (SWRCB, 2022a).

Minimum stormwater control requirements under the permit are determined by project risk categories. Risk categories include the sediment risk factor and the receiving water risk factor. The sediment risk factor and the receiving water risk factor are combined to determine a construction site's project risk level. The project risk level governs the applicable minimum best management practices (BMPs), monitoring requirements, reporting requirements, and the effluent standards used to assess monitoring data and compliance.

Once the project risk level is determined, minimum BMP requirements are specified in attachments to the CGP. BMPs are separated into five overall categories:

- Good Site Management "Housekeeping"
- Non-stormwater Management
- Erosion Control
- Sediment Controls
- Run-on and Runoff Controls

Monitoring and reporting requirements under the permit are also dependent on the project risk level. Visual monitoring of stormwater and non-stormwater discharges is required of all projects. Water quality sampling and analysis requirements increase with risk category. Monitoring is required during normal construction site hours. Rain events also trigger monitoring in the case that there is a forecast of a 50 percent or greater probability of precipitation and a quantitative precipitation forecast of one-half inch or more within a period of 24 hours.

The CGP requires that a registered Qualified Stormwater Pollution Prevention Plan (SWPPP) Developer (QSD) prepare a SWPPP, and a registered QSD, Qualified SWPPP Practitioner (QSP), and/or a properly trained and supervised QSP delegate perform inspections, sampling, and BMP implementation.

In order to obtain coverage under the CGP, the permit applicant must submit the following documents to the SWRCB:

- Notice of Intent
- Risk Assessment
- Site Map
- Stormwater Pollution Prevention Plan
- Annual Fee
- Signed Certification Statement

California Department of Transportation National Pollutant Discharge Elimination System Permit

The California Department of Transportation (Caltrans) is subject to the NPDES *Statewide Stormwater Permit and Waste Discharge Requirement*s (WDR) for the State of California Department of Transportation (Order No. 2022-0033-DWQ, NPDES No. CAS000003) (SWRCB, 2022b) that regulates the discharge of construction- and post-construction phase stormwater from Caltrans properties, facilities, and activities. The Caltrans NPDES permit applies to those portions of the Project Study Area that are under the jurisdiction of Caltrans.

Redevelopment projects within the Caltrans right-of-way (ROW) are subject to construction site BMPs and would be required to comply with the *Construction Site Best Management Practices (BMP) Manual* (Caltrans, 2017) to control and minimize the impacts of construction-related activities. The Construction Site BMP Manual incorporates the requirements of the Caltrans NPDES Statewide Stormwater Permit and the CGP. Post-construction phase stormwater from the portions of the Project under the jurisdiction of Caltrans would also be required to comply with the *Project Planning and Design Guide* (Caltrans, 2023) and related requirements in accordance with the Caltrans NPDES Statewide Stormwater Permit for incorporating treatment BMPs. In addition, the Caltrans NPDES permit includes policies and requirements for maintaining drainage systems, including culverts, to protect roadways from flooding. This includes modifications and/or removal and replacement of these systems.

In compliance with the Caltrans Statewide Stormwater Permit, the Caltrans Statewide Stormwater Management Plan addresses stormwater pollution control related to Caltrans activities, including planning, design, construction, maintenance, and operation of roadways and facilities to reduce or eliminate the discharge of pollutants to storm drain systems and receiving waters. The Statewide Stormwater Management Plan addresses discharges resulting from stormwater, as well as non-stormwater discharges, including illicit discharges, authorized non-stormwater discharges, and initial emergency response activities. The Statewide Stormwater Management Plan requires implementation of stormwater management procedures and practices including training, public education, monitoring, program evaluation, and reporting activities, in addition to the implementation of construction BMPs to reduce or eliminate pollutants from construction sites.

The *I-405 Stormwater Quality Master Plan* (Caltrans, 2008) was prepared in response to a Stipulation and Order (Case No. 93-6073-ER [JRX]) signed by the U.S. District Court on January 17, 2008, which mandates stormwater management studies to be prepared on the Caltrans District 7 drainage systems for freeway corridors situated in Los Angeles and Ventura Counties. In order to meet the Stipulation and Order, the I-405 Stormwater Quality Master Plan evaluates and identifies potential opportunities to include treatment BMPs (e.g., infiltration devices, media filters, detention devices, biofiltration strips, biofiltration swales) in the I-405 corridor.

3.6.1.3 Regional

County of Los Angeles General Plan – Safety Element

The purpose of the *County of Los Angeles General Plan, Safety Element* (LA County Planning, 2022a) is to reduce the potential risk of death, injuries, property damage, economic loss, and social dislocation resulting from natural and human-made hazards. The *County of Los Angeles General Plan, Safety Element* works in conjunction with the *Operational Area Emergency Response Plan* (OAERP). The following are goal and policies of the *County of Los Angeles General Plan, Safety Element* that addresses geotechnical, subsurface, and seismicity:

- **Goal S 1** – An effective regulatory system that prevents or minimizes personal injury, loss of life, and property damage due to seismic and geotechnical hazards.
  - **Policy S 1.1** – Discourage development in Seismic Hazard and Alquist-Priolo Earthquake Fault Zones.
  - **Policy S 1.2** – Prohibit construction of structures of human occupancy adjacent to active faults unless a comprehensive fault study that address seismic hazard risks and proposes appropriate actions to minimize the risk is approved.
  - **Policy S 1.3** – Require developments to mitigate geotechnical hazards, such as soil instability and landsliding, in Hillside Management Areas through siting and development standards.
  - **Policy S 1.4** – Support the retrofitting of unreinforced masonry structures and softy-story buildings to help reduce the risk of structural and human loss due to seismic hazards.

County of Los Angeles Code, Title 26 - Building Code

The County of Los Angeles has adopted the 2022 CBC, with local changes as part of the County of Los Angeles Code, Title 26, Building Code. Chapter 1, Section 111 (Engineering Geology and Soils Engineering Reports) addresses engineering geology or soils engineering reports to address safety of a site from hazards such as landslides, settlement, or slippage, and a finding regarding the effect. Section 112 (Earthquake Fault Maps) and Section 113 (Earthquake Faults) address requirements and regulations for buildings or structures within earthquake fault zones. Chapter 18 addresses soils and foundations requirements and regulations (County of Los Angeles, 2023).

County of Los Angeles Chief Executive Office – Operational Area Emergency Response Plan

The County of Los Angeles, Chief Executive Office - Office of Emergency Management prepares the OAERP, which addresses the County of Los Angles operational area’s coordinated response to emergency situations associated with natural, human-made, and technological incidents. The OAERP does not address normal day-to-day emergencies; the operational concepts reflected in this plan focus on potential large-scale disasters that can generate unique situations that require an unusual or extraordinary emergency response. The OAERP establishes the coordinated emergency management system, which includes prevention, protection, response, recovery, and mitigation within the operational area. This plan describes the emergency organization, authorities, and responsibilities of the operational area emergency organization and the mutual aid process during emergencies to ensure effective coordination of needed resources (CoLA CEO, 2012).

County of Los Angeles All-Hazards Mitigation Plan

In 2020, the County of Los Angeles prepared an *All-Hazards Mitigation Plan* (CoLA CEO, 2020) to identify the County of Los Angeles's hazards, review and assess past disaster occurrences, estimate the probability of future occurrences, and set goals to reduce or eliminate long-term risk to people and property from natural hazards. Potential hazards evaluated by the *All-Hazards Mitigation Plan* include hazards resulting from earthquake, flooding, wildfires, tsunami, landslide, dam failure, and climate change.

Los Angeles County Metropolitan Transportation Authority – Public Transportation Agency Safety Plan

The *Public Transportation Agency Safety Plan* (PTASP) addresses all requirements and standards as set forth in Federal Transit Administration's (FTA) Public Transportation Safety Program and the *National Public Transportation Safety Plan*, in addition to adhering to requirements of the California Public Utilities Commission (CPUC) (Metro, 2020). The LA Metro Board of Directors approved Version 1.3 of the PTASP in January of 2024 (Metro, 2024a).

CPUC General Order (GO) 143-B, Section 14.05, requires the establishment of a track inspection and maintenance program. All rail system tracks must be inspected and maintained in accordance with CPUC GO 143-B, Section 14.05. In addition to these track-specific requirements, the CPUC GO 164 series requires rail transit agencies to conduct annual internal safety reviews of compliance with their PTASPs. The internal safety review evaluates both qualitative and quantitative aspects of performance. In addition, every three years, the CPUC conducts a review of the rail transit agency's safety programs and compliance with applicable safety standards. For new projects, rail transit agencies must obtain safety certification from the CPUC to ensure that all safety requirements are met before the project begins service. This safety certification process includes CPUC review of design, construction, testing, and operational readiness. All design and construction will be done using the *American Railway Engineering and Maintenance of Way Association Manual* as a guideline, as required by CPUC GO 143-B, Section 9.01.

As a result, frequent track inspection is performed to identify potential safety hazards and to report on the changing conditions of track geometry. For example, previous projects have accommodated this objective by inspecting mainline track twice each week with at least a one-day interval between inspections. Track geometry and fit is inspected for obvious gage and alignment defects, improper ballast section and washouts, and tightness and proper fit of switch points and other moving parts. Rail is checked for cracks, deterioration, corrugation, and excessive wear. The ROW is inspected for vegetation growth and for possible clearance infringements.

Under requirements of the CPUC GO 164 series, the annual PTASP internal safety review reviews and evaluates state of California required elements of the PTASP on an on-going basis and is completed over a three-year cycle. The internal safety review evaluates both qualitative and quantitative aspects of performance.

Los Angeles County Metropolitan Transportation Authority - Rail Design Criteria

The Los Angeles County Metropolitan Transportation Authority (Metro) Rail Design Criteria (MRDC) incorporates various design specifications from the Federal Highway Administration, Caltrans, State of California, County of Los Angeles, and other sources by reference. The MRDC is applicable to Alternative 6 and an equivalent to the MRDC guidance is required for Alternatives 1, 3, 4, and 5. Section 5 of the MRDC provides specifications for structural and geotechnical work and governs all matters pertaining to the design of Metro-owned facilities, including the following:

- 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
- Other non-structural and operationally critical components and facilities supported on or inside Metro structures.

These criteria also establish the design parameters for temporary structures. The main reference document controlling the seismic design of Metro facilities under these criteria is the *Section 5 Appendix, Metro Supplemental Seismic Design Criteria* (SSDC). Section 5.3 of the MRDC provides specifications for aerial guideways and structures. Section 5.4 provides specifications for underground structures used for rail transit. Section 5.6 requires subsurface investigation and laboratory testing, geotechnical reporting and temporary excavation, and detailed foundation design requirements to address geological hazards.

Per MRDC, Section 5.5.1, the criteria and codes specified in MRDC shall govern all matters pertaining to the design of Metro-owned facilities including bridges, elevated rail guideways, underground structures, trenches, 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. These criteria also establish the design parameters for temporary structures. The Metro SSDC outlined in the MRDC Section 5 appendix provides seismic design guidelines for structures including aerial guideways and bridges, underground structures, tunnels, and surface structures. The Metro SSDC follows a two-level ground motion approach for the seismic design of structures: Operating Design Earthquake (ODE) and Maximum Design Earthquake (MDE). The ODE is defined as an earthquake event likely to occur only once in the design life where structures are designed to respond without significant damage, and MDE is defined as an earthquake event with a low probability of occurring in the design life where structures are designed to respond with repairable damage and to maintain a life-safety-performance level (no collapse) of structural elements. Current Metro design criteria is based on probabilistic seismic ground motion criteria; the design earthquake motions are defined as:

- ODE: 50 percent probability of exceedance in 100 years, design return period of 150 years.
- MDE: 4 percent probability of exceedance in 100 years, design return period of 2,500 years.

Seismic design of aerial and surface structures is based on site-specific ODE and MDE horizontal ground surface 5 percent damped acceleration response spectra developed using the USGS Unified Hazard Tool

(USGS, 2022). Based on the Metro SSDC, acceleration response spectrum (ARS) for rail transit structures should not result in less performance capability than that required by Caltrans ARS. The Metro SSDC also considers seismic design based on Caltrans SDC (Caltrans, 2019) for rail transit structures. The seismic design of surface structures and aboveground structures not subject to rail transit loading should comply with the requirements of the CBC and the site-specific ODE and MDE horizontal ground motions per Metro's SSDC (2017). SSDC outlined in the MRDC Section 5 appendix provides seismic design for ground and embankment stability. The appendix recommends the seismic stability and potential permanent deformation of sloping ground or embankments supporting aerial guideway and bridges along proposed alignments be investigated. The appendix also provides guidance for liquefaction studies to assess the potential for liquefaction.

Los Angeles County Metropolitan Transportation Authority – Systemwide Station Design Standards Policy

The Metro System Safety Program Plan (SSPP) outlines comprehensive safety management protocols for Metro's rail and bus operations, developed in compliance with federal and state regulations. The SSPP covers a range of critical safety elements, including hazard identification, risk assessment, and emergency response procedures. It is structured to ensure the safety of passengers, employees, and contractors through a combination of engineering controls, operational guidelines, and ongoing training. Furthermore, the SSPP includes guidelines for inspections, maintenance protocols, and safety audits to prevent and mitigate risks. These efforts are coordinated across departments to ensure compliance with safety standards, such as those set by the FTA and CPUC.

Los Angeles County Metropolitan Transportation Authority – Tunnel Advisory Panel

Metro requires the formation of a Tunnel Advisory Panel (TAP) for major transit tunnel projects as part of its commitment to safety, reliability, and transparency in underground construction. The TAP provides expert oversight to assess and mitigate risks associated with tunneling, including technical issues like ground stability and environmental considerations. This advisory group includes geotechnical and structural engineers, construction experts, and environmental specialists who review tunnel design, construction methods, and mitigation strategies to reduce potential hazards.

3.6.1.4 Local

City of Los Angeles General Plan – Safety Element

The *City of Los Angeles, Safety Element of the General Plan* (DCP, 2021) addresses the issue of protection of its people from unreasonable risks associated with disasters (e.g., fires, floods, and earthquakes). The *Safety Element of the General Plan* is a contextual framework for understanding the relationship between hazard mitigation, response to a natural disaster, and initial recovery from a natural disaster. The *Safety Element* sets forth policies that are applicable to the proposed Sepulveda Transit Corridor Project (Project) for geology, soil, and seismicity:

- **Policy 1.1.8 Land Use** – Consider hazard information and available mitigations when making decisions about future land use. Maintain existing low density and open space designations in Very High Fire Hazard Severity Zones (VHFHSZs). Ensure mitigations are incorporated for new development in hazard areas such as VHFHSZs, landslide areas, flood zones and in other areas with limited adaptive capacity.

City of Los Angeles Municipal Code - Los Angeles Building Code

The City of Los Angeles adopted the 2022 CBC within the Los Angeles City Building Code 2022. The Los Angeles City Building Code 2022 is a portion of the City of Los Angeles Municipal Code. The purpose of the Los Angeles City Building Code 2022 is to safeguard the public by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within the City of Los Angeles (City of Los Angeles, 2022). Chapters 18/18A address soils and foundations, and Chapter 70 addresses grading, excavations, and fills. Chapters 91 through 96 address earthquake hazard reduction for tilt-up concrete wall buildings, wood-frame buildings, hillside buildings, reinforced concrete buildings, and masonry buildings.

City of Los Angeles Local Hazard Mitigation Plan

The City of Los Angeles has developed a *Local Hazard Mitigation Plan* (City of Los Angeles, 2018) to reduce risks from disasters to the people, property, economy, and environment within the City of Los Angeles. The *City of Los Angeles Local Hazard Mitigation Plan* is the use of long-term and short-term policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. The *Local Hazard Mitigation Plan* is incorporated as a component of the *Safety Element* to illustrate the *Safety Element's* adherence to state requirements. Potential hazards evaluated by the *Local Hazards Mitigation Plan* include hazards resulting from earthquake, flooding, wildfires, tsunami, landslide, dam failure, and other potential hazards.

3.6.2 Methodology

3.6.2.1 Geology, Soils, Seismicity, Mineral, and Paleontological Resources

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, mineral, and paleontological resources. The Project was evaluated against Appendix G of the California Environmental Quality Act (CEQA) Guidelines.

The method for assessing the geologic and seismic impacts involved reviewing available published and unpublished literature, and consultants' reports within the project area for known geologic hazards. Documents included:

- *County of Los Angeles General Plan* (LA County Planning, 2022a)
- *City of Los Angeles General Plan* (DCP, 2021)
- *County of Los Angeles All-Hazards Mitigation Plan* (CoLA CEO, 2020)
- *City of Los Angeles 2018 Local Hazard Mitigation Plan* (City of Los Angeles, 2018)
- Official Alquist-Priolo Earthquake Fault Zone Maps
- Seismic Hazard Zone Maps
- Geologic and topographic maps
- Other publications by the California Geological Survey

Geologic impacts pertain primarily to construction activities. Operational impacts of the Project are considered in the context of seismic and/or other geological hazards to residents, employees, and visitors. Adherence to design and construction standards, as required by state and local regulations, would ensure maximum practicable protection for users of the buildings and associated infrastructure. Potential effects related to mineral resources were evaluated through a review of mineral resource locations, as identified by the *County of Los Angeles General Plan* and the *City of Los Angeles General Plan*.

Potential effects related to paleontological resources were evaluated through record searches of the Natural History Museum of Los Angeles County (NHMLAC), and the review of professional paleontological publications.

3.6.2.2 Resource Study Area

The Resource Study Area (RSA) for geotechnical, subsurface, and seismic conditions is the Project Study Area. Given the nature of geological formations and seismic systems, the RSAs for both are defined distinctly. The RSA for soils and geology is defined as the project footprint (composed of all underground and aboveground features). The RSA for seismicity, however, is the entirety of Southern California. This relatively large scale is due to the fault system that spans multiple miles and that is typically connected to a system of multiple faults. As such, a seismic activity in one part of a region often affects structures (underground and aboveground) many miles away.

The RSA for paleontological resources is defined as the area necessary to construct, operate, and maintain the Project Alternatives, and includes all proposed ROW and acquisition and construction areas, and all parcels adjacent to permanent site improvements and facilities, including tunnel boring machine (TBM) launch sites, stations, and power substations; parking facilities; and maintenance yards and buildings.

For paleontological resources, this includes areas where temporary or permanent ground disturbance may occur. Typically, the RSA extends out from the alignment from one to three parcels, depending on parcel sizes, intervening landscape, and buildings, and whether the historic land use is sensitive to the proposed change in setting.

Where potential geological hazards are identified, such hazards would be expected to affect any proposed development in the hazard area. In *California Building Industry v. Bay Area Air Quality Management District* (2015) 62 Cal.4th 369, the California Supreme Court clarified that CEQA does not generally require an analysis of the impacts of the existing environment on a proposed project, but rather focuses on the potential impacts of the project on the environment. As it pertains to geology and soils, this ruling means that while CEQA requires an assessment of how the Project might exacerbate existing geological conditions – such as increasing erosion potential or causing instability – it does not mandate an analysis of how existing geological hazards, such as earthquakes or landslides, might affect the project itself. Instead, those considerations are typically addressed through compliance with state and local building codes and safety standards, such as those set forth in the CBC, which are designed to minimize risks to future users. Therefore, this Draft Environmental Impact Report's (DEIR) analysis of geology, soils, and seismicity focuses on evaluating the potential for the Project to contribute to adverse environmental effects. Adherence to design and construction standards, as required by state and local regulations, would ensure maximum practicable protection for users of buildings and associated infrastructure, including the aerial and underground alignments.

Adherence to design and construction standards, as required by state and local regulations, would ensure maximum practicable protection for users of the buildings and associated infrastructure. The potential increased geologic hazards resulting from development under the proposed Project were evaluated against the sample initial study checklist in Appendix G of the CEQA Guidelines, as well as the existing goals and policies of the *County of Los Angeles General Plan* (LA County Planning, 2022a), the *City of Los Angeles General Plan* (DCP, 2021), and the *County of Los Angeles All-Hazard Mitigation Plan* (CoLA CEO, 2020) and the *City of Los Angeles Local Hazard Mitigation Plan* (City of Los Angeles, 2018).

3.6.2.3 CEQA Thresholds of Significance

For the purposes of the Environmental Impact Report, impacts are considered significant if the Project would:

- 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.
- Result in substantial soil erosion or the loss of topsoil.
- 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.
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property.
- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

3.6.3 Existing Conditions

3.6.3.1 Regional Geology

The Project Study Area encompasses portions of Interstate 405 (I-405) and includes portions of the Los Angeles-San Diego-San Luis Obispo (LOSSAN) rail corridor ROW, between the existing Van Nuys Metrolink Station and Metro’s Expo/Sepulveda Station. The Project Study Area includes portions of three distinct geographies: the San Fernando Valley, the Santa Monica Mountains, and the Los Angeles Basin.

The Project Study Area is within two geologic formations belonging to the Transverse Ranges geomorphic provinces and the Peninsular Ranges geomorphic provinces. The northern portion of the Project Study Area is located within the Transverse Ranges. The southern portion of the Project Study Area is located within the Los Angeles Basin, which is the northernmost basin of the Peninsular Ranges. Further detail on the region’s geologic formations is provided in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a).

3.6.3.2 Project Study Area Soil Types and Characteristics

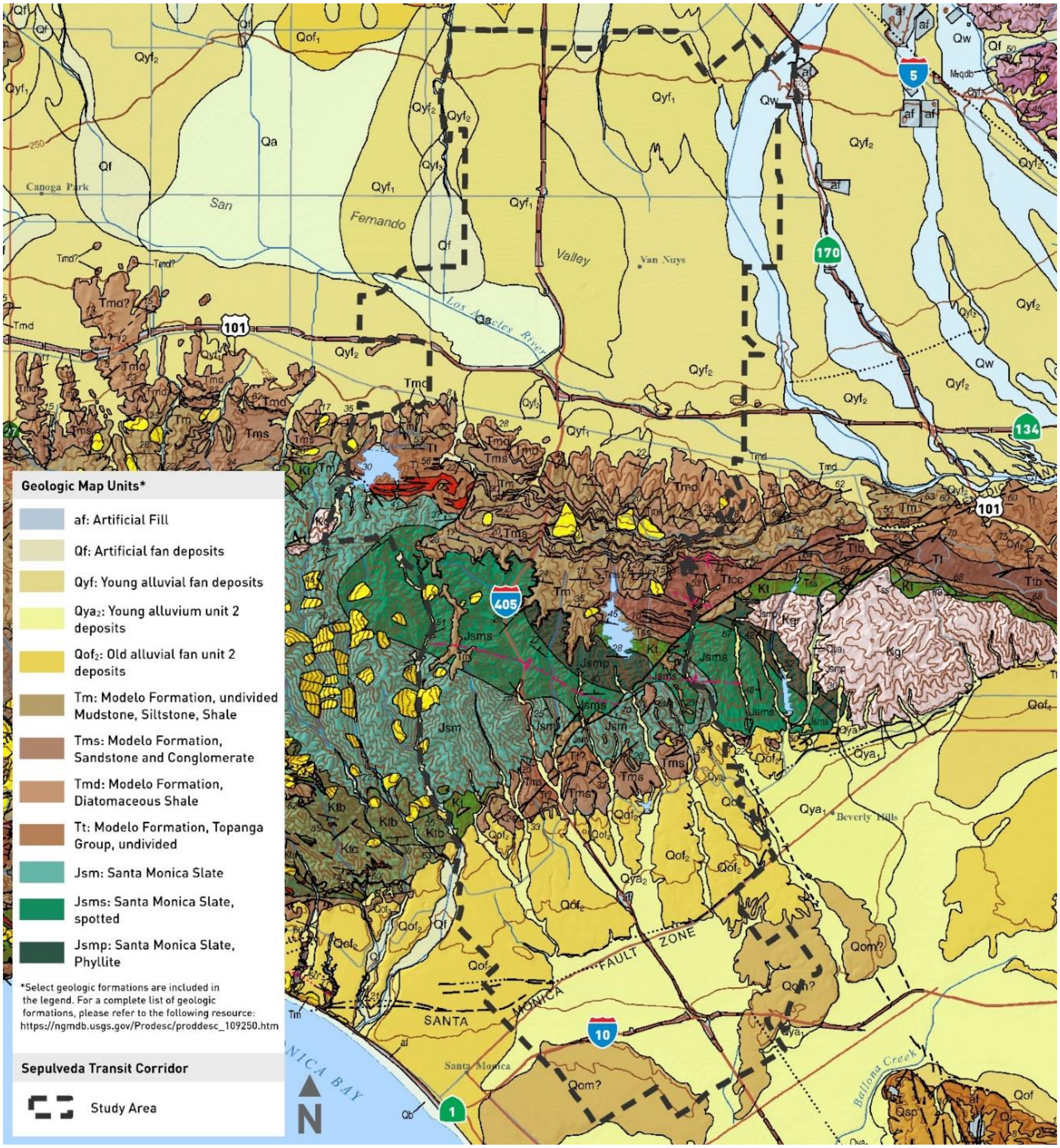
The geologic features of the Project Study Area are shown on Figure 3.6-1, Figure 3.6-2, Figure 3.6-3, Figure 3.6-4, Figure 3.6-5, and Figure 3.6-6 and depict each of the project alternatives relative to the Project Study Area geologic features. Geologic formations exposed within the Project Study Area can be found in Table 3.6-1. The Project Study Area is generally underlain by nearly horizontal Quaternary sediments overlying Tertiary-age sediments and sedimentary rocks that have been deformed into folds and offset by faults. The sedimentary strata lap onto the Santa Monica slate that forms the core of the Santa Monica Mountains; bedrock units on the south flank generally dip southerly, and bedrock units on the north flank generally dip northerly. Along the higher elevations within the Project Study Area, particularly through the Santa Monica Mountains, sedimentary and metamorphic bedrock are exposed at the surface with some localized colluvial and alluvial soils within tributary valleys.

Table 3.6-1. Geologic Units Within the Project Study Area

Geologic Map Unit	Description	Age
Qf	Artificial Fill	Recent
Qa	Very young alluvium	Holocene
Qya_2	Young alluvium – unit 2	Holocene
Qof_2	Older alluvial fan deposits – unit 2	Pleistocene
Qof_1	Older alluvial fan deposits – unit 1	Pleistocene
Qom	Older shallow marine deposits	Pleistocene
Qls	Quaternary landslide debris	Pleistocene
Qvoa	Very old alluvium	Pleistocene
Tmud	Modelo Formation – Undivided	Miocene
Tmd	Modelo Formation – Diatomaceous Shale Member	Miocene
Tmss	Modelo Formation – Sandstone	Miocene
Tt	Topanga Group – Undivided	Miocene
Kt	Tonalite	Cretaceous
Jsm	Santa Monica Slate – Undivided	Late Jurassic
Jsms	Santa Monica Slate – Spotted slate	Late Jurassic
Jsmp	Santa Monica Slate – Phyllite	Late Jurassic

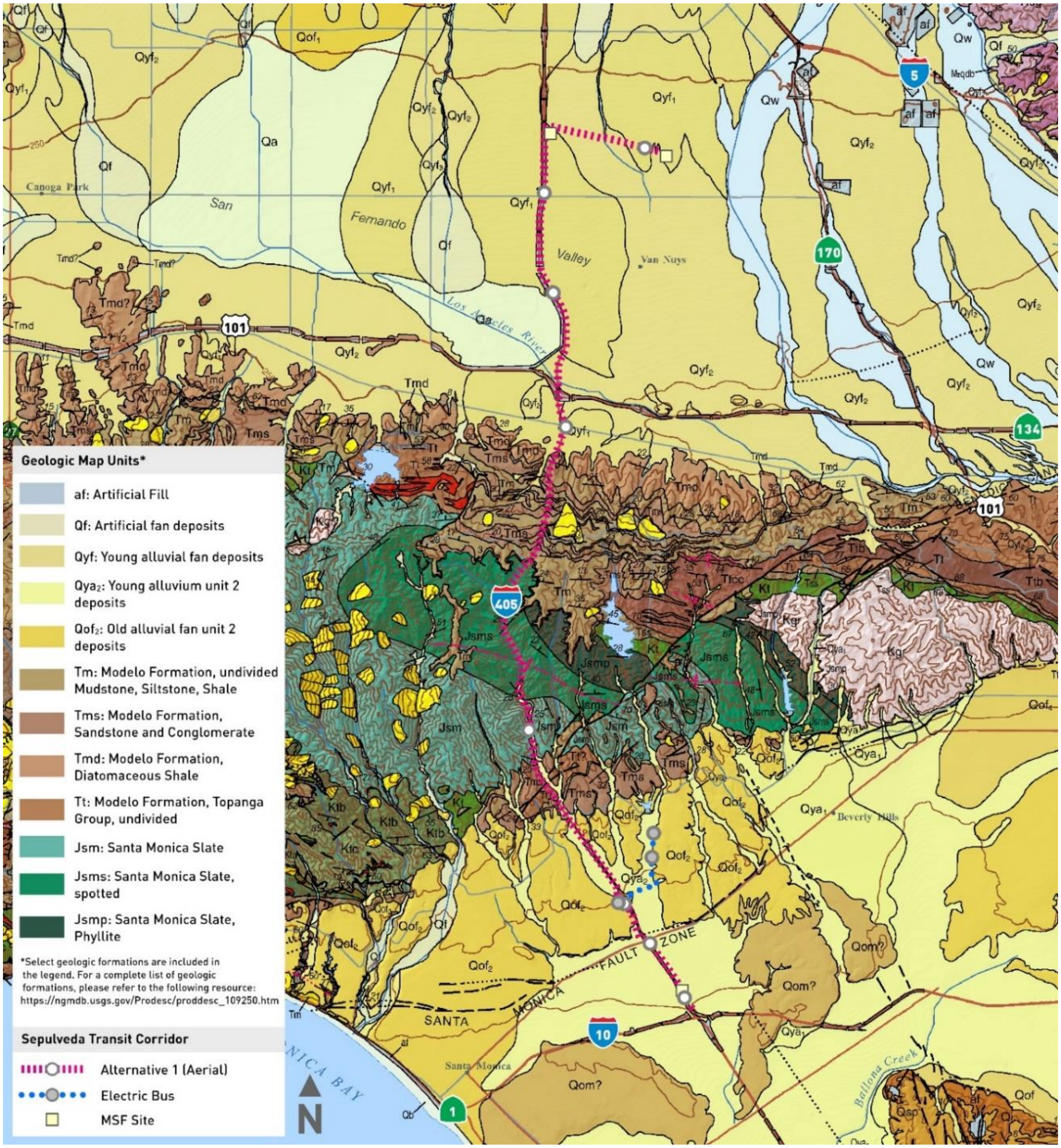
Source: Campbell et al., 2016

Figure 3.6-1. Geologic Units



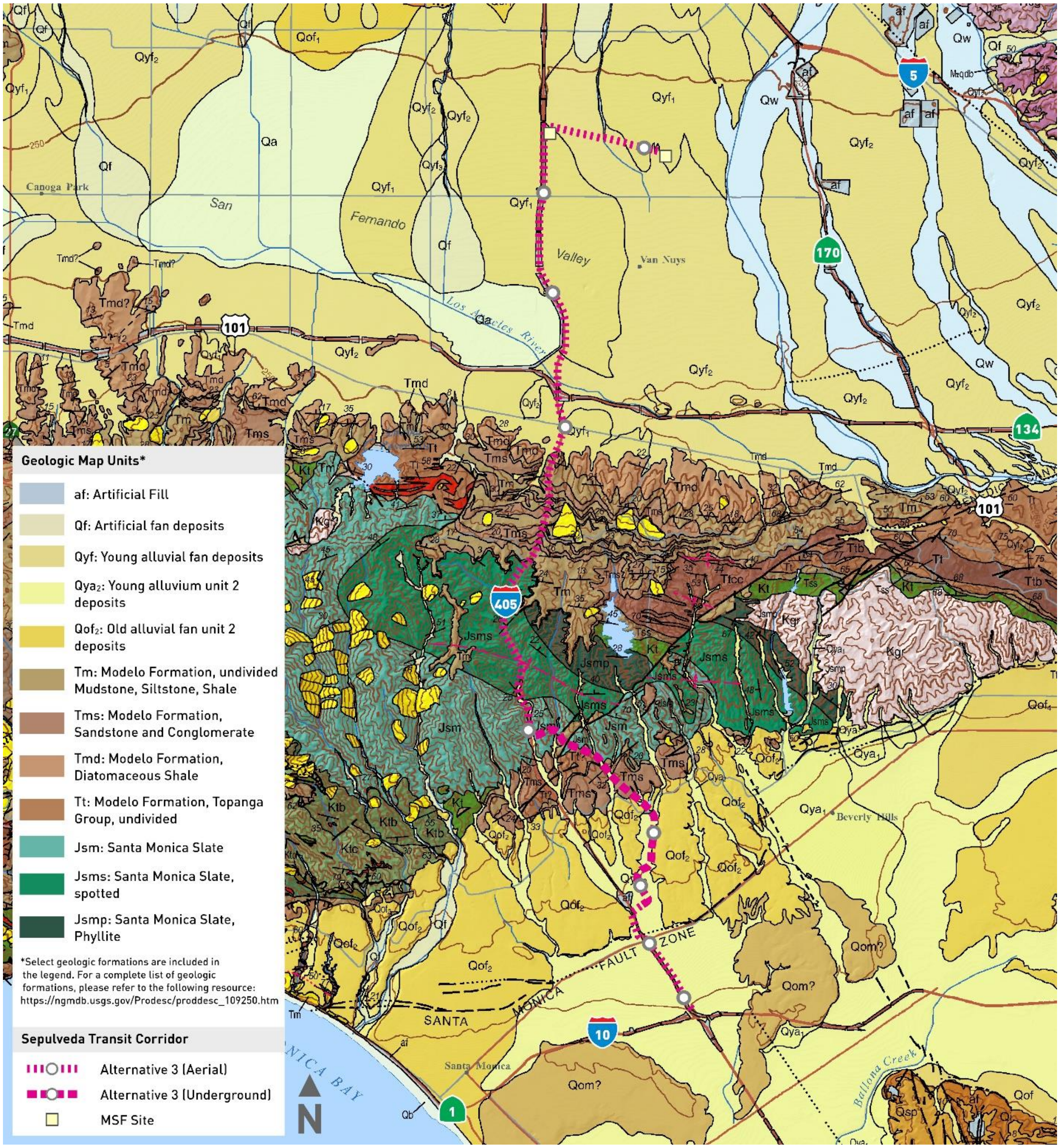
Source: USGS, 2015; HTA, 2024

Figure 3.6-2. Alternative 1: Geologic Units



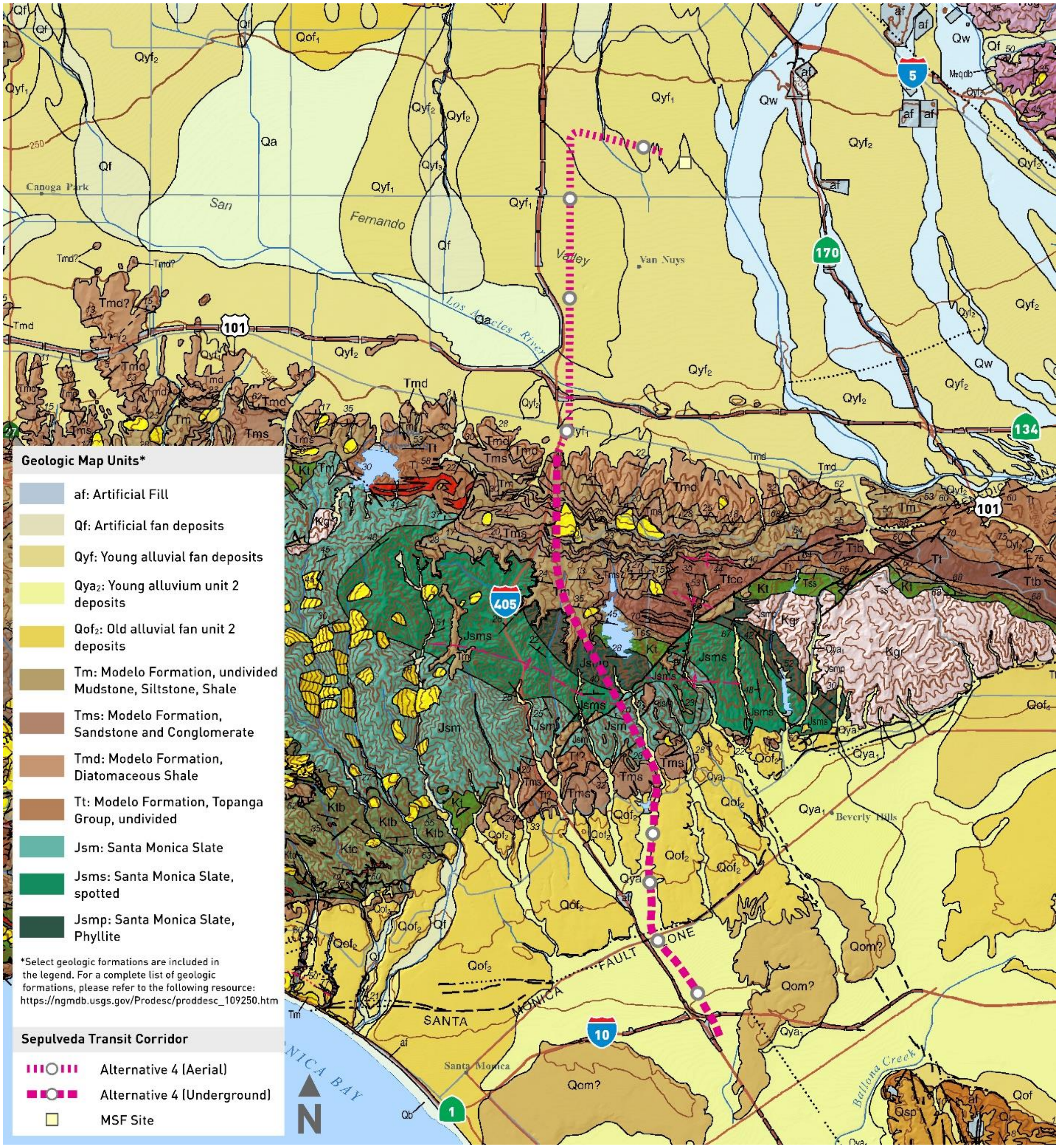
Source: USGS, 2015; HTA, 2024

Figure 3.6-3. Alternative 3: Geologic Units



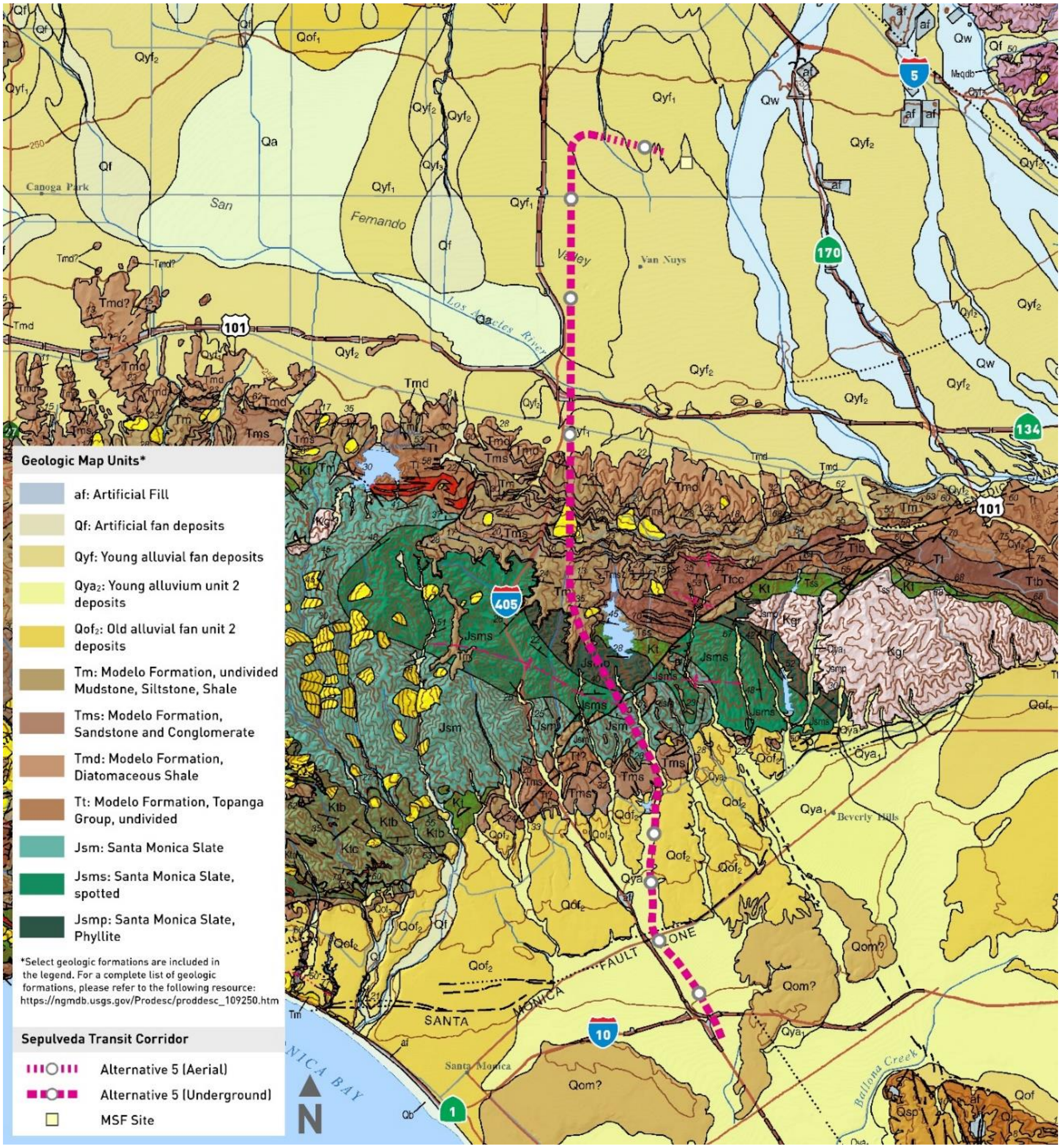
Source: USGS, 2015; HTA, 2024

Figure 3.6-4. Alternative 4: Geologic Units



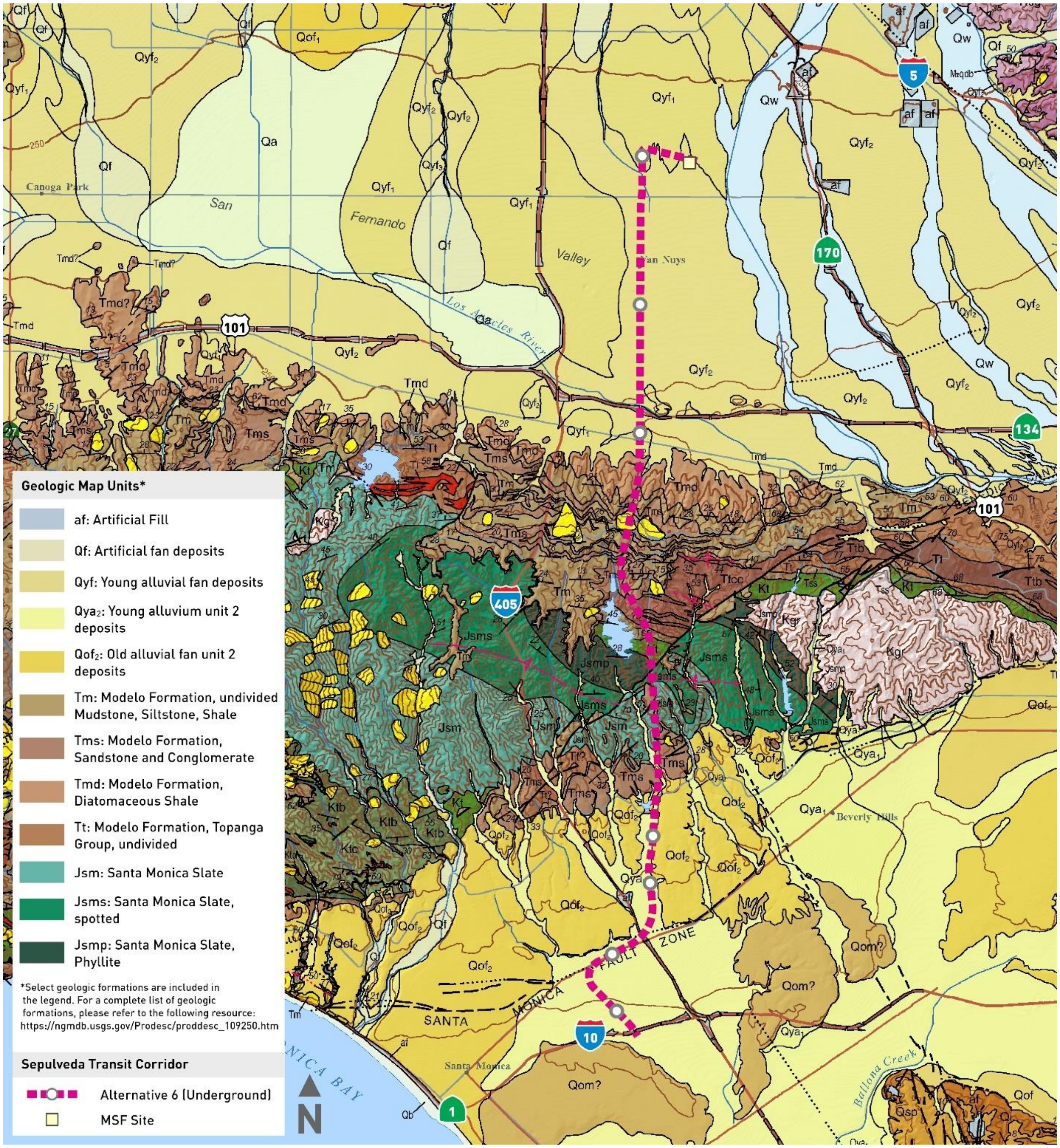
Source: USGS, 2015; HTA 2024

Figure 3.6-5. Alternative 5: Geologic Units



Source: USGS, 2015; HTA 2024

Figure 3.6-6. Alternative 6: Geologic Units



Source: USGS, 2015; HTA 2024

Thick alluvial deposits are found in the valley/basin portions of the Study Area, including the areas north and south of the Santa Monica Mountains. The San Fernando Valley to the north is underlain by up to 2,000 feet of alluvial sediment, with Cretaceous-aged crystalline bedrock below the thick alluvium.

The RSA is directly underlain by unconsolidated, Quaternary age, sandy sediments. The soil could be subdivided into loose, unconsolidated, Holocene age sediments, which cover the bulk of the basin, and late Pleistocene materials, which comprise the surface over much of the uplifts of the Newport Inglewood Structural Zone and the marginal plains. Hard rocks occur only in the mountains surrounding the basins and at depths ranging from about 5,000 feet to as much as 30,000 feet in the deepest part of the central basin.

The lithologic units exposed along the RSA include artificial fill, landslide debris, young and old alluvium, and bedrock most commonly associated with the Modelo Formation and Santa Monica Slate. Much of I-405 and associated improvements are underlain by artificial fill associated with the construction of I-405. Young and old alluvial fan and stream deposits are found predominantly along the northern and southern sides of the Santa Monica Mountains. These surficial units are generally composed of unconsolidated to poorly to moderately consolidated sediments of Holocene to Pleistocene age and are either found at the surface or buried under the fill associated with I-405. Further detail on the RSA's various geologic units is provided in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report*.

3.6.3.3 Seismicity

The entire Southern California region is seismically active. A network of major regional faults and minor local faults crisscrosses the region. The faulting and seismicity are dominated by the San Andreas Fault system, which separates two of the major tectonic plates that comprise the earth's crust. The Pacific Plate lies west of the San Andreas Fault system. This plate is moving in a northwesterly direction relative to the North American Plate, which lies east of the San Andreas Fault system. This relative movement between the two plates is the driving force of fault ruptures in western California. The San Andreas Fault generally trends northwest–southeast; however, north of the Transverse Ranges province, the fault trends more in an east–west direction, causing a north–south compression between the two plates. North–south compression in Southern California has been estimated from 5 millimeters per year (mm/year) to 20 mm/year. This compression has produced rapid uplift of many of the mountain ranges in Southern California (Metro, 2023a).

In addition to the San Andreas Fault, numerous faults in Southern California are categorized as active, potentially active, and inactive. A fault is classified as active if it has either moved during the Holocene epoch (from about 10,000 years to the present) or is included in an Alquist-Priolo Earthquake Fault Zone (as established by CGS). A fault is classified as potentially active if it has experienced movement within the Quaternary period (geologic time starting 1.6 million years ago and continuing to the present day). Faults that have not moved in the last 1.8 million years generally are considered inactive. Surface displacement can be recognized by the existence of cliffs in alluvium, terraces, offset stream courses, fault troughs, and saddles, the alignment of depressions, sag ponds, and the existence of steep mountain fronts.

Generally defined, an earthquake is an abrupt release of accumulated energy in the form of seismic waves that are created when movement occurs along a fault plane. The severity of an earthquake is generally expressed in two ways: magnitude and intensity. The energy released, measured on the Moment Magnitude (M_w) scale, represents the "size" of an earthquake. The Richter Magnitude (M) scale has been replaced in most modern building codes by the M_W scale because the M_W scale provides more useful information to design engineers. The Project Study Area is subject to earthquakes of M_W 6.0 to M_W 8.0 by the surrounding faults.

The intensity of an earthquake is measured by the Modified Mercalli Intensity (MMI) scale, which emphasizes the current seismic environment at a particular site and measures ground-shaking severity according to damage done to structures, changes in the earth surface, and personal accounts. Table 3.6-2 identifies the level of intensity according to the MMI scale and describes that intensity with respect to how it would be received or sensed by its receptors.

Table 3.6-2. Modified Mercalli Intensity Scale

Intensity	Shaking	Description/Damage
I	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration is similar to the passing of a truck. Duration is estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some are awakened. Dishes, windows, doors are disturbed; walls make cracking sound. Sensation is like a heavy truck striking a building. Standing motor cars are rocked noticeably.
V	Moderate	Felt by nearly everyone; many are awakened. Some dishes and windows are broken. Unstable objects are overturned. Pendulum clocks may stop.
VI	Strong	Felt by all; many are frightened. Some heavy furniture is moved; there are a few instances of fallen plaster. Damage is slight.
VII	Very Strong	Damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, considerable in poorly built structures; some chimneys are broken.
VIII	Severe	Damage is slight in specially designed structures, considerable in ordinary substantial buildings with partial collapse, great in poorly built structures. Chimneys, factory stacks, columns, monuments, walls fall. Heavy furniture is overturned.
IX	Violent	Damage is considerable in specially designed structures; well-designed frame structures are thrown out of plum. Damage is great in substantial buildings, with partial collapse. Buildings are shifted off of foundations.
X	Extreme	Some well-built wooden structures are destroyed; most masonry and frame structures are destroyed with foundations. Rails are bent.

Source: USGS, 2022

Ground motions also are reported in terms of a percentage of the acceleration of gravity (percent g, where g equals 32 feet per second). One hundred percent of gravity is the acceleration a skydiver would experience during free-fall. An acceleration of 0.4 gravity is equivalent to accelerating from 0 to 60 miles per hour in about 7 seconds.

Over the past 54 years, Southern California has experienced three significant earthquakes: the 1971 San Fernando earthquake (also known as the Sylmar earthquake, on the Sierra Madre Fault), which registered as M_W 6.6; the 1987 Whittier Narrows earthquake, which registered as M_W 5.9; and the Northridge earthquake, which occurred in January 1994 and registered as M_W 6.7.

3.6.3.4 Regional and Local Faults

Major regional and local faults are identified in Table 3.6-3 and are shown on Figure 3.6-7 through Figure 3.6-18. Further detail on each fault is provided in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a).

Table 3.6-3. Summary of Major Regional and Local Faults

Fault Name	Alquist-Priolo Earthquake Fault Zone	Distance from Alternative 1 (miles)	Distance from Alternative 3 (miles)	Distance from Alternative 4 (miles)	Distance from Alternative 5 (miles)	Distance from Alternative 6 (miles)
Charnock Fault	NO	3.2	3.2	2.6	2.6	3.4
Chatsworth Fault	NO	7.3	7.3	7.7	7.7	8.6
Clearwater Fault	NO	26.0	26.0	26.2	26.2	26.5
Del Valle Fault	NO	17.3	17.3	17.5	17.5	18.5
Eagle Rock Fault	NO	13.4	13.4	12.9	12.9	13.1
Hollywood Fault	YES	1.9	1.8	1.7	1.7	2.0
Holser Fault	NO	14.2	14.2	14.4	14.4	14.9
Malibu Coast Fault	YES	10.7	10.7	12.0	12.0	12.6
Mission Hills Fault	NO	4.2	4.2	4.4	4.4	4.5
Newport-Inglewood-Rose Canyon Fault	YES	1.9	1.8	1.8	1.8	3.1
Northridge Blind Thrust Fault	NO	8.3	8.3	8.4	8.4	8.5
Northridge Hills Fault	NO	1.3	1.3	1.5	1.5	1.9
Overland Avenue Fault	NO	0.8	0.8	0.7	0.7	1.8
Oak Ridge Fault	NO	19.5	19.5	19.9	19.9	20.8
Palos Verdes Fault	NO	15.2	15.2	14.7	14.7	15.0
Puente Hills Blind Thrust System	NO	18.9	18.9	18.3	18.3	19.7
Raymond Fault	YES	13.2	13.2	12.5	12.5	12.7
San Andreas Fault	YES	29.5	29.5	29.5	29.5	29.5
San Gabriel Fault	YES	10.4	10.4	10.4	10.4	10.4
Santa Felicia Fault	NO	21.5	21.5	21.9	21.9	22.7

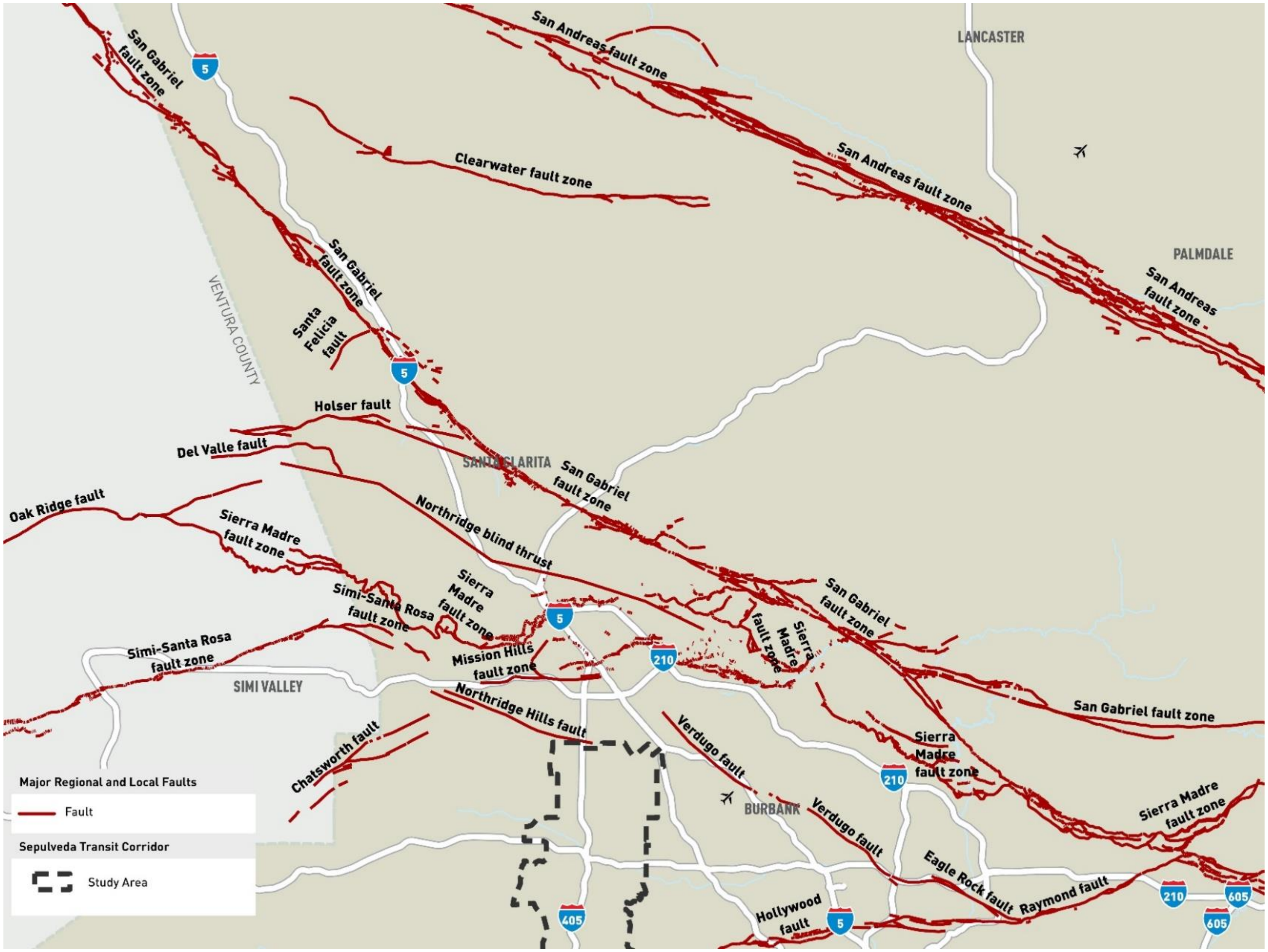
Fault Name	Alquist-Priolo Earthquake Fault Zone	Distance from Alternative 1 (miles)	Distance from Alternative 3 (miles)	Distance from Alternative 4 (miles)	Distance from Alternative 5 (miles)	Distance from Alternative 6 (miles)
Santa Monica Fault	YES	Crosses Alternative 1 north of Massachusetts Avenue and Interstate 405	Crosses Alternative 3 north of Massachusetts Avenue and Interstate 405	Crosses Alternative 4 southeast of South Bentley Avenue and Massachusetts Avenue	Crosses Alternative 5 southeast of South Bentley Avenue and Massachusetts Avenue	Crosses Alternative 6 north of Massachusetts Avenue and Interstate 405
Sierra Madre Fault	YES	4.7	4.7	4.8	4.8	5.3
Simi-Santa Rosa Fault	YES	8.5	8.5	9.0	9.0	9.8
Verdugo Fault	NO	6.9	6.9	6.4	6.4	3.4

Source: CGS, 2023; USGS, 2017a, 2017b, 2017c, 2017d, and 2023; SCEDC, 2023a, 2023b, 2023c, 2023d, 2023e, 2023f, 2023g, 2023h, 2023i, 2023j, 2023k, 2023l, 2023m, 2023n, 2023o, 2023p, 2023q, and 2023r; and Shaw et al. 2002.

Figure 3.6-7. Major Regional and Local Faults – South

Source: CGS, 2023; HTA, 2024

Figure 3.6-8. Major Regional and Local Faults - North

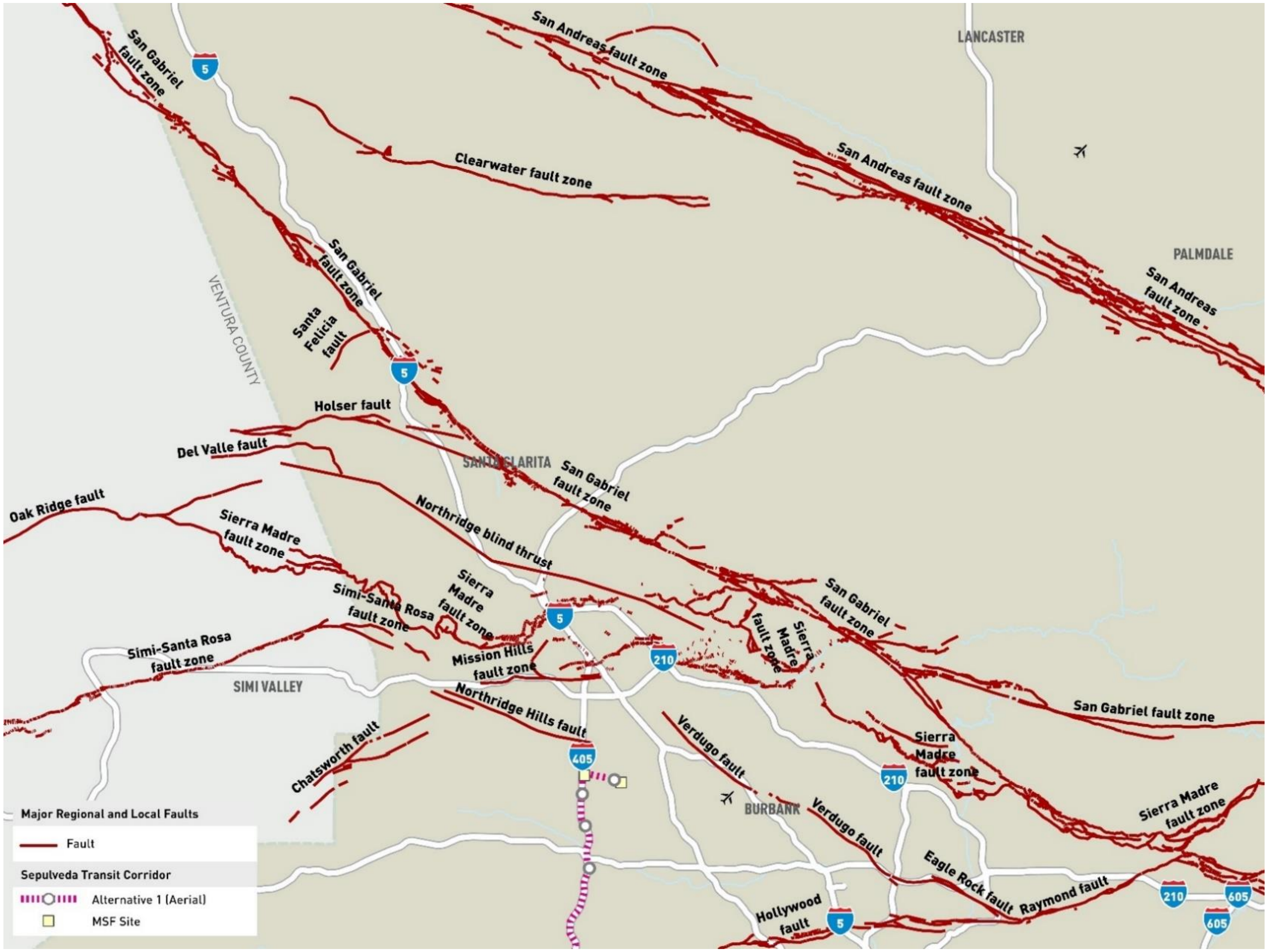


Source: CGS, 2023; HTA, 2024

Figure 3.6-9. Alternative 1: Major Regional and Local Faults – South

Source: CGS, 2023; HTA 2024

Figure 3.6-10. Alternative 1: Major Regional and Local Faults – North

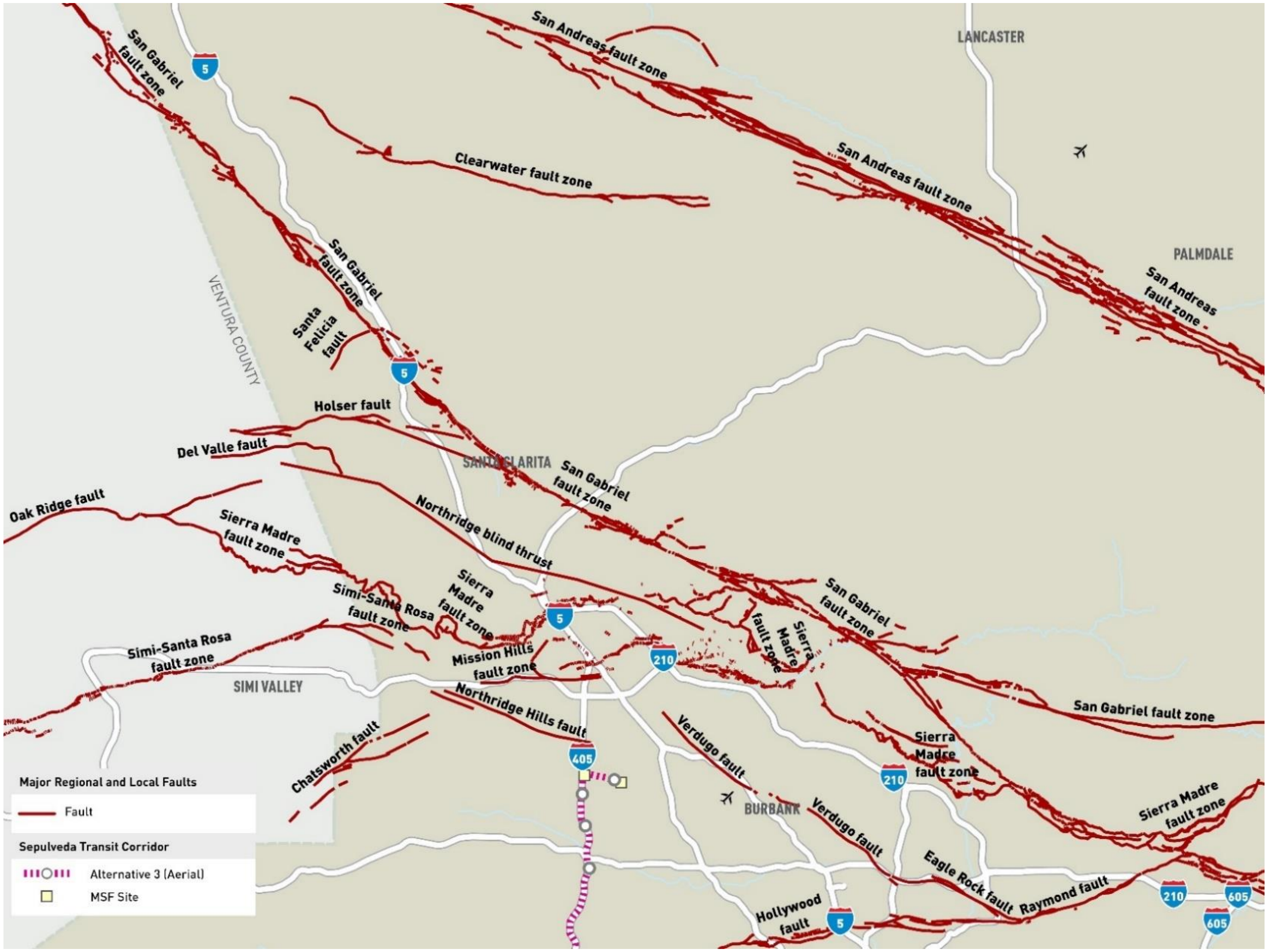


Source: CGS, 2023; HTA 2024

Figure 3.6-11. Alternative 3: Major Regional and Local Faults – South

Source: CGS, 2023; HTA 2024

Figure 3.6-12. Alternative 3: Major Regional and Local Faults – North

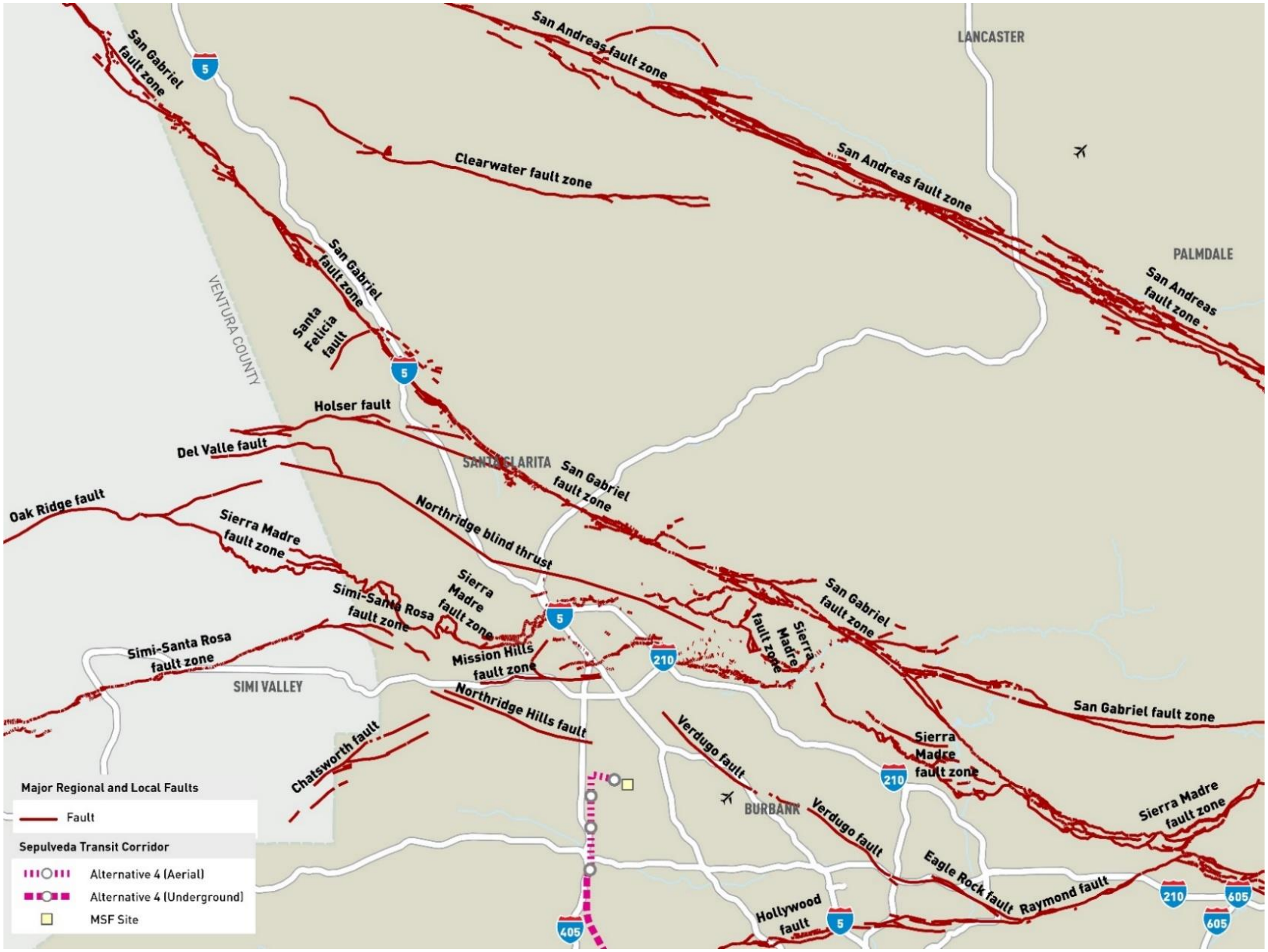


Source: CGS, 2023; HTA 2024

Figure 3.6-13. Alternative 4: Major Regional and Local Faults – South

Source: CGS, 2023; HTA, 2024

Figure 3.6-14. Alternative 4: Major Regional and Local Faults – North

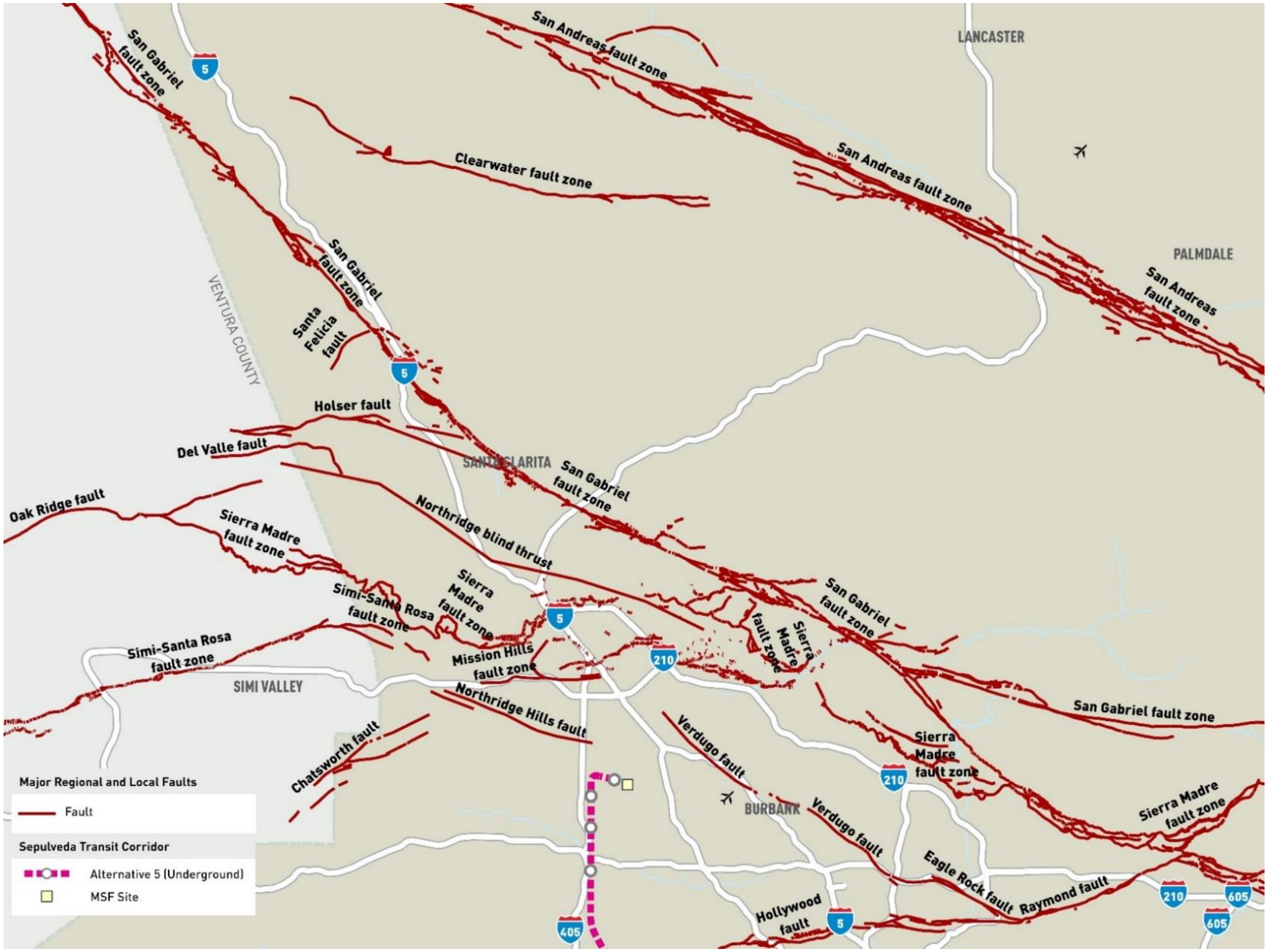


Source: CGS, 2023; HTA, 2024

Figure 3.6-15. Alternative 5: Major Regional and Local Faults – South

Source: CGS, 2023; HTA, 2024

Figure 3.6-16. Alternative 5: Major Regional and Local Faults – North

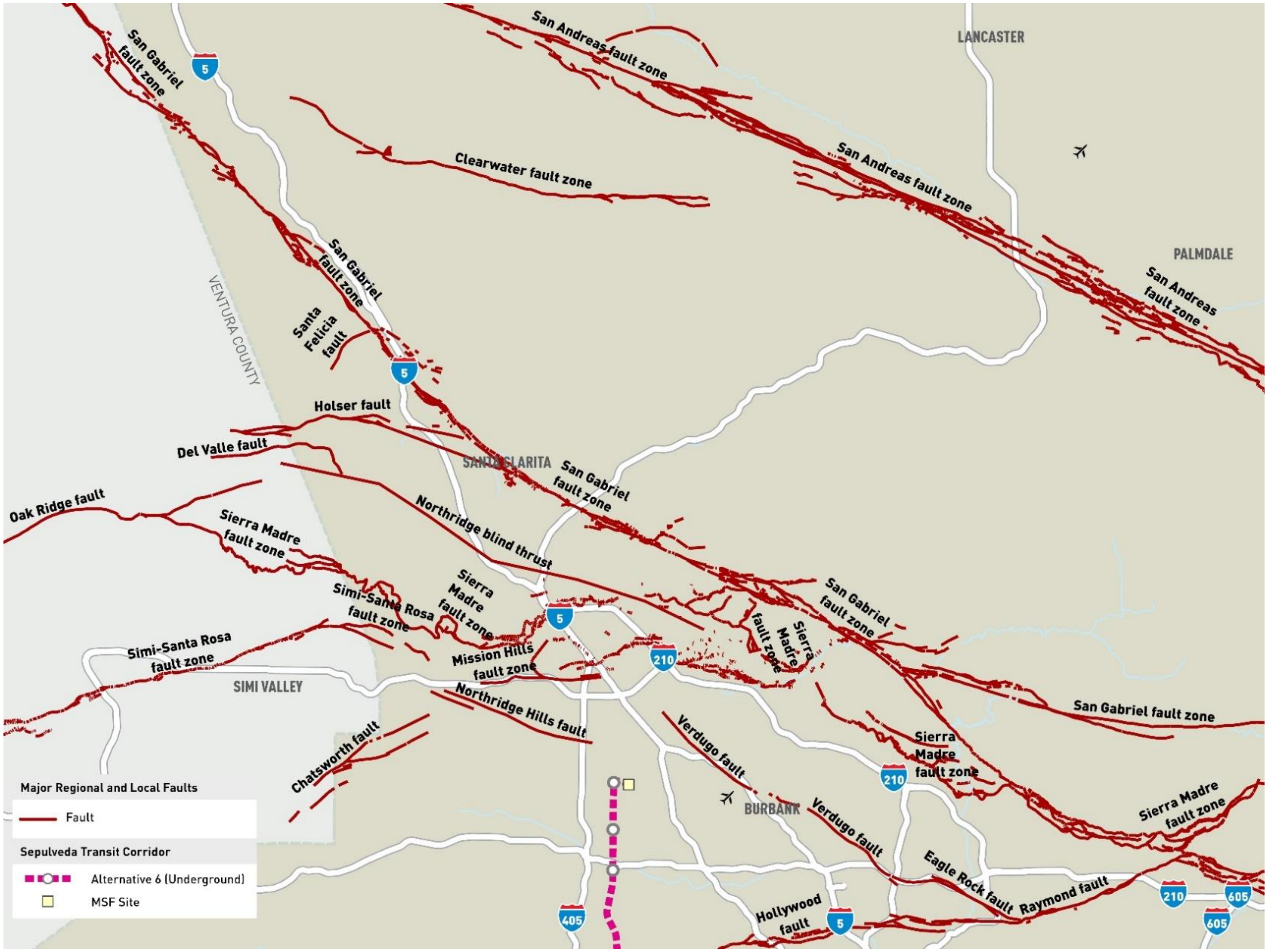


Source: CGS, 2023; HTA, 2024

Figure 3.6-17. Alternative 6: Major Regional and Local Faults – South

Source: CGS, 2023; HTA, 2024

Figure 3.6-18. Alternative 6: Major Regional and Local Faults – North



Source: CGS, 2023; HTA, 2024

3.6.3.5 Geological Hazards

Fault Rupture

Faults are geologic zones of weakness. Surface rupture occurs when movement on a fault deep in the earth breaks through to the ground surface. Surface ruptures associated with the 1994 Northridge earthquake began as a rupture at a depth of about 10.9 miles beneath the San Fernando Valley. For 8 seconds following the initial break, the rupture propagated upward and northwestward along the fault plane at a rate of about 1.9 miles per second. The size of the rupture covered an area of approximately 9.3 by 12.4 miles (USGS, 2013). Not all earthquakes result in surface rupture; however, due to the proximity of known active faults, fault ruptures and the subsequent hazard posed by seismic activity are potentially high. An earthquake could cause major damage and not have the fault trace break at the ground surface. Fault rupture almost always follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking.

Ground Shaking

A major cause of structural damage that results from earthquakes is ground shaking. The amount of motion can vary from “zero to forceful” depending upon the distance to the fault, the magnitude of the earthquake, and the local geology. Greater movement can be expected at sites located on poorly consolidated material such as alluvium located near the source of the earthquake epicenter or in response to an earthquake of great magnitude. Strong ground shaking can damage large freeway overpasses and unreinforced masonry buildings. It can also trigger a variety of secondary hazards such as liquefaction, landslides, fire, and dam failure.

The amount of damage to a building does not depend solely on how hard it is shaken. In general, smaller buildings such as houses are damaged more by higher frequencies, and houses must be relatively close to the epicenter to be severely damaged. Larger structures such as high-rise buildings are damaged more by lower frequencies and will be more noticeably affected by the largest earthquakes, even at considerable distances.

Damage as a result of ground shaking is not limited to aboveground structures. Seismic waves generated by the earthquake cause the ground to move, leading to dynamic forces on underground structures. This shaking can induce ground deformation and displacements and can potentially damage the structural integrity of tunnels, basements, and other underground facilities.

The intensity of ground motion expected at a particular site depends upon the magnitude of the earthquake, the distance to the epicenter, and the geology of the area between the epicenter and the property. Another factor affecting structural damage due to ground shaking is the quality and condition of the existing structure, which is influenced by whether it adheres to current or past building codes. Greater movement can be expected at sites on poorly consolidated material, such as loose alluvium, in proximity to the causative fault, or in response to an event of great magnitude. The general area is susceptible to earthquakes of M_w 6.0 to M_w 8.0. Due to the proximity of known active faults, the hazard posed by seismic shaking is potentially high.

3.6.3.6 Dry Sand Settlement

Settlement is defined as areas that are prone to rates of ground-surface collapse and densification (soil particle compaction) that are greater than those of the surrounding area. Such areas are often underlain by sediments that differ laterally in composition or degree of existing compaction. Differential settlement refers to areas that have more than one rate of settlement. Settlement can damage structures, pipelines, and other subsurface entities.

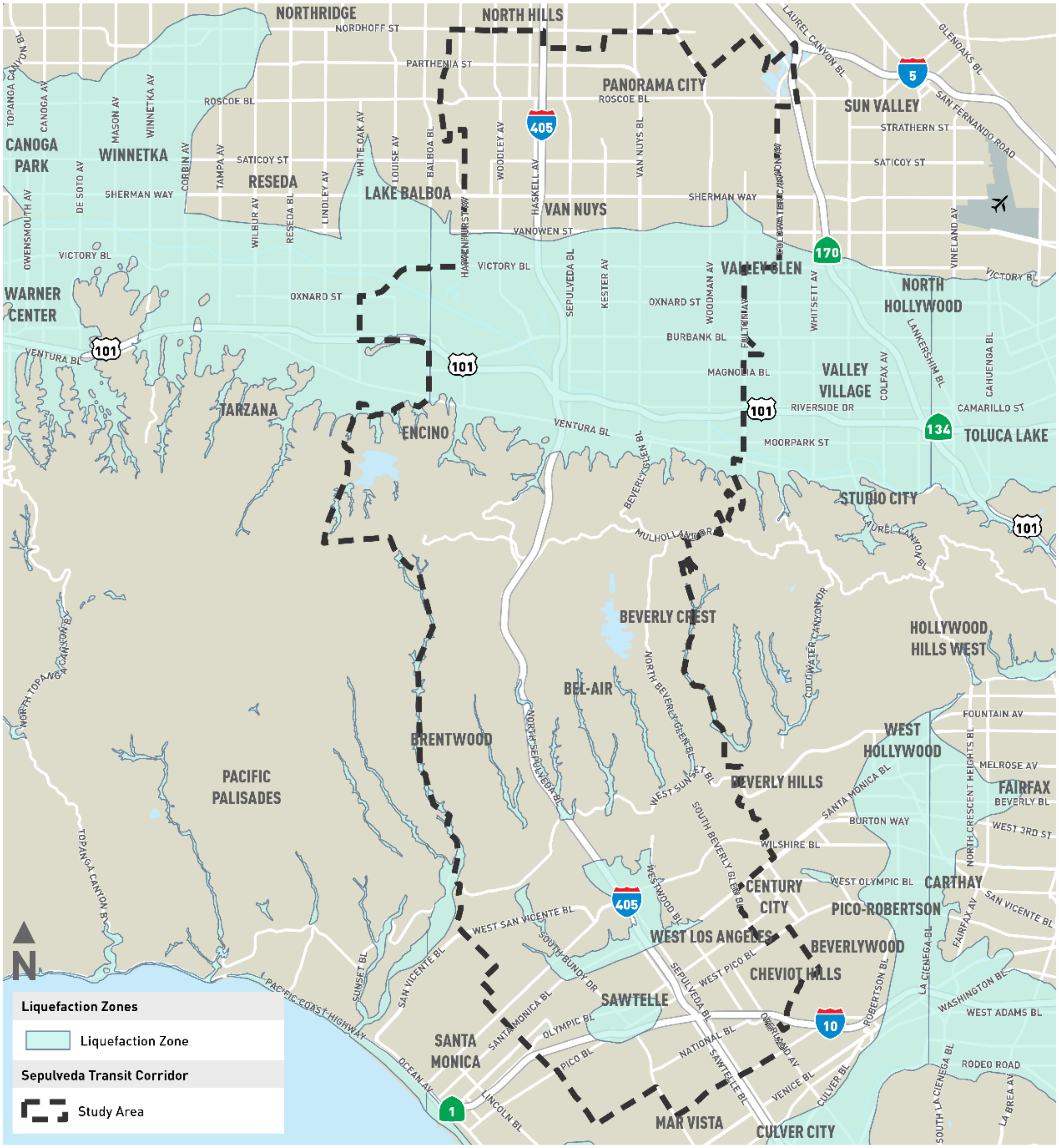
Strong ground shaking can cause soil settlement by vibrating sediment particles into more tightly compacted configurations, thereby reducing pore space. Unconsolidated, loosely packed alluvial deposits and sand (unsaturated or saturated) are especially susceptible to this phenomenon. Poorly compacted artificial fills may experience seismically induced settlement. Due to the presence of alluvial deposits in the Project Study Area, the hazard posed by seismically induced settlement is potentially high.

3.6.3.7 Liquefaction

Liquefaction involves a sudden loss in strength of a saturated, cohesionless, uniformly particle-sized soil, and is typically caused by ground-shaking activities that cause temporary transformation of the soil to a fluid mass. In rare instances, ground-borne vibrations can cause liquefaction from activities such as pile driving or tunnel boring. If the liquefying layer is near the ground surface, the effects may resemble those of quicksand. If the layer is deep below the ground surface, it may provide a sliding surface for the material above it and/or cause differential settlement of the ground surface, which may damage building foundations by altering weight-bearing characteristics.

During a liquefaction event, soils behave similarly to liquids, losing bearing strength. Structures built on these soils may tilt or settle when the soils liquefy. Liquefaction occurs more often in earthquake-prone areas that are underlain by young, sandy alluvium where the groundwater table is less than 50 feet below ground surface. As shown on Figure 3.6-19, liquefaction zones exist within the Project Study Area.

Figure 3.6-19. Liquefaction Zones



Source: County of Los Angeles, Enterprise GIS (eGIS) 2022b; HTA 2024

3.6.3.8 Subsidence and Expansive Soils

Subsidence involves a sudden sinking or gradual settling and compaction of soil and other surface material with little or no horizontal motion. Expansive soils have a significant amount of clay particles that can give up water (shrink) or take on water (swell). The change in volume exerts stress on buildings and other loads placed on these soils. The occurrence of these soils is often associated with geologic units having marginal stability. Expansive soils can be dispersed widely and can be found in hillside areas as well as low-lying areas in alluvial basins. Municipal grading and building codes require routine soils testing to identify expansive characteristics and appropriate remediation measures. Specific treatments to eliminate expansion of soils at building sites include grouting (cementing the soil particles together), re-compaction (watering and compressing the soils), and replacement with non-expansive material (excavation of unsuitable soil followed by filling with suitable material), all of which are common practice in California. Due to the presence of alluvial deposits in the Project Study Area, the hazard posed by subsidence and expansive soils is potentially high at those locations.

3.6.3.9 Collapsible Soils

Collapsible soils undergo a rearrangement of their grains and a loss of cementation, resulting in substantial and rapid settlement under relatively low loads. Collapsible soils occur predominantly at the base of mountain ranges where Holocene-age alluvial fan and wash sediments have been deposited during rapid runoff events. Soils prone to collapse are commonly associated with human-made fill, wind-laid sands and silts, and alluvial fan and mudflow sediments that are deposited during flash floods. Additionally, desert soils are commonly associated with hydro-compression and collapse associated with wetting. Examples of common problems associated with collapsible soils include tilting and sagging floors, cracking or separation in structures, sagging floors, and nonfunctional windows and doors. Due to the presence of alluvial deposits in the Project Study Area, the hazard posed by collapsible soils is potentially high at those locations.

3.6.3.10 Lateral Spreading

Lateral spreading is a phenomenon where large blocks of intact, non-liquefied soil move downslope by riding on a liquefied substrate of large extent. The mass moves toward an unconfined area, such as a descending slope or stream-cut bluff and can occur on slope gradients as gentle as 1 degree. Due to the presence of mountainside areas in the Project Study Area, the hazard posed by lateral spreading is potentially high at those locations.

3.6.3.11 Slope Stability

Slope failures include many phenomena that involve the downslope displacement of material, which is triggered by static (i.e., gravity) or dynamic (i.e., earthquake) forces, such as landslides, rock-falls, debris slides, and soil creeps. Slope stability can depend on complex variables, including the geology, structure, and amount of groundwater present, as well as external processes such as climate, topography, slope geometry, and human activity. Landslides and other slope failures may occur on slopes of 15 percent or less; however, the probability is greater on steeper slopes that exhibit old landslide features such as scarps, slanted vegetation, and offset surfaces. Due to the presence of slopes (of 15 percent or greater) in the Project Study Area, the hazard posed by slope failures is potentially high at those locations.

3.6.3.12 Landslides

Landslides are the downhill movement of a mass of earth and rock. Landslides are a geological phenomenon that includes a wide range of ground movements, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over-steepened slope is the primary cause of a landslide, the following other factors contribute:

- Erosion by rivers, glaciers, or ocean waves
- Rock and soil slopes that are weakened through saturation by snowmelt or heavy rains
- Earthquakes that create stresses such that weak slopes fail
- Volcanic eruptions that produce loose ash deposits, heavy rain, and/or debris flows

- Vibrations from machinery, traffic, blasting, and even thunder
- Excess weight from accumulation of rain or snow, from stockpiling of rock or ore from waste piles, or from man-made structures

As shown on Figure 3.6-20, the landsliding hazard is focused within the Santa Monica Mountains portion of the Study Area.

Figure 3.6-20. Landslide Hazard Zones

Source: eGIS, 2022b; HTA, 2024

3.6.3.13 Soil Erosion

Soil erosion is the process by which soil particles are removed from a land surface by wind, water, or gravity. Most natural erosion occurs at slow rates; however, the rate of erosion increases when land is cleared of vegetation or structures, or otherwise altered and left in a disturbed condition. Erosion can occur as a result of, and can be accelerated by, site preparation activities associated with development. Vegetation removal in pervious landscaped areas could reduce soil cohesion, as well as the buffer provided by vegetation from wind, water, and surface disturbance, which could render the exposed soils more susceptible to erosive forces.

Excavation or grading may result in erosion during construction activities, irrespective of whether hardscape previously existed at the construction site, because bare soils would be exposed and could be eroded by wind or water. The effects of erosion are intensified with an increase in slope (as water moves faster, it gains momentum to carry more debris), and the narrowing of runoff channels (which increases the velocity of water). Surface structures, such as paved roads and buildings, decrease the potential for erosion. Once covered, soil is no longer exposed to the elements, and erosion generally does not occur.

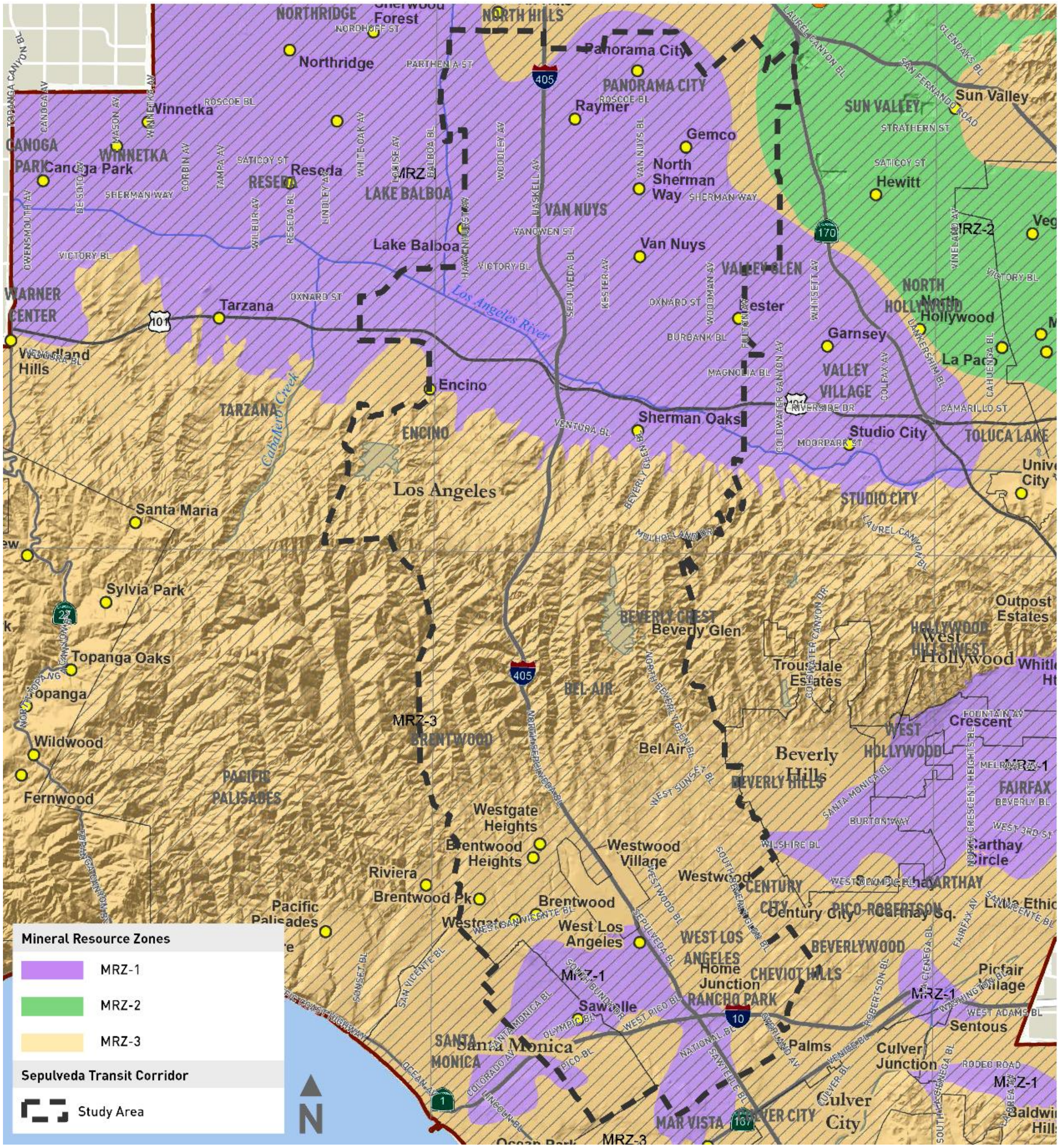
3.6.3.14 Mineral Resources

Mineral resource areas are identified according to the Surface Mining and Reclamation Act of 1975 and the following criteria for Mineral Resource Zones (MRZs), Scientific Resource Zones (SZs), and Identified Resource Areas. The MRZ and SZ categories used by the State Geologist in classifying the state's lands, the geologic and economic data, and the substantiation of which each unit MRZ or SZ assignment is based on land classification information provided by the State Geologist to the Board of Supervisors for the following areas:

- **MRZ-1:** Adequate information indicates that no significant mineral deposits are present or little likelihood exists for their presence. This zone shall be applied where well-developed lines of reasoning, based on economic geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is nil or slight.
- **MRZ-2:** Adequate information indicates that significant mineral deposits are present or a high likelihood for their presence exists. This zone shall be applied to known mineral deposits or where well-developed lines of reasoning, based on economic geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is high.
- **MRZ-3:** Areas containing deposits whose significance cannot be evaluated from available data.
- **MRZ-4:** Available information is inadequate for assignment to any other MRZ zone.
- **SZ Areas:** Areas containing unique or rare occurrences of rocks, minerals, or fossils that are of outstanding scientific significance shall be classified in this zone.

The California Department of Conservation, Division of Mines and Geology has classified areas of regional mineral significance as MRZ 2 (CGS, 2021). The Project Study Area is not located within an area designated as MRZ 2. As shown on Figure 3.6-21, the Project Study Area is largely located within areas designated as MRZ-3, which contain deposits whose significance cannot be evaluated from available data. The Project Study Area also encompasses areas designated as MRZ-1 in the northern portion of the Project Study Area in the Valley, as well as the southern portion near West Los Angeles. MRZ-1-designated areas indicate that no significant mineral deposits are present or little likelihood exists for their presence.

Figure 3.6-21: Mineral Resources



Source: CGS, 2021; HTA, 2024

3.6.3.15 Paleontological Resources

The Modelo Formation (Tm, Tms, Tmd) is a late Miocene-age sedimentary bedrock that generally consists of gray to brown, thinly bedded mudstone, and shale and siltstone, with interbeds of very fine-grained to coarse-grained sandstone. The most commonly observed lithology for the No Project Alternative is near I-405, with thinly bedded shale to shaley siltstone with interbeds of fine sandstone. Additionally, localized diatomaceous shale and siltstone with interbeds of bentonite and fine sandstone are within the formation. (Refer to *Sepulveda Transit Corridor Project Paleontological Technological Memorandum* [Metro, 2025b], which is Attachment 1 of the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Resources Technical Report* [Metro, 2025a].) A paleontological records search from the NHMLAC revealed a fossil locality (LACM VP 1681) recorded within the Project Study Area. The fossil locality is located in the central portion of the RSA just west of the I-405 Sepulveda Freeway Cut, adjacent to where Royal Ridge Road ends. LACM VP 1681 indicated a fossil Pipefish (*Syngnathus avus*) from within the Miocene Modelo Formation. Pipefish are considered rare in the fossil record, are indicators of paleoenvironmental conditions, and thus increase the scientific importance of this locality. Paleontologists have previously sampled the locality, and subsequent construction activities (i.e., I-405) have effectively removed the locality, but it is still indicative of the fossiliferous (fossil rich) nature of the Modelo Formation (SVP, 1995; Bell, 2023). Additionally, 14 other fossil localities are located within 5 miles of the RSA that produced fossil vertebrates and invertebrates.

Paleontological sensitivity refers to the paleontological potential for a geologic unit to contain fossil remains, traces, and fossil-collecting localities. The following sensitivity ratings indicate the potential for containing significant paleontological resources.

- High paleontological sensitivity indicates that geologic units have a history of or are considered to have a high potential for paleontological resources (i.e., fossil remains).
- Moderate paleontological sensitivity indicates that fossil remains or traces have been found but are in poor condition, are a common paleontological resource, or do not have scientific significance.
- Low paleontological sensitivity indicates a low potential for containing fossil paleontological resources.
- No paleontological sensitivity indicates areas that are not conducive to significant paleontological resources due to environmental conditions.

For the Project, it is difficult to quantify the number of sensitive formations and their sensitivity level with precision due to a blanket of soil that covers the entire Project Study Area underground and current construction in the area. Attachment 1 to the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report*, the stand-alone *Paleontological Technical Memorandum*, contains a detailed analysis of paleontological resources (Metro, 2025b).

3.6.4 Environmental Impacts

3.6.4.1 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 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.

Project Alternatives

No Project Alternative

<u>**Impact Statement**</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. In absence of the Project, the reasonably foreseeable transit improvement within the Project Study Area would be the rerouting of the existing Metro Line 761. Rerouting Metro Line 761 would not present new seismic risks because the bus route is an existing route which would be rerouted along existing streets and highways. Other than potential for new bus shelters, no habitable structures would be constructed as part of the No Project Alternative. These activities do not have the potential to disturb geological processes such as faults. Therefore, impacts associated with the No Project Alternative associated with loss, injury, or death involving the Alquist-Priolo Earthquake Fault Zone would have no during operations.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The No Project Alternative would include any construction activities associated with the rerouting of Metro Line 761. Construction associated with rerouting Metro Line 761 would be minimal and consist primarily of installing potentially new bus stops and potentially minor curb revisions. Construction activities for the No Project Alternative would not directly or indirectly exacerbate rupture of a known earthquake fault causing substantial adverse effects, including the risk of loss, injury, or death because these elements do not reach a depth or be of an intensity that would affect geological processes such as faults. Therefore, construction impacts associated with loss, injury, or death involving the Alquist-Priolo Earthquake Fault Zone would have no impact.

Alternative 1

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

Alternative 1 traverses the Santa Monica Fault at approximately north of Massachusetts Avenue and the I-405 median, north of Santa Monica Boulevard. The next nearest Alquist-Priolo Earthquake Fault Zones to Alternative 1 are the Hollywood Fault, located approximately two miles northeast from its mid-section of Alternative 1, and the Newport-Inglewood-Rose Canyon Fault, located approximately two miles east of the southern portion of Alternative 1.

The Alquist-Priolo Earthquake Fault Zoning Act prohibits the construction of structures for human occupancy (i.e., houses, apartments, offices, etc.) on the surface trace of active faults. However, the Alquist-Priolo Earthquake Fault Zoning Act does not prohibit the construction of non-habitable structures (i.e., not suitable to be lived in such as carport, roads, train tracks, bridges, etc.). Alternative 1 would include an entirely aerial monorail alignment that would run along the I-405 corridor and include eight aerial monorail transit (MRT) stations and traction power substation (TPSS) sites. Alternative 1's alignment would include a fixed guideway within the Alquist-Priolo Earthquake Fault Zone. Alternative 1 would also include the operation of an electric bus which would serve as a shuttle between the Wilshire Boulevard/Metro D Line and UCLA Gateway Plaza Stations.

Operation of Alternative 1 including the electric bus would not directly or indirectly cause the rupture of a fault because its elements are entirely aerial or at-grade for the electric bus. Neither component involves ground-disturbing activities or habitable structures directly on or near fault traces.

Furthermore, Alternative 1 would be designed to comply with current seismic safety standards, including structural engineering measures to account for the potential impacts of seismic activity, as discussed in detail in Section 3.6.1. As such, the operational components of Alternative 1 would not exacerbate fault rupture risks or contribute to the potential for loss, injury, or death associated with known earthquake.

While operational activities of Alternative 1 would not exacerbate fault rupture risks, Alternative 1 would be constructed in a way that would reduce the risk of loss, injury, or death *as a result* of a fault rupture through compliance and adherence to existing regulations as described in Section 3.6.1. Construction of Alternative 1 would also incorporate earthquake-resistant design recommendations provided during final geotechnical engineering. Therefore, operational impacts associated with substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault would be less than significant.

Construction Impacts

Construction of Alternative 1 would occur within the Santa Monica Fault zone, north of Santa Monica Boulevard and along I-405. This construction would involve installing cast-in-drilled-hole (CIDH) piles, precast beams, and precast bent caps within the I-405 ROW. These elements would not reach a depth or involve an intensity of activity that would affect geological processes such as faults. As detailed in Section 3.6.1, compliance with applicable seismic and geotechnical regulations would ensure that construction activities are conducted in a manner that accounts for the presence of active faults. The CIDH piles, for instance, would be engineered to remain stable under seismic conditions without triggering or exacerbating fault activity. Because the depth and intensity of construction activities would not be sufficient to influence geological processes such as fault rupture, and due to adherence to strict safety and design standards, construction of Alternative 1 would not directly or indirectly exacerbate rupture of a known earthquake fault in a manner that could result in substantial adverse effects, including the risk of loss, injury, or death. Therefore, construction impacts related to fault rupture would be less than significant.

As described in Section 3.6.3, Alternative 1 would be located in an earthquake-prone area (Southern California). Construction activities would be carried out in compliance with the regulatory requirements as defined in Project Measure (PM) GEO-1 and Section 3.6.1, to account for the potential effects of ground shaking and the portion of Alternative 1 within the Santa Monica Fault. Moreover, while temporary structures such as office trailers and staging areas would be located throughout the alignment, no habitable structures associated with construction activities would be located within the Alquist-Priolo Earthquake Fault Zone.

Alternative 3

<u>**Impact Statement**</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

As shown in Table 3.6-3, Alternative 3 traverses the Santa Monica Fault at approximately north of Massachusetts Avenue and the I-405 median, north of Santa Monica Boulevard. The next nearest Alquist-Priolo Earthquake Fault Zones to Alternative 3 are the Hollywood Fault, located approximately two miles northeast from its mid-section of Alternative 3, and the Newport-Inglewood-Rose Canyon Fault, located approximately two miles east of the southern portion of Alternative 3.

The Alquist-Priolo Earthquake Fault Zoning Act prohibits the construction of structures for human occupancy (i.e., houses, apartments, offices, etc.) on the surface trace of active faults. However, the Alquist-Priolo Earthquake Fault Zoning Act does not prohibit the construction of non-habitable structures (i.e., not suitable to be lived in such as carport, roads, train tracks, bridges, etc.). Alternative 3 is an aerial monorail alignment that would run along the Interstate 405 (I-405) corridor and would include seven aerial monorail transit (MRT) stations and an underground tunnel alignment between the Getty Center and Wilshire Boulevard with two underground stations, and TPSS sites. Alternative 3's alignment would include a fixed guideway within the Alquist-Priolo Earthquake Fault Zone.

Operation of Alternative 3 includes both aerial and underground segments. Aerial operations of Alternative 3 would not directly or indirectly cause the rupture of a fault because the monorail vehicles would straddle a guide beam 16.5 feet and 32 feet above ground level. Moreover, underground operations of Alternative 3 similarly involves monorail vehicles straddling a beam guideway ranging between 20 to 300 feet below surface level which would not cause fault rupture. Furthermore, Alternative 3 would be designed to comply with current seismic safety standards, including structural engineering measures to account for the potential impacts of seismic activity, as discussed in detail in Section 3.6.1.

While operational activities of Alternative 3 would not exacerbate fault rupture risks, Alternative 3 would be constructed in a way that would reduce the risk of loss, injury, or death *as a result* of a fault rupture through compliance and adherence to existing regulations as described in Section 3.6.1. Construction of Alternative 3 would also incorporate earthquake-resistant design recommendations provided during final geotechnical engineering. Therefore, operational impacts associated with substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault would be less than significant.

Construction Impacts

Construction of Alternative 3 would occur within the Santa Monica Fault zone, north of Santa Monica Boulevard and along I-405. Aerial guideway and station construction would involve installing CIDH piles, precast beams, and precast bent caps within the I-405 ROW. These components would be constructed in compliance with applicable seismic and geotechnical regulatory requirements, as described and Section 3.6.1, and using established engineering practices to minimize ground disturbance and ensure structural stability in areas near active faults. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 20 feet to 300 feet. Underground stations, including the Wilshire Boulevard/Metro D Line Station and the UCLA Gateway Plaza Station, would use a "cut-and-cover" construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction. Construction of Alternative 3 would not directly or indirectly exacerbate rupture of a known earthquake fault causing substantial adverse effects, including the risk of loss, injury, or death because these elements, including the CIDH piles, TBM-excavated tunnels, and cut-and-cover stations, do not reach a depth or be of an intensity that would affect geological processes such as faults. Therefore, construction impacts related to the rupture of a fault are less than significant.

Alternative 4

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

As shown in Table 3.6-3, Alternative 4 crosses the Santa Monica Fault, designated as an Alquist-Priolo Earthquake Fault Zone, in an underground alignment. The Santa Monica Fault Zone is located approximately 1,000 feet north of the proposed Santa Monica Boulevard Station. The next nearest Alquist-Priolo Earthquake Fault Zones to Alternative 4 are the Hollywood Fault, located approximately 1.7 miles east from its mid-section, and the Newport-Inglewood-Rose Canyon Fault, located approximately 1.8 miles east of the southern portion of Alternative 4.

The Alquist-Priolo Earthquake Fault Zoning Act prohibits the construction of structures for human occupancy (i.e., houses, apartments, offices, etc.) on the surface trace of active faults. However, the Alquist-Priolo Earthquake Fault Zoning Act does not prohibit the construction of non-habitable structures (i.e., not suitable to be lived in such as carport, roads, train tracks, bridges, etc.). Alternative 4 is a heavy rail transit (HRT) system with a hybrid underground and aerial guideway track configuration that would include four underground stations, four aerial stations, and TPSS sites. Alternative 4's alignment would include a fixed guideway within the Alquist-Priolo Earthquake Fault Zone.

More specifically, Alternative 4 is a heavy rail transit (HRT) system with a hybrid underground and aerial guideway track configuration. Aerial operations of Alternative 4 would not directly or indirectly cause the rupture of a fault because the HRT trains would travel along an aerial guideway at least 15 feet above ground level. Moreover, underground operations of Alternative 4 involves traveling along a guideway ranging between 40 to 470 feet below surface level which would not cause fault rupture. Both the aerial and subterranean components would be constructed in compliance with applicable seismic and geotechnical regulatory requirements, as described and Section 3.6.1, and using established engineering practices to minimize ground disturbance and ensure structural stability in areas near active faults. Therefore, operational impacts associated with substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault would be less than significant.

Construction Impacts

Construction of Alternative 4 would occur within the Santa Monica Fault zone, north of Santa Monica Boulevard and along I-405. Aerial guideway and station construction would involve installing CIDH piles (shafts with both precast and CIP structural elements), simple spans, and longer balanced cantilever spans within the I-405 ROW, arterials, and street crossings. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 40 feet to 470 feet. Underground stations would use a "cut-and-cover" construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction.

These components would be constructed in compliance with applicable seismic and geotechnical regulatory requirements, as described and Section 3.6.1, and using established engineering practices to minimize ground disturbance and ensure structural stability in areas near active faults. Construction of Alternative 4 would not directly or indirectly exacerbate rupture of a known earthquake fault causing substantial adverse effects, including the risk of loss, injury, or death because these elements, including the CIDH piles, TBM-excavated tunnels, and cut-and-cover stations, do not reach a depth or be of an intensity that would affect geological processes such as faults. Therefore, construction impacts related to the rupture of a fault are less than significant.

Alternative 5

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

As shown in Table 3.6-3, Alternative 5 crosses the Santa Monica Fault, designated as an Alquist-Priolo Earthquake Fault Zone, in an underground alignment. The Santa Monica Fault Zone is located approximately 1,000 feet north of the proposed Santa Monica Boulevard Station. The next nearest Alquist-Priolo Earthquake Fault Zones to Alternative 5 are the Hollywood Fault, located approximately 1.7 miles east from its mid-section, and the Newport-Inglewood-Rose Canyon Fault, located approximately 1.8 miles east of the southern portion of Alternative 5.

The Alquist-Priolo Earthquake Fault Zoning Act prohibits the construction of structures for human occupancy (i.e., houses, apartments, offices, etc.) on the surface trace of active faults. However, the Alquist-Priolo Earthquake Fault Zoning Act does not prohibit the construction of non-habitable structures (i.e., not suitable to be lived in such as carport, roads, train tracks, bridges, etc.). Alternative 5 consists of a heavy rail transit (HRT) system with a primarily underground guideway track configuration, including seven underground stations and one aerial station, and TPSS sites. Alternative 5's alignment would include a fixed guideway within the Alquist-Priolo Earthquake Fault Zone.

Alternative 5 is an HRT system with a hybrid underground and aerial guideway track configuration. Aerial operations of Alternative 5 would not directly or indirectly cause the rupture of a fault because HRT trains would travel along an aerial guideway at least 15 feet above ground level. Moreover, underground operations of Alternative 5 involves traveling along a guideway ranging between 40 to 470 feet below surface level which would not cause fault rupture. Both the aerial and subterranean components would be constructed in compliance with applicable seismic and geotechnical regulatory requirements, as described and Section 3.6.1, and using established engineering practices to minimize ground disturbance and ensure structural stability in areas near active faults. Therefore, operational impacts associated with substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault would be less than significant.

Construction Impacts

Construction of Alternative 5 would occur within the Santa Monica Fault zone, north of Santa Monica Boulevard and along I-405. Aerial guideway and station construction would involve installing CIDH piles (shafts with both precast and CIP structural elements), simple spans, and longer balanced cantilever spans within the I-405 ROW, arterials, and street crossings. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 40 feet to 470 feet. Underground stations would use a "cut-and-cover" construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction. These components would be constructed in compliance with applicable seismic and geotechnical regulatory requirements, as described and Section 3.6.1, and using established engineering practices to minimize ground disturbance and ensure structural stability in areas near active faults. Alternative 5 construction would not directly or indirectly exacerbate rupture of a known earthquake fault causing substantial adverse effects, including the risk of loss, injury, or death because these elements, including the CIDH piles, TBM-excavated tunnels, and cut-and-cover stations, do not reach a depth or be of an intensity that would affect geological processes such as faults. Therefore, construction impacts related to the rupture of a fault are less than significant.

Alternative 6

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

As shown in Table 3.6-3, the Santa Monica Fault, designated as an Alquist-Priolo Earthquake Fault Zone, crosses the Alternative 6 alignment, which runs underground at this location. The fault intersects the alignment north of Massachusetts Avenue and I-405. The next nearest Alquist-Priolo Earthquake Fault Zones to Alternative 6 are the Hollywood Fault, located approximately 1.95 miles northeast of the mid-section of Alternative 6, and the Newport-Inglewood-Rose Canyon Fault, located approximately 3.14 miles northeast of the southern portion of Alternative 6.

The Alquist-Priolo Earthquake Fault Zoning Act prohibits the construction of structures for human occupancy (i.e., houses, apartments, offices, etc.) on the surface trace of active faults. However, the Alquist-Priolo Earthquake Fault Zoning Act does not prohibit the construction of non-habitable structures (i.e., not suitable to be lived in such as carport, roads, train tracks, bridges, etc.). Alternative 6 would construct a public transportation line with a fixed guideway within the Alquist-Priolo Earthquake Fault Zone. Because known active faults are capable of ground rupture under and in proximity to the proposed underground alignment, stations, and at-grade traction power substation (TPSS) sites, fault rupture would present a risk, including the risk of loss, injury, or death to transit patrons and workers during operations. For Alternative 6, this could include damage to tunnel structures and stations, and at-grade and underground TPSSs. Damage to these structures, in turn, could lead to operational and electrical hazards and compromise the safety and accessibility of Alternative 6. Despite these risks, transit structures have been and continue to be successfully designed and constructed based on mandatory design criteria as described in the following sections.

Alternative 6 is an HRT system with an underground track configuration and seven underground stations and TPSS sites. Operations of Alternative 6 would not directly or indirectly cause the rupture of a fault because the HRT trains would travel along a fixed guideway at a depth ranging between 40 to 470 feet below surface level which would not cause fault rupture. Therefore, operational impacts associated with substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault would be less than significant.

Construction Impacts

Construction of Alternative 6 would occur within the Santa Monica Fault zone, north of Santa Monica Boulevard and along I-405. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 60 feet to 750 feet. Underground stations would use a “cut-and-cover” construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction. In addition, portions of the Wilshire Boulevard/Metro D Line Station crossing underneath the Metro D Line Westwood/UCLA Station and underneath a mixed-use building at the north end of the station would be constructed using sequential excavation method (SEM) as it would not be possible to excavate the station from the surface.

Alternative 6 construction would not directly or indirectly exacerbate rupture of a known earthquake fault causing substantial adverse effects, including the risk of loss, injury, or death, because these elements do not reach a depth or be of an intensity that would affect geological processes such as faults. Therefore, construction impacts related to the rupture of a fault are less than significant.

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed (maintenance and storage facility) MSF Base Design would be located west of Hazeltine Avenue and south of the LOSSAN rail corridor ROW. The proposed MSF Base Design is not within an Alquist-Priolo Earthquake Fault Zone. The closest Alquist-Priolo Earthquake Fault Zone is the Hollywood Fault located approximately 8.5 miles southeast from the proposed MSF Base Design. Therefore, the proposed MSF would cause no impacts related to loss, injury, or death involving the rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, during operations or construction.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed MSF Design Option 1 would be located east of the I-405 overpass and south of the LOSSAN rail corridor ROW. The proposed MSF Design Option 1 is not within an Alquist-Priolo Earthquake Fault Zone. The closest Alquist-Priolo Earthquake Fault Zone is the Hollywood Fault located approximately 9.5 miles southeast from the proposed MSF Design Option 1. Therefore, no impacts related to loss, injury, or death involving the rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map during operations or construction.

Electric Bus Maintenance and Storage Facility (Alternative 1)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed Electric Bus MSF would be located west of Cotner Avenue and north of the Pico Boulevard, both of which are adjacent to I-405. The proposed Electric Bus MSF is not within the Alquist-Priolo Earthquake Fault Zone. The closest Alquist-Priolo Earthquake Fault Zone is the Santa Monica Fault located approximately 0.9 mile north from the proposed Electric Bus MSF. Therefore, no impacts related to loss, injury, or death involving the rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map during operations or construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed MSF would be located west of Woodman Avenue and south of the LOSSAN rail corridor ROW. The proposed MSF is not within the Alquist-Priolo Earthquake Fault Zone. The closest Alquist-Priolo Earthquake Fault Zone is the Hollywood Fault located approximately 8.3 miles southeast from the proposed MSF. Therefore, no impacts related to loss, injury, or death involving the rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map during operations or construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed MSF would be situated east of the existing Van Nuys Metrolink Station, bounded by the Metrolink tracks on the north, Woodman Place on the south, Hazeltine Avenue on the west, and Woodman Avenue on the east. The proposed MSF is not within the Alquist-Priolo Earthquake Fault Zone. The closest Alquist-Priolo Earthquake Fault Zone is the Hollywood Fault located approximately 8.4 miles southeast from the proposed MSF. Therefore, no impacts related to loss, injury, or death involving the rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map during operations or construction.

3.6.4.2 Impact GEO-2. Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking and/or seismic-related ground failure, including liquefaction?

Project Alternatives

No Project Alternative

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. In absence of the Project, the reasonably foreseeable transit improvement within the Project Study Area consists of rerouting the existing Metro Line 761. Other than potential for new bus stops, no habitable structures would be constructed as part of the No Project Alternative. While the No Project Alternative would be located in a seismically active region and may be subject to the effects of ground shaking, operations of the No Project Alternative would not directly or indirectly cause strong seismic ground shaking including liquefaction. Therefore, No Project Alternative would have a less than significant impact related to liquefaction during operations.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The projects associated with the No Project Alternative are located in a seismically active area. In addition, the No Project Alternative would include any construction activities associated with the rerouting of Metro Line 761. Construction associated with rerouting Metro Line 761 would be minimal and consist primarily of installing potentially new bus stops and potentially minor curb revisions. However, construction of the No Project Alternative would not have the potential to cause liquefaction because construction would not produce seismic ground shaking such that loose granular soils below the groundwater table become to liquefy. Therefore, impacts associated with construction activities related to the No Project Alternative are less than significant.

Alternative 1

<u>Impact Statement</u>

Operational Impact: Less than Significant

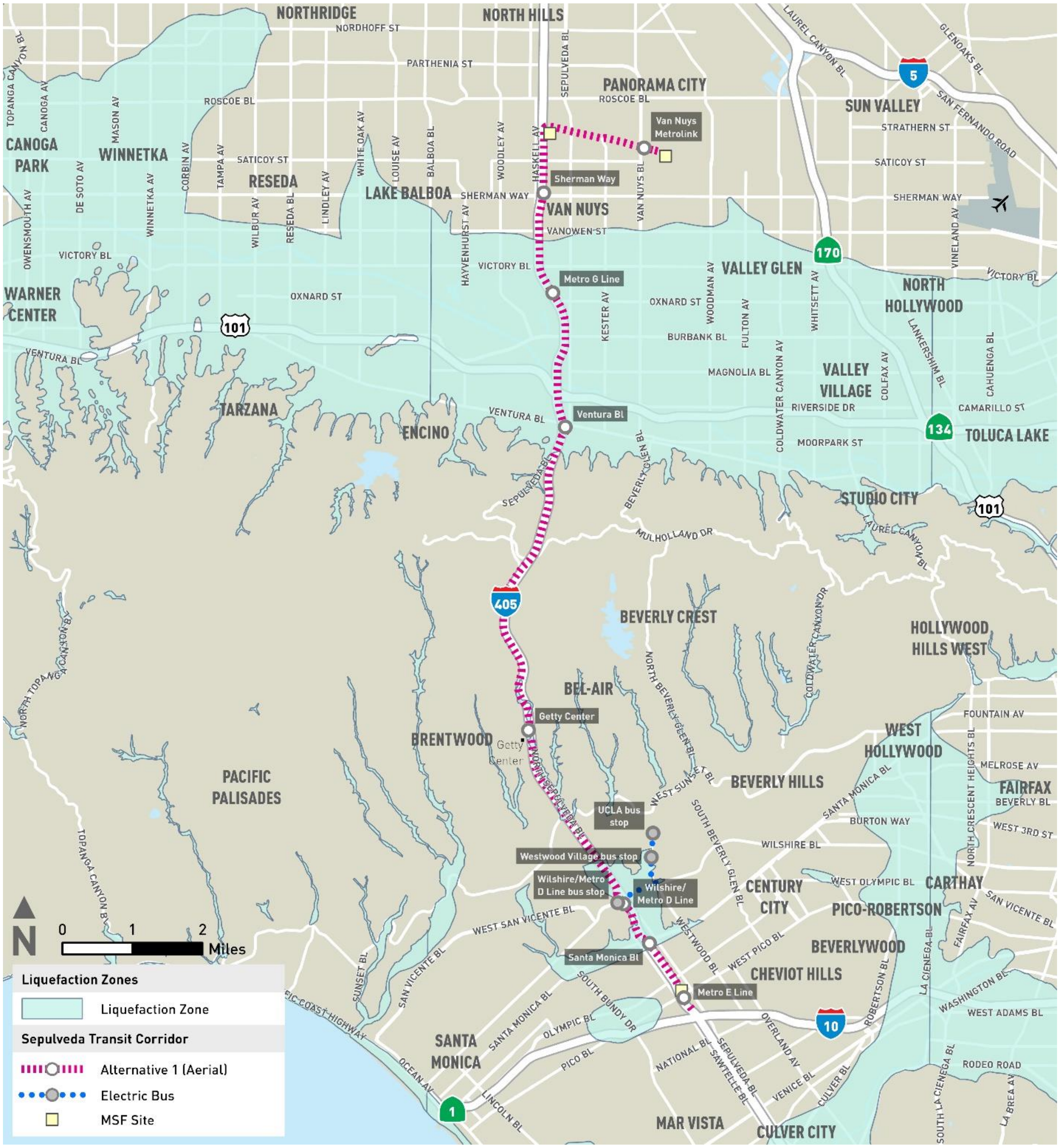
Construction Impact: Less than Significant

Operational Impacts

As previously discussed, Alternative 1 would include an entirely aerial monorail alignment that would traverse the I-405 corridor and include eight aerial monorail transit (MRT) stations and TPSS sites. As shown on Figure 3.6-22, the alignment of Alternative 1 would traverse a Liquefaction Zone. Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake.

Alternative 1, during operation activities, could experience earthquake-induced ground shaking activity because of its proximity to known active faults as shown in Table 3.6-3. However, while Alternative 1 would be located in a seismically active region and may be subject to the effects of ground shaking, operational activities associated with Alternative 1 would not directly or indirectly cause strong seismic ground shaking including liquefaction. This is because operational activities, such as the movement of monorail vehicles along the guideway and electric bus operations, would not involve ground-disturbing activities or the application of forces that could affect geological processes. As described in Section 3.6.1, the design and construction of Alternative 1 would comply with applicable seismic and geotechnical regulations, which require infrastructure in liquefaction-prone areas to incorporate engineering measures, such as reinforced foundations for the elevated guideway, to ensure that the design is capable of withstanding seismic forces during operation. Therefore, Alternative 1 would have a less than significant impact related to liquefaction during operations.

Figure 3.6-22. Alternative 1: Liquefaction Zones



Source: eGIS, 2022a; HTA, 2024

Construction Impacts

Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake. Liquefaction is more likely to happen where groundwater is moderate to shallow and the stratigraphy consists of loose, unconsolidated soils like fill and young alluvial deposits. Liquefaction is generally considered possible when the depth to groundwater is within about 50 feet from the ground surface. Much of the portion of the corridor within the Santa Monica

Mountains is not considered to be liquefiable as soil coverage is relatively thin and much of the area is underlain by bedrock. However, as shown on Figure 3.6-22, Alternative 1 traverses several Liquefaction Zones both within the San Fernando Valley and the Los Angeles Basin.

Construction of Alternative 1 would occur within the Santa Monica Fault zone, north of Santa Monica Boulevard and along I-405. This construction would involve installing CIDH piles, precast beams, and precast bent caps within the I-405 ROW. Construction activities for Alternative 1 would not reach a depth or involve ground disturbances of sufficient intensity to trigger liquefaction or affect geological processes such as faults. As a result, construction would not directly or indirectly cause strong seismic ground shaking or seismic-related ground failure. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during construction activities.

Special construction considerations to protect workers and future users of the alternative against liquefaction hazards can be found within the *Final Draft Geotechnical Design Report* (Metro, 2023b).

Alternative 3

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

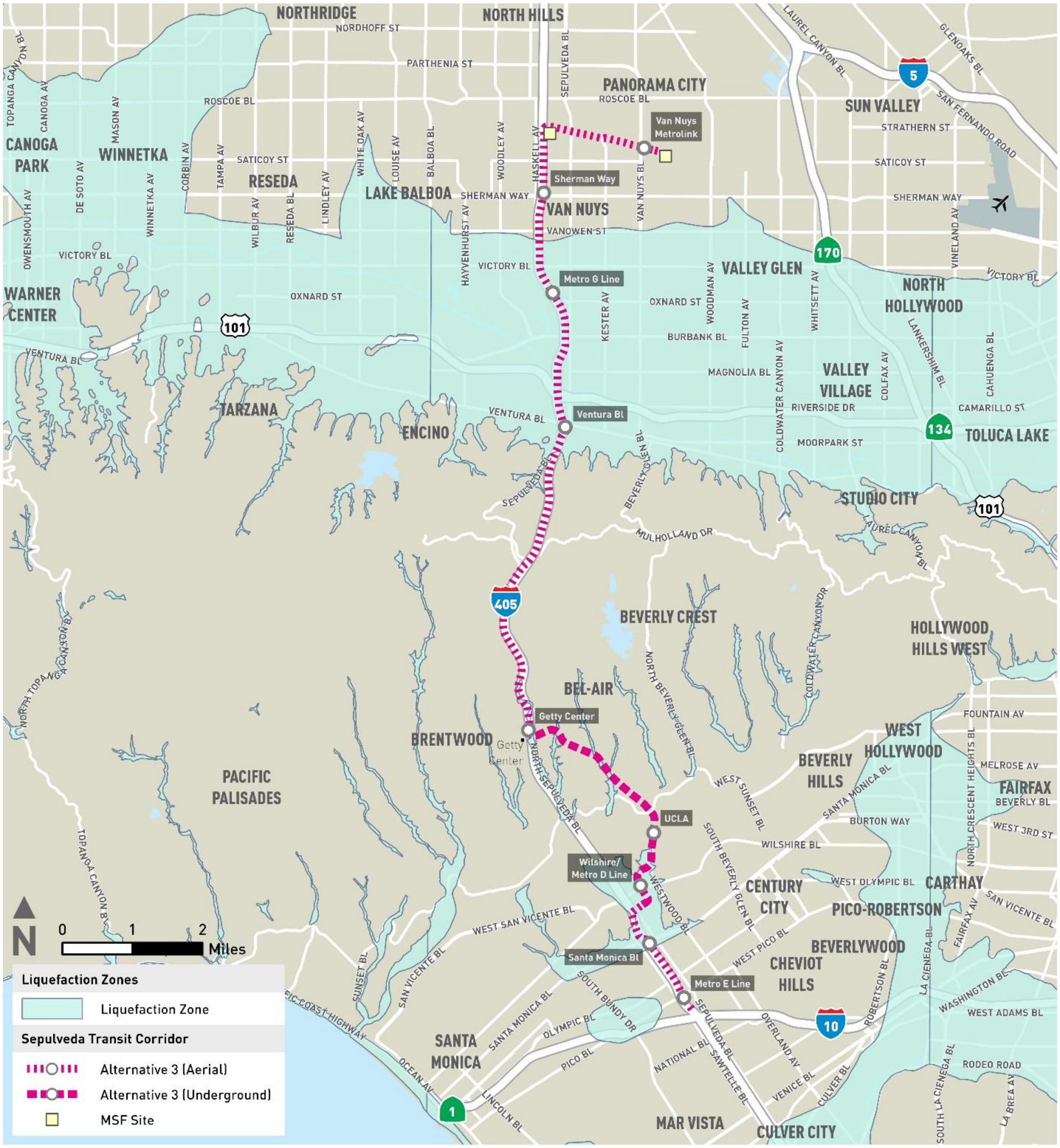
As shown on Figure 3.6-23, Alternative 3 would traverse through a Liquefaction Zone. Alternative 3, while operating both at an aerial and underground configuration, would have the same liquefaction risks as those described for Alternative 1 because they are located in the same regional seismic conditions.

During operations, Alternative 3 could experience earthquake-induced ground shaking due to its proximity to known active faults, as shown in Table 3.6-3. However, operational activities, including the movement of monorail vehicles along the elevated guideway and within the underground segment, would not involve ground-disturbing activities and would not exert forces capable of triggering liquefaction or other geological processes such as fault movement.

Further, as described in Section 3.6.1, the design and construction of Alternative 3 would comply with seismic and geotechnical regulations, which require infrastructure in liquefaction-prone areas to incorporate engineering measures, such as reinforced foundations for elevated guideways and structural stabilization for underground tunnels, to minimize risks to acceptable levels.

Therefore, Alternative 3 would have a less than significant impact related to liquefaction during operations.

Figure 3.6-23. Alternative 3: Liquefaction Zones



Source: eGIS, 2022b; HTA, 2024

Construction Impacts

Alternative 3 has the same potential liquefaction risks as Alternative 1 (both traverse through a Liquefaction Zone).

Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake. Liquefaction is more likely to happen where groundwater is moderate to shallow and the stratigraphy consists of loose, unconsolidated soils like fill and young alluvial deposits. Liquefaction is generally considered possible when the depth to groundwater is within about 50 feet from the ground surface. However, much of the portion of the corridor within the Santa Monica Mountains is not considered to be liquefiable as soil coverage is relatively thin and much of the area is underlain by bedrock.

As shown on Figure 3.6-23, Alternative 3 traverses several Liquefaction Zones both within the San Fernando Valley and the Los Angeles Basin. Aerial guideway and station construction would involve installing CIDH piles, precast beams, and precast bent caps within the I-405 ROW. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 20 feet to 300 feet. Underground stations, including the Wilshire Boulevard/Metro D Line Station and the UCLA Gateway Plaza Station, would use a “cut-and-cover” construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction.

While construction activities for the underground alignment would involve subsurface work at depths where liquefaction could potentially occur, these activities would not directly or indirectly cause seismic ground shaking or induce liquefaction because the construction processes would not be of sufficient intensity to cause geological processes such as faults or liquefaction. Moreover, as described in Section 3.6.1, the construction of Alternative 3 would adhere to seismic and geotechnical regulations, which would require appropriate engineering measures to ensure that liquefaction risks do not exceed unacceptable levels. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during construction activities.

Special construction considerations to protect workers and future users of the alternative against liquefaction hazards can be found within the *Final Draft Geotechnical Design Report* (Metro, 2023b).

Alternative 4

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

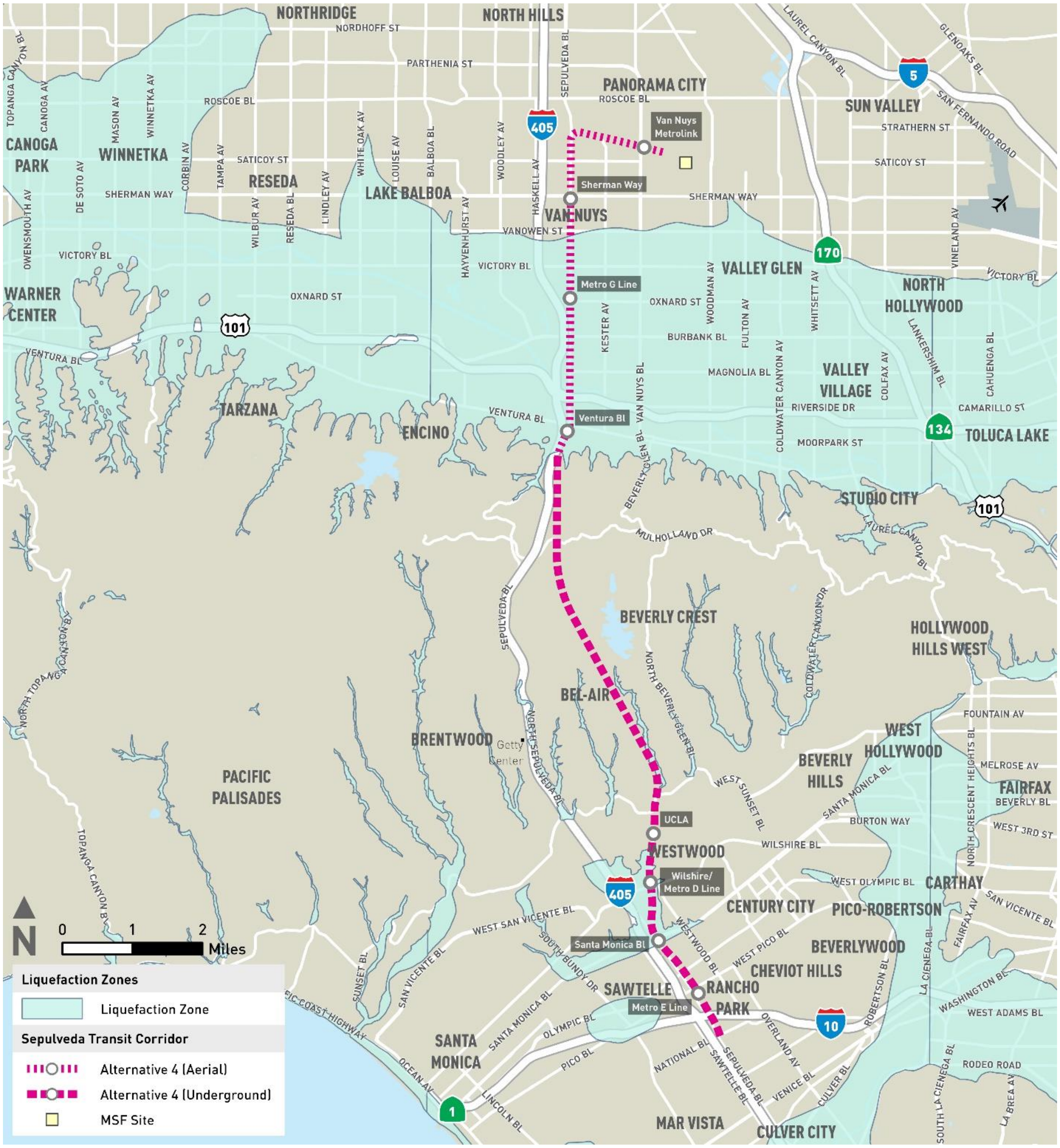
Operational Impacts

As shown on Figure 3.6-24, the alignment of Alternative 4 would traverse a Liquefaction Zone. Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake.

During operations, Alternative 4 could experience earthquake-induced ground shaking due to its proximity to known active faults, as shown in Table 3.6-3. However, operational activities, including the movement of HRT trains along the elevated guideway and within the underground segment, would not involve ground-disturbing activities and would not exert forces capable of triggering liquefaction or other geological processes such as fault movement.

Further, as described in Section 3.6.1, the design and construction of Alternative 4 would comply with seismic and geotechnical regulations, which require infrastructure in liquefaction-prone areas to incorporate engineering measures, such as reinforced foundations for elevated guideways and structural stabilization for underground tunnels, to minimize risks to acceptable levels. Therefore, Alternative 4 would have a less than significant impact related to liquefaction during operations.

Figure 3.6-24. Alternative 4: Liquefaction Zones



Source: eGIS, 2022b; HTA, 2024

Construction Impacts

Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake. Liquefaction is more likely to happen where groundwater is moderate to shallow and the stratigraphy consists of loose, unconsolidated soils like fill and young alluvial deposits. Liquefaction is generally considered possible when the depth to groundwater is within about 50 feet from the ground surface. Much of the portion of the corridor within the Santa Monica

Mountains is not considered to be liquefiable as soil coverage is relatively thin and much of the area is underlain by bedrock. As shown on Figure 3.6-24, Alternative 4 traverses several Liquefaction Zones both within the San Fernando Valley and the Los Angeles Basin.

Construction of Alternative 4 would occur within liquefaction zones, both within the San Fernando Valley and the Los Angeles Basin. Aerial guideway and station construction would involve installing CIDH piles (shafts with both precast and CIP structural elements), simple spans, and longer balanced cantilever spans within the I-405 ROW, arterials, and street crossings. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 40 feet to 470 feet. Underground stations would use a “cut-and-cover” construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction.

While construction activities for the underground alignment would involve subsurface work at depths where liquefaction could potentially occur, these activities would not directly or indirectly cause seismic ground shaking or induce liquefaction because the construction processes would not be of sufficient intensity to cause geological processes such as faults or liquefaction. Moreover, as described in Section 3.6.1, the construction of Alternative 4 would adhere to seismic and geotechnical regulations, which would require appropriate engineering measures to ensure that liquefaction risks do not exceed unacceptable levels. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during construction activities.

Special construction considerations to protect workers and future users of the alternative against liquefaction hazards can be found within the *Final Draft Geotechnical Design Report* (Metro, 2023b).

Alternative 5

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

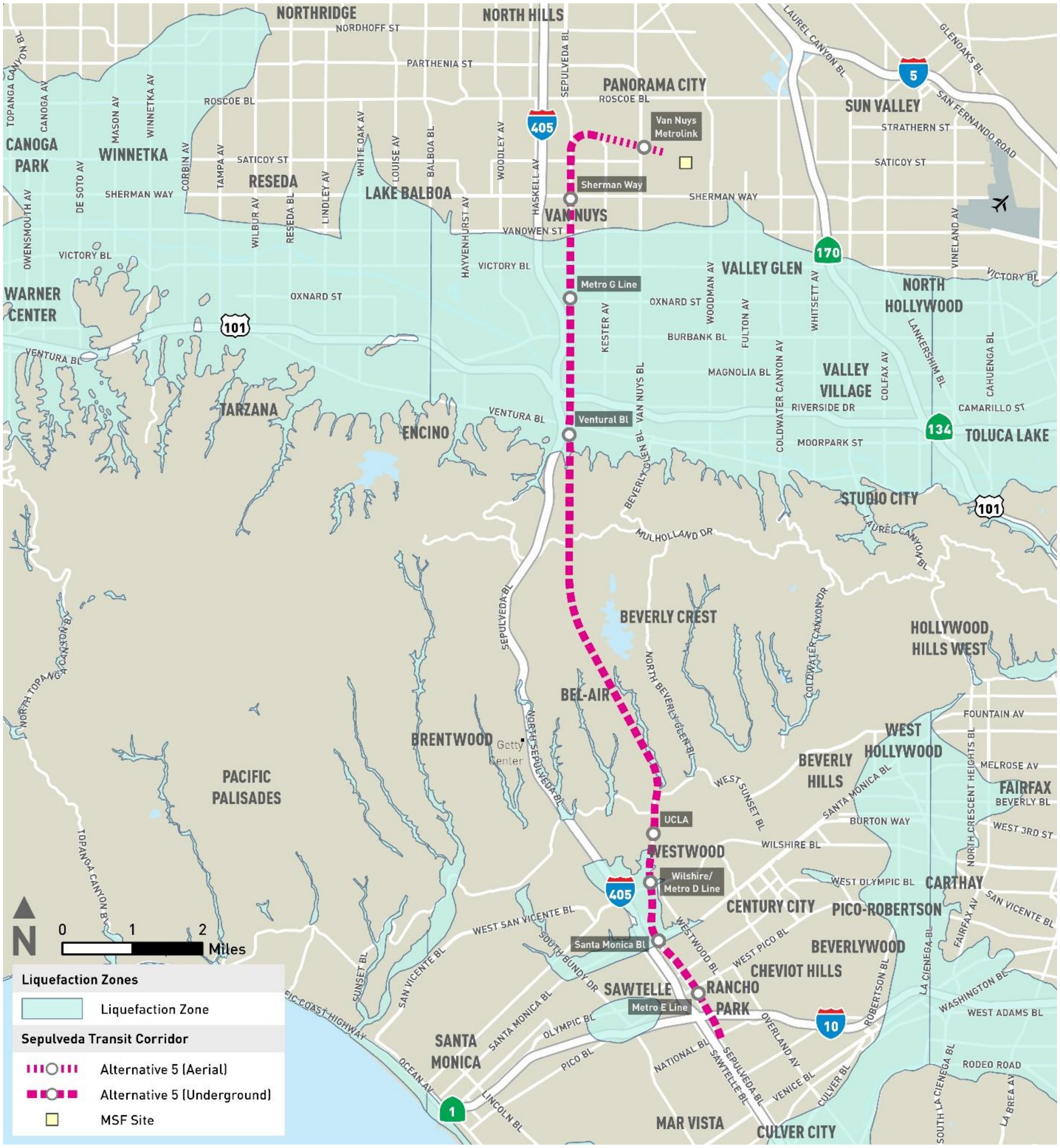
As shown on Figure 3.6-25, the alignment of Alternative 5 would traverse a Liquefaction Zone. Alternative 5 would have the same liquefaction risks as those described for Alternative 4 because they would both be located in the same region.

During operations, Alternative 5 could experience earthquake-induced ground shaking due to its proximity to known active faults, as shown in Table 3.6-3. However, operational activities, including the movement of HRT trains along the elevated guideway and within the underground segment, would not involve ground-disturbing activities and would not exert forces capable of triggering liquefaction or other geological processes such as fault movement.

Further, as described in Section 3.6.1, the design and construction of Alternative 5 would comply with seismic and geotechnical regulations, which require infrastructure in liquefaction-prone areas to incorporate engineering measures, such as reinforced foundations for elevated guideways and structural stabilization for underground tunnels, to minimize risks to acceptable levels.

As such, the potential impacts related to seismic-related ground failure liquefaction would be less than significant during operations.

Figure 3.6-25. Alternative 5: Liquefaction Zones



Source: eGIS, 2022b; HTA, 2024

Construction Impacts

Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake. Liquefaction is more likely to happen where groundwater is moderate to shallow and the stratigraphy consists of loose, unconsolidated soils like fill and young alluvial deposits. Liquefaction is generally considered possible when the depth to groundwater is within about 50 feet from the ground surface. Much of the portion of the corridor within the Santa Monica

Mountains is not considered to be liquefiable as soil coverage is relatively thin and much of the area is underlain by bedrock. As shown on Figure 3.6-25, Alternative 5 traverses several Liquefaction Zones both within the San Fernando Valley and the Los Angeles Basin. Construction of Alternative 5 would occur within liquefaction zones, both within the San Fernando Valley and the Los Angeles Basin. Aerial guideway and station construction would involve installing CIDH piles (shafts with both precast and CIP structural elements), simple spans, and longer balanced cantilever spans within the I-405 ROW, arterials, and street crossings. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 40 feet to 470 feet. Underground stations would use a “cut-and-cover” construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction.

While construction activities for the underground alignment would involve subsurface work at depths where liquefaction could potentially occur, these activities would not directly or indirectly cause seismic ground shaking or induce liquefaction because the construction processes would not be of sufficient intensity to cause geological processes such as faults or liquefaction. Moreover, as described in Section 3.6.1, the construction of Alternative 5 would adhere to seismic and geotechnical regulations, which would require appropriate engineering measures to ensure that liquefaction risks do not exceed unacceptable levels.

Special construction considerations to protect workers and future users of the alternative against liquefaction hazards can be found within the *Final Draft Geotechnical Design Report* (Metro, 2023b).

Alternative 6

<u>Impact Statement</u>

Operational Impact: Less than Significant

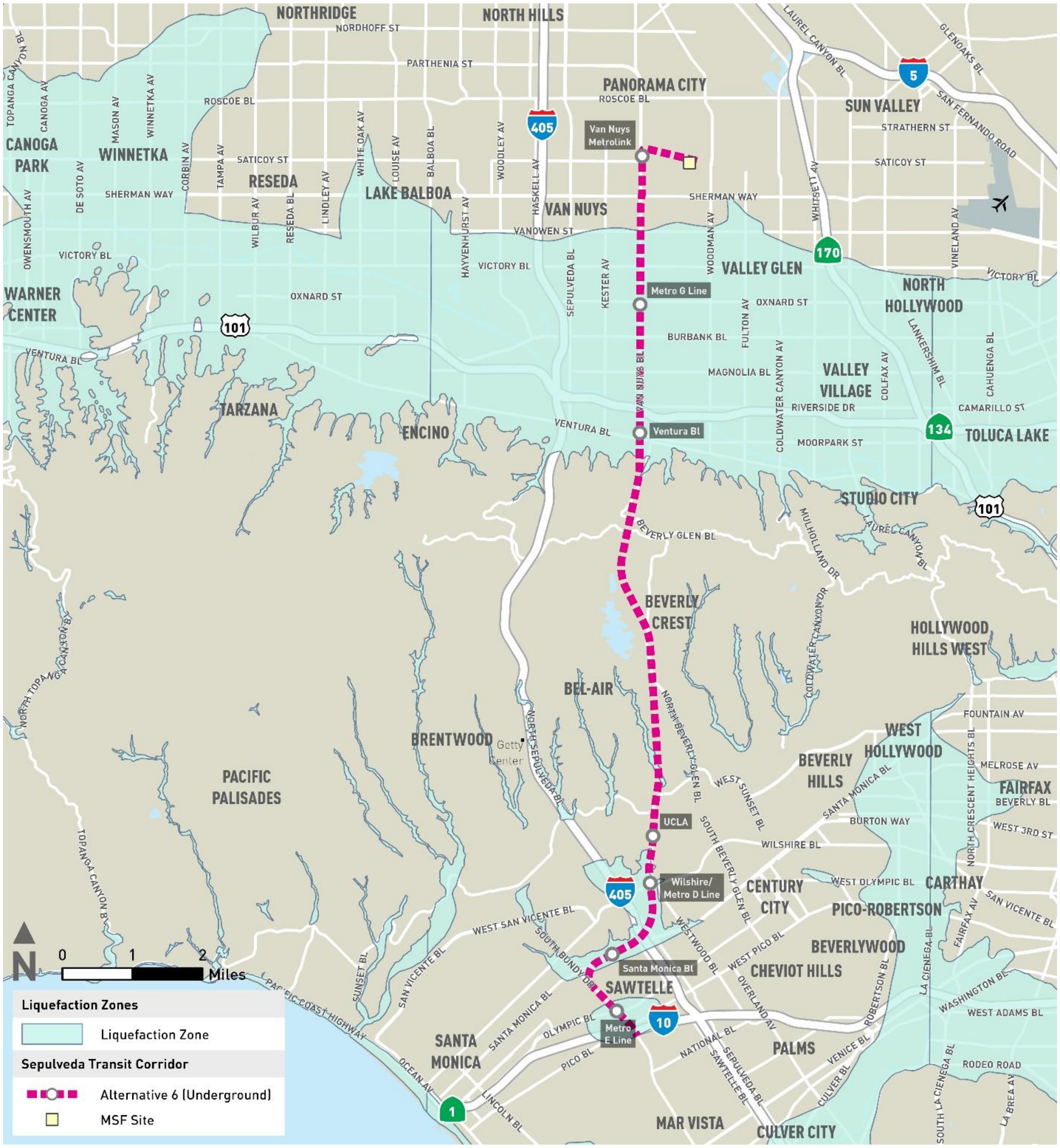
Construction Impact: Less than Significant

Operational Impacts

As shown on Figure 3.6-26, the alignment of Alternative 6 would traverse a Liquefaction Zone. Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake.

During operational activities, Alternative 6 could experience earthquake-induced ground shaking activity because of its proximity to known active faults as shown in Table 3.6-3 However, while Alternative 6 would be located in a seismically active region and may be subject to the effects of ground shaking, operational activities associated with Alternative 6 would not directly or indirectly cause strong seismic ground shaking including liquefaction because operations would not affect geological processes such as faults. Therefore, Alternative 6 would have a less than significant impact related to liquefaction during operations.

Figure 3.6-26. Alternative 6: Liquefaction Zones



Source: eGIS, 2022b; HTA, 2024

Construction Impacts

Liquefaction occurs when a mass of saturated soil loses significant strength and stiffness due to applied stress, usually from an earthquake. Liquefaction is more likely to happen where groundwater is moderate to shallow and the stratigraphy consists of loose, unconsolidated soils like fill and young alluvial deposits. Liquefaction is generally considered possible when the depth to groundwater is within about 50 feet from the ground surface. Much of the portion of the corridor within the Santa Monica

Mountains is not considered to be liquefiable as soil coverage is relatively thin and much of the area is underlain by bedrock. As shown on Figure 3.6-26, Alternative 6 traverses several Liquefaction Zones both within the San Fernando Valley and the Los Angeles Basin.

Construction of Alternative 6 would occur within liquefaction zones, both within the San Fernando Valley and the Los Angeles Basin. A TBM would be used to construct the underground segment of the guideway. Tunneling depth would range between 60 feet to 750 feet. Underground stations would use a “cut-and-cover” construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction. In addition, portions of the Wilshire Boulevard/Metro D Line Station crossing underneath the Metro D Line Westwood/UCLA Station and underneath a mixed-use building at the north end of the station would be constructed using SEM as it would not be possible to excavate the station from the surface.

While TBM construction of the Alternative 6 would reach a depth that could cause ground disturbances thereby inducing liquefaction, construction of the underground alignment would not directly or indirectly cause strong seismic ground shaking and/or seismic-related ground failure. This is because construction activities of Alternative 6 do not reach a depth or be of an intensity that would affect geological processes such as faults. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during construction activities.

Special construction considerations to protect workers and future users of the alternative against liquefaction hazards can be found within the *Final Draft Geotechnical Design Report* (Metro, 2023b).

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

The proposed MSF Base Design would be located west of Hazeltine Avenue and south of the LOSSAN rail corridor ROW. The site would include the following facilities:

- Primary maintenance building that would include administrative offices, operations control center and maintenance shop and office
- Train car wash building
- Emergency generator
- TPSS
- Maintenance-of-way (MOW) building
- Parking area for employees

Operation and construction of the proposed MSF Base Design do not involve extensive excavation and do not reach a depth or be of an intensity that would affect geological processes such as faults. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during operation and construction.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

The proposed MSF Design Option 1 would be located east of the I-405 overpass and south of the LOSSAN rail corridor ROW.

The site would include the following facilities:

- Primary entrance with guard shack
- Primary maintenance building that would include administrative offices, an operations control center, and a maintenance shop and office
- Train car wash building
- Emergency generator
- TPSS
- MOW building
- Parking area for employees

Operation and construction of the proposed MSF Design Option 1 do not involve extensive excavation and do not reach a depth or be of an intensity that would affect geological processes such as faults. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during operation and construction.

Electric Bus Maintenance and Storage Facility (Alternative 1)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

An electric bus MSF would be located on the northwest corner of Pico Boulevard and Cotner Avenue and would be designed to accommodate 14 electric buses. The site would be approximately 2 acres and would comprise six parcels bounded by Cotner Avenue to the east, I-405 to the west, Pico Boulevard to the south, and the I-405 northbound on-ramp to the north.

The site would include approximately 45,000 square feet of buildings and include the following facilities:

- Maintenance shop and bay
- Maintenance office
- Operations center
- Bus charging equipment
- Parts storeroom with service areas
- Parking area for employees

Operation and construction of the proposed electric bus MSF do not involve extensive excavation and do not reach a depth or be of an intensity that would affect geological processes such as faults. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during operation and construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

The HRT MSF for Alternative 4 and 5 would be located east of the Van Nuys Metrolink Station and would encompass approximately 46 acres. The HRT MSF would be designed to accommodate 184 rail cars and would be bounded by single-family residences to the south, the LOSSAN rail corridor to the north, Woodman Avenue on the east, and Hazeltine Avenue and industrial manufacturing enterprises to the west. Trains would access the site from the fixed guideway's tail tracks at the northwest corner of the site. Trains would then travel southeast to maintenance facilities and storage tracks.

The site would include the following facilities:

- Two entrance gates with guard shacks
- Main shop building
- MOW building
- Storage tracks
- Carwash building
- Cleaning and inspections platforms
- Material storage building
- Hazmat storage locker
- TPSS located on the west end of the MSF to serve the mainline
- TPSS located on the east end of the MSF to serve the yard and shops
- Parking area for employees
- Grade-separated access roadway (over the HRT tracks at the east end of the facility, and necessary drainage)

Operation and construction of the proposed HRT MSF do not involve extensive excavation and do not reach a depth or be of an intensity that would affect geological processes such as faults. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during operation and construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

The HRT MSF for Alternative 6 would be located east of the Van Nuys Metrolink Station and would encompass approximately 41 acres. The MSF would be designed to accommodate 94 vehicles and would be bounded by single-family residences to the south, the LOSSAN rail corridor to the north, Woodman Avenue to the east, and Hazeltine Avenue and industrial manufacturing enterprises to the west. Heavy rail trains would transition from underground to an at-grade configuration near the MSF, the northwest corner of the site. Trains would then travel southeast to maintenance facilities and storage tracks.

The site would include the following facilities:

- Two entrance gates with guard shacks
- Maintenance facility building
- MOW facility
- Storage tracks
- Carwash
- Cleaning platform
- Administrative offices
- Pedestrian bridge connecting the administrative offices to employee parking
- Two TPSSs

Operation and construction of the proposed HRT MSF do not involve extensive excavation and do not reach a depth or be of an intensity that would affect geological processes such as faults. As such, impacts related to seismic ground shaking including liquefaction would be less than significant during operation and construction.

3.6.4.3 Impact GEO-3. Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?

Project Alternatives

No Project Alternative

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The rerouted Metro Line 761 would utilize existing streets and highways that are not typically subject to landslides. Portions of I-405 along the bus route are located within designated landslide zones; however, the existing Metro Line 761 already operates along the same stretch of I-405. These operational activities do not have the potential to cause landslides and impacts would be less than significant during operations.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The CBC*,* County of Los Angeles, and City of Los Angeles guidelines as well as by Cal/OSHA contains site-specific slope-stability design standards as requirements for stabilization. No construction activities associated with the rerouting of Metro Line 761 would occur within a landslide zone. These construction activities do not have the potential to cause landslides and impacts associated with landslides and/or slope instability during construction activities would be less than significant.

Alternative 1

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

As shown on Figure 3.6-27, Alternative 1 would traverse the Santa Monica Mountains, which are within a designated Landslide Hazard Zone (LHZ) and contain areas prone to landslides. Alternative 1 would include an entirely aerial monorail alignment that would traverse the I-405 corridor and include eight aerial monorail transit (MRT) stations and TPSS sites. The segments for the aerial alignment and stations extending along the west side of I-405 between Getty Center Drive and Bel Air Crest Road, and the east side of I-405 into the Bel Air community along the south side of the Santa Monica Mountains have a potential for seismic-induced landslides where ground surfaces consist of steep slopes. The *Final Draft Geotechnical Design Report* has identified that the elevated guideway structure would be predominately located within the I-405 ROW and generally stay above the top of the existing slopes extending along the west side of I-405 (Metro, 2023a). As a result, the guideway would generally not interact with the slopes themselves, thereby minimizing the risk of slope instability and interference with the existing topography.

According to the Caltrans Geotechnical Manual, the most adverse slope behavior is greatly influenced by water (Caltrans, 2020). Concentrated storm runoff can result in severe slope erosion leading to a loss of structural support and catastrophic failure. Perched groundwater and infiltration from irrigation, rainfall, or snowmelt frequently cause landslides. However, as discussed in Section 3.6.4.4, impacts related to topsoil erosion and water infiltration are managed separately and would not directly influence the operational impacts related to landslides.

Earthquake-induced landslides are slope failures/movements that occur from shaking during an earthquake event. Operational activities associated with Alternative 1 would not directly or indirectly cause strong seismic ground shaking including landslides as these activities would not involve interaction with geological processes such as faults or the alteration of natural slopes.

According to the USGS, certain human activities can cause landslides. They are commonly a result of building roads and structures without adequate grading of slopes, poorly planned alteration of drainage patterns, and disturbing old landslides (USGS, 2024). However, operational activities for Alternative 1 would not involve grading of slopes, modification of drainage systems, or disturbance of existing landslides. Additionally, the design of Alternative 1 would minimize interaction with natural slopes by employing an elevated guideway positioned above steep terrain and avoiding direct contact with unstable areas. The design would also incorporate drainage and erosion control measures to prevent water-related slope instability and comply with applicable geotechnical and engineering standards described in Section 3.6.1. Therefore, Alternative 1 would have a less than significant impact related to landslides during operations.

Construction Impacts

The Santa Monica Mountains are within a designated LHZ, as shown on Figure 3.6-27. Alternative 1 would include an entirely aerial monorail alignment that would traverse the I-405 corridor and include eight aerial MRT stations and TPSS sites. Areas that affect the existing slope along I-405 and increase landslides would be further investigated consistent with local requirements for slope stability during the design phase when site-specific data and final geometry of improvements are available. The foundation types would be determined as part of the required geotechnical investigation conducted during the final design phase and would ensure that the potential for landslides would not cause potential for substantial adverse effects, including the risk of loss, injury, or death.

Construction activities for Alternative 1 would include widening the freeway and demolishing and rebuilding the retaining walls that hold back the mountains. Retaining-wall construction would occur in the Sepulveda Pass at the proposed reconfigured northbound I-405 Getty On-Ramp and require the excavation of existing hills and slopes within the Santa Monica Mountains. Temporary engineering structures, such as shoring or bracing, would be erected to support the retaining walls while excavation is underway. However, because these activities would occur within a designated LHZ, there is a heighted risk of landslides, particularly during periods of heavy rainfall or seismic activity. Such landslides could result in the destabilization of the slopes, potentially leading to injury or death of construction workers and substantial damage to the infrastructure under construction.

To address these risks, all grading and construction activities would be carried out in compliance with the regulatory requirements defined in Section 3.6.1, including state regulations and the equivalent seismic design criteria such as the MRDC, to account for the portion of Alternative 1 that would be within a landslide zone. The final design of the retaining walls and the temporary engineering required to construct them would abide with structural engineering standards set forth in the provisions listed in the CBC.

Figure 3.6-27. Alternative 1: Landslide Hazard Zones

Source: eGIS, 2022b; HTA, 2024

Alternative 1 would be compliance with the regulatory requirements as defined in PM GEO-1 through PM GEO-3. PM GEO-1 requires a site-specific slope-stability design, and a design to address landslide potentials as required by the standards contained in the CBC and County of Los Angeles and City of Los Angeles guidelines, as well as by Cal/OSHA requirements for stabilization. Alternative 1 would include manufactured slopes in the retention basins, which would occur mostly on the perimeter of the sites. PM GEO-2 would recommend site-specific evaluations of unstable soil conditions and also provides recommendations for necessary ground preparation in conformance with CBC and other applicable regulations. Finally, PM GEO-3 would require that the alternative demonstrate that the design complies with all applicable provisions including the CBC.

Provisions provided in the CBC relating to the construction and design of the retaining walls include requirements for foundation and soil investigations, excavation, grading, fill-allowable, and load-bearing values of soils. Section 1810 of the CBC also includes regulations related to the design of footings, foundations, and slope clearances, retaining walls, and pier, pile, driven, and CIP foundation support systems. Chapter 33 of the CBC includes requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes. CBC Appendix J includes grading requirements for the design of excavations and fills (Sections J106 and J107) and for erosion control (Section J110). Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in Cal/OSHA regulations (CCR Title 8).

In terms of temporary slopes, excavation activities at Alternative 1 could occur in unstable soils. In general, the risk of slope failure is considered higher for temporary slopes due to generally steeper gradients versus permanent, manufactured slopes. Similar to the construction of permanent slopes, temporary slopes would be required to adhere to the Cal/OSHA and CBC requirements for shoring and stabilization. In summary, the design and construction of Alternative 1 would be in compliance with the regulatory requirements as defined in PM GEO-1, PM GEO-2, and PM GEO-3 as integral components of the project. These measures would provide site-specific slope stability designs, evaluations of unstable soil conditions, and necessary ground preparation to address landslide potentials and slope stability. Combined with adherence to applicable regulatory standards, including the CBC and Cal/OSHA requirements, these project measure ensure that impacts associated with landslides and/or slope instability during construction activities would be less than significant.

Alternative 3

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

As shown on Figure 3.6-28, Alternative 3 would traverse the Santa Monica Mountains, which are within a designated LHZ. The tunnel portal for the proposed Alternative 3 underground alignment would be located within a designated LHZ. Alternative 3 would have the same landslide risks as those described for Alternative 1. Please refer to the Operational Impact section in Alternative 1 for details on landslide risks. Operation of Alternative 3 would not involve grading, excavation, or other actions that could destabilize slopes or exacerbate landslide risks. Furthermore, the design of Alternative 3 would comply with the regulatory requirements described in Section 3.6.1, which would measures ensure the Alternative 3 infrastructure is designed to withstand natural slope movement and minimize interaction with unstable areas. Therefore, operation activities related to Alternative 3 would have a less than significant impact.

Construction Impacts

The aerial portions of Alternative 3 would have the same potential landslide risks as Alternative 1, and the same CBC design requirements and project measures described in Alternative 1 would be applicable to Alternative 3. Please refer to the Construction Impact section in Alternative 1 for details on landslide risks and associated geotechnical design requirements and regulations.

As shown on Figure 3.6-28, the tunnel portal for the proposed Alternative 3 underground alignment would be located within a LHZ making it vulnerable to landslide activity, which could impact the stability of the tunnel and surrounding infrastructure. Alternative 3 would require a site-specific slope-stability design, and design to address landslide potentials as required by the standards contained in the CBC and County of Los Angeles and City of Los Angeles guidelines, as well as by Cal/OSHA requirements for stabilization. Alternative 3 would include manufactured slopes (using grading techniques) in the retention basins which would mostly occur at the perimeter of the sites where they would also serve as a buffer to protect the tunnel and surrounding infrastructure from landslide-related hazards. Retention basins would be designed with due consideration for slope stability ensuring that they do not create additional landslide risk.

The combination of site-specific slope-stability design, compliance with applicable regulatory requirements, and the use of manufactured slopes and retention basins is anticipated to effectively manage constructed-slope instability such that impacts associated with constructed-slope instability, including landslides, are reduced, but may still be potentially significant.

Figure 3.6-28. Alternative 3: Landslide Hazard Zones

Source: eGIS, 2022b; HTA, 2024

This is particularly true for temporary slopes, as excavation activities for Alternative 3 within Landslide Zones could encounter unstable soils. Temporary slopes generally pose a higher risk of slope failure due to their steeper gradients compared to permanent, manufactured slopes. Similar to permanent slope construction, temporary slopes would be required to comply with Cal/OSHA requirements for shoring and stabilization.

To address these significant impacts, mitigation measure (MM) GEO-2 would be implemented so that any excavations for the construction of the underground segment of Alternative 3 would shore excavation walls or flatten or "lay back" the excavation walls to a shallower gradient as required by applicable local, state, or federal laws or regulations to ensure stability of temporary slopes.

With the implementation of MM GEO-2, the impacts associated with landslides and/or slope instability during construction activities would be reduced to less than significant.

Alternative 4

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

As shown on Figure 3.6-29, the underground segment of Alternative 4 would traverse the Santa Monica Mountains, which are within a designated LHZ and contain surface areas prone to landslides.

According to the Caltrans Geotechnical Manual, the most adverse slope behavior is greatly influenced by water (Caltrans, 2020). Concentrated storm runoff can result in severe slope erosion leading to a loss of structural support and catastrophic failure. Perched groundwater and infiltration from irrigation, rainfall, or snowmelt frequently cause landslides. However, as discussed in Section 3.6.4.4, impacts related to topsoil erosion and water infiltration are managed separately and would not directly influence the operational impacts related to landslides.

Earthquake-induced landslides are slope failures/movements that occur from shaking during an earthquake event. Operational activities associated with Alternative 4 would not directly or indirectly cause strong seismic ground shaking including landslides as these activities would not involve interaction with geological processes such as faults or the alteration of natural slopes.

According to the USGS, certain human activities can cause landslides. They are commonly a result of building roads and structures without adequate grading of slopes, poorly planned alteration of drainage patterns, and disturbing old landslides (USGS, 2024). However, operational activities for Alternative 4 would not involve grading of slopes, modification of drainage systems, or disturbance of existing landslides. Additionally, the design of Alternative 4 would minimize interaction with natural slopes by employing an elevated guideway positioned above steep terrain and avoiding direct contact with unstable areas. The design would also incorporate drainage and erosion control measures to prevent water-related slope instability and comply with applicable geotechnical and engineering standards described in Section 3.6.1. Therefore, Alternative 4 would have a less than significant impact related to landslides during operations.

Construction Impacts

As shown on Figure 3.6-29, the tunnel portal for Alternative 4 traverses through the Santa Monica Mountains which are within a designated LHZ making construction near surface-level soils vulnerable to inducing a landslide. As such, the impacts associated with a landslide hazard within the Santa Monica Mountains are potentially significant.

However, the portions of Alternative 4 that cross the LHZ would be situated deep underground in this location and the risk of landslides would be low. According to the *Final Draft Geotechnical Design Report* (Metro, 2023b), the north tunnel portal in Sherman Oaks would be the most impacted section of the

Alternative 4 alignment in terms of landslide risk. The Modelo Formation, which consists of diatomaceous shale, is exposed in a slope in this area. The layers of this shale are angled toward the north, which is not ideal for the proposed portal excavation. To improve long-term slope stability in this area, Alternative 4 may install an anchored retaining wall or use ground anchors (Metro, 2023b).

Consistent with local requirements, further investigations into the slope along I-405 would be conducted during the design phase when site-specific data and final geometry of improvements are available. The foundation types would be determined as part of the required site-specific geotechnical investigation conducted during the final design phase and would ensure that the potential for landslides would not cause potential for substantial adverse effects, including the risk of loss, injury, or death.

Construction activities for Alternative 4 would also include the installation of the portal in the Sherman Oaks community. Temporary engineering would be erected to support the retaining wall during cut-and-cover excavation. These activities would be located within a designated LHZ, and potential landslides during construction could cause injury or death to construction workers.

Construction of Alternative 4 would adhere to existing regulations and the provisions listed in the CBC and equivalent design criteria as the MRDC that require site-specific geotechnical evaluation during the final design phase that would include specific structural engineering recommendations. Grading and construction activities would be carried out in compliance with the regulatory requirements defined in Section 3.6.1, including state regulations and the equivalent design criteria such as the MRDC, to account for the portion of Alternative 4 that would be within an LHZ.

The final design of the tunnel portal's retaining walls, and its temporary engineering would abide with structural engineering standards set forth in the provisions listed in the CBC. The CBC provisions that relate to the construction and design of the retaining walls include the requirements for foundation and soil investigations, excavation, grading, and fill-allowable, load-bearing values of soils. The CBC provision also relates to design of footings, foundations, and slope clearances, retaining walls, and pier, pile, driven, and CIP foundation support systems (Section 1810). Chapter 33 includes requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes). Appendix J includes grading requirements for the design of excavations and fills (Sections J106 and J107) and for erosion control (Section J110). Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in Cal/OSHA regulations (CCR Title 8).

Figure 3.6-29. Alternative 4: Landslide Hazard Zones

Source: eGIS, 2022b; HTA, 2024

Alternative 4 would require a site-specific slope-stability design to ensure adherence to the standards contained in the CBC and any County of Los Angeles and City of Los Angeles guidelines, as well as by Cal/OSHA requirements for stabilization. Alternative 4 would include manufactured slopes (using grading techniques) in the retention basins, which would mostly occur on the perimeter of the construction sites where they would also serve as a buffer to protect the tunnel and surrounding infrastructure from landslide-related hazards. Retention basins would be designed with due consideration for slope stability.

The combination of site-specific slope-stability design, compliance with applicable regulatory requirements, and the use of manufactured slopes and retention basins is anticipated to effectively manage constructed-slope instability such that impacts associated with constructed-slope instability, including landslides, are reduced, but may still be potentially significant.

This is particularly true for temporary slopes, as excavation activities for Alternative 4 within Landslide Zones could encounter unstable soils. Temporary slopes generally pose a higher risk of slope failure due to their steeper gradients compared to permanent, manufactured slopes. Similar to permanent slope construction, temporary slopes would be required to comply with Cal/OSHA requirements for shoring and stabilization.

To address these significant impacts, MM GEO-2 would be implemented so that any excavations for the construction of the underground segment of Alternative 4 would shore excavation walls or flatten or "lay back" the excavation walls to a shallower gradient as required by applicable local, state, or federal laws or regulations to ensure stability of temporary slopes.

With the implementation of MM GEO-2, the impacts associated with landslides and/or slope instability during construction activities would be reduced to less than significant.

Alternative 5

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

As shown on Figure 3.6-30, Alternative 5 would traverse the Santa Monica Mountains which are within a designated LHZ and contain surface areas prone to landslides.

According to the Caltrans Geotechnical Manual, the most adverse slope behavior is greatly influenced by water (Caltrans, 2020). Concentrated storm runoff can result in severe slope erosion leading to a loss of structural support and catastrophic failure. Perched groundwater and infiltration from irrigation, rainfall, or snowmelt frequently cause landslides. However, as discussed in Section 3.6.4.4, impacts related to topsoil erosion and water infiltration are managed separately and would not directly influence the operational impacts related to landslides.

Earthquake-induced landslides are slope failures/movements that occur from shaking during an earthquake event. Operational activities associated with Alternative 5 would not directly or indirectly cause strong seismic ground shaking including landslides as these activities would not involve interaction with geological processes such as faults or the alteration of natural slopes.

According to the USGS, certain human activities can cause landslides. They are commonly a result of building roads and structures without adequate grading of slopes, poorly planned alteration of drainage patterns, and disturbing old landslides (USGS, 2024). However, operational activities for Alternative 5 would not involve grading of slopes, modification of drainage systems, or disturbance of existing landslides. Additionally, the design of Alternative 5 would minimize interaction with natural slopes by employing an elevated guideway positioned above steep terrain and avoiding direct contact with unstable areas. The design would also incorporate drainage and erosion control measures to prevent water-related slope instability and comply with applicable geotechnical and engineering standards described in Section 3.6.1.Therefore, Alternative 5 would have a less than significant impact related to landslides during operations.

Construction Impacts

As shown on Figure 3.6-30, Alternative 5 traverses underground through the Santa Monica Mountains, a designated LHZ. This makes the landslide-related hazards during construction of the tunnel and surrounding infrastructure vulnerable and thus potentially significant.

However, Alternative 5 would be situated deep underground in this location and the risk of landslides would be low. Additionally, the portions of Alternative 5 that cross the LHZ would be situated deep underground in this location and the risk of landslides would be low. According to the *Final Draft Geotechnical Design Report* (Metro, 2023b), the north tunnel portal in Sherman Oaks would be the most impacted section of the Alternative 5 alignment in terms of landslide risk. The Modelo Formation, which consists of diatomaceous shale, is exposed in a slope in this area. The layers of this shale are angled toward the north, which is not ideal for the proposed portal excavation. To improve long-term slope stability in this area, Alternative 5 may install an anchored retaining wall or use ground anchors (Metro, 2023b).

Consistent with local requirements, further investigations into the slope along I-405 would be conducted during the design phase when site-specific data and final geometry of improvements are available. The foundation types would be determined as part of the required site-specific geotechnical investigation conducted during the final design phase and would ensure that the potential for landslides would not cause potential for substantial adverse effects, including the risk of loss, injury, or death.

Construction activities for Alternative 5 would include the installation of the portal in the Sherman Oaks community. Temporary engineering would be erected to support the retaining wall during cut-and-cover excavation. These activities would be located within a designated LHZ, and potential landslides during construction could cause injury or death to construction workers.

Construction of Alternative 5 would adhere to existing regulations and the provisions listed in the CBC and equivalent design criteria as the MRDC that require site-specific geotechnical evaluation during the final design phase that would include specific structural engineering recommendations. Grading and construction activities would be carried out in compliance with the regulatory requirements defined in Section 3.6.1, including state regulations and the equivalent design criteria such as the MRDC, to account for the portion of Alternative 5 that would be within an LHZ.

The final design of the tunnel portal's retaining walls, and its temporary engineering would abide with structural engineering standards set forth in the provisions listed in the CBC. The CBC provisions that relate to the construction and design of the retaining walls include the requirements for foundation and soil investigations, excavation, grading, and fill-allowable, load-bearing values of soils. The CBC provision also relates to design of footings, foundations, and slope clearances, retaining walls, and pier, pile, driven, and CIP foundation support systems (Section 1810). Chapter 33 includes requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes). Appendix J includes grading requirements for the design of excavations and fills (Sections J106 and J107) and for erosion control (Section J110). Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in Cal/OSHA regulations (CCR Title 8).

Figure 3.6-30. Alternative 5: Landslide Hazard Zones

Source: eGIS, 2022b; HTA, 2024

Alternative 5 would require a site-specific slope-stability design to ensure adherence to the standards contained in the CBC and County of Los Angeles and City of Los Angeles guidelines, as well as by Cal/OSHA requirements for stabilization. The proposed Alternative 5 would include manufactured slopes in the retention basins, which would mostly occur on the perimeter of the construction sites where they would also serve as a buffer to protect the tunnel and surrounding infrastructure from landslide-related hazards. Retention basins would be designed with due consideration for slope stability.

The combination of site-specific slope-stability design, compliance with applicable regulatory requirements, and the use of manufactured slopes and retention basins is anticipated to effectively manage constructed-slope instability such that impacts associated with constructed-slope instability, including landslides, are reduced, but may still be potentially significant.

This is particularly true for temporary slopes, as excavation activities for Alternative 5 within Landslide Zones could encounter unstable soils. Temporary slopes generally pose a higher risk of slope failure due to their steeper gradients compared to permanent, manufactured slopes. Similar to permanent slope construction, temporary slopes would be required to comply with Cal/OSHA requirements for shoring and stabilization.

To address these significant impacts MM GEO-2 would be implemented so that any excavations for the construction of the underground segment of Alternative 5 shall either shore excavation walls, as required by applicable local, state, or federal laws or regulations to ensure stability of temporary slopes.

With the implementation of MM GEO-2, the impacts associated with landslides and/or slope instability during construction activities would be reduced to less than significant.

Alternative 6

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

As shown on Figure 3.6-31, Alternative 6 would traverse the Santa Monica Mountains, which are within a designated LHZ and contain surface areas prone to landslides.

According to the Caltrans Geotechnical Manual, the most adverse slope behavior is greatly influenced by water (Caltrans, 2020). Concentrated storm runoff can result in severe slope erosion leading to a loss of structural support and catastrophic failure. Perched groundwater and infiltration from irrigation, rainfall, or snowmelt frequently cause landslides. However, as discussed in Section 3.6.4.4, impacts related to topsoil erosion and water infiltration are managed separately and would not directly influence the operational impacts related to landslides.

Earthquake-induced landslides are slope failures/movements that occur from shaking during an earthquake event. Operational activities associated with Alternative 6 would not directly or indirectly cause strong seismic ground shaking including landslides as these activities would not involve interaction with geological processes such as faults or the alteration of natural slopes.

According to the USGS, certain human activities can cause landslides. They are commonly a result of building roads and structures without adequate grading of slopes, poorly planned alteration of drainage patterns, and disturbing old landslides (USGS, 2024). However, operational activities for Alternative 6 would not involve grading of slopes, modification of drainage systems, or disturbance of existing landslides. Additionally, the design of Alternative 6 would minimize interaction with natural slopes by employing an elevated guideway positioned above steep terrain and avoiding direct contact with unstable areas. The design would also incorporate drainage and erosion control measures to prevent water-related slope instability and comply with applicable geotechnical and engineering standards described in Section 3.6.1. Therefore, Alternative 6 would have a less than significant impact related to landslides during operations.

Construction Impacts

As shown on Figure 3.6-31, the tunnel portal for Alternative 6 traverses through the Santa Monica Mountains which are within a designated LHZ making the stability of the tunnel and surrounding infrastructure during construction vulnerable during a landslide-related hazard. As such, the impacts associated with a landslide hazard within the Santa Monica Mountains are potentially significant.

Alternative 6 would be below ground surface and would traverse the Santa Monica Mountains but would be situated deep underground in a tunnel in this location and the risk of landslides would be low. The one location where the potential for landslides should be a consideration is at the proposed mid-mountain shaft site, including its existing access road to the location of the shaft site, which will be widened and graded; this location is within a CGS earthquake-induced LHZ (Metro, 2023c). No landslides are shown on any of the published geologic maps at the shaft location. Therefore, based on the available information, there does not appear to be a significant landslide hazard at the mid-mountain shaft site. Nevertheless, due to the steep terrain that characterizes the shaft site, there is some potential for a landslide. Future investigations to confirm the absence of a landslide at the shaft site would be required during the final design phase.

Construction of Alternative 6 would adhere to existing regulations and the provisions listed in the CBC and equivalent design criteria as the MRDC that require site-specific geotechnical evaluation during the final design phase that would include specific structural engineering recommendations. Grading and construction activities would be carried out in compliance with the regulatory requirements defined in Section 3.6.1, including state regulations and the equivalent design criteria such as the MRDC, to account for the portion of Alternative 6 that would be within an LHZ.

The final design of the tunnel portal's retaining walls, and its temporary engineering would abide with structural engineering standards set forth in the provisions listed in the CBC. The CBC provisions that relate to the construction and design of the retaining walls include the requirements for foundation and soil investigations, excavation, grading, and fill-allowable, load-bearing values of soils. The CBC provision also relates to design of footings, foundations, and slope clearances, retaining walls, and pier, pile, driven, and CIP foundation support systems (Section 1810). Chapter 33 includes requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes). Appendix J includes grading requirements for the design of excavations and fills (Sections J106 and J107) and for erosion control (Section J110). Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in Cal/OSHA regulations (CCR Title 8).

Figure 3.6-31. Alternative 6: Landslide Hazard Zones

Source: eGIS, 2022b; HTA, 2024

Alternative 6 would require a site-specific slope-stability design to ensure adherence to the standards contained in the CBC and County of Los Angeles and City of Los Angeles guidelines, as well as by Cal/OSHA requirements for stabilization. The proposed Alternative 6 would include manufactured slopes in the retention basins, which would mostly occur on the perimeter of construction sites.

The combination of site-specific slope-stability design, compliance with applicable regulatory requirements, and the use of manufactured slopes and retention basins is anticipated to effectively manage constructed-slope instability such that impacts associated with constructed-slope instability, including landslides, are reduced, but may still be potentially significant.

This is particularly true for temporary slopes, as excavation activities for Alternative 6 within Landslide Zones could encounter unstable soils. Temporary slopes generally pose a higher risk of slope failure due to their steeper gradients compared to permanent, manufactured slopes. Similar to permanent slope construction, temporary slopes would be required to comply with Cal/OSHA requirements for shoring and stabilization.

To address these significant impacts MM GEO-2 would be implemented so that any excavations for the construction of the underground segment of Alternative 6 would shore excavation walls or flatten or "lay back" the excavation walls to a shallower gradient as required by applicable local, state, or federal laws or regulations to ensure stability of temporary slopes.

In addition, the construction of Alternative 6 would include a new vent shaft and access road in Stone Canyon, which is a sloped area that may be susceptible to landslides. Potential landslides during construction could cause injury or death to construction workers.

With the implementation of MM GEO-2 , the impacts associated with landslides and/or slope instability during construction activities would be reduced to less than significant.

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed MSF Base Design would be located west of Hazeltine Avenue and south of the LOSSAN rail corridor ROW. The proposed MSF Base Design would not be located on land designated as a LHZ Area shown on Figure 3.6-27 and Figure 3.6-28; the closest landslide zone would be located 4.16 miles south from the proposed MSF Base Design site. Therefore, the proposed MSF Base Design would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides, and no impact would occur.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed MSF Design Option 1 would abut Orion Avenue west of Sepulveda Boulevard and south of the LOSSAN rail corridor ROW. The proposed MSF Design Option 1 would not be located on land designated as an LHZ Area shown on Figure 3.6-27 and Figure 3.6-28; the closest landslide zone would be located 4.14 miles south from the proposed MSF Design Option 1. Therefore, the proposed MSF Design Option 1 would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides, and no impact would occur.

Electric Bus Maintenance and Storage Facility (Alternative 1)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed Electric Bus MSF would be located on the northwest corner of Pico Boulevard and Cotner Avenue. The proposed Electric Bus MSF would not be located on land designated as an LHZ Area shown on Figure 3.6-27; the closest landslide zone would be located 3.08 miles north from the proposed Electric Bus MSF site. Therefore, the proposed Electric Bus MSF would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides, and no impact would occur.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed MSF would be located west of Woodman Avenue and south of the LOSSAN rail corridor ROW. The proposed MSF would not be located on land designated as a LHZ Area shown on Figure 3.6-29 and Figure 3.6-30; the closest landslide zone would be located approximately 4.10 miles south from the proposed MSF. Therefore, the proposed MSF would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides, and no impact would occur.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The proposed MSF would be located west of Woodman Avenue and south of the LOSSAN rail corridor ROW. The proposed MSF would not be located on land designated as a LHZ Area shown on Figure 3.6-31, the closest landslide zone would be located approximately 4.10 miles south from the proposed MSF. Therefore, the proposed MSF would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides, and no impact would occur.

3.6.4.4 Impact GEO-4. Would the project result in substantial soil erosion or the loss of topsoil?

Project Alternatives

No Project Alternative

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The Study Area for the No Project Alternative would be located in areas where there may be erosion or loss of topsoil. Metro Line 761 would be rerouted along existing streets and highways that do not involve exposed soils, though erosion does occur within portions of the Sepulveda Pass where the bus would operate. Compliance with Section J110 of the CBC would result in a less than significant impact to soil erosion during operations. Section 3.6.1.2 provides further information about the CBC.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The rerouted Metro Line 761 would not involve construction activities in areas with exposed soil such that construction-related soil erosion may occur. Compliance with existing regulations would minimize any potential effects from erosion and ensure consistency with the *Los Angeles Regional Water Quality Control Board Water Quality Control Plan*. By adhering to these requirements, the rerouted Metro Line 761 would have a less than significant impact associated with soil erosion or loss of topsoil during construction activities.

Alternative 1

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

Implementation of Alternative 1 would not result in substantial soil erosion or the loss of topsoil during operations. Topsoil is the uppermost layer of soil—usually the top 6 to 8 inches—which has the highest concentration of organic matter and micro-organisms and is where most biological soil activity occurs. Plants generally concentrate roots in, and obtain most nutrients from, this layer. Topsoil erosion is of concern when the topsoil layer is blown or washed away, which makes plant life or agricultural production impossible. In addition, significant erosion typically occurs on steep slopes where stormwater and high winds can carry topsoil down hillsides.

Within the Project Study Area, pervious surfaces are associated with the open space areas within the adjacent Santa Monica Mountain region and a minimal extent of setbacks and residential yards along the Alternative 1 alignment. Alternative 1 would include an entirely aerial monorail alignment that would traverse the I-405 corridor and would include eight aerial MRT stations and a new electric bus route. Operation of Alternative 1 would not result in substantial ground disturbance or an increase in the amount of exposed soil as compared to existing conditions and would not change the amount of erosion and spreading grounds within the Santa Monica Mountains and residential yards along the Alternative 1 RSA compared to existing conditions.

Alternative 1 would comply with post-construction measures in applicable NPDES permits and Low Impact Development (LID) standards required by Los Angeles County and other local jurisdictions, which aim to minimize erosion impacts from development projects. With adherence to existing regulations, Alternative 1 would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations.

Construction Impacts

Ground-disturbing activities occurring during construction would temporarily expose surficial soils to wind and water erosion and have the potential to temporarily increase erosion and loss of topsoil. Construction work that would involve ground-disturbing activities include installation of CIDH piles for the MRT aerial guideway, I-405 widening, street construction and reconstruction, installation of TPSS sites, utility relocations, and grading relating to these activities. In the Sepulveda Pass area, adjacent to the Santa Monica Mountains, areas of pervious surfaces could be particularly susceptible to erosion. Retaining-wall installation would be required to accommodate the reconfiguration of Sepulveda Boulevard and Getty Center on- and off-ramps. Such construction would involve considerable earth-moving activities, including the partial excavation of the Santa Monica Mountains to increase the setback of the retaining walls. However, construction activities would be required to comply with existing regulatory requirements as described in Section 3.6.1 , including implementation of BMPs and other erosion and sedimentation control measures that would ensure grading, excavation, and other earth-moving activities would avoid a significant impact.

Metro would be required to prepare a site-specific Standard Urban Storm Water Mitigation Plan (SUSMP), which is part of the NPDES Municipal General Permit. Preparation of the site-specific SUSMP would describe the minimum required BMPs to be incorporated into Alternative 1 design and on-going operation of the facilities. Prior to the initiation of grading activities associated under Alternative 1, Metro would submit a site-specific SUSMP to reduce the discharge of pollutants to the maximum extent practical using BMPs, control techniques and systems, design and engineering methods, and other provisions that are appropriate during construction activities. All development activities associated with Alternative 1 would comply with the site-specific SUSMP.

Preparation of a site-specific SUSMP and adherence to existing regulations would ensure the maximum practicable protection available for soils excavated during the construction of buildings and associated infrastructure. Compliance with existing regulations would minimize effects from erosion and ensure consistency with the *Regional Water Quality Control Board Water Quality Control Plan*. In view of these requirements, Alternative 1 would have a less than significant impact associated with soil erosion or loss of topsoil during construction activities.

Alternative 3

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

Alternative 3 would have the same potential to result in topsoil loss or erosion as that described for Alternative 1. Please refer to the Operational Impact section in Alternative 1 for details on erosion potential. Some areas of pervious surfaces are associated with the open space areas within the adjacent Santa Monica Mountain region and a minimal extent of setbacks and residential yards along the Alternative 3 alignment. Alternative 3 would consist of an aerial monorail alignment along the I-405 corridor with seven aerial MRT stations and an underground tunnel alignment between the Getty Center and Wilshire Boulevard, with two underground stations. Operation of Alternative 3 would not result in substantial ground disturbance or an increase in the amount of exposed soil as compared to existing conditions and would not change the amount of erosion and spreading grounds within the Santa Monica Mountains and residential yards along the Alternative 3 RSA compared to existing conditions.

Alternative 3 would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and other local jurisdictions, which aim to minimize erosion impacts from development projects. With adherence to existing regulations, Alternative 3 would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations.

Construction Impacts

Ground disturbing activities associated with aerial components of Alternative 3 would be similar to those of Alternative 1 and associated erosion potential would be the same. Please refer to the Construction Impact section in Alternative 1 for details on construction-related erosion. Unlike Alternative 1, Alternative 3 includes an underground alignment just before the proposed Wilshire Boulevard/Metro D Line Station continuing north through the Santa Monica Mountains. Alternative 3 alignment would transition from an underground configuration to an aerial guideway structure after exiting the tunnel portal located at the northern end of the Leo Baeck Temple parking lot. The alignment would cross over Sepulveda Boulevard and the I-405 lanes to the proposed Getty Center Station. The southern portion of the tunnel would be at a depth between 20 to 50 feet to connect with the UCLA Gateway Plaza Station, which would be constructed using cut-and-cover methods. As the tunnel extends beneath the University of California, Los Angeles (UCLA) campus and the Bel Air Country Club, it would reach depths between 40 to 60 feet. Through the Santa Monica Mountains, the tunnel would range between 50 to 300 feet deep. The only places where excavation would occur for the construction of the underground alignment would be at the portals to retrieve or drop the TBMs. These activities would not result in substantial soil erosion or the loss of topsoil.

As with Alternative 1, construction activities would be required to comply with existing regulatory requirements, including implementation of BMPs, preparation of SUSMP, and other erosion and sedimentation control measures that would ensure that grading, excavation, and other earth-moving activities would avoid a significant impact.

Metro would be required to prepare a site-specific SUSMP, which is part of the NPDES Municipal General Permit. Preparation of the site-specific SUSMP would describe the minimum required BMPs to be incorporated into the Alternative 3 design and on-going operation of the facilities. Prior to the initiation of grading activities associated with the implementation of Alternative 3, Metro would submit a site-specific SUSMP to reduce the discharge of pollutants to the maximum extent practical using BMPs, control techniques and systems, design and engineering methods, and other provisions that are appropriate during construction activities. All development activities associated with Alternative 3 would comply with the site-specific SUSMP.

Preparation of a site-specific SUSMP and adherence to existing regulations would ensure the maximum practicable protection available for soils excavated during the construction of buildings and associated infrastructure. Compliance with existing regulations would minimize effects from erosion and ensure consistency with the *Los Angeles* Regional Water Quality Control Board Water Quality Control Plan. In view of these requirements, Alternative 3 would have a less than significant impact associated with soil erosion or loss of topsoil during construction activities.

Alternative 4

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

Implementation of Alternative 4 would not result in substantial soil erosion or the loss of topsoil during operations. Topsoil is the uppermost layer of soil — usually the top 6 to 8 inches —which has the highest concentration of organic matter and micro-organisms and is where most biological soil activity occurs. Plants generally concentrate roots in, and obtain most nutrients from, this layer. Topsoil erosion is of concern when the topsoil layer is blown or washed away, which makes plant life or agricultural production impossible. In addition, significant erosion typically occurs on steep slopes where stormwater and high winds can carry topsoil down hillsides.

Some areas of pervious surfaces are associated with the open space areas within the adjacent Santa Monica Mountain region and a minimal extent of setbacks and residential yards along the Alternative 4 alignment. Alternative 4 would traverse the Santa Monica Mountains deep in an underground tunnel. North of the Santa Monica Mountain, Alternative 4 would operate at an aerial alignment along the Sepulveda Corridor. The aerial guideway viaduct would be primarily situated in the center of Sepulveda Boulevard in the San Fernando Valley, a highly urbanized and developed area, with guideway columns located in both the center and outside of the ROW of Sepulveda Boulevard. The depth of cover at which the tunnel segments would operate vary along the alignment but would vary between 40 feet to 470 feet, much deeper than what is considered topsoil (6 to 8 inches of the uppermost layer of soil). As such, operation of Alternative 4 would not result in substantial ground disturbance or an increase in the amount of exposed soil as compared to existing conditions. Moreover, operational activities would not change the amount of erosion and spreading grounds within the Santa Monica Mountains and residential yards along the Alternative 4 RSA compared to existing conditions.

Alternative 4 would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and other local jurisdictions, which aim to minimize erosion impacts from development projects.

With adherence to existing regulations, Alternative 4 would result in less than significant impact related to substantial soil erosion or the loss of topsoil during operations.

Construction Impacts

Ground-disturbing activities occurring during construction would temporarily expose surficial soils to wind and water erosion and have the potential to temporarily increase erosion and loss of topsoil. Construction work that would involve ground-disturbing activities would include installation of CIDH piles for the HRT aerial guideway, installation of temporary engineering for the portal, installation of TPSS sites, utility relocations, mass excavation of the underground stations, and grading relating to these activities. Retaining-wall installation at the portal would involve considerable earth-moving activities. However, construction activities would be required to comply with existing regulatory requirements, including implementation of BMPs and other erosion and sedimentation control measures that would ensure that grading, excavation, and other earth-moving activities would avoid a significant impact.

Metro would be required to prepare a site-specific SUSMP, which is part of the NPDES Municipal General Permit. Preparation of the site-specific SUSMP would describe the minimum required BMPs to be incorporated into the Alternative 4 design and on-going operation of the facilities. Prior to the initiation of grading activities associated with the implementation of Alternative 4, Metro would submit a site-specific SUSMP to reduce the discharge of pollutants to the maximum extent practical using BMPs, control techniques and systems, design and engineering methods, and other provisions that are appropriate during construction activities. All development activities associated with Alternative 4 would comply with the site-specific SUSMP.

Preparation of a site-specific SUSMP and adherence to existing regulations would ensure the maximum practicable protection available for soils excavated during the construction of buildings and associated infrastructure. Compliance with existing regulations would minimize effects from erosion and ensure consistency with the *Regional Water Quality Control Board Water Quality Control Plan*. In view of these requirements, Alternative 4 would have a less than significant impact associated with soil erosion or loss of topsoil during construction activities.

Alternative 5

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

Alternative 5 would have the same potential to result in topsoil loss or erosion as that described for Alternative 4. Please refer to the Operational Impact section in Alternative 4 for details on erosion potential.

Alternative 5 would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and other local jurisdictions, which aim to minimize erosion impacts from development projects. With adherence to existing regulations, Alternative 5 would result in less than significant impact related to substantial soil erosion or the loss of topsoil during operations.

Construction Impacts

Ground disturbing activities of Alternative 5 would be similar to those of Alternative 4 and associated erosion potential would be the same. Please refer to the Construction Impact section in Alternative 4 for details on construction-related erosion.

The developers of Alternative 5 would be required to prepare a site-specific SUSMP, which is part of the NPDES Municipal General Permit. Preparation of the site-specific SUSMP would describe the minimum required BMPs to be incorporated into the Alternative 5 design and on-going operation of the facilities. Prior to the initiation of grading activities associated with the implementation of Alternative 5, a site-specific SUSMP would be submitted to reduce the discharge of pollutants to the maximum extent practical using BMPs, control techniques and systems, design and engineering methods, and other provisions that are appropriate during construction activities. All development activities associated with Alternative 5 would comply with the site-specific SUSMP.

Preparation of a site-specific SUSMP and adherence to existing regulations would ensure the maximum practicable protection available for soils excavated during the construction of buildings and associated infrastructure. Compliance with existing regulations would minimize effects from erosion and ensure consistency with the *Regional Water Quality Control Board Water Quality Control Plan*. In view of these requirements, Alternative 5 would have a less than significant impact associated with soil erosion or loss of topsoil during construction activities.

Alternative 6

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

Implementation of Alternative 6 would not result in substantial soil erosion or the loss of topsoil during operations. Topsoil is the uppermost layer of soil — usually the top 6 to 8 inches —which has the highest concentration of organic matter and micro-organisms and is where most biological soil activity occurs. Plants generally concentrate roots in, and obtain most nutrients from, this layer. Topsoil erosion is of concern when the topsoil layer is blown or washed away, which makes plant life or agricultural production impossible. In addition, significant erosion typically occurs on steep slopes where stormwater and high winds can carry topsoil down hillsides.

Some areas of pervious surfaces are associated with the open space areas within the adjacent Santa Monica Mountain region and a minimal extent of setbacks and residential yards along the Alternative 6 alignment. Alternative 6 would be entirely underground, operation of Alternative 6 would not result in substantial ground disturbance or an increase in the amount of exposed soil as compared to existing conditions and would not change the amount of erosion and spreading grounds within the Santa Monica Mountains and residential yards along the Alternative 6 RSA compared to existing conditions.

Alternative 6 would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and other local jurisdictions, which aim to minimize erosion impacts from development projects. With adherence to existing regulations, Alternative 6 would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations.

Construction Impacts

Ground-disturbing activities occurring during construction would temporarily expose surficial soils to wind and water erosion and have the potential to temporarily increase erosion and loss of topsoil. Construction work that would involve ground-disturbing activities would include installation of the emergency vent access road, utility relocations, mass excavation of the underground stations, and grading relating to these activities. The Santa Monica Mountains have areas of pervious surfaces at the proposed access road at the Stone Water Canyon emergency vent shaft. Construction of the access road would involve considerable earth-moving activities to grade and pave the roadway. However, construction activities would be required to comply with existing regulatory requirements, including implementation of BMPs and other erosion and sedimentation control measures that would ensure that grading, excavation, and other earth-moving activities would avoid a significant impact.

There would be a potential for temporary construction-related soil erosion because Alternative 6 would involve grading and excavation operations that could expose soils. Metro would be required to prepare a site-specific SUSMP, which is part of the NPDES Municipal General Permit. Preparation of the site-specific SUSMP would describe the minimum required BMPs to be incorporated into the Alternative 6 design and on-going operation of the facilities. Prior to the initiation of grading activities associated with the implementation of Alternative 6, Metro would submit a site-specific SUSMP to reduce the discharge of pollutants to the maximum extent practical using BMPs, control techniques and systems, design and engineering methods, and other provisions that are appropriate during construction activities. All development activities associated with Alternative 6 would comply with the site-specific SUSMP.

Preparation of a site-specific SUSMP and adherence to existing regulations would ensure the maximum practicable protection available for soils excavated during the construction of buildings and associated infrastructure. Compliance with existing regulations would minimize effects from erosion and ensure consistency with the *Regional Water Quality Control Board Water Quality Control Plan*. Therefore, Alternative 6 would have a less than significant impact associated with soil erosion or loss of topsoil during construction activities.

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operation of the proposed MSF Base Design would include the maintenance, cleaning, and storage of monorail vehicles. The proposed MSF Base Design site would be located within an urbanized area that is primarily impervious with no exposed soil. Operation of the proposed MSF Base Design would not result in ground disturbance or a change in the amount of exposed soil as compared to existing conditions and would adhere to existing regulations. The proposed MSF Base Design would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and the City of Los Angeles that aim to minimize erosion impacts from development projects. Therefore, the proposed MSF Base Design would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations and construction.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operation of the proposed MSF Design Option 1 would include the maintenance, cleaning, and storage of monorail vehicles. The proposed MSF Design Option 1 site would be located within an urbanized area that is primarily impervious with no exposed soil. Operation of the proposed MSF Design Option 1 would not result in ground disturbance or a change in the amount of exposed soil as compared to existing conditions and would adhere to existing regulations. The proposed MSF Design Option 1 would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and the City of Los Angeles that aim to minimize erosion impacts from development projects. Therefore, the proposed MSF Design Option 1 would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations and construction.

Electric Bus Maintenance and Storage Facility (Alternative 1)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operation of the proposed Electric Bus MSF would include the maintenance, cleaning, and storage of the proposed electric bus fleet. The proposed Electric Bus MSF site would be located within an urbanized area that is primarily impervious with no exposed soil. Operation of the proposed Electric Bus MSF would not result in ground disturbance or a change in the amount of exposed soil as compared to existing conditions and would adhere to existing regulations. The proposed Electric Bus MSF would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and the City of Los Angeles that aim to minimize erosion impacts from development projects. Therefore, the proposed Electric Bus MSF would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations and construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operation of the proposed MSF would include the maintenance, cleaning, and storage of HRT vehicles. The proposed MSF site would be located within an urbanized area that is primarily impervious with no exposed soil. Operation of the proposed MSF would not result in ground disturbance or a change in the amount of exposed soil as compared to existing conditions and would adhere to existing regulations. The proposed MSF would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and the City of Los Angeles that aim to minimize erosion impacts from development projects. Therefore, the proposed MSF would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations and construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operation of the proposed MSF would include the maintenance, cleaning, and storage of HRT vehicles. The proposed MSF site would be located within an urbanized area that is primarily impervious with no exposed soil. Operation of the proposed MSF would not result in ground disturbance or a change in the amount of exposed soil as compared to existing conditions and would adhere to existing regulations. The proposed MSF would comply with post-construction measures in applicable NPDES permits and LID standards required by Los Angeles County and the City of Los Angeles that aim to minimize erosion impacts from development projects. Therefore, the proposed MSF would result in a less than significant impact related to substantial soil erosion or the loss of topsoil during operations and construction.

3.6.4.5 Impact GEO-5. 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?

Project Alternatives

No Project Alternative

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. In absence of the Project, the reasonably foreseeable transit improvement within the Project Study Area consists of rerouting the existing Metro Line 761. Rerouting of Metro Line 761 would not present new seismic risks because the bus route is an existing route which would simply be rerouted along existing streets and highways. Other than potential for new bus stops, no habitable structures would be constructed as part of the No Project Alternative. During operations, the projects associated with the No Project Alternative would experience earthquake-induced ground-shaking activity because of their proximity to known active faults. The No Project Alternative would be located in a seismically active region and may be subject to the effects of ground shaking. Therefore, No Project Alternative would probably experience moderate to high ground shaking from these fault zones, as well as some background shaking from other seismically active areas of the Southern California region.

Earthquakes are prevalent within Southern California, and there is no practicable way to avoid ground shaking when it occurs. The CBC includes measures to minimize the risk of loss, injury, and death from the effects of earthquakes and ground shaking on buildings, with specific provisions for seismic design. The development that would be part of the No Project Alternative would be required to resist seismic ground shaking in accordance with the CBC Chapter 16 design parameters identified in the CBC. With adherence to the provisions listed in the CBC, potential impacts related to ground shaking would be less than significant during operations.

During severe ground shaking, loose granular soils below the groundwater table may liquefy. Projects associated with the No Project Alternative would, upon completion of construction, have complied with applicable standards, requirements, and building codes related to seismic ground shaking and possible ground failure, such as liquefaction. With adherence to the provisions listed in the CBC, the potential impacts related to liquefaction would be less than significant during operations.

Using unsuitable materials for fill and/or foundation support would have the potential to create future heaving, subsidence, spreading, or collapse problems leading to building settlement and/or utility line and pavement disruption. Using such materials exclusively for landscaping would not cause these problems. Rerouting Metro Line 761 would not use fill or foundation support, because new structures associated with the bus route would be limited to typical bus stop facilities such as signage and potentially street furniture. The No Project Alternative would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils during operations.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. Impacts related to liquefaction and landslides are addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter, and detailed in *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a).

Using unsuitable materials for fill and/or foundation support would have the potential to create future heaving, subsidence, spreading, or collapse problems leading to building settlement and/or utility line and pavement disruption. Rerouting Metro Line 761 would not use fill or foundation support because new structures associated with the bus route would be limited to typical bus stop facilities such as signage and potentially street furniture.

Adherence to existing regulations and policies would ensure the maximum practicable protection available for users of buildings and infrastructure and associated trenches, slopes, and foundations. Therefore, the No Project Alternative would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils.

Alternative 1

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Impacts related to liquefaction and landslides are addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, and Seismic Technical Report* (Metro, 2025a). This analysis addresses impacts related to unstable soils as a result of subsidence, differential settlement, lateral spreading, or collapse. The aerial segments of Alternative 1 are not located on a geologic unit or soil that is unstable, or that would become unstable, potentially resulting in lateral spreading, subsidence, liquefaction, or collapse.

Collapsible soils and the potential for lateral spreading to affect Alternative 1 is low because most of the areas with liquefaction potential are along relatively flat terrain, and liquefiable layers are below the groundwater table as identified in the *Final Draft Geotechnical Design Report* (Metro, 2023a). However, existing lateral spreading may exist along I-405 and the Santa Monica Mountains due to liquefiable soils and steep slope topography for the aerial alignment, stations, and TPSS sites. Additionally, ground shaking leading to liquefaction of saturated soil could result in lateral spreading where the soil undergoes a temporary loss of strength, and if the liquefied soil is not contained laterally, it may result in deformation or translation of the slope.

Using unsuitable materials for fill and/or foundation support would have the potential to create future heaving, subsidence, spreading, or collapse problems, which would lead to building settlement and/or utility line and pavement disruption. However, structural engineering standards are designed to address geological conditions during operations, ensuring infrastructure stability and minimizing the potential for structural damage to buildings, utilities, and transportation systems over time. These standards are integral to standard construction practices and operational safeguards. Alternative 1 would be designed in accordance with and equivalent to MRDC Section 5, Structural; Metro's SSDC (2017); and the California Seismic Hazards Mapping Act (refer to Section 3.6-1, Regulatory and Policy Framework for additional information). Furthermore, Alternative 1 would be designed in accordance with recommendations developed in a detailed geotechnical report prepared during final design, which would provide site-specific information pertaining to the depths and areal extents of lateral spreading, subsidence, or collapse. During the design process, if it is determined that these conditions identified in the geotechnical report could result in an unacceptable soil or structural response (to be defined during final design and dependent on the type of structure), the resulting final geotechnical engineering would include recommendations that would be incorporated into the final design plans consistent with standard practice to address any unstable geologic and related conditions present along the alignment. Recommendations may include deep foundations and/or ground improvements such as dynamic compaction, stone columns, jet grouting, and cement deep soil mixing and compaction grouting. Given compliance with these regulatory and design requirements, Alternative 1 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils as a result of subsidence, differential settlement, lateral spreading, or collapse during operations.

Construction Impacts

Impacts related to liquefaction and landslides are addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a).

The analysis addresses impacts related to unstable soils as a result of subsidence, differential settlement, lateral spreading, or collapse. Construction activities for Alternative 1 would involve foundation support installation and earthwork along the alignment. Certain construction activities, such as CIDH drilling for the aerial guideway and excavation and erection of the temporary engineering of the retaining walls along the Santa Monica Mountains in Sepulveda Pass, could affect soil stability leading to ground movements (both lateral movements and settlements) or subsidence. Additionally, the use of unsuitable materials for fill and/or foundation support could have the potential to create future heaving, subsidence, spreading, or collapse problems leading to foundation or roadway settlement and impacts would be potentially significant.

Alternative 1 would be in compliance with the regulatory requirements as defined in PM GEO-2 as described in Section 3.6.5. Implementation of PM GEO-2 would require preparation of a site-specific evaluation of soil conditions that shall contain recommendations for ground preparation, earthwork, and compaction specification based on the geological conditions specific to the site.

As described in Section 3.6.6, MM GEO-1 through MM GEO-5 would be implemented as part of Alternative 1. MM GEO-3 ensures compliance with the recommendations of the final soils and geotechnical report, which would provide site-specific information pertaining to the depths and areal extents of lateral spreading, subsidence, or collapse. MM GEO-5 specifies that the Alternative 1 developer shall prepare a Construction Management Plan (CMP) prior to construction detailing how to address geologic constraints and minimize or avoid impacts to geologic hazards during construction.

Adherence to existing regulations and policies and implementation of MM GEO-1 through MM GEO-5 would ensure the maximum practicable protection available for users of buildings and infrastructure and associated trenches, slopes, and foundations. With the implementation of these mitigation measures, Alternative 1 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils.

Alternative 3

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

The aerial alignment for Alternative 3 is subject to the same potential for unstable soils as Alternative 1. Please refer to the Operational Impact section in Alternative 1 for details on unstable soil potential during operations along the aerial alignment. The underground and aerial segments of Alternative 3 would not be located on a geologic unit or soil that is unstable, or that would become unstable, potentially resulting in lateral spreading, subsidence, liquefaction, or collapse. Based on the flat topography at station/facility sites and limited locations having open free-face conditions (and given that a significant portion of the alignment would be in a tunnel), the overall potential for earthquake-induced lateral spreading is considered low as identified in the *Final Draft Geotechnical Design Report* (Metro, 2023b). Additionally, ground shaking leading to liquefaction of saturated soil could result in lateral spreading where the soil undergoes a temporary loss of strength, and if the liquefied soil is not contained laterally, it may result in deformation of the slope.

As with Alternative 1, given compliance with regulatory and design requirements, Alternative 3 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils as a result of subsidence, differential settlement, lateral spreading, or collapse during operations.

Construction Impacts

The aerial alignment of Alternative 3 would have similar construction impacts related to unstable soils as those of Alternative 1. Please refer to the Construction Impact section in Alternative 1 for details on construction-related risks due to unstable soils during construction of the aerial alignment. Excavation for construction of underground structures, such as station boxes, cut-and-cover tunnels, and tunnel portals, would be reinforced by shoring systems to protect abutting buildings, utilities, and other infrastructure. Tunneling using a TBM would result in ground volume loss and potential ground movements. Dewatering, when performed to create a dry work condition for construction of the underground structures, would result in compaction or consolidation of the subsurface soils and thus result in surface settlements. These surface settlements could potentially affect the stability of nearby buildings, roads, and utilities, leading to structural damage, uneven ground surfaces, and the need for additional maintenance or repair work in the affected areas. This would be a potentially significant impact.

Alternative 3 would be in compliance with the regulatory requirements as defined in PM GEO-2 and described in Section 3.6.5. Under PM GEO-2, a site-specific evaluation of soil conditions shall be conducted and shall contain recommendations for ground preparation, earthwork, and compaction specifications based on the geological conditions specific to the site. However, even with implementation of these project measures, impacts may still be significant.

As described in Section 3.6.6, MM GEO-1 through MM GEO-5 would be implemented as part of Alternative 3. MM GEO-3 ensures compliance with the recommendations of the final soils and geotechnical report. MM GEO-5 specifies that prior to construction, the developer shall prepare a CMP that explains how to address geologic constraints and minimize or avoid impacts to geologic hazards during construction.

Adherence to existing regulations and policies and implementation of MM GEO-1 through MM GEO-5 would ensure the maximum practicable protection available for users of buildings and infrastructure and associated trenches, slopes, and foundations. Therefore, with the implementation of mitigation measures, Alternative 3 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils.

Alternative 4

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Impacts related to liquefaction and landslides are addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter, and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a). The analysis in this section addresses impacts related to unstable soils as a result of subsidence, differential settlement, lateral spreading, or collapse. The underground and aerial segments of Alternative 4 would not be located on a geologic unit or soil that is unstable, or that would become unstable, potentially resulting in lateral spreading, subsidence, liquefaction, or collapse. Based on the flat topography at station/facility sites and limited locations having open free-face conditions (and given that a significant portion of the alignment would be in a tunnel), the overall potential for earthquake-induced lateral spreading is considered low as identified in the *Final Draft Geotechnical Design Report* (Metro, 2023b). Additionally, ground shaking leading to liquefaction of saturated soil could result in lateral spreading where the soil undergoes a temporary loss of strength, and if the liquefied soil is not contained laterally, it may result in deformation of the slope.

Using unsuitable materials for fill and/or foundation support would have the potential to create future heaving, subsidence, spreading, or collapse problems, which would lead to building settlement and/or utility line and pavement disruption. Structural engineering standards to address geological conditions are part of standard construction requirements and standard construction practices. Alternative 4 would be designed consistent with equivalent design criteria such as an equivalent to MRDC Section 5, Structural; Metro's SSDC (2017); and the California Seismic Hazards Mapping Act (refer to Section 3.6-1, Regulatory and Policy Framework for additional information). Furthermore, Alternative 4 would be designed in accordance with recommendations developed in a detailed geotechnical report prepared during final design, which would provide site-specific information pertaining to the depths and areal extents of lateral spreading, subsidence, or collapse. During the design process, if it is determined that these conditions identified in the geotechnical report could result in an unacceptable soil or structural response (to be defined during final design and dependent on the type of structure), the resulting final geotechnical engineering would include recommendations that would be incorporated into the final design plans consistent with standard practice to address any unstable geologic and related conditions present along the alignment. Recommendations may include deep foundations and/or ground improvements such as dynamic compaction, stone columns, jet grouting, and cement deep soil mixing and compaction grouting. Given compliance with these regulatory and design requirements, Alternative 4 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils as a result of subsidence, differential settlement, lateral spreading, or collapse during operations.

Construction Impacts

Impacts related to liquefaction and landslides are addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter, and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a). The analysis in this section addresses impacts related to unstable soils as a result of subsidence, differential settlement, lateral spreading, or collapse. Construction activities for Alternative 4 would involve foundation support installation and earthwork at the tunnel portal at the Sherman Oaks community. Certain construction activities, such as CIDH drilling for the aerial guideway and excavation and erection of the temporary engineering of the tunnel portal, could affect soil stability leading to ground movements (both lateral movements and settlements) or subsidence. Additionally, the use of unsuitable materials for fill and/or foundation support would have the potential to create future heaving, subsidence, spreading, or collapse problems, leading to foundation and roadway settlement. Excavation for construction of underground structures — such as station boxes, cut-and-cover tunnels, and tunnel portals — would be reinforced by shoring systems to protect abutting buildings, utilities, and other infrastructure. Tunneling using a TBM would result in ground volume loss and potential ground movements. Dewatering, when performed to create a dry work condition for construction of the underground structures, if allowed to draw down the groundwater table beyond the limits of excavation, could result in compaction or consolidation of the subsurface soils and thus potentially result in surface settlements. These surface settlements could potentially affect the stability of nearby buildings, roads, and utilities, leading to structural damage, uneven ground surfaces, and the need for additional maintenance or repair work in the affected areas. This would be a potentially significant impact.

However, Alternative 4 would be in compliance with the regulatory requirements as defined in PM GEO-2 and described in Section 3.6.5. Under PM GEO-2, a site-specific evaluation of soil conditions shall be conducted and shall contain recommendations for ground preparation, earthwork, and compaction specifications based on the geological conditions specific to the site.

As described in Section 3.6.6, MM GEO-1 through MM GEO-5 would be implemented as part of Alternative 4. MM GEO-3 ensures compliance with the recommendations of the final soils and geotechnical report, which would provide site-specific information pertaining to the depths and areal extents of lateral spreading, subsidence, or collapse. MM GEO-5 specifies preparation of a CMP prior to construction detailing how to address geologic constraints and minimize or avoid impacts to geologic hazards during construction.

Adherence to existing regulations and policies and implementation of MM GEO-1 through MM GEO-5 would ensure the maximum practicable protection available for users of buildings and infrastructure and associated trenches, slopes, and foundations. Therefore, with the implementation of mitigation measures, Alternative 4 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils.

Alternative 5

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Alternative 5 is subject to the same potential for unstable soils as Alternative 4. Please refer to the Operational Impact section in Alternative 4 for details on unstable soil potential. As with Alternative 4, given compliance with regulatory and design requirements, Alternative 5 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils as a result of subsidence, differential settlement, lateral spreading, or collapse during operations.

Construction Impacts

Alternative 5 would have similar construction impacts related to unstable soils as those of Alternative 4. Please refer to the Construction Impact section in Alternative 4 for details on construction-related risks due to unstable soils.

Alternative 5 would be in compliance with the regulatory requirements as defined in PM GEO-2 and described in Section 3.6.5. Under PM GEO-2, a site-specific evaluation of soil conditions shall be conducted and shall contain recommendations for ground preparation, earthwork, and compaction specification based on the geological conditions specific to the site.

As described in Section 3.6.6, MM GEO-1 through MM GEO-5 would be implemented as part of Alternative 5. MM GEO-3 ensures compliance with the recommendations of the final soils and geotechnical report. MM GEO-5 specifies that the developer shall prepare a CMP prior to construction explaining how to address geologic constraints and minimize or avoid impacts to geologic hazards during construction.

Adherence to existing regulations and policies and implementation of MM GEO-1 through MM GEO-5 would ensure the maximum practicable protection available for users of buildings and infrastructure and associated trenches, slopes, and foundations. Therefore, Alternative 5 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils.

Alternative 6

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Impacts related to liquefaction and landslides are addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a). This analysis addresses impacts related to unstable soils as a result of subsidence, differential settlement, lateral spreading, or collapse. Collapsible soils and the potential for lateral spreading to impact Alternative 6 is low because most of the areas with liquefaction potential are along relatively flat terrain and liquefiable layers are below the groundwater table as identified in the *Preliminary Geotechnical Design and Data Report* (Metro, 2023c). Additionally, ground shaking leading to liquefaction of saturated soil could result in lateral spreading where the soil undergoes a temporary loss of strength, and if the liquefied soil is not contained laterally, it may result in deformation of the slope.

Using unsuitable materials for fill and/or foundation support would have the potential to create future heaving, subsidence, spreading, or collapse problems, which would lead to building settlement and/or utility line and pavement disruption. Structural engineering standards to address geological conditions are part of standard construction requirements and standard construction practices. Alternative 6 would be designed in accordance with MRDC Section 5, Structural; Metro's SSDC (2017); and the California Seismic Hazards Mapping Act (refer to Section 3.6-1, Regulatory and Policy Framework for additional information). Furthermore, Alternative 6 would be designed in accordance with recommendations developed in a detailed geotechnical report prepared during final design, which would provide site-specific information pertaining to the depths and areal extents of lateral spreading, subsidence, or collapse. During the design process, if it is determined that these conditions identified in the geotechnical report could result in an unacceptable soil or structural response (to be defined during final design and dependent on the type of structure), the resulting final geotechnical engineering would include recommendations that would be incorporated into the final design plans consistent with standard practice to address any unstable geologic and related conditions present along the alignment. Recommendations may include deep foundations and/or ground improvements such as dynamic compaction, stone columns, jet grouting, and cement deep soil mixing and compaction grouting. Given compliance with these regulatory and design requirements, Alternative 6 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils as a result of subsidence, differential settlement, lateral spreading, or collapse during operations.

Construction Impacts

Impacts related to liquefaction and landslides are addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a). This analysis addresses impacts related to unstable soils as a result of subsidence, differential settlement, lateral spreading, or collapse.

Excavation for construction of underground structures, such as station boxes, cut-and-cover tunnels, and tunnel portals would be reinforced by shoring systems to protect abutting buildings, utilities, and other infrastructure. Tunneling using a TBM would result in ground volume loss and potential ground movements. Dewatering, when performed to create a dry work condition for construction of the underground structures, would result in compaction or consolidation of the subsurface soils and thus result in surface settlements. These surface settlements could potentially affect the stability of nearby buildings, roads, and utilities, leading to structural damage, uneven ground surfaces, and the need for additional maintenance or repair work in the affected areas. This would be a potentially significant impact.

Additionally, the use of unsuitable materials for fill and/or foundation support would have the potential to create future heaving, subsidence, spreading, or collapse problems leading to foundation and pavement settlement. Using such materials exclusively for landscaping would not cause these problems. An acceptable degree of soil stability can be achieved for expansive or compressible material by the incorporation of soil treatment programs (replacement, grouting, compaction, drainage control, etc.) in the excavation and construction plans that will be prepared to address site-specific soil conditions. In addition to the treatment of soils for underground facilities, Alternative 6 would include installation of the emergency vent access road. Construction of the access road would involve considerable earth-moving activities to grade and pave the roadway. A site-specific evaluation of soil conditions is required and must contain recommendations for ground preparation and earthwork specific to the site.

Alternative 6 would be in compliance with the regulatory requirements as defined in PM GEO-2 as described in Section 3.6.5. Under PM GEO-2, a site-specific evaluation of soil conditions shall be conducted and shall contain recommendations for ground preparation, earthwork, and compaction specification based on the geological conditions specific to the site.

To reduce this impact, Alternative 6 would implement MM GEO-1 through MM GEO-5 as described in Section 3.6.6, implementing MM GEO-3 would ensure compliance with the recommendations of the final soils and geotechnical report, which would provide site-specific information pertaining to the depths and areal extents of lateral spreading, subsidence, or collapse. Additionally, prior to construction, MM GEO-5 specifies that Metro shall prepare a CMP detailing how to address geologic constraints and minimize or avoid impacts to geologic hazards during construction.

Adherence to existing regulations and policies, and implementation of MM GEO-1 through MM GEO-5, would ensure the maximum practicable protection available for users of buildings and infrastructure and associated trenches, slopes, and foundations. Therefore, Alternative 6 would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils.

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

The proposed MSF Base Design would be located on stable soils where no liquefaction or landslide zones are present as addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter. Construction and operations would not occur on a geologic unit or soil that is unstable, or that would become unstable as a result of the proposed MSF Base Design, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. The proposed MSF Base Design would be designed in compliance with applicable local, state, or federal laws or regulations, including recommendations on engineering and design considerations as described in Sections 3.6.4.2 and 3.6.4.3 and identified in MM GEO-1 through MM GEO-5. Thus, operation and construction of the proposed MSF Base Design would have less than significant impacts related to soil stability that could potentially result in landslides, lateral spreading, subsidence, liquefaction, or collapse.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

The proposed MSF Design Option 1 would be located on stable soils where no liquefaction or landslide zones are present as addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a). Construction and operations would not occur on a geologic unit or soil that is unstable, or that would become unstable as a result of the proposed MSF Design Option 1, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. As with the Alternative 1, the proposed MSF Design Option 1 would be designed in compliance with applicable local, state, or federal laws or regulations, including recommendations on engineering and design considerations as described in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter, detailed in the *Sepulveda Transit Corridor Draft Geotechnical, Subsurface, and Seismic Technical Report* (Metro, 2025a), and identified in MM GEO-1 through MM GEO-5. Thus, operation and construction of the proposed MSF Design Option 1 would have less than significant impacts related to soil stability that could potentially result in landslides, lateral spreading, subsidence, liquefaction, or collapse.

Electric Bus Maintenance Storage Facility (Alternative 1)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

The proposed Electric Bus MSF would be located on stable soils where no liquefaction or landslide zones are present as addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter, and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a). Construction and operations would not occur on a geologic unit or soil that is unstable, or that would become unstable as a result of the proposed Electric Bus MSF, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. As with the Alternative 1, the proposed Electric Bus MSF would be designed in compliance with applicable local, state, or federal laws or regulations, including recommendations on engineering and design considerations as described in Sections 3.6.4.2and 3.6.4.3 of this EIR Chapter, detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a), and identified in MM GEO-1 through MM GEO-5. Thus, operation and construction of the proposed Electric Bus MSF would have less than significant impacts related to soil stability that could potentially result in landslides, lateral spreading, subsidence, liquefaction, or collapse.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

The proposed MSF would be located on stable soils where no liquefaction or landslide zones are present as addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, and Seismic Technical Report* (Metro, 2025a). Construction and operations would not occur on a geologic unit or soil that is unstable, or that would become unstable as a result of the proposed MSF, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. As with Alternative 4, the proposed MSF would be designed in compliance with applicable local, state, or federal laws or regulations, including recommendations on engineering and design considerations as described in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter, detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a), and identified in MM GEO-1 through MM GEO-5. Thus, operation and construction of the proposed MSF would have less than significant impacts related to soil stability that could potentially result in landslides, lateral spreading, subsidence, liquefaction, or collapse.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

The proposed MSF would be located on stable soils where no liquefaction or landslide zones are present as addressed in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter and detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a). Construction and operations would not occur on a geologic unit or soil that is unstable, or that would become unstable as a result of the proposed MSF, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. As with Alternative 6, the proposed MSF would be designed in compliance with applicable local, state, or federal laws or regulations, including recommendations on engineering and design considerations as described in Sections 3.6.4.2 and 3.6.4.3 of this EIR Chapter, detailed in the *Sepulveda Transit Corridor Project Geotechnical, Subsurface, Seismic, and Paleontological Technical Report* (Metro, 2025a), and identified in MM GEO-1 through MM GEO-5. Thus, operation and construction of the proposed MSF would have less than significant impacts related to soil stability that could potentially result in landslides, lateral spreading, subsidence, liquefaction, or collapse.

3.6.4.6 Impact GEO-6. Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?

Project Alternatives

No Project Alternative

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. In absence of the Project, the only reasonably foreseeable transit improvement in the Project Study Area would involve changes to Metro Line 761. Rerouting Metro Line 761 would not involve placing infrastructure in any areas with expansive soil as the bus would operate on existing streets and highways. Changes to the Metro Line 761 would not result in any new habitable structures and the structures anticipated to be required would be small structures common to Metro bus stops. These operational activities do not create substantial direct or indirect risks to life or property as it relates to being located on expansive. As such, impacts would be less than significant.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The No Project Alternative would be required to comply with applicable provisions of the CBC with regard to soil hazard-related design. The County of Los Angeles Building Code and City of Los Angeles Building Code require a site-specific foundation investigation and report for each construction site that identifies potentially unsuitable soil conditions and contains appropriate recommendations for foundation type and design criteria that conform to the analysis and implementation criteria described in the County of Los Angeles Building Code and the City of Los Angeles Building Code. Regulations exist to address weak soil issues, including expansion. With adherence to existing regulations, the No Project Alternative would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils.

Alternative 1

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

The majority of fine-grained soil and rock encountered in the Project Study Area exhibited low plasticity, with very low to medium expansion potential (Metro, 2023a). However, expansive soils can be found almost anywhere, particularly in coastal plains and low-lying valleys such as the Los Angeles Basin and San Fernando Valley. Expansive clays can be found in weathered bedrock along the Santa Monica Mountains. Much of the northern section of the Santa Monica Mountains is in Modelo Formation. Clay-rich soils may exist locally within alluvial soils present along Alternative 1 that could swell and shrink with wetting and drying. The change in soil volume is capable of exerting enough force on structures to damage foundations, structures, and underground utilities. Damage can also occur as these soils dry out and contract. As part of PM GEO-2 during construction, a California-registered geologist and geotechnical engineer would submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils.

While expansive soils could have an impact on project elements, operational activities of Alternative 1 do not directly or indirectly cause risks of life or property as operations would not involve wetting or drying of expansive soils. Therefore, impacts related to expansive soils are less than significant during operations.

Construction Impacts

Construction activities associated with Alternative 1 primarily pertain to the construction of the aerial guideway, and aerial stations. Construction of the guideway would take place within the median along I-405 and local street lanes. Aerial station construction related to groundwork includes drilling and installation of CIDH piles, pile cap, and pier column construction, and excavation of elevator pits.

Expansive soils can be found almost anywhere including the Los Angeles Basin and San Fernando Valley. Expansive soils could have an impact on project elements, including the proposed aerial stations, guideway, and TPSS sites. Though construction is primarily on developed land, since the construction of Alternative 1 includes excavation and surface ground disturbances, if expansive soils do exist, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

To reduce these risks, Alternative 1 would be designed in accordance with the equivalent seismic design criteria such as the MRDC equivalent, Los Angeles County and other applicable local building codes, and the CBC. This includes compliance with equivalent MRDC Section 5 (or equivalent seismic design criteria), which requires preparation of a geotechnical investigation during final design (refer to Section 3.6-1, Regulatory and Policy Framework for additional information). This design-level geotechnical investigation must include a detailed evaluation of geologic hazards, including the depths and areal extents of liquefaction, soil expansiveness, lateral spread, and seismically induced settlement. This investigation would include collecting soil samples and performing tests to assess the potential for corrosion, consolidation, expansion, and collapse. Based on the investigation and test results, specific design recommendations, including potential remediation of expansive soils, would be developed to address any identified issues. Expansive soil remediation could include soil removal and replacement, chemical treatment, or structural enhancements.

Alternative 1 would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site.

Moreover, Alternative 1 would be required to demonstrate compliance with applicable provisions of the CBC and the MRDC equivalent with regard to soil hazard-related design, as described by PM GEO-3. The MRDC equivalent and the County of Los Angeles and City of Los Angeles building codes require site-specific investigations and reports for each construction site. The reports must identify any unsuitable soil conditions and provide recommendations for foundation type and design criteria consistent with the analysis and building code standards. Regulations exist to address weak soil issues, including expansion. As part of PM GEO-3, as described in Section 3.6.5, Alternative 1 would comply with applicable local, state, or federal laws or regulations.

Finally, prior to construction, the Project shall implement MM GEO-5, which requires preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO-2, PM GEO-3, and implementation of MM GEO-5, Alternative 1 would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Alternative 3

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Alternative 3 is subject to the same potential for expansive-soils-related hazards as Alternative 1 and would similarly be required to comply with applicable provisions of the CBC and MRDC regarding soil hazard-related design. However, operational activities associated with Alternative 3 would not directly or indirectly expose people or structures to hazards related to expansive soils. Therefore, impacts related to operational activities are less than significant.

Construction Impacts

While construction activities for Alternative 3 would primarily take place within the median of I-405, and local streets, the underground alignment of Alternative 3 would travel underground between the Wilshire Boulevard/Metro D Line Station, UCLA Gateway Station, and just before the Getty Center Station. Underground stations, including the Wilshire Boulevard/Metro D Line Station and the UCLA

Gateway Plaza Station, would use a “cut-and-cover” construction method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction. A TBM would be used to construct the underground segment of the guideway.

Expansive soils can be found almost anywhere including the Los Angeles Basin and San Fernando Valley. Expansive soils could have an impact on project elements, including the proposed stations, guideway, and TPSS sites. Construction of Alternative 3 includes excavation and surface ground disturbances, if expansive soils do exist, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

To reduce these risks, Alternative 3 would be designed in accordance with the equivalent seismic design criteria such as the MRDC equivalent, Los Angeles County and other applicable local building codes, and the CBC. This includes compliance with equivalent MRDC Section 5 (or equivalent seismic design criteria), which requires preparation of a geotechnical investigation during final design (refer to Section 3.6-1, Regulatory and Policy Framework for additional information). This design-level geotechnical investigation must include a detailed evaluation of geologic hazards, including the depths and areal extents of liquefaction, soil expansiveness, lateral spread, and seismically induced settlement. This investigation would include collecting soil samples and performing tests to assess the potential for corrosion, consolidation, expansion, and collapse. Based on the investigation and test results, specific design recommendations, including potential remediation of expansive soils, would be developed to address any identified issues. Expansive soil remediation could include soil removal and replacement, chemical treatment, or structural enhancements.

Alternative 3 would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site and take into consideration both aerial and underground construction.

Moreover, Alternative 3 would be required to comply with applicable provisions of the CBC and MRDC equivalent with regard to soil hazard-related design. The County of Los Angeles Building Code and City of Los Angeles Building Code require a site-specific foundation investigation and report for each construction site that identifies potentially unsuitable soil conditions and contains appropriate recommendations for foundation type and design criteria that conform to the analysis and implementation criteria described in the County of Los Angeles Building Code and the City of Los Angeles Building Code. Regulations exist to address weak soil issues, including expansion. PM GEO-3, as described in Section 3.6.5, would be required, as required by applicable local, state, or federal laws or regulations.

Finally, prior to construction, the Project shall implement MM GEO-5, which requires preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO-2, PM GEO-3, and implementation of MM GEO-5, Alternative 3 would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Alternative 4

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

The majority of fine-grained soil and rock encountered in the Project Study Area exhibited low plasticity, with very low to medium expansion potential (Metro, 2023a). However, expansive soils can be found almost anywhere, particularly in coastal plains and low-lying valleys such as the Los Angeles Basin and San Fernando Valley. Expansive clays can be found in weathered bedrock along the Santa Monica Mountains. Much of the northern section of the Santa Monica Mountains is in Modelo Formation. Clay-rich soils may exist locally within alluvial soils present along Alternative 4 that could swell and shrink with wetting and drying. The change in soil volume is capable of exerting enough force on structures to damage foundations, structures, and underground utilities. Damage can also occur as these soils dry out and contract. As part of PM GEO-2 during construction, a California-registered geologist and geotechnical engineer would submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils.

While expansive soils could have an impact on project elements, operational activities of Alternative 4 do not directly or indirectly cause risks of life or property as operation would not involve wetting or drying of expansive soils. Therefore, impacts related to expansive soils are less than significant during operations.

Construction Impacts

Construction activities for Alternative 4 involve building both aerial and underground sections, as well as its aerial and underground stations. The underground guideway will be constructed using a TBM whereas the aerial guideway would consist of simple spans and longer balanced cantilever spans. Foundations require CIDH shafts with both precast and CIP structural elements. Underground stations would be constructed using a “cut-and-cover” method whereby the station structure would be constructed within a trench excavated from the surface with a portion or all being covered by a temporary deck and backfilled during the later stages of station construction. Aerial stations would include construction of CIDH elevated viaduct with two parallel side platforms supported by outrigger bents.

Expansive soils can be found almost anywhere, including the Los Angeles Basin, Santa Monica Mountains, and San Fernando Valley. Expansive soils could have an impact on project elements, including the proposed stations, guideway, and TPSS sites. Construction of Alternative 4 includes excavation and surface ground disturbances, if expansive soils do exist, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

To reduce these risks, Alternative 4 would be designed in accordance with the equivalent seismic design criteria such as the MRDC, Los Angeles County and other applicable local building codes, and the CBC. This includes compliance with equivalent MRDC Section 5 (or equivalent seismic design criteria), which requires preparation of a geotechnical investigation during final design (refer to Section 3.6-1, Regulatory and Policy Framework for additional information). This design-level geotechnical investigation must include a detailed evaluation of geologic hazards, including the depths and areal extents of liquefaction, soil expansiveness, lateral spread, and seismically induced settlement. This investigation would include collecting soil samples and performing tests to assess the potential for corrosion, consolidation, expansion, and collapse. Based on the investigation and test results, specific design recommendations, including potential remediation of expansive soils, would be developed to address any identified issues. Expansive soil remediation could include soil removal and replacement, chemical treatment, or structural enhancements.

Alternative 4 would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site and take into consideration both aerial and underground construction.

Moreover, Alternative 4 would be required to comply with applicable provisions of the CBC and the MRDC equivalent with regard to soil hazard-related design, as described by PM GEO-3. The MRDC equivalent and the County of Los Angeles and City of Los Angeles building codes require site-specific investigations and reports for each construction site. The reports must identify any unsuitable soil conditions and provide recommendations for foundation type and design criteria, consistent with the analysis and building code standards. Regulations exist to address weak soil issues, including expansion. PM GEO-3, as described in Section 3.6.5, would be implemented and as such, Alternative 4 would comply with applicable local, state, or federal laws or regulations to address any potential weak soil issues during construction.

Finally, prior to construction, the Project shall implement MM GEO-5, which requires preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO 2, PM GEO-3, and implementation of MM GEO-5, Alternative 4 would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Alternative 5

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Alternative 5 is subject to the same potential for expansive soils as Alternative 4. Please refer to the Operational Impact section in Alternative 4 for details on expansive soil potential. Operational activities under Alternative 5 do not have the potential for creating substantial direct or indirect risks to life or property related to expansive soils. Therefore, impacts related to operational activities for Alternative 5 would be less than significant.

Construction Impacts

Alternative 5 would have similar construction impacts related to expansive soils as those of Alternative 4. Please refer to the Construction Impact section in Alternative 4 for details on construction-related risks due to expansive soils.

Alternative 5 would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site and take into consideration both aerial and underground construction.

Alternative 5 would be required to comply with applicable provisions of the CBC and the MRDC equivalent with regard to soil hazard-related design, as described by PM GEO-3. The MRDC equivalent and the County of Los Angeles and City of Los Angeles building codes require site-specific investigations and reports for each construction site. The reports must identify any unsuitable soil conditions and provide recommendations for foundation type and design criteria, consistent with the analysis and building code standards. Regulations exist to address weak soil issues, including expansion. PM GEO-3, as described in Section 3.6.5, would be implemented, and as such, Alternative 5 would comply with applicable local, state, or federal laws or regulations to address any potential weak soil issues during construction.

Finally, prior to construction, the Project shall implement MM GEO-5, which requires preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO-2, PM GEO-3, and implementation of MM GEO-5, Alternative 5 would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Alternative 6

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Expansive soils can be found almost anywhere, particularly in coastal plains and low-lying valleys such as the Los Angeles Basin and San Fernando Valley. Clay-rich soils may exist locally within alluvial soils present along Alternative 6 that could swell and shrink with wetting and drying. The change in soil volume is capable of exerting enough force on structures to damage foundations, structures, and underground utilities. Damage can also occur as these soils dry out and contract. As part of PM GEO-2, a California-registered geologist and geotechnical engineer would submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils.

While expansive soils could have an impact on project elements, operational activities of Alternative 6 do not directly or indirectly cause risks of life or property as operation would not involve wetting or drying of expansive soils. Therefore, impacts related to expansive soils are less than significant during operations.

Construction Impacts

Construction activities for Alternative 6 primarily involve building underground sections and its underground stations. The underground guideway will be constructed using a TBM. All stations would be constructed using a “cut-and-cover” method whereby the station structure would be constructed within a trench excavated from the surface that is covered by a temporary deck and backfilled during the later stages of station construction. In addition, portions of the Wilshire Boulevard/Metro D Line Station crossing underneath the Metro D Line Westwood/UCLA Station and underneath a mixed-use building at the north end of the station would be constructed using SEM as it would not be possible to excavate the station from the surface.

Expansive soils can be found almost anywhere, including the Los Angeles Basin, Santa Monica Mountains, and San Fernando Valley. Expansive soils could have an impact on project elements, including the proposed stations, guideway, and TPSS sites. Construction of Alternative 6 includes excavation and surface ground disturbances, if expansive soils do exist, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

To reduce these risks, Alternative 6 would be designed in accordance with the equivalent seismic design criteria such as the MRDC, Los Angeles County and other applicable local building codes, and the CBC. This includes compliance with MRDC Section 5 (or equivalent seismic design criteria), which requires the preparation of a geotechnical investigation during final design (refer to Section 3.6-1, Regulatory and Policy Framework for additional information). This design-level geotechnical investigation must include a detailed evaluation of geologic hazards, including the depths and areal extents of liquefaction, soil expansiveness, lateral spread, and seismically induced settlement. This investigation would include collecting soil samples and performing tests to assess the potential for corrosion, consolidation, expansion, and collapse. Based on the investigation and test results, specific design recommendations, including potential remediation of expansive soils, would be developed to address any identified issues. Expansive soil remediation could include soil removal and replacement, chemical treatment, or structural enhancements.

Alternative 6 would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site.

Moreover, Alternative 6 would be required to comply with applicable provisions of the CBC and the MRDC with regard to soil hazard-related design, as described by PM GEO-3. The MRDC and the County of Los Angeles and City of Los Angeles building codes require site-specific investigations and reports for each construction site. The reports must identify any unsuitable soil conditions and provide recommendations for foundation type and design criteria, consistent with the analysis and building code standards. Regulations exist to address weak soil issues, including expansion. PM GEO-3, as described in Section 3.6.5, would be implemented and as such, Alternative 6 would comply with applicable local, state, or federal laws or regulations to address any potential weak soil issues during construction.

Finally, prior to construction, the Project shall implement MM GEO-5, which requires preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined PM GEO-2, PM GEO-3, and implementation of MM GEO-5, Alternative 6 would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

The proposed MSF Base Design would be required to comply with applicable provisions of an MRDC equivalent, Los Angeles County and other applicable local building codes, and CBC with regard to soil hazard-related design.

The County of Los Angeles Building Code and City of Los Angeles Building Code require a site-specific foundation investigation and report for each construction site that identifies potentially unsuitable soil conditions and contains appropriate recommendations for foundation type and design criteria that conform to the analysis and implementation criteria described in the County of Los Angeles Building Code and the City of Los Angeles Building Code. Regulations exist to address weak soil issues, including expansion.

With compliance with the regulatory requirements as defined in PM GEO-3 and described in Section 3.6.5, and adherence to existing regulations, the proposed MSF Base Design would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

<u>Impact Statement</u>

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operations related to the proposed MSF Design Option 1 do not involve grading, excavation, or other ground disturbances. Therefore, impacts related to operational activities are less than significant.

Construction of the proposed MSF Design Option 1 may involve grading, excavation, or other ground disturbances. If expansive soils exist at these sites, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

The proposed MSF Design Option 1 would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site. Moreover, the proposed MSF Design Option 1 would be required to comply with applicable provisions of the CBC and an MRDC equivalent with regard to soil hazard-related design, as described by PM GEO-3. Finally, prior to construction, the proposed MSF Design Option 1 shall implement MM GEO-5, which requires the preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO-2, PM GEO-3, and implementation of MM GEO-5, the proposed MSF Design Option 1 would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Electric Bus Maintenance Storage Facility (Alternative 1)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operations related to the proposed Electric Bus MSF do not involve grading, excavation, or other ground disturbances. Therefore, impacts related to operational activities are less than significant.

Construction of the proposed Electric Bus MSF may involve grading, excavation, or other ground disturbances. If expansive soils exist at these sites, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

The proposed Electric Bus MSF would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site. Moreover, the proposed Electric Bus MSF would be required to comply with applicable provisions of the CBC and an MRDC equivalent with regard to soil hazard-related design, as described by PM GEO-3. Finally, prior to construction, the proposed Electric Bus MSF shall implement MM GEO-5, which requires the preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO-2, PM GEO-3, and implementation of MM GEO-5, the proposed Electric Bus MSF would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operations related to the proposed MSF do not involve grading, excavation, or other ground disturbances. Therefore, impacts related to operational activities are less than significant.

Construction of the proposed MSF may involve grading, excavation, or other ground disturbances. If expansive soils exist at these sites, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

The proposed MSF would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site. Moreover, the proposed MSF would be required to comply with applicable provisions of the CBC and an MRDC equivalent with regard to soil hazard-related design, as described by

PM GEO-3. Finally, prior to construction, the proposed MSF shall implement MM GEO-5, which requires the preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO-2, PM GEO-3, and implementation of MM GEO-5, the proposed MSF would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: Less than Significant

Construction Impact: Less than Significant with Mitigation

Operations related to the proposed MSF do not involve grading, excavation, or other ground disturbances. Therefore, impacts related to operational activities are less than significant.

Construction of the proposed MSF may involve grading, excavation, or other ground disturbances. If expansive soils exist at these sites, construction activities have the potential to create substantial direct or indirect risks to life or property. As such, impacts related to construction activities could be potentially significant.

The proposed MSF would be in compliance with the regulatory requirements as defined in PM GEO-2 which calls for a California-registered geologist and geotechnical engineer to submit to and conduct a site-specific evaluation of unstable soil conditions to confirm the existence of expansive soils. The evaluation would also provide recommendations for ground preparation and earthwork activities specific to the site. Moreover, the proposed MSF would be required to comply with applicable provisions of the CBC and the MRDC with regard to soil hazard-related design, as described by PM GEO-3. Finally, prior to construction, the proposed MSF shall implement MM GEO-5, which requires the preparation of a CMP which addresses geologic hazards such as soils with shrink-swell potential (expansive soils) and outlines strategies to minimize or avoid impacts.

With compliance with the regulatory requirements as defined in PM GEO-2, PM GEO-3, and implementation of MM GEO-5, the proposed MSF would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils during construction.

3.6.4.7 Impact GEO-7. Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

Project Alternatives

No Project Alternative

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. In absence of the Project, the only reasonably foreseeable transit improvement in the Project Study Area would involve changes to Metro Line 761. It is expected that the No Project Alternative would have no impact associated with soils incapable of adequately supporting such systems during operations.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. In absence of the Project, the only reasonably foreseeable transit improvement in the Project Study Area would involve changes to Metro Line 761. The No Project Alternative would have no impact associated with soils incapable of adequately supporting such systems during construction activities.

Alternative 1

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

Operational Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 1. As described previously, Metro would be required to prepare a site-specific SUSMP, which is part of the NPDES Municipal General Permit.

Preparation of the site-specific SUSMP would describe the minimum required best management practices to be incorporated into Alternative 1 design and on-going operation of the facilities. All development activities associated with Alternative 1 would comply with the site-specific SUSMP.

Preparation of a site-specific SUSMP and adherence to existing regulations would ensure the maximum practicable protection available for soils excavated during the construction of buildings and associated infrastructure. Compliance with existing regulations would minimize effects from erosion and ensure consistency with the *Los Angeles Regional Water Quality Control Board Water Quality Control Plan*. In view of these requirements, Alternative 1 would have no impacts associated with soils incapable of adequately supporting such systems during operations.

Construction Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 1. Alternative 1 would have no impact associated with soils incapable of adequately supporting such systems during construction activities.

Alternative 3

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

Operational Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 3. As described previously, Metro would be required to prepare a site-specific SUSMP, which is part of the NPDES Municipal General Permit.

Preparation of the site-specific SUSMP would describe the minimum required best management practices to be incorporated into Alternative 3 design and on-going operation of the facilities. All development activities associated with Alternative 3 would comply with the site-specific SUSMP.

Preparation of a site-specific SUSMP and adherence to existing regulations would ensure the maximum practicable protection available for soils excavated during the construction of buildings and associated infrastructure. Compliance with existing regulations would minimize effects from erosion and ensure consistency with the *Los Angeles Regional Water Quality Control Board Water Quality Control Plan*. In view of these requirements, Alternative 3 would have no impacts associated with soils incapable of adequately supporting such systems during operations.

Construction Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 3. Alternative 3 would have no impacts associated with soils incapable of adequately supporting such systems during construction activities.

Alternative 4

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

Operational Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 4. Alternative 4 would have no impacts associated with soils incapable of adequately supporting such systems during operations.

Construction Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 4. Alternative 4 would have no impacts associated with soils incapable of adequately supporting such systems during construction activities.

Alternative 5

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

Operational Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 5. Alternative 5 would have no impacts associated with soils incapable of adequately supporting such systems during operations.

Construction Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 5. Alternative 5 would have no impacts associated with soils incapable of adequately supporting such systems during construction activities.

Alternative 6

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: No Impact

Operational Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 6. Alternative 6 would have no impacts associated with soils incapable of adequately supporting such systems during operations.

Construction Impacts

No septic systems or alternative wastewater disposal systems are proposed for Alternative 6. Alternative 6 would have no impacts associated with soils incapable of adequately supporting such systems during construction activities.

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: No Impact

No septic systems or alternative wastewater disposal systems are proposed for the proposed MSF Base Design. Therefore, the proposed MSF Base Design would have no impact associated with soils incapable of adequately supporting such systems during operations and construction.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: No Impact

No septic systems or alternative wastewater disposal systems are proposed for the proposed MSF Design Option 1. Therefore, the proposed MSF Design Option 1 would have no impact associated with soils incapable of adequately supporting such systems during operations and construction.

Electric Bus Maintenance Storage Facility (Alternative 1)

No septic systems or alternative wastewater disposal systems are proposed for the proposed Electric Bus MSF. Therefore, the proposed Electric Bus MSF would have no impact associated with soils incapable of adequately supporting such systems during operations and construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: No Impact

No septic systems or alternative wastewater disposal systems are proposed for the proposed MSF. Therefore, the proposed MSF would have no impacts associated with soils incapable of adequately supporting such systems during operations and construction.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

No septic systems or alternative wastewater disposal systems are proposed for the proposed MSF. Therefore, the proposed MSF would have no impacts associated with soils incapable of adequately supporting such systems during operations and construction.

3.6.4.8 Impact GEO-8. Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Project Alternatives

No Project Alternative

Impact Statement

Operational Impact: No Impact

Construction Impact: Less than Significant

Operational Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. In absence of the Project, the only reasonably foreseeable transit improvement in the Project Study Area would involve changes to Metro Line 761. Operations of the projects associated with the No Project Alternative does not include activities that involve ground disturbance other than bus stop facilities associated with the rerouting of Metro Line 761. Therefore, there would be no operational impacts related to paleontological resources.

Construction Impacts

The No Project Alternative would not include construction and operation of the Project, and impacts associated with the Project would not occur. The only reasonably foreseeable transportation project under the No Project Alternative is a set of improvements to Metro Line 761, including bus stop facility updates. Bus stop facilities associated with the rerouting of Metro Line 761 would require minor ground disturbance at shallow depths within existing fill and does not involve excavation or use TBM construction. The No Project Alternative would undergo its own environmental evaluation and mitigation measures may be included to reduce impacts related to paleontological resources. Standard paleontological resources mitigation would reduce impacts related to excavation from the surface level. Therefore, the No Project Alternative for construction impacts would result in a less than significant impact.

Alternative 1

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: Less than Significant with Mitigation

Operational Impacts

Alternative 1 would have eight proposed aerial monorail stations and three bus stops. The MRT station on Wilshire Boulevard would connect to an electric bus shuttle that would operate on the street and connect people to the Metro D Line Westwood/VA Station. Operations of Alternative 1 do not include on-going activities that involve ground disturbance. Therefore, there would be no operational impacts related to paleontological resources.

Construction Impacts

Alternative 1 is a transportation infrastructure project that would operate a public transportation line with a fixed aerial guideway as well as operation of an electric bus route. The electric bus connection that would extend to Wilshire and Westwood Boulevards (or Kinross Avenue) to accommodate new electric bus stops and to the limits of the Metro Division 7 property. Construction of Alternative 1 would impact the ground surface by requiring designated access and staging and laydown areas for building the foundations and columns of the monorail. Specifically, an approximately 8-foot-wide work area would be needed along each guideway beam, on each side of the concrete straddle beams, and around each column/foundation. Additionally, construction activities would extend along the I-405 corridor to provide construction access and staging/laydown areas within and adjacent to the Caltrans ROW.

Most of the ground disturbance activities from Alternative 1 would result from the construction of the foundation columns for the MRT alignment and the foundations needed for the aerial MRT stations, switch locations, and long-span structures. The columns involved in Alternative 1 would range from 6 feet in diameter in the main alignment with a 7-foot-diameter foundation; 4-foot to 7-foot columns with an 8-foot-wide foundation at the I-405 median; 5-foot to 8-foot columns with a 9-foot foundation at the aerial MRT stations; 5-foot-diameter columns with a 6-foot foundation at the switch locations; and lastly 10-foot diameter columns with a foundation of 11 feet in diameter for the long-span structures. It is expected that the CIDH method would be used during the construction of the foundations for the columns. CIDH excavation in areas mapped as paleontologically sensitive geologic formations has the potential to encounter and disturb paleontological resources.

Because of the uncertainty regarding the depth of sensitive sediments and the potential for encountering unique paleontological resources during ground disturbance, the impact would be significant. To address this significant impact, MM GEO-6 through MM GEO-9 would be implemented. These measures include the use of onsite paleontological monitors who can quickly identify and protect resources until any discovered localities can be safely removed. These mitigation measures are designed to minimize impacts to paleontological resources by ensuring that any discoveries are properly documented, evaluated, and protected during construction activities. With the implementation of MM GEO-6 through MM GEO-9, impacts to paleontological resources would be reduced to less than significant.

Alternative 3

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: Significant and Unavoidable

Operational Impacts

Operations of Alternative 3 do not include activities that involve ground disturbance. Therefore, there would be no operational impacts related to paleontological resources.

Construction Impacts

The footprint for Alternative 3 is the same as Alternative 1 north of the proposed Getty Center Station and south of the proposed Wilshire/Metro D Line Station. The ground disturbance specific to Alternative 3 also include the staging areas and activity that would also occur at the two proposed underground portal locations (General Services Administration property and the east side of I-405 across from Getty Center), the proposed UCLA Gateway Plaza Station, the Metro D Line Station, and within the underground easement proposed for the MRT system.

The portion of Alternative 3 that lies between these two proposed stations would have a 3.7-mile underground alignment located to the east of I-405. The underground alignment would go north of Wilshire Boulevard and travel underneath Westwood Village and UCLA, before returning to the I-405 corridor just south of the proposed Getty Center Station. The tunnel would consist of a 43-foot-wide single-bore structure flanked by two 8-foot-wide walkways or drive aisles, with a maximum depth of approximately 440 feet below the surface before ascending back to grade. Additionally, Alternative 3 would have two proposed underground MRT stations: the Wilshire/Metro D Line Station and the UCLA Gateway Plaza Station. Construction of the underground MRT stations would involve building MRT platforms and all vertical circulation elements required to facilitate pedestrian entrances and connections to the local roadways and the Metro D Line subway station.

The geologic units affected by the tunnel and underground stations include young alluvium, unit 2 (Qya2), Modelo Formation sandstone (Tms), and Modelo Formation Topanga Group undivided (Tt). However, these units may not fully represent the subsurface conditions, as the stratigraphy beneath the area is variable and less understood. For instance, beneath old alluvial fan deposits (Qof2) and Qya2, additional geologic units may be present.

Construction impacts of Alternative 3 would also extend to the ground surface, where access, staging, and laydown areas are needed to construct the foundations and columns required for the monorail. These activities would require an 8-foot-wide work area along each guideway beam, and an 8-foot-wide work area around each column/foundation. Additionally, construction activities would affect areas along the I-405 corridor to provide construction access and staging/laydown areas within and adjacent to the Caltrans ROW.

In addition, construction activities for Alternative 3 would occur at the two proposed underground portal locations (the General Service Administration property and the east side of I-405 across from Getty Center). Additional construction would occur at the proposed UCLA Gateway Plaza Station, Metro D Line Station, and within the underground easement designated for the MRT system. These stations would be constructed using a cut-and-cover method which would allow for monitoring and extraction of unknown paleontological resources.

Many of the impacts from Alternative 3 would result from the construction of the foundation columns for the MRT alignment and the foundations needed for the aerial MRT stations, switch locations, and long-span structures. The columns involved in Alternative 3 would range from 6 feet in diameter in the main alignment with a 7-foot-diameter foundation; 4-foot to 7-foot columns with an 8-foot-wide foundation at the I-405 median; 5-foot to 8-foot columns with a 9-foot foundation at the aerial MRT stations; 5-foot-diameter column with a 6-foot foundation at the switch locations; and lastly 10-foot diameter columns with a foundation 11 feet in diameter for the long-span structures.

The CIDH method would be used during the construction of the foundations for the columns. This method involves drilling deep into the ground, which could disturb paleontologically sensitive formations, particularly in areas mapped as having high paleontological sensitivity (*Paleontological Resources Technical Memorandum, Attachment 1, Figure 5,* Metro, 2025b). These activities could cause potentially significant impacts to paleontological resources if sensitive sediments are encountered.

However, the depth and disturbances of these sediments are difficult to discern, and it would be possible to destroy unique paleontological resource without proper monitoring. This would constitute a significant impact. To address this significant impact, MM GEO-6 through MM GEO-9 would be implemented. These measures include the use of onsite paleontological monitors who can quickly identify and protect resources until any discovered localities can be safely removed. These mitigation measures are designed to minimize impacts to paleontological resources by ensuring that any discoveries are properly documented, evaluated, and protected during construction activities. With the implementation of MM GEO-6 through MM GEO-9, impacts to paleontological resources would be reduced to less than significant for non-TBM activities.

However, for the underground tunnels of Alternative 3, which would require use of a TBM, it may not be possible to mitigate impacts paleontological resources to less than significant levels. TBMs are designed to excavate sediments to the precise dimensions of the finished tunnel, removing the excavated material through an internal conveyor belt while simultaneously erecting the tunnel's concrete walls. However, the operation of the TBM does not allow for real-time monitoring of the excavated sediments or the tunnel walls prior to the installation of the concrete lining. As a result, it is not possible to identify, document, and recover of paleontological resources that may be present within the paleontologically sensitive geologic units encountered during tunneling. Therefore, excavations for tunnel construction would result in a significant and unavoidable impact to paleontological resources when a TBM is used.

Alternative 4

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: Significant and Unavoidable

Operational Impacts

Operations of Alternative 4 does not include activities that involve ground disturbance. Therefore, there would be no operational impacts related to paleontological resources.

Construction Impacts

Alternative 4 would have more than half of the rail it proposes to be located under the ground surface. The proposed tunnel would be nearly 9 miles long and would begin just east of Sepulveda Boulevard and south of National Boulevard. Possible construction impacts involved with Alternative 4 would all be a result of access, staging, and lay down areas that would be required for placing the heavy rail track and excavating the tunnel. The proposed tunnel would include four underground stations and would transition to an elevated guideway extending from Sepulveda Boulevard to Raymer Street, where it would turn southeast and run along the south side of the Amtrak/Metrolink corridor to Van Nuys Boulevard. The surface sediments that the elevated guideway would overlie are mapped as alluvium (Qa), young alluvium fan deposits, unit 1 (Qyf1), and young alluvium fan deposits, unit 2 (Qyf2). The units listed are not representative of what could be encountered below the surface level. (Campbell et al., 2014).

Geologic units such as the Santa Monica Slate (Jsm, Jsms, and Jsmp) lack paleontological sensitivity and are not known to preserve fossil material. Santa Monica Slate is a geologic unit composed of metamorphic rock, formed under intense pressure and temperature which limits fossil preservation potential. This metamorphic process usually destroys or deforms any fossil material that could have been present. However, due to the relatively low grade of metamorphism in this unit, some relevant features of fossils may still be preserved (Imlay, 1963). Additionally, the Quaternary young alluvium (Qya2) has a low sensitivity due to limited potential for preserving fossil material because this unit is too young to have preserved any significant fossil material. The Modelo Formation labeled Tm, Tms, and Tmd have a high sensitivity for preserving fossil material due to their age and the presence of fossil localities within the same units in nearby areas (SVP, 1995; Bell, 2023).

Because of the uncertainty regarding the depth of sensitive sediments and the potential for encountering unique paleontological resources during ground disturbance, the impact would be significant. To address this significant impact, MM GEO-6 through MM GEO-9 would be implemented. These measures include the use of onsite paleontological monitors who can quickly identify and protect resources until any discovered localities can be safely removed. These mitigation measures are designed to minimize impacts to paleontological resources by ensuring that any discoveries are properly documented, evaluated, and protected during construction activities. With the implementation of MM GEO-6 through MM GEO-9, impacts to paleontological resources would be reduced to less than significant for non-TBM activities.

However, for the underground tunnels of Alternative 4, which would require use of a TBM, it may not be possible to mitigate impacts paleontological resources to less than significant levels. TBMs are designed to excavate sediments to the precise dimensions of the finished tunnel, removing the excavated material through an internal conveyor belt while simultaneously erecting the tunnel's concrete walls. However, the operation of the TBM does not allow for real-time monitoring of the excavated sediments or the tunnel walls prior to the installation of the concrete lining. As a result, it is not possible to identify, document, and recover of paleontological resources that may be present within the paleontologically sensitive geologic units encountered during tunneling. Therefore, excavations for tunnel construction would result in a significant and significant impact to paleontological resources when a TBM is used.

Alternative 5

<u>Impact Statement</u>

Operational Impact: No Impact

Construction Impact: Significant and Unavoidable

Operational Impacts

Operations of Alternative 5 do not include activities that involve ground disturbance. Therefore, there would be no operational impacts related to paleontological resources.

Construction Impacts

Alternative 5 would involve a heavy rail system with majority of the proposed rail to be located under the ground surface. The proposed tunnel would extend the existing tunnel system from the Metro D Line north along Sepulveda Boulevard. Possible construction impacts involved with Alternative 5 would all be a result of access, staging, and lay down areas that would be required for placing the heavy rail track and excavating the tunnel. Additionally, there would also be potentially significant impacts to surrounding sediments for staging areas and access pathways for all seven of the underground stations that are proposed for Alternative 5 (Sherman Way, Metro G Line, Ventura Boulevard, UCLA Gateway Plaza, Wilshire/Metro D Line, Santa Monica Boulevard, and the Metro E Line).

Alternative 5 would have seven underground stations (Sherman Way, Metro G Line, Ventura Boulevard, UCLA Gateway Plaza, Wilshire/Metro D Line, Santa Monica Boulevard, Metro E Line) and one aerial station (Van Nuys Metrolink). Alternative 5 would mostly affect sediments that are located below the ground surface. As stated before, knowing for certain what geologic units will be affected at depth is difficult to say for certain without someone monitoring the sediments in any given working area. However, the sediments mapped at the surface where the tunnel system would be emplaced for Alternative 5 are mapped as young alluvium, unit 2 (Qya2), young alluvium fan deposits, unit 1 (Qyf1), young alluvium fan deposits, unit 2 (Qyf2), Modelo Formation undivided I, Modelo Formation sandstone (Tms), Modelo Formation diatomaceous shale (Tmd), Santa Monica Slate spotted slate (Jsms), Santa Monica Slate undivided (Jsm), and Santa Monica Slate phyllite (Jsmp). Generally, geologic units such as the Santa Monica Slate (Jsms, Jsmp) do not have any paleontological sensitivity to preserve fossil material. The Santa Monica Slate is a geologic unit that comprises metamorphic rock, which undergoes intense pressure and temperature. This metamorphic process usually destroys and deforms any fossil material that could have been located within the rock; however, because of the relatively low grade of metamorphism, enough relevant features of the fossils were preserved in portions of the Santa Monica Slate. When the Santa Monica Slate (Jsms, Jsmp) is encountered, the project paleontologist would determine whether low-grade metamorphic conditions are present. If that is the case, that portion of the unit (Jsms) may be considered "Low" paleontological sensitivity and monitored accordingly (Imlay, 1963). Additionally, the Qyf1, Qyf2, and Qya2 units have a "Low" sensitivity for preserving fossil material, because these units are too young to have preserved any significant fossil material. The geologic map unit labeled as Tm, Tms, and Tmd all have a high sensitivity for preserving fossil material due to their age, as well as the fossil localities found within the same map units nearby (SVP, 1995; Bell, 2023).

Because of the uncertainty regarding the depth of sensitive sediments and the potential for encountering unique paleontological resources during ground disturbance, the impact would be significant. To address this significant impact, MM GEO-6 through MM GEO-9 would be implemented. These measures include the use of onsite paleontological monitors who can quickly identify and protect resources until any discovered localities can be safely removed. These mitigation measures are designed to minimize impacts to paleontological resources by ensuring that any discoveries are properly documented, evaluated, and protected during construction activities. With the implementation of MM GEO-6 through MM GEO-9, impacts to paleontological resources would be reduced to less than significant for non-TBM activities.

However, for the underground tunnels of Alternative 5, which would require use of a TBM, it may not be possible to mitigate impacts paleontological resources to less than significant levels. TBMs are designed to excavate sediments to the precise dimensions of the finished tunnel, removing the excavated material through an internal conveyor belt while simultaneously erecting the tunnel's concrete walls.

However, the operation of the TBM does not allow for real-time monitoring of the excavated sediments or the tunnel walls prior to the installation of the concrete lining. As a result, it is not possible to identify, document, and recover of paleontological resources that may be present within the paleontologically sensitive geologic units encountered during tunneling. Therefore, excavations for tunnel construction would result in a significant and unavoidable impact to paleontological resources when a TBM is used.

Alternative 6

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

Operational Impacts

Operation of Alternative 6 would not require excavation that may affect mineral resources. No mining operations are present within the Alternative 6 RSA, so operation of Alternative 6 would not disrupt mining operations. Therefore, Alternative 6 would have no operational impacts related to the loss of availability of a known mineral resource or a locally important mineral resource recovery site.

Construction Impacts

Alternative 6 would utilize a heavy rail system with seven underground stations. The path the heavy rail system would take for Alternative 6 would be located to the east of the I-405 corridor. The southern terminus of the tunnel for Alternative 6 would be located beneath Bundy Drive to the southeast of the station. The tunnel would travel north under the Santa Monica Mountains and curve to the west and onto Los Angeles Department of Water and Power's Stone Canyon Reservoir property to allow for construction of a ventilation and access shaft in the mountains. A proposed underground station would be just south of the existing Van Nuys Metrolink Station. This station would serve as a transfer point to Metrolink and the planned East San Fernando Valley Light Rail Transit Line station at this location. North of the station, the alignment would curve east toward Woodman Avenue to connect to the proposed MSF.

Possible construction impacts involved with Alternative 6 would all be a result of access, staging and lay down areas that would be required for placing the heavy rail track and excavating the tunnel. Additionally, there would also be potentially significant impacts to surrounding sediments for staging areas and access pathways for all seven of the underground stations that are planned for Alternative 6 (Metro E Line Expo/Bundy Station, Santa Monica Boulevard Station, Wilshire Boulevard/Metro D Line Station, UCLA Gateway Plaza Station, Ventura Boulevard/Van Nuys Boulevard Station, Metro G Line Van Nuys Station, Van Nuys Metrolink Station).

The geologic units mapped within the project footprint for Alternative 6 are young alluvium, unit 2 (Qya2), young alluvium fan deposits, unit 1 (Qyf1), young alluvium fan deposits, unit 2 (Qyf2), Modelo Formation undivided (Tm), Modelo Formation sandstone (Tms), Modelo Formation Topanga Group undivided (Tt), Modelo Formation diatomaceous shale (Tmd), Cretaceous tonalite (Kt), Santa Monica Slate spotted slate (Jsms), and Santa Monica Slate phyllite (Jsmp). Cretaceous tonalite (Kt) was formed by the cooling of molten rock and thus cannot contain fossils; the Santa Monica Slate – Phyllite (Jsmp), and artificial fill (af), have "No" paleontological sensitivity. As stated before, knowing for certain what geologic units would be impacted at depth is difficult to specify without on-site monitoring of the sediments in any given working area. However, the sediments mapped at the surface of where the tunnel system would go for Alternative 6 are mapped as Qya2, Qyf1, Qyf2, Tm, Tms, Tt, Tmd, Jsms, Santa Monica Slate undivided (Jsm), and Jsmp. Generally, geologic units such as the Santa Monica Slate (Jsms, Jsmp) do not have any paleontological sensitivity to preserve fossil material. The Santa Monica Slate is a geologic unit consisting of metamorphic rock, which undergoes intense pressure and temperature, chemically altering it from the original form. This metamorphic process usually destroys and deforms any fossil material that could have been located within; however, because of the relatively low grade of metamorphism, enough relevant features of the fossils were preserved in portions of the Santa Monica Slate. When the portion of the Santa Monica Slate with "Unknown" sensitivity (Jsms) is encountered, the project paleontologist would need to determine if low-grade metamorphic conditions are present. If that is the case, that portion of the unit (Jsms) may be considered "Low" paleontological sensitivity and monitored accordingly (Imlay, 1963). Additionally, the Qyf1, Qyf2, and Qya2 have a "Low" sensitivity for preserving fossil material because these units are too young to have preserved any significant fossil material. The geologic map units labeled as Tm, Tms, Tmd, and Tt all have a high sensitivity for preserving fossil material due to their age, as do the fossil localities found within the same map units nearby (Bell, 2023).

Because of the uncertainty regarding the depth of sensitive sediments and the potential for encountering unique paleontological resources during ground disturbance, the impact would be significant. To address this significant impact, MM GEO-6 through MM GEO-9 would be implemented. These measures include the use of onsite paleontological monitors who can quickly identify and protect resources until any discovered localities can be safely removed. These mitigation measures are designed to minimize impacts to paleontological resources by ensuring that any discoveries are properly documented, evaluated, and protected during construction activities. With the implementation of MM GEO-6 through MM GEO-9, impacts to paleontological resources would be reduced to less than significant for non-TBM activities.

However, for the underground tunnels of Alternative 6, which would require use of a TBM, it may not be possible to mitigate impacts paleontological resources to less than significant levels. TBMs are designed to excavate sediments to the precise dimensions of the finished tunnel, removing the excavated material through an internal conveyor belt while simultaneously erecting the tunnel's concrete walls. However, the operation of the TBM does not allow for real-time monitoring of the excavated sediments or the tunnel walls prior to the installation of the concrete lining. As a result, it is not possible to identify, document, and recover of paleontological resources that may be present within the paleontologically sensitive geologic units encountered during tunneling. Therefore, excavations for tunnel construction would result in a significant and unavoidable impact to paleontological resources when a TBM is used(*Paleontological Resources Technical Memorandum, Attachment A*, Figure 5).

Maintenance and Storage Facilities

Monorail Transit Maintenance and Storage Facility Base Design (Alternatives 1 and 3)

<u>**Impact Statement**</u>

Operational Impact: No Impact

Construction Impact: Less than Significant with Mitigation

The impacts involved with the MSF include the construction of the administrative buildings, maintenance buildings, wash facilities, drive aisles, storage tracks, and the columns for the aerial MSF. The surface rocks in the underground portions of the proposed MSF are mapped as Qya2 but may be more paleontologically sensitive (older) than indicated, at depth. With the implementation of

MM GEO-6 through MM GEO-9, including construction monitoring, impacts associated with the MSF Base Design would be less than significant.

Monorail Transit Maintenance and Storage Facility Design Option 1 (Alternatives 1 and 3)

Impact Statement

Operational Impact: No Impact

Construction Impact: Less than Significant with Mitigation

The impacts involved with the MSF include the construction of the administrative buildings, maintenance buildings, wash facilities, drive aisles, storage tracks, and the columns for the aerial MSF. The surface rocks in the underground portions of the proposed MSF are mapped as Qya2 but may be more paleontologically sensitive (older) than indicated, at depth. Since the depth and extent of sensitive sediments are unknown, there is a potential to impact sensitive paleontological resources during ground disturbance activities. This would constitute a significant impact.

To address these impacts, Monorail MSF Design Option 1 would be required to implement MM GEO-6 through MM GEO-9, which include requirements for construction monitoring and resource management. With the implementation of these measures, the impact on paleontological resources from construction of the Monorail MSF Design Option 1 would be reduced to less than significant.

Electric Bus Maintenance Storage Facility (Alternative 1)

Impact Statement

Operational Impact: No Impact

Construction Impact: No Impact

The type of buildings and uses in the electric bus MSF would not likely require deep excavation. Therefore, no impacts related to paleontological resources would occur.

Heavy Rail Transit Maintenance and Storage Facility (Alternatives 4 and 5)

Impact Statement

Operational Impact: No Impact

Construction Impact: Less than Significant with Mitigation

The impacts involved with the MSF include the construction of the administrative buildings, maintenance buildings, wash facilities, drive aisles, and storage tracks. The surface rocks in the underground portions of the proposed MSF are mapped as Qya2 but may be more paleontologically sensitive (older) than indicated, at depth. Since the depth and extent of sensitive sediments are unknown, there is a potential to impact sensitive paleontological resources during ground disturbance activities. This would constitute a significant impact.

To address these impacts, the MSF would be required to implement MM GEO-6 through MM GEO-9, which include requirements for construction monitoring and resource management. With the implementation of these measures, the impact on paleontological resources from construction of the MSF would be reduced to less than significant.

Heavy Rail Transit Maintenance and Storage Facility (Alternative 6)

Impact Statement

Operational Impact: No Impact

Construction Impact: Less than Significant with Mitigation

The impacts involved with the MSF include the construction of the administrative buildings, maintenance buildings, wash facilities, drive aisles, and storage tracks. The surface rocks in the underground portions of the proposed MSF are mapped as Qya2 but may be more paleontologically sensitive (older) than indicated, at depth. Since the depth and extent of sensitive sediments are unknown, there is a potential to impact sensitive paleontological resources during ground disturbance activities. This would constitute a significant impact.

To address these impacts, the MSF would be required to implement MM GEO-6 through MM GEO-9, which include requirements for construction monitoring and resource management. With the implementation of these measures, the impact on paleontological resources from construction of the MSF would be reduced to less than significant.

3.6.5 Project Measures

3.6.5.1 Operational Impacts

No project measure is required.

3.6.5.2 Construction Impacts

The alternatives shall implement the following project measures:

PM GEO-1: *The Project shall demonstrate to the County of Los Angeles and the City of Los Angeles that the design of the Project complies with all applicable provisions of the California Building Code with respect to seismic design. Compliance shall include the following:*

- *California Building Code Seismic Zone 4 Standards as the minimum seismic-resistant design for all proposed facilities.*
- *Seismic-resistant earthwork and construction design criteria (i.e., for the construction of the tunnel below ground surface, liquefaction, landslide, etc.), based on the site-specific recommendations of a California Registered Geologist in cooperation with the Project Engineers.*
- *An engineering analysis to characterize site-specific performance of alluvium or fill where either forms part or all of the support.*

PM GEO-2: *A California-registered geologist and geotechnical engineer shall submit to and have approval by the Project a site-specific evaluation of unstable soil conditions, including recommendations for ground preparation and earthwork activities specific to the site and in conformance with City of Los Angeles Building Code, County of Los Angeles Building Code, the California Building Code, Metro Rail Design Criteria (as applicable), and Caltrans Structure Seismic Design Criteria.*

PM GEO-3: *The Project shall demonstrate that the design of the Project complies with all applicable provisions of the County of Los Angeles Building Code and City of Los Angeles Building Code.*

3.6.6 Mitigation Measures

3.6.6.1 Operational Impacts

No mitigation is required.

3.6.6.2 Construction Impacts

The alternatives shall implement the following mitigation measures to reduce the impacts to geology, soils, seismicity, and paleontological to less than significant during construction activities, where feasible. MM GEO-2 would be implemented during construction activities for Alternative 3, Alternative 4, Alternative 5, and Alternative 6:

MM GEO-1: *The Project's design shall include integration and installation of early warning system to detect and respond to strong ground motion associated with ground rupture. Known active fault(s) (i.e., Santa Monica Fault) shall be monitored. Linear monitoring systems such as time domain reflectometers or equivalent or more effective technology shall be installed along fixed guideway in the zone of potential ground rupture.*

MM GEO-2: *Where excavations are made for the construction of the below surface tunnel, the Project shall either shore excavation walls with shoring designed to withstand additional loads or flatten or reduce the slope of the excavation walls by laying them back to a shallower gradient. Excavation spoils shall not be placed immediately adjacent to excavation walls unless the excavation wall is shored to support the added load. Spoils should be stored at a safe distance from the excavation site to prevent undue pressure on the walls.*

MM GEO-3: *The Project shall comply with the recommendations of the final soils and geotechnical report. These recommendations shall be implemented in the design of the Project, including but not limited to measures associated with site preparation, fill placement, temporary shoring and permanent dewatering, groundwater seismic design features, excavation stability, foundations, soil stabilization, establishment of deep foundations, concrete slabs and pavements, surface drainage, cement type and corrosion measures, erosion control, shoring and internal bracing, and plan review.*

MM GEO-4: *In locations where soils have a potential to be corrosive to steel and concrete, the soils shall be removed, and buried structures shall be designed for corrosive conditions, and corrosion-protected materials shall be used in infrastructure.*

MM GEO-5: *Prior to construction, the Project shall prepare a Construction Management Plan that addresses geologic constraints and outlines strategies to minimize or avoid impacts to geologic hazards during construction. The plan shall address the following geological and geotechnical constraints/resources and incorporate standard mitigation (shown in parentheses):*

- *Groundwater withdrawal (using dewatering pumps and proper disposal of contaminated groundwater according to legal requirements)*

- *Risk of ground failure from unstable soils (retaining walls and inserting soil stabilizers)*
- *Subsidence (retaining walls and shoring)*
- *Erosion control methods (netting on slopes, bioswales, sediment basins, re-vegetation)*
- *Soils with shrink-swell potential (inserting soil stabilizers including chemical treatment of soils)*
- *Soils with corrosive potential (protective coatings and protection for metal, steel or concrete structures, soil treatment, removal of corrosive soils, and proper disposal of any corrosive soils)*
- *Impact to topsoils (netting, and dust control)*

The recommendations of the Construction Management Plan shall be incorporated into the project plans and specifications.

MM GEO-6: *The potential to avoid impacts to previously unrecorded paleontological resources shall be avoided by having a qualified paleontologist or archaeologist cross-trained in paleontology, meeting the Society of Vertebrate Paleontology Standards retained as the project paleontologist, with a minimum of a bachelor's degree (Bachelor of Science/Bachelor of Arts) in geology, or related discipline with an emphasis in paleontology and demonstrated experience and competence in paleontological research, fieldwork, reporting, and curation. A paleontological monitor, under the guidance of the project paleontologist, shall be present as required by the type of earth-moving activities in the Project, specifically in areas south of Ventura Boulevard that have been deemed areas of high sensitivity for paleontological resources. The monitor shall be a trained paleontological monitor with experience and knowledge of sediments, geologic formations, and the identification and treatment of fossil resources.*

MM GEO-7: *A Paleontological Resources Impact Mitigation Program shall be prepared by a qualified paleontologist. The Paleontological Resources Impact Mitigation Program shall include guidelines for developing and implementing mitigation efforts, including minimum requirements, general fieldwork, and laboratory methods, threshold for assessing paleontological resources, threshold for excavation and documentation of significant or unique paleontological resources, reporting requirements, considerations for the curation of recovered paleontological resources into a relevant institution, and process of documents to Metro and peer review entities.*

MM GEO-8: *The project paleontologist or paleontological monitor shall perform a Workers Environmental Awareness Program training session for each worker on the project site to familiarize the worker with the procedures in the event a paleontological resource is discovered. Workers hired after the initial Workers Environmental Awareness Program training conducted at the pre-grade meeting shall be required to take additional Workers Environmental Awareness Program training as part of their site orientation.*

MM GEO-9: *To prevent damage to unanticipated paleontological resources, a paleontological monitor shall observe ground-disturbing activities including but not limited to grading, trenching, drilling, etc. Paleontological monitoring shall start at full time for geological units deemed to have "High" paleontological sensitivity. Geological units deemed to have "Low" paleontological sensitivity shall be monitored by spot checks. No monitoring is required for geologic units identified as having "No" paleontological sensitivity. "Unknown" paleontological sensitivity is assigned to the less metamorphosed portions of the Santa Monica Slate, as detailed below.*

- *The monitor shall be empowered to temporarily halt or redirect construction efforts if paleontological resources are discovered. The paleontological monitor shall flag an area 50 feet around the discovery and notify the construction crew immediately. No further disturbance in the flagged area shall occur until the qualified paleontologist has cleared the area. In consultation with the qualified paleontologist, the monitor shall quickly assess the nature and significance of the find. If the specimen is not significant, it shall be quickly removed, and the area cleared. In the event paleontological resources are discovered and deemed by the project paleontologist to be scientifically important, the paleontological resources shall be recovered by excavation (i.e., salvage and bulk sediment sample) or immediate removal if the resource is small enough and can be removed safely in this fashion without damage to the paleontological resource. If the discovery is significant, the qualified paleontologist shall notify Metro immediately. In consultation with Metro, the qualified paleontologist shall develop a plan of mitigation, which will likely include salvage excavation and removal of the find, removal of sediment from around the specimen (in the laboratory), research to identify and categorize the find, curation of the find in a local qualified repository, and preparation of a report summarizing the find.*
- *Recovered paleontological resources shall be prepared, identified to the lowest taxonomic level possible, and curated into a recognized repository (i.e., Natural History Museum of Los Angeles County). Bulk sediment samples, if collected, shall be "screen-washed" to recover the contained paleontological resources, which will then be identified to the lowest taxonomic level possible, and curated (as above). The report and all relevant field notes shall be accessioned along with the paleontological resources.*

3.6.6.3 Impacts After Mitigation Measures

A summary of mitigation measures and impacts before and after mitigation for the project alternatives and maintenance facilities are provided in Table 3.6-4 and Table 3.6-5. With adherence to existing regulations, Alternative 1 would have a less than significant impact associated with landslides (Impact GEO-3) and/or slope instability (Impact GEO-5) during construction. With adherence to existing regulations and implementation of MM GEO-2, Alternative 3, Alternative 4, Alternative 5, and Alternative 6 would have a less than significant impact associated with landslides (Impact GEO-3) and/or slope instability (Impact GEO-5) during construction. For all alternatives, adherence to existing regulations and policies and with the implementation of MM GEO-1, MM GEO-2, MM GEO-3, MM GEO-4, and MM GEO-5 would ensure that maximum practicable protection is available for users of buildings and infrastructure and associated trenches, slopes, and foundations. Therefore, all alternatives would have a less than significant impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils (Impact GEO-5).

With the implementation of MM GEO-5 and adherence to existing regulations, all alternatives would have a less than significant impact regarding the exposure of people or structures to hazards related to expansive soils (Impact GEO-6).

When grading and trenching activities are employed by any of the alternatives, adherence to MM GEO-6 through MM GEO-9 would reduce the impact to paleontological resources to less than significant (Impact GEO-8). However, use of CIDH method associated with all alternatives would grind the soil and not allow careful inspection for paleontological resources. Where CIDH methods are used, impacts would remain significant and unavoidable. Similarly, for Alternative 3, Alternative 4, Alternative 5, and Alternative 6, use of a TBM would grind the soil and not allow careful inspection for paleontological resources (Impact GEO-8); therefore, impacts would remain significant and unavoidable.

Table 3.6-4. Summary of Mitigation Measures and Impacts Before and After Mitigation for the Project Alternatives

CEQA Impact Topic		No Project	Alt 1	Alt 3	Alt 4	Alt 5	Alt 6
Operational							
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 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.	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-2: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking and/or seismic-related ground failure, including liquefaction?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-3: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-4: Would the project result in substantial soil erosion or the loss of topsoil?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-5: 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?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-6: Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

CEQA Impact Topic		No Project	Alt 1	Alt 3	Alt 4	Alt 5	Alt 6
Impact GEO-7: Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	Impacts Before Mitigation	NI	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI	NI
Impact GEO-8: Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Construction							
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 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.	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-2: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking and/or seismic-related ground failure, including liquefaction?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-3: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?	Impacts Before Mitigation	LTS	LTS	PS	PS	PS	PS
	Applicable Mitigation	NA	NA	MM GEO-2	MM GEO-2	MM GEO-2	MM GEO-2
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-4: Would the project result in substantial soil erosion or the loss of topsoil?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

CEQA Impact Topic		No Project	Alt 1	Alt 3	Alt 4	Alt 5	Alt 6
Impact GEO-5: 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?	Impacts Before Mitigation	LTS	PS	PS	PS	PS	PS
	Applicable Mitigation	NA	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-6: Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	Impacts Before Mitigation	LTS	PS	PS	PS	PS	PS
	Applicable Mitigation	NA	MM GEO-5	MM GEO-5	MM GEO-5	MM GEO-5	MM GEO-5
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact GEO-7: Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	Impacts Before Mitigation	NI	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI	NI
Impact GEO-8: Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	Impacts Before Mitigation	LTS	PS	PS	PS	PS	PS
	Applicable Mitigation	NA	MM GEO-6 through MM GEO-9	MM GEO-6 through MM GEO-9	MM GEO-6 through MM GEO-9	MM GEO-6 through MM GEO-9	MM GEO-6 through MM GEO-9
	Impacts After Mitigation	LTS	LTS	SU	SU	SU	SU

Source: HTA, 2024

GEO = geology, soils, seismicity, and paleontological resources
LTS = less than significant
MM = mitigation measure
NA = not applicable
NI = no impact
PS = potentially significant
SU = significant and unavoidable

Table 3.6-5. Summary of Mitigation Measures and Impacts Before and After Mitigation for the Maintenance and Storage Facilities

CEQA Impact Topic		MRT MSF Base Design (Alts 1 and 3)	MRT MSF Design Option 1 (Alts 1 and 3)	Electric Bus MSF (Alt 1)	HRT MSF (Alts 4 and 5)	HRT MSF (Alt 6)
Operational						
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 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.	Impacts Before Mitigation	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI
Impact GEO-2: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking and/or seismic-related ground failure, including liquefaction?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
Impact GEO-3: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?	Impacts Before Mitigation	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI
Impact GEO-4: Would the project result in substantial soil erosion or the loss of topsoil?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
Impact GEO-5: 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?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
Impact GEO-6: Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
	Impacts Before Mitigation	NI	NI	NI	NI	NI

CEQA Impact Topic		MRT MSF Base Design (Alts 1 and 3)	MRT MSF Design Option 1 (Alts 1 and 3)	Electric Bus MSF (Alt 1)	HRT MSF (Alts 4 and 5)	HRT MSF (Alt 6)
Impact GEO-7: Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI
Impact GEO-8: Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	Impacts Before Mitigation	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI
Construction						
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 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.	Impacts Before Mitigation	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI
Impact GEO-2: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking and/or seismic-related ground failure, including liquefaction?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
Impact GEO-3: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?	Impacts Before Mitigation	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI
Impact GEO-4: Would the project result in substantial soil erosion or the loss of topsoil?	Impacts Before Mitigation	LTS	LTS	LTS	LTS	LTS
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
	Impacts Before Mitigation	PS	PS	PS	PS	PS

CEQA Impact Topic		MRT MSF Base Design (Alts 1 and 3)	MRT MSF Design Option 1 (Alts 1 and 3)	Electric Bus MSF (Alt 1)	HRT MSF (Alts 4 and 5)	HRT MSF (Alt 6)
Impact GEO-5: 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?	Applicable Mitigation	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5	MM GEO-1 through MM GEO-5
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
Impact GEO-6: Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	Impacts Before Mitigation	PS	PS	PS	PS	PS
	Applicable Mitigation	MM GEO-5	MM GEO-5	MM GEO-5	MM GEO-5	MM GEO-5
	Impacts After Mitigation	LTS	LTS	LTS	LTS	LTS
Impact GEO-7: Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	Impacts Before Mitigation	NI	NI	NI	NI	NI
	Applicable Mitigation	NA	NA	NA	NA	NA
	Impacts After Mitigation	NI	NI	NI	NI	NI
Impact GEO-8: Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	Impacts Before Mitigation	PS	PS	NI	PS	PS
	Applicable Mitigation	MM GEO-6 through MM GEO-9	MM GEO-6 through MM GEO-9	NA	MM GEO-6 through MM GEO-9	MM GEO-6 through MM GEO-9
	Impacts After Mitigation	LTS	LTS	NI	LTS	LTS

Source: HTA, 2024

GEO = geology, soils, seismicity, and paleontological resources
LTS = less than significant
MM = mitigation measure
NA = not applicable
NI = no Impact
PS = potentially significant
SU = significant and unavoidable