INTRODUCTION

This section describes the existing geological and seismic conditions at and near the Project Sites and analyzes the Project’s potential impacts in regards to the existing conditions. Specifically, this section evaluates potential impacts related to exposing people or structures to the risk of loss, injury or death due to seismic ground shaking and/or seismic ground failure; being located on an unstable geologic unit; and/or conflict with the Hillside Management Area Ordinance or hillside design standards in the County General Plan Conservation and Open Space Element.

The following analysis is based on the following geotechnical evaluations for the Project:

- **Geotechnical Assessment, Site 1: Proposed Office Building and Parking Structure, 500, 510, 526, and 532 South Vermont Avenue including 523 and 531 South Shatto Place, Los Angeles, California**, prepared by Geotechnologies, Inc., August 15, 2017 (Draft EIR Appendix 4.5-1);

- **Geotechnical Assessment, Site 2: Proposed Adaptive Reuse Project and Mixed-Use Structure, 540, 542, and 550 South Vermont Avenue and 3175 West 6th Street, Los Angeles, California**, prepared by Geotechnologies, Inc., August 15, 2017 (Draft EIR Appendix 4.5-2); and

- **Geotechnical Assessment, Site 3: Proposed Affordable Housing Development, 427 and 433 South Vermont Avenue, Los Angeles, California**, prepared by Geotechnologies, Inc., August 15, 2017 (Draft EIR Appendix 4.5-3).

These reports present the geotechnical assessments of the Project Sites and discuss the subsurface conditions anticipated at each site as well as the potential for seismic hazards that could affect the sites. These reports are based on review of the proposed Project and review of published geotechnical and geological information. Furthermore, the analysis in this section includes a description of the regulatory framework, thresholds for determining if the Project would result in significant impacts, mitigation measures (if determined applicable), and the level of significance after mitigation.

ENVIRONMENTAL SETTING

Existing Conditions

*Regional Geologic Setting*

The Project Sites are located in the Los Angeles Basin, which is at the northern end of the Peninsular Ranges Geomorphic Province that borders the Transverse Ranges Province. The Transverse Ranges geomorphic province is characterized by east-west trending mountain ranges that include the Santa Monica Mountains. The southern boundary of the province is marked by the Santa Monica, Hollywood, Raymond, Sierra Madre, and Cucamonga faults. The Peninsular Range province is characterized by northwest-southeast trending alignments of mountains and hills and intervening basins, reflecting the influence of northwest trending major faults and folds controlling the general geologic structural fabric of the region. This province extends northwesterly from Baja California into the Los Angeles Basin and westerly into the offshore area, including Santa Catalina, Santa Barbara, San Clemente, and San Nicolas islands. This province is bounded on the east by the San Jacinto fault zone.
Over 22 million years ago the Los Angeles basin was a deep marine basin formed by tectonic forces between the North American and Pacific plates. Since that time, over five miles of marine and non-marine sedimentary rock, as well as intrusive and extrusive igneous rocks have filled the basin. During the last two million years, defined by the Pleistocene and Holocene epochs, the Los Angeles basin and surrounding mountains have been uplifted to form the present day landscape. Erosion of the surrounding mountains has resulted in deposition of unconsolidated sediments in low-lying areas by rivers such as the Los Angeles River.

**Local Geologic Setting**

The topography of the Project Sites is relatively flat with no pronounced highs or lows. Based on review of previous geotechnical investigations conducted in the vicinity of the Project Sites and published geological information, the anticipated geologic materials underlying the Project Sites consist of deep fill materials, alluvial soils, and bedrock of the Puente Formation. The alluvial soils underlying the fill generally consist of mixtures of sands, silty sands, and silty clays. The alluvium is typically medium dense to very dense, or stiff, and well-consolidated with expansion characters that range from low to moderate. Local variations in moisture content and soil type may occur. It is anticipated that the alluvial soils would be underlain by Puente Formation bedrock. This bedrock was encountered at depths ranging between 28 and 46 feet below grade in a previous investigation conducted to the north of Site 1.

**Groundwater**

Current groundwater levels at the Project are anticipated to be approximately 28 and 30 feet below grade as based on previous investigations near the Project Sites. According to groundwater data provided in the Seismic Hazard Zone Report of the Hollywood 7.5-Minute Quadrangle, the historic-high groundwater level for the Project Sites was on the order of 20 feet below ground surface. Fluctuations in the level of groundwater can be expected to occur over time due to variations in rainfall, temperature, and other factors, including in the vicinity of the Project Sites.

**Faulting and Seismicity**

The numerous faults in Southern California include active, potentially active, and inactive faults. The criteria for these three major groups are based on criteria developed by the California Geological Survey for the Alquist-Priolo Earthquake Fault Zoning Program. By definition, an active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). A potentially active fault is a fault that has demonstrated surface displacement of Quaternary age deposits (last 1.6 million years). Inactive faults have not moved in the last 1.6 million years.

Review of the Earthquake Zones of Required Investigation Map of the Hollywood Quadrangle indicates that none of the Project Sites are located within an Alquist-Priolo Earthquake Fault Zone. In addition, City of Los Angeles data show that none of the Project Sites are located in a Preliminary Fault Rupture Study Area. Furthermore, based on research of available literature and the results of site reconnaissance, no known active or potentially active faults underlie the Project Sites. However, there are known faults in the immediate vicinity of the Project Sites.¹ The fault nearest to the Project Sites is the Hollywood Fault,

¹ City of Los Angeles’ GIS databases including Zoning Information Map Access System (ZIMAS) and NavigateLA indicate a northwest-southeast trending fault is located approximately 0.3 mile to the southeast of the Project.
approximately three miles to the northwest.

The Hollywood Fault is a reverse, north-dipping fault located along the southern edge of the eastern Santa Monica Mountains. The fault dips steeply to the north and juxtaposes Miocene sedimentary rocks over Pleistocene and Holocene alluvium. Surface rupture is believed to have occurred between 6,000 and 11,000 years ago. The Hollywood Fault is considered active by the State Geologist and the City of Los Angeles considers it active for planning purposes. The California Geological Survey designated an Earthquake Fault Zone for this Fault in the Earthquake Fault Zone map published on November 6, 2014.

**Landslide/Slope Stability**

The probability of seismically-induced landslides affecting the Project Sites is low due to the lack of significant slopes on the site and surrounding areas. Moreover, the Project Sites are not in an area identified as having a potential for seismic slope instability. The Project Sites are not included in an area of “Landslide Inventory and Hillside Areas” and there are no known landslides at the Project Sites, nor are the Project Sites in the path of any known or potential landslides.²

**Liquefaction/Lateral Spreading**

Liquefaction is the process in which saturated, silty to cohesionless soils below the groundwater table temporarily lose strength during strong ground shaking as a consequence of increased pore pressure during conditions such as those caused by earthquakes. The vast majority of liquefaction hazards are associated with sandy soils and silty soils of low plasticity. Potentially liquefiable soils must be saturated or nearly saturated to be susceptible to liquefaction. Significant factors that affect liquefaction include water level, soil type, particulate size and gradation, relative density, confining pressure, intensity of shaking, and duration of shaking. Liquefaction potential has been found to be the greatest where the groundwater level is shallow and submerged loose, fine sands occur within a depth of about 50 feet or less. Liquefaction potential decreases with increasing grain size and clay and gravel content, but increases as the ground acceleration and duration of shaking increase. Liquefaction is therefore more likely to occur in sand dune areas. Structures founded on or above potentially liquefiable soils may experience bearing capacity failures due to the temporary loss of foundation support, vertical settlements (both total and differential), and undergo lateral spreading.

The California Geological Survey’s Seismic Hazards Map of the Hollywood Quadrangle does not classify the Project Sites as part of a potentially liquefiable area. This determination is based on groundwater depth records, soil type, and distance to a fault capable of producing a substantial earthquake.

² City of Los Angeles Department of City Planning, General Plan, Safety Element, Exhibit C, Landslide Inventory & Hillside Areas in the City of Los Angeles, June 1994.
**Tsunamis, Seiches, Inundation, and Flooding**

Tsunamis are large ocean waves generated by sudden water displacement caused by a submarine earthquake, landscape, or volcanic eruption. The Project Sites are located approximately 12 miles from the Pacific Ocean shoreline and are not in an area with the potential to be impacted by a tsunami. Moreover, the Project Sites are not located in close proximity to a contained body of water, and as such, there is no potential impact associated with a seiche (wave oscillations in an enclosed or semi-enclosed body of water).

The Project Sites are not located in a flood zone, including the 100-year or 500-year flood zone as designated by the Federal Emergency Management Agency (“FEMA”). However, the Project Sites are in a potential inundation zone in the event of a breached upgradient reservoir at the Silver Lake Reservoir.

**Subsidence**

Subsidence is a localized mass movement that involves the gradual downhill settling or sinking of the surface, resulting from the extraction of mineral resources, subsurface oil, groundwater, or other subsurface liquids, such as natural gas. While the Project Sites are in the Los Angeles City Oil Field, subsidence has not been identified in that oil field.

**Expansive Soils**

Expansive soils are clay-based soils that tend to expand (increase in volume) as they absorb water and shrink (lessen in volume) as water is drawn away. If soils consist of expansive clays, foundation movement and/or damage can occur if wetting and drying of the clay does not occur uniformly across the entire area. Materials underlying the Project Sites are anticipated to be deep fill materials, alluvial soils, and bedrock of the Puente Formation. The alluvial soils underlying the fill generally consists of mixtures of sands, silty sands, and silty clays. The alluvium is typically medium dense to very dense, or stiff, and well-consolidated with expansion characters that range from low to moderate. However, local variations in moisture content and soil type may occur.

**Proximity to Subway Tunnel**

Los Angeles County Metropolitan Transportation Authority (“Metro”) operates a subway tunnel for the Metro Red Line generally along Vermont Avenue near the western boundary of Sites 1 and 2 and the eastern boundary of Site 3.

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3. County of Los Angeles Flood and Inundation Hazards Map.
5. County of Los Angeles Flood and Inundation Hazards Map.
Regulatory Framework

**Federal**

There are no specific federal regulations addressing geology and soils issues that are not addressed by the more stringent State or local requirements.

**State**

**Alquist-Priolo Earthquake Fault Zoning Act**

The Alquist-Priolo Geologic Hazards Zone Act (the “Alquist-Priolo Act”) was enacted by the State of California in 1972 to address the hazards and damage caused by surface fault rupture during an earthquake. The Alquist-Priolo Act was enacted in response to the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged homes, commercial buildings, and other structures. The primary purpose of the Alquist-Priolo Act is to prevent the construction of buildings intended for human occupancy on the surface traces of active faults. The Alquist-Priolo Act is also intended to provide the citizens with increased safety and to minimize the loss of life during and immediately following earthquakes by facilitating seismic retrofitting to strengthen buildings against ground shaking. The Alquist-Priolo Act has been amended ten times, and was renamed the Alquist-Priolo Earthquake Fault Zoning Act, effective January 1, 1994.

The Alquist-Priolo Earthquake Fault Zoning Act requires the State Geologist to establish regulatory zones, known as “Earthquake Fault Zones,” around the surface traces of active faults and to issue appropriate maps to assist cities and counties in planning, zoning, and building regulation functions. Maps are distributed to all affected cities and counties for the controlling of new or renewed construction and are required to sufficiently define potential surface rupture or fault creep. The State Geologist is charged with continually reviewing new geologic and seismic data, and revising existing zones and delineating additional earthquake fault zones when warranted by new information. Local agencies must enforce the Alquist-Priolo Earthquake Fault Zoning Act with respect to local development. For buildings proposed in identified fault zones, cities and counties shall require a geologic investigation, prepared by a licensed geologist, to demonstrate that buildings will not be constructed across active faults. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault, and must be setback. Although setback distances may vary, a minimum 50-foot setback is required.

**Seismic Safety Act**

The California Seismic Safety Commission was established by the Seismic Safety Act in 1975 with the intent of providing oversight, review, and recommendations to the Governor and State Legislature regarding seismic issues. The commission’s name was changed to Alfred E. Alquist Seismic Safety Commission in 2006. Since then, the Commission has adopted several documents based on recorded earthquakes, such as the 1994 Northridge earthquake, 1933 Long Beach earthquake, the 1971 Sylmar earthquake, etc. Some of these documents are listed as follows:

Findings and Recommendations on Hospital Seismic Safety, report dated November 2001;

Commercial Property Owner’s Guide to Earthquakes Safety, report dated October 2006; and


**Seismic Hazards Mapping Act**

The Seismic Hazard Mapping Act of 1990 (the “Seismic Act”) [Public Resources Code (“PRC”) Section 2690-2699] was enacted, in part, to address seismic hazards not included in the Alquist-Priolo Act, including strong ground shaking, landslides, and liquefaction. Under the Seismic Act, the State Geologist is assigned the responsibility of identifying and mapping seismic hazards zones. Cities and counties must regulate certain development projects within these zones until the geologic and soil conditions of the project site are investigated and appropriate mitigation measures, if any, are incorporated into development plans. The State Mining and Geology Board provides additional regulations and policies to assist municipalities in preparing the Safety Element of their General Plan and encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety. Under PRC Section 2697, cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard.

The State of California Geological Survey (formerly known as the California Division of Mines and Geology), adopted seismic design provisions in Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, on March 13, 1997, which was revised as Special Publication 117A on September 11, 2008.

**State of California Building Code**

The California Building Code ("CBC") [California Code of Regulations ("CCR"), Title 24] is a compilation of building standards, including seismic safety standards, for new buildings. CBC standards are based on building standards that have been adopted by state agencies without change from a model code; building standards based on a national model code that have been changed to address particular California conditions; and building standards authorized by the California legislature but not covered by the national model code. Given the State’s susceptibility to seismic events, the seismic standards within the CBC are among the strictest in the world. The CBC includes provisions for demolition and construction as well as regulations regarding building foundations and soil types. The CBC applies to all occupancies in California, except where stricter standards have been adopted by local agencies. The CBC is published on a triennial basis and supplements and errata can be issued throughout the cycle. The operative edition of the CBC is currently the 2016 edition, which became effective on January 1, 2017. The CBC incorporates the latest seismic design standards for structural loads and materials as well as provisions from the National Earthquake Hazards Reduction Program to mitigate losses from an earthquake and provide for the latest in earthquake safety. Specific CBC building and seismic safety regulations have been incorporated by reference in the County and City of Los Angeles’ Building Codes.

**Local**

**County of Los Angeles**

Site 1 is owned by the County and would be developed for County use. Site 1 development would be subject to County building regulations. Site 3 is located on land owned by the County and would be
developed with a public benefit (senior affordable housing) project. Site 3 development would be subject to County building code requirements.

**Los Angeles County Code**

In addition to adoption of the CBC by reference, the Los Angeles County Code also contains rules and regulations that govern activities that could result in soil erosion or slope instability. These rules and regulations are organized as Title 26 where provisions for excavation, grading, and earthwork construction have been established; permitting procedures are set forth; and plan approval and grading inspection protocols and procedures have been identified. Section J110 of this chapter also contains provisions for construction-related erosion control, including the preparation of cut-and-fill slopes and the implementation of erosion control measures such as check dams, cribbing, riprap, or other devices or methods.

The County Code also includes seismic safety requirements for certain building types, such as older concrete tilt-up buildings and unreinforced masonry bearing wall buildings (refer to Title 26, Chapters 95 and 96). The stated goal of the County Code is to promote public safety and welfare by reducing the risk of death or injury that could result from earthquake damage to certain types of older buildings during moderate or strong earthquakes. Based on the findings of required structural analysis, deficient buildings may need to be strengthened or demolished.

**Los Angeles County General Plan 2035**

California Government Code Section 65300 requires general plans to include “a safety element for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides, subsidence and other geologic hazards known to the legislative body; flooding; and wildland and urban fires.” As such, the Los Angeles County General Plan Update (updated in 2015 to horizon year 2035) Safety Element (Chapter 12) addresses hazards, which must be considered in the physical development of the County, including seismic, geologic, erosion; flooding; hazardous materials; noise control; and emergency/disaster preparedness.

**County of Los Angeles Low Impact Development (“LID”) Requirements**

LID is a design strategy using naturalistic, on-site best management practices (BMPs) to lessen the impacts of development on stormwater quality and quantity. The goal of LID is to mimic the undeveloped runoff conditions of the development site with the post-development conditions. If a project includes water infiltration and/or on-site storage (dry ponds/extended detention basins), geotechnical investigations are required to evaluate effects on ground and slope stability.

**Metro**

Where facilities constructed and operated by Metro are potentially affected by development or infrastructure proposals, the development shall comply with the requirements of Metro’s most recent “Design Criteria and Standards, Volume III, Adjacent Construction Design Manual.” The specific requirements are administrative and are related to the submittal and review of documents provided by the project proponent. In general, these requirements include, but are not limited to, the following:

1. Facility or structure drawings and calculations showing the relationship between the proposed project and Metro facilities shall be submitted for Metro review.
2. Submittals shall be made at each level of completion such as Preliminary, In-Progress, Pre-final and Final, etc. to facilitate the review.
3. If uncertainty exists on the possible impacts before submitting a formal letter requesting a review, the Metro Third Party Administrator (Permits) shall be contacted for an informal evaluation of the amount of detail required for Metro review.
4. A period of 30 working days shall be allowed for the initial and each successive review as required.
5. The project proponent shall reimburse Metro for any technical review or support services costs.
6. Each part of the project’s design may be reviewed and approved by Metro, and after written acceptance of the design, the project proponent must notify Metro prior to the start of construction as noted therein.

**City of Los Angeles**

Site 2 is located on land owned by the County. Development on Site 2 would be mixed residential and commercial uses under a ground lease, and would be subject to City of Los Angeles building regulations.

**General Plan Safety Element**

The City’s primary seismic regulatory document is the Safety Element of the City’s General Plan, adopted November 26, 1996. The City’s regulations incorporate the State’s requirements. The objective of the Safety Element is to better protect occupants and equipment during various types and degrees of seismic events. In the City’s Safety Element, specific guidelines are included for the evaluation of liquefaction, tsunamis, seiches, non-structural elements, fault rupture zones, and engineering investigation reports. The City’s Emergency Operations Organization helps to administer certain policies and provisions of the Safety Element, and centralizes the direction and control of the planning, coordination and management of disaster preparedness, mitigation, response and recovery. The Emergency Operations Organization is part of the City’s Emergency Management Department and includes representatives from all City agencies.

**Los Angeles Building Code**

The City of Los Angeles Building Code addresses issues related to site grading, cut and fill slope design, soil expansion, geotechnical investigations before and during construction, slope stability, allowable bearing pressures and settlement below footings, effects of adjacent slopes on foundations, retaining walls, basement walls, shoring of adjacent properties, and potential primary and secondary seismic effects.

The Building Code also addresses ground-disturbing activities, such as grading, that are codified in the Los Angeles Municipal Code (LAMC). Specifically, LAMC Chapter IX, Article 1, section 91.7006 outlines regulations specific to the import and export of materials. Additionally, LAMC Section 91.7010 outlines regulations specific to excavations required for project construction, while LAMC Section 91.7011 outlines regulations specific to the import of fill materials to a project site. Erosion control and drainage guidelines are set forth in LAMC Section 91.7013, and regulations pertaining to flooding and mudflows are set forth in LAMC Section 91.7014. Lastly, LAMC Section 91.7016 outlines regulations specific to soil stability.

The Grading Division of the Department of Building and Safety has also adopted Rules of General Application, a series of Grading Standards that supplement the requirements of the Building Code. The Rules of General Application include specific requirements of seismic design, slope stability, grading, foundation design, geologic investigations and reports, soil and rock testing, and groundwater. Building and Safety is responsible for implementing the provisions of the Building Code and the Grading Standards.
The City requires that firms performing geotechnical investigations, sampling, and testing have their laboratory certified by the Building and Safety Materials Control Section.

ENVIRONMENTAL IMPACTS

Methodology

To evaluate potential impacts relative to geology and soils, a preliminary geotechnical assessment was prepared for each of the Project Sites. The preliminary geotechnical assessments were prepared to address soil and geological issues required by CEQA. These assessments discuss the subsurface conditions anticipated at the sites, the potential for seismic hazards that could affect the sites, and provides an opinion regarding the feasibility of the proposed development at each site from a geotechnical perspective. The reports are based on review of available Project files, published geotechnical and geological information, and the Project summary. The preliminary geotechnical assessments are provided in Appendices 4.5-1, 4.5-2, and 4.5-3 of this Draft EIR.

The proposed site plans, building footprints, and cross sections showing subterranean structures have been reviewed (see Section 3.0, Project Description and Environmental Setting) to ensure that the characteristics of each site and whether reasonable design features can provide adequate protection from potentially adverse geologic and geotechnical features. The presence of the Metro Red Line tunnel passing near the Project Sites generally along Vermont Avenue is also addressed. The analysis addresses how these features could be affected by Project construction for each site individually.

Thresholds of Significance

The potential for the proposed Project to result in impacts associated with geology and soils is based on the CEQA significance thresholds specified by Appendix G of the State CEQA Guidelines, which are addressed in this section. These significance thresholds are listed below. The balance of the significance thresholds not shown in this section have been determined to have no impact or a less-than-significant impact. These impacts include surface rupture along known faults, landslides, erosion, septic tanks/wastewater treatment, and conflicts with hillside management area ordinance. The analyses for these determinations are provided in Section 6.5, Effects Found Not to be Significant.

The California Supreme Court held that CEQA generally does not require a lead agency to consider the impacts of the existing environment on the future residents or users of a project. An exception to this general rule is a project that may exacerbate a condition in the existing environment. For such a situation, the lead agency is required to analyze the impact of that exacerbated condition on future residents and users of a project (as well as other impacted individuals). Thus, the analysis associated with seismicity, soil stability, or expansive soils below focuses on whether the Project would exacerbate environmental conditions so as to increase the potential to expose people to impacts.

Threshold 4.5-1: Would the project expose people or structures to potential substantial adverse effects, caused in whole or in part by the project’s exacerbation of the existing environmental conditions, including the risk of loss, injury, or death involving:

- Strong seismic ground shaking?
- Seismic-related ground failure, including liquefaction and lateral spreading?
Threshold 4.5-2: 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 caused in whole or in part by the project’s exacerbation of the existing environmental conditions?

An affirmative answer to either of these questions would represent a significant impact.

Project Design Elements

Proposed Project development at each of the Project Sites would incorporate the recommendations of the geotechnical assessments as a Project design element. In addition, adherence to design and construction standards, as required by State, County, and City (where applicable) regulations and codes described previously, would ensure maximum practicable protection for users of the buildings. All aspects of seismic-related hazards, other geotechnical hazards, and erosion and sedimentation issues are regulated by the County, City, and/or the State of California.

**Site 1**

The current groundwater level at the Site 1 is anticipated to be on the order of 28 feet below grade. The historically highest groundwater level for Site 1 is on the order of 20 feet below grade. The historically highest groundwater level was considered when designing the underground portion of proposed structures. For new development consisting of two levels of underground parking, temporary dewatering would be necessary to achieve a dry and stable excavation, and the expected number and depths of well-points, expected flow rates, and expected pre-pumping timeframes would be determined during a dewatering test program conducted by a qualified dewatering consultant following all applicable regulatory requirements. Once the temporary construction dewatering is discontinued, the water table would likely return to its current elevation.

Due to the depth of the proposed subterranean levels and their proximity to the property lines, shoring would be required for construction of the subterranean levels, and soldier piles would be recommended for shoring. Furthermore, the proposed development on Site 1 would be designed in accordance with the current County Code provisions, which take into account the potential effects of strong ground shaking which would avoid potential collapse and impacts to neighboring properties.

**Site 2**

The historically highest groundwater level of 20 feet below grade on Site 2 was considered when designing the underground portion of the proposed structures. For new development consisting of an underground and aboveground parking structure (3.5 levels above grade and 1.5 levels below grade), and a possible mixed use building containing five levels of residential uses above the parking structure and ground level retail, temporary dewatering would be necessary to achieve a dry and stable excavation, and the expected number and depths of well-points, expected flow rates, and expected pre-pumping timeframes would be determined during a dewatering test program conducted by a qualified dewatering consultant following all applicable regulatory requirements. Once the temporary construction dewatering is discontinued, the water table would likely return to its current elevation. Thus, as a Project design element, proposed subterranean walls extending below the historically highest groundwater level shall be designed for an undrained condition with full hydrostatic pressure. Proposed concrete slabs-on-grade bearing below the
historically highest groundwater level would be designed to withstand the hydrostatic uplift pressure for an undrained condition.

Due to the depth of the proposed subterranean levels (approximately 20-foot excavation) and their proximity to the property lines, shoring would be required for construction of the subterranean levels, and soldier piles would be recommended for shoring. Furthermore, the proposed development on Site 2 would be designed in accordance with the current City Code provisions, which take into account the potential effects of strong ground shaking which would avoid potential collapse and impacts to neighboring properties.

**Site 3**

The historically highest groundwater level of 20 feet below grade on Site 3 was considered when designing the underground portion of the proposed structures. Temporary dewatering would be necessary to achieve a dry and stable excavation, and the expected number and depths of well-points, expected flow rates, and expected pre-pumping timeframes would be determined during a dewatering test program conducted by a qualified dewatering consultant following all applicable regulatory requirements. Once the temporary construction dewatering is discontinued, the water table would likely return to its current elevation. The bottom of the proposed structure (three-story underground parking structure) is anticipated to extent below the historically highest groundwater level. Accordingly, a mat foundation may be required to resist hydrostatic uplift pressures anticipated at the lowest finished floor elevation. Thus, as a Project design element, the proposed subterranean walls extending below the historically highest groundwater level shall be designed for an undrained condition with full hydrostatic pressure. Subterranean walls to be located above the historically highest groundwater level would be designed for a drained condition, provided that a retaining wall subdrain would be installed.

Due to the depth of the proposed subterranean levels and their proximity to the property lines, shoring would be required for construction of the subterranean levels, and soldier piles would be recommended for shoring. Furthermore, the proposed development on Site 3 would be designed in accordance with the current County Code provisions, which take into account the potential effects of strong ground shaking which would avoid potential collapse and impacts to neighboring properties.

**Impact Analysis**

**Threshold 4.5-1:** Would the project expose people or structures to potential substantial adverse effects, caused in whole or in part by the project’s exacerbation of the existing environmental conditions, including the risk of loss, injury, or death involving:

- Strong seismic ground shaking?
- Seismic-related ground failure, including liquefaction and lateral spreading?

**Site 1**

**Strong Seismic Ground Shaking**

Because the Los Angeles region is generally considered to be geologically active, most projects would be exposed to some risk from geologic hazards, such as earthquakes. Faults in the County and region present a risk of very strong ground shaking that must be considered for facilities where public safety and post-
earthquake evacuation are necessary. An impact would be considered significant if a project exacerbates a seismic hazard.

Site 1 is within the seismically active Southern California region and is, therefore, susceptible to ground shaking during a seismic event. Seismic ground shaking could damage the building and utility infrastructure. However, State and local regulatory and code requirements discussed above are intended to protect public safety. Project design and construction would be consistent with all applicable provisions of the State and Los Angeles County Building Codes, including Regulatory Requirements RR GS-1 and RR GS-2, which require consideration of seismic loading factors and engineering geology and geotechnical hazards. Project development at Site 1 would also adhere to the recommendations of the geotechnical assessments including but not limited to consideration of the CBC Seismic Parameters. Regulatory Requirement RR GS-3 requires the Developer to undertake the preparation of a Project design-specific geotechnical assessment and to comply with its recommendations. With the implementation of the regulatory requirements, that include specific design, and shoring requirements designed to address building safety during seismic events, Project development at Site 1 would not cause, exacerbate or accelerate geologic hazards. Therefore, risks from seismic ground shaking at Site 1 would be less than significant.

**Liquefaction/Lateral Spreading and Dynamic Settlement**

Site 1 is not identified as part of a potentially liquefiable area as based on California Geological Survey’s Seismic Hazards Map of the Hollywood Quadrangle. Moreover, based on the depth to the historically highest and current groundwater levels, results from the site-specific liquefaction analysis conducted immediately to the north of Site 1 (separate from the Project), the potential for liquefaction or lateral spreading at Site 1 is considered to be remote. Nonetheless, Regulatory Requirements RR GS-1 through RR GS-3 require preparation of a design-level geotechnical investigation at Site 1. While it is unlikely the underlying soils at Site 1 are susceptible to liquefaction, any design recommendations based on the design-level geotechnical investigation, including site-specific liquefaction conditions, would be required to be incorporated into the Project’s design at Site 1 in accordance with Regulatory Requirements RR GS-1 through RR GS-3.

Some seismically-induced dry settlement of the proposed structure could be expected at Site 1 as a result of strong ground-shaking. However, based on the typically dense, stiff, and consolidated nature of the alluvial soils and bedrock expected to underlie Site 1, the potential dynamic settlements would be expected to be negligible. Even so, Project design and construction would be consistent with all applicable provisions of the State and Los Angeles County Code, including Regulatory Requirements RR GS-1 through RR GS-3, which require consideration of seismic loading factors and engineering geology and geotechnical hazards. With the implementation of the regulatory requirements, that include specific design, and shoring requirements designed to address building safety during seismic events, Project development at Site 1 would not cause or exacerbate seismic ground failure. Therefore, risks from seismic ground failure at Site 1 would be less than significant.

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7 Geotechnical Assessment, Site 1: Proposed Office Building and Parking Structure, 500, 510, 526, and 532 South Vermont Avenue including 523 and 531 South Shatto Place, Los Angeles, California, prepared by Geotechnologies, Inc., August 15, 2017 (Draft EIR Appendix 4.5-1).
Site 2

Strong Seismic Ground Shaking

Because the Los Angeles region is generally considered to be geologically active, most projects would be exposed to some risk from geologic hazards, such as earthquakes. Faults in the County and region present a risk of very strong ground shaking that must be considered for facilities where public safety and post-earthquake evacuation are necessary. An impact would be considered significant if a project exacerbates a seismic hazard.

Site 2 is in the seismically active Southern California region and is, therefore, susceptible to ground shaking during a seismic event. Seismic ground shaking could damage the building and utility infrastructure. However, State and local regulatory and code requirements discussed above are intended to protect public safety. Project design and construction would be consistent with all applicable provisions of the State and City Building Codes, including Regulatory Requirements RR GS-5 and RR GS-6, which require consideration of seismic loading factors and engineering geology and geotechnical hazards. The Project development at Site 2 would also adhere to the recommendations of the geotechnical assessments including but not limited to consideration of the California Building Code Seismic Parameters. Regulatory Requirement RR GS-4 requires the Project to undertake the preparation of a Project design-specific geotechnical assessment and to comply with its recommendations. With the implementation of the regulatory requirements, that include specific design, and shoring requirements designed to address building safety during seismic events, Project development at Site 2 would, thus, not cause, exacerbate or accelerate geologic hazards or expose people to substantial risk of injury. Therefore, risks from seismic ground shaking at Site 2 would be less than significant.

Liquefaction/Lateral Spreading and Dynamic Settlement

Site 2 is not identified as part of a potentially liquefiable area as based on California Geological Survey’s Seismic Hazards Map of the Hollywood Quadrangle. Moreover, based on the depth to the historically highest and current groundwater levels, results from the site-specific liquefaction analysis conducted north of Site 2 (separate from the Project), the potential for liquefaction or lateral spreading at Site 2 is considered to be remote. Nonetheless, Regulatory Requirements RR GS-4 through RR GS-6 require preparation of a design-level geotechnical investigation at Site 2. While it is unlikely that the underlying soils at Site 2 are susceptible to liquefaction, any design recommendations based on the design-level geotechnical investigation, including site-specific liquefaction conditions, are required to be incorporated into the Project’s design at Site 2 in accordance with Regulatory Requirements RR GS-4 through RR GS-6.

Some seismically-induced dry settlement of the proposed structure could be expected at Site 2 as a result of strong ground-shaking. However, based on the typically dense, stiff, and consolidated nature of the alluvial soils and bedrock expected to underlie Site 2, the potential dynamic settlements would be expected to be negligible. Even so, Project design and construction would be consistent with all applicable provisions of the State and City Codes, including Regulatory Requirements RR GS-4 through RR GS-6, which require consideration of seismic loading factors and engineering geology and geotechnical hazards. With the implementation of the regulatory requirements, that include specific design, and shoring requirements designed to address building safety during seismic events, Project development at Site 2 would observe the geotechnical assessment.
Site 2 would not cause or exacerbate seismic ground failure. Therefore, risks from seismic ground failure at Site 2 would be less than significant.

**Site 3**

**Strong Seismic Ground Shaking**

Because the Los Angeles region is generally considered to be geologically active, most projects would be exposed to some risk from geologic hazards, such as earthquakes. Faults in the County and region present a risk of very strong ground shaking that must be considered for facilities where public safety and post-earthquake evacuation are necessary. An impact would be considered significant if a project exacerbates a seismic hazard.

Site 3 is within the seismically active Southern California region and is, therefore, susceptible to ground shaking during a seismic event. Seismic ground shaking could damage the building and utility infrastructure. However, State and local regulatory and code requirements discussed above are intended to protect public safety. Project design and construction would be consistent with all applicable provisions of the State and Los Angeles County Code, including Regulatory Requirements RR GS-1 and RR GS-2, which require consideration of seismic loading factors and engineering geology and geotechnical hazards. The Project development at Site 3 would also adhere to the recommendations of the geotechnical assessments including but not limited to consideration of the California Building Code Seismic Parameters. Regulatory Requirement RR GS-3 requires the Project to undertake the preparation of a Project design-specific geotechnical assessment and to comply with its recommendations. With the implementation of the regulatory requirements, that include specific design, and shoring requirements designed to address building safety during seismic events, Project development at Site 3 would, thus, not cause, exacerbate or accelerate geologic hazards or expose people to substantial risk of injury. Therefore, risks from seismic ground shaking at Site 3 would be less than significant.

**Liquefaction/Lateral Spreading and Dynamic Settlement**

Site 3 is not identified as part of a potentially liquefiable area as based on California Geological Survey’s Seismic Hazards Map of the Hollywood Quadrangle. Moreover, based on the depth to the historically highest and current groundwater levels, results from the site-specific liquefaction analysis conducted southeast of Site 3 (separate from the Project), the potential for liquefaction or lateral spreading at Site 3 is considered to be remote. Nonetheless, Regulatory Requirements RR GS-1 through RR GS-3 require preparation of a design-level geotechnical investigation at Site 3. While it is unlikely the underlying soils at Site 3 are susceptible to liquefaction, any design recommendations based on the design-level geotechnical investigation, including site-specific liquefaction conditions, are required to be incorporated into the Project’s design at Site 3 in accordance with Regulatory Requirements RR GS-1 through RR GS-3.

Some seismically-induced dry settlement of the proposed structure could be expected at Site 3 as a result of strong ground-shaking. However, based on the typically dense, stiff, and consolidated nature of the alluvial soils and bedrock expected to underlie Site 3, the potential dynamic settlements would be expected to be negligible.⁹ Even so, Project design and construction would be consistent with all

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⁹ *Geotechnical Assessment, Site 3: Proposed Affordable Housing Development, 427 and 433 South Vermont Avenue, Los Angeles, California, prepared by Geotechnologies, Inc., August 15, 2017 (Draft EIR Appendix 4.5-3).*
applicable provisions of the State and County Codes, including Regulatory Requirements RR GS-1 through RR GS-3, which require consideration of seismic loading factors and engineering geology and geotechnical hazards. With the implementation of the regulatory requirements, that include specific design, and shoring requirements designed to address building safety during seismic events, Project development at Site 3 would not cause or exacerbate seismic ground failure. Therefore, risks from seismic ground failure at Site 3 would be less than significant.

**Threshold 4.5-2:** 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 caused in whole or in part by the project’s exacerbation of the existing environmental conditions?

**Site 1**

Geologic or soil unit instability resulting from liquefaction/lateral spreading, including dynamic settlement, are discussed above. Subsidence is not considered to be a potential hazard at Site 1, as discussed above. Moreover, there are no known physical characteristics of surficial geologic units present within Site 1 that would result in a significant impact or constraint to development. The probability of seismically-induced landslides affecting Site 1 is low due to the lack of significant slopes on the site and surrounding areas, and there are no known landslides at Site 1, nor is Site 1 in the path of any known or potential landslides.

The potential for impacts to the Metro Red Line tunnel exists due to the proximity of Site 1 to the subway tunnel and the potential for Project excavations to affect soils in the vicinity of the tunnel. Therefore, site exploration and planned facilities (e.g., subterranean levels) could impact the tunnel and train operations. Metro has specific requirements with regard to design and construction of any structures within proximity to one of its tunnels (Design Criteria and Standards Volume III). Each situation (i.e., type of structure, proximity to tunnel, future uses) is evaluated individually because there are no set rules governing minimum setback distances vertically or horizontally. Compliance with Metro’s design manual for adjacent construction is required through Regulatory Requirement RR GS-7. Based on these requirements, development at Site 1 would not have an adverse effect on the structural integrity of the tunnel or the operation of the trains.

In summary, with implementation of the required standard, comprehensive geotechnical and soils engineering investigation and analysis mandated by State and County regulations, specifically the current County Code, California Building Code, and Metro Adjacent Construction Design Manual Design Criteria and Standards, Volume III, including Regulatory Requirements RR GS-1 through RR GS-3, and RR GS-7 geologic unit and soil related impacts would be less than significant.

**Site 2**

Geologic or soil unit instability resulting from liquefaction/lateral spreading, including dynamic settlement, are discussed above. Subsidence is not considered to be a potential hazard at Site 2, as discussion above. Moreover, there are no known physical characteristics of surficial geologic units present at Site 2 that would result in a significant impact or constraint to development. It is anticipated that the majority of the fill materials in the eastern portion of the Site where the mixed-use structure is proposed to be located would be removed during excavation, exposing adequate alluvial soils or bedrock at the subgrade. The proposed subterranean walls extending below the historically highest groundwater level would be
designed for an undrained condition with full hydrostatic pressure. Proposed concrete slabs-on-grade bearing below the historically highest groundwater level would be designed to withstand the hydrostatic uplift pressure for an undrained condition. Furthermore, the probability of seismically-induced landslides affecting Site 2 is low due to the lack of significant slopes on the site and surrounding areas, and there are no known landslides at Site 2 nor is Site 2 in the path of any known or potential landslides.

The potential for impacts to the Metro Red Line tunnel exists due to the proximity of Site 2 to the subway tunnel and the potential for Project excavations to affect soils in the vicinity of the tunnel. Therefore, site exploration and planned facilities (e.g., subterranean levels) could impact the tunnel and train operations. Metro has specific requirements with regard to design and construction of any structures within proximity to one of its tunnels (Design Criteria and Standards Volume III). Each situation (i.e., type of structure, proximity to tunnel, future uses) is evaluated individually because there are no set rules governing minimum setback distances vertically or horizontally. Compliance with Metro’s design manual for adjacent construction is required through Regulatory Requirement RR GS-7. Based on these requirements, development at Site 2 would not have an adverse effect on the structural integrity of the tunnel or the operation of the trains.

In summary, with implementation of the required standard, comprehensive geotechnical and soils engineering investigation and analysis mandated by State and County regulations, specifically the current County Code, California Building Code, and Metro Adjacent Construction Design Manual Design Criteria and Standards, Volume III, including Regulatory Requirements RR GS-4 through RR GS-7, geologic unit and soil related impacts would be less than significant.

**Site 3**

Geologic or soil unit instability resulting from liquefaction/lateral spreading, including dynamic settlement, are discussed above. Subsidence is not considered to be a potential hazard at Site 3, as discussion above. Moreover, there are no known physical characteristics of surficial geologic units present within Site 3 that would result in a significant impact or constraint to development. In order to withstand the hydrostatic uplift imposed by the historically highest groundwater level, it is anticipated that the structure would have to be supported on a mat foundation at the lowest finished floor elevation. Subterranean walls to be located above the historically highest groundwater level may be designed for a drained condition, provided that a retaining wall subdrain would be installed. Furthermore, the probability of seismically-induced landslides affecting Site 3 is low due to the lack of significant slopes on the site and surrounding areas, and there are no known landslides at Site 3, nor is Site 3 in the path of any known or potential landslides.

The potential for impacts to the Metro Red Line tunnel exists from the proximity of Site 3 to the subway tunnel and the potential for Project excavations to affect soils in the vicinity of the tunnel. Therefore, site exploration and planned facilities (e.g., subterranean levels) could impact the tunnel and train operations. Metro has specific requirements with regard to design and construction of any structures within proximity to one of its tunnels (Design Criteria and Standards Volume III). Each situation (i.e., type of structure, proximity to tunnel, future uses) is evaluated individually as there are no set rules governing minimum setback distances vertically or horizontally. Compliance with Metro’s design manual for adjacent construction is required through Regulatory Requirement RR GS-7. Overall, development at Site 3 would not have an adverse effect on the structural integrity of the tunnel or the operation of the trains.
In summary, with implementation of the required standard, comprehensive geotechnical and soils engineering investigation and analysis mandated by State and County regulations, specifically the current County Code, California Building Code, and Metro Adjacent Construction Design Manual Design Criteria and Standards, Volume III, including Regulatory Requirements RR GS-1 through RR GS-3, and RR GS-7, geologic unit and soil related impacts would be less than significant.

CUMULATIVE IMPACTS

Geotechnical hazards are site-specific and there is little, if any, cumulative geological relationship between the Project and any related projects. Similar to the Project, potential impacts related to geology and soils would be assessed on a case-by-case basis and, if necessary, the applicants of the related projects would be required to implement the appropriate mitigation measures. None of the related projects would occur directly adjacent to the Project Sites, thus lowering the possibility of localized geological or soil impacts around the Project Sites. Notwithstanding, as with the Project, the related projects would be subject to established guidelines and regulations pertaining to building design and seismic safety, including those set forth in the California Building Code and the Los Angeles Building Code. With adherence to such regulations, potential impacts with regard to geology and soils would not be cumulatively considerable. Furthermore, the analysis of the Project’s geology and soils impacts concluded that Project impacts would be less than significant and, consequently, the Project would not contribute to a potential cumulative impact. Therefore, cumulative geology and soil impacts would be less than significant.

PROJECT DESIGN FEATURES AND REGULATORY REQUIREMENTS

Project Design Features

No specific Project Design Features are proposed relevant to geology and soils.

Regulatory Requirements

The following standards would be imposed by existing laws and regulations and would work to address Project impacts. These are not required mitigation but are inherent Project components.

County Requirements (Sites 1 and 3)

**RR GS-1:** Structural designs will need to consider seismic (earthquake) loading factors in compliance with Title 26 of the Los Angeles County Code.

**RR GS-2:** Slope stability, expansive soils, compressible soils and other similar engineering geology and geotechnical hazard considerations are addressed by the grading standards in the State of California Building Code, Appendix J of Title 26 of the Los Angeles County Code, and by the general requirement for engineering investigation reports, and by many of the implementation programs within other categories.

**RR GS-3:** A Project design-specific geotechnical and engineering geology report is required to be prepared by a California-licensed geotechnical engineer, California-certified engineering geologist, and civil engineer with expertise in geotechnical issues registered in the State of California during Project design and prior to Project construction in compliance with the most current County of Los Angeles Department of Public Works Geotechnical and Materials Engineering Division (“GMED”) guidelines.
The investigation is required to address the proposed Project foundation and structure design to minimize effects from adverse soil conditions including any liquefiable or otherwise unstable/consolidation-prone soils; bedrock characteristics; subsidence; earthquake ground shaking; slope instability; subsurface gas; groundwater; and/or other geotechnical and engineering geologic hazards. The design and construction recommendations will be incorporated into the foundation and structural design of proposed project components, implemented in accordance with the design, and subjected to on-going inspection by the relevant entities/agencies. Prior to Grading Plan approval and issuance of permits, all construction/development plans will be approved by GMED for construction of such improvements. Construction will occur in accordance with the approved plans.

**City Requirements (Site 2)**

**RR GS-4:** In accordance with the Los Angeles Building Code, Los Angeles Municipal Code ("LAMC") Chapter IX, Article 1, the Project Developer, or successor in interest, shall have a Geotechnical Study prepared for the Project Site that shall be approved by the Department of Building and Safety prior to issuance of building and grading permits. The Project shall be designed and constructed in accordance with the recommendations provided in the Geotechnical Study, as overseen by the Department of Building and Safety.

**RR GS-5:** Earthwork activities associated with the grading and export of soil shall occur in accordance with City requirements, as specified in the Los Angeles Building Code and CBC and through the grading plan review and approval process, including a haul route approval as specified in the LAMC.

**RR GS-6:** Project building design and construction shall conform to the current building and safety design provisions of the LAMC, which incorporates the CBC, including all provisions related to seismic activity.

**Metro Requirements (Sites 1, 2 and 3)**

**RR GS-7:** The Developer shall comply with the requirements of Metro’s most recent “Design Criteria and Standards, Volume III, Adjacent Construction Design Manual.” The general requirements include, but are not limited to, the following:

1. Facility or structure drawings and calculations showing the relationship between the proposed Project and Metro facilities shall be submitted for Metro review.

2. Submittals shall be made at each level of completion such as Preliminary, In-Progress, Pre-final and Final, etc. to facilitate the review.

3. If uncertainty exists on the possible impacts before submitting a formal letter requesting a review, the Metro Third Party Administrator (Permits) shall be contacted for an informal evaluation of the amount of detail required for Metro review.
4. A period of 30 working days shall be allowed for the initial and each successive review as required.

5. The project proponent shall reimburse Metro for any technical review or support services costs.

6. Each part of the project’s design may be reviewed and approved by Metro, and after written acceptance of the design, the project proponent must notify Metro prior to the start of construction as noted therein.

Due to the proximity of the tunnel and the uncertainty that exists on the possible impacts, before submitting a formal letter requesting a review, the Developer shall contact the Metro Third Party Administrator (Permits) for an informal evaluation of the amount of detail required for Metro review. In addition, prior to any geotechnical or other site investigation requiring subsurface exploration (e.g., geotechnical drilling, monitoring wells), the Developer shall obtain approval of drilling locations, drilling depths, and downhole activities from Metro. The Developer shall obtain prior written approval to proceed from Metro prior to commencing exploration activities; written approval shall be submitted to County Department of Regional Planning and GMED. Similarly, the Developer shall submit to GMED a written approval from Metro that final project design may be developed.

MITIGATION MEASURES

Because the Project’s impacts would be less than significant, no mitigation measures are required.

LEVEL OF SIGNIFICANCE AFTER MITIGATION

Project impacts with regard to geology and soils would be less than significant.

Cumulative impacts with regard to geology and soils would be less than significant.