3.6 Geology and Soils

This section describes the affected environment and regulatory setting for Geology and Soils related to the Project Area. In addition, this section describes the potential impacts related to Geology and Soils that would result from the implementation of the proposed Project. As noted in the analysis below, impacts associated with Geology and Soils during the construction and operation of the proposed Project would be less than significant and no mitigation measures are required.

The analysis in this section is based on the Geotechnical Site Investigation report (Hushmand Associates, Inc., 2018) prepared for the proposed Project, which also incorporates findings from the *Foundation Report* prepared for the Viaduct Replacement Project (Earth Mechanics, Inc., 2016). In addition, the environmental setting and analysis in this section rely on information from the Paleontological Resource Assessment (Applied EarthWorks, 2019).

3.6.1 Regulatory Setting

A review of the various federal, state, regional, and local government regulatory requirements was conducted to identify regulations that relate to Geology and Soils. This section summarizes the various regulatory requirements that are relevant to the proposed Project.

3.6.1.1 Federal

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (PRC Section 2621.5) was passed to mitigate hazards of surface faulting on structures built for human occupancy (California Department of Conservation, 2018). The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is preventing the construction of buildings used for human occupancy in active fault zones.

3.6.1.2 State

California Building Standards Code

The 2016 California Building Standards Code (CCR, Title 24), which went into effect on January 1, 2017, is included in the City's Municipal Code. The California Building Standards Code is based on the federal Uniform Building Code but has been modified to reflect the seismic and environmental conditions of California. The California Building Standards Code includes guidelines for building design and construction, and includes the following components: California Building, Residential, Electrical, Mechanical, Plumbing, Energy, Historical Building, Fire, Existing Building, and Green Building Codes.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (PRC Section 2690-2699.6) requires the identification and mapping of areas that are prone to liquefaction, earthquake-induced landslides, and amplified ground shaking (California Geological Survey, 2003b). The Seismic Hazards Mapping Act aims to minimize the loss of life and property by identifying seismic hazards and mitigation for these hazards.

3.6.1.3 Local

City of Los Angeles General Plan

As required by the State of California, the City's General Plan addresses goals, policies, and standards related to land use, circulation, housing, conservation, open space, noise, and safety (City of Los Angeles, 2017). To address goals that meet the unique needs of the City, the General Plan also includes elements related to health and wellness, air quality, historic preservation and cultural resources, and public facilities and services. Several of the General Plan elements are currently undergoing revision. The General Plan element that pertains to Geology and Soils is described in more detail in the following section.

Safety Element

The Safety Element of the City's General Plan addresses the protection of people from risks associated with natural disasters (City of Los Angeles, 1996). The Safety Element includes goals, objectives, and policies that guide the City's Emergency Operations Organization, which is the City's department responsible for emergency planning, training, and mitigation, as well as response and recovery operations. Chapter IV of the Safety Element describes areas within the City that are susceptible to fault rupture, liquefaction, and landslides, and includes standards related to seismic hazards. Specific policies pertaining to Geology and Soils include:

Hazard Mitigation

- **Policy 1.1.5**: Risk Reduction. Reduce potential risk hazards due to natural disaster to the greatest extent feasible within the resources available, including provision of information and training.

Conservation Element

The Conservation Element of the City of Los Angeles General Plan (adopted September 2001) primarily addresses preservation, conservation, protection and enhancement of the city's natural resources. The Conservation Element specifically addresses paleontological resources in Section 3 of Chapter 2.

With regard to paleontological resources, the Conservation Element contains the following objective with an associated policy and program:

- **Objective:** protect the city's archaeological and paleontological resources for historical, cultural, research and/or educational purposes.
- **Policy:** continue to identify and protect significant archaeological and paleontological sites and/or resources known to exist or that are identified during land development, demolition or property modification activities.
- **Program:** permit processing, monitoring, enforcement and periodic revision of regulations and procedures.
- **Responsibility:** departments of Building and Safety, City Planning and Cultural Affairs and/or the lead agency responsible for project implementation.

City of Los Angeles Building Code

The Los Angeles Building Code is a component of the City's Municipal Code (Chapter IX, Article 1). The Building Code aims to protect public health and property through regulating the design, construction, quality of materials, use and occupancy, and location and maintenance of buildings and structures proposed for development within the City. The Building Code includes requirements regarding the transport of material, excavation, fill materials, erosion control, and general construction activities.

3.6.2 Environmental Setting

3.6.2.1 Regional Geology

The Project Area is in the northern margin of the Los Angeles Basin (Basin), an actively subsiding basin bound by the Santa Monica Mountains and the Elysian, Repetto, and Puente Hills to the north, and the Santa Ana Mountains and San Joaquin Hills to the east and southeast (U.S. Geological Survey, 1965). The Basin is an alluviated lowland that gently slopes south towards the ocean and is interrupted by hills and mesas. The Basin is a northwest-trending structural depression and is filled with sedimentary formations of Tertiary and Cretaceous origin, overlain with Pleistocene and Holocene age alluvium.

3.6.2.2 Local Geologic Setting

According to the California Geological Survey (CGS) Seismic Hazard Zone Report for the Los Angeles 7.5-Minute Quadrangle (California Geological Survey, 1998), the Project Area is located in a region with Holocene age Quaternary alluvial deposits fan consisting of sand, silt, and gravel (Hushmand Associates, Inc., 2018). Based on the Foundation Report for the Viaduct Replacement Project (Earth Mechanics, Inc., 2016), the Project Area is underlain with:

- **Artificial Fill**: Generally, consists of disturbed and reworked alluvial sands, silts, and gravels, varying up to 15 feet thick in the Project Area, due to recent construction along the Los Angeles River.
- **Quaternary Alluvium**: Holocene to Pleistocene age alluvium consisting of active stream channel and unconsolidated floodplain deposits of gravel, sand, silt, and hardened remnants of older deposits.
- **Fernando Formation, Upper (Pico) and Lower (Repetto) Members**: Pliocene-age marine deposits consisting of tan to olive brown, semi-friable sandstone and conglomerate, in addition to gray to greenish gray, soft, poorly bedded marine claystone and siltstone.

3.6.2.3 Faulting, Seismicity, and Ground Shaking

The Project Area is located within a seismically active region, where several active faults could produce substantial shaking (California Department of Transportation and City of Los Angeles, 2011). There are no faults within the Project Area, but nearby active faults include Elysian Park (Lower CFM), Elysian Park (Upper), Puente Hills (LA), Hollywood, Raymond, Verdugo-Eagle Rock, Newport-Inglewood Fault Zone, and Elsinore Fault Zone (Whittier section), which range from 1.5 to 10.3 miles from the Project Area (Hushmand Associates, Inc., 2018).

According to the most recent Alquist-Priolo Earthquake Fault Zoning Map, there are no potentially active faults that pass through the Project Area (California Department of Conservation, 1977). There is no known surface expression of active faults within the Project Area. Therefore, the potential for a fault rupture through the Project Area is considered very low (Hushmand Associates, Inc., 2018).

According to California Geological Survey maps showing the earthquake shaking potential in California, there is a medium intensity of ground shaking and damage in the Project Area from anticipated future earthquakes (California Geological Survey, 2003a).

3.6.2.4 Subsurface Soils

Based on the borehole investigation, subsurface conditions consisted of about 5 to 20 feet of fill soils consisting of loose to medium dense silty sand to poorly graded sand with silt. The fill is underlain by generally dense to very dense coarse-grained materials comprising of sands, silty sands, gravelly sands, sandy gravels, cobbles, and possibly boulders (Hushmand Associates, Inc., 2018).

3.6.2.5 Expansive Soil

Expansive soil is soil that is prone to large volume changes (swelling and shrinking) that are directly related to changes in water content — with higher moisture levels, the soils will swell, and with lower moisture levels, the soils will shrink. According to Table 18-1-B of the California Building Code, a special foundation design is required if the Expansion Index (which predicts the swelling potential of compacted soils) is higher than 20. Based on a 1989 United States Geological Survey (USGS) map, the proposed Project is located in an area where data is insufficient to indicate the clay content and/or swelling potential of clay (U.S. Geological Survey, 1989). The Geotechnical Site Investigation did not include laboratory testing for expansive soils. However, the soils that were observed in the borehole investigation, as described in Section 3.6.2.4, are predominately gravels, sands, and cobbles, which tend to have a low potential for expansive soils. Clayey soils, on the other hand, can have a high expansion potential, but were not observed during borehole investigations (Hushmand Associates, Inc., 2018). Therefore, the potential for expansive soils in the Project Area is expected to be low.

3.6.2.6 Groundwater

Based on the Foundation Report for the Viaduct Replacement Project, measured groundwater elevations varied significantly throughout the Project Area and ranged from 170.9 to 228 feet below ground surface (bgs) (Earth Mechanics, Inc., 2015). Groundwater was not encountered in any of the boreholes performed during the investigations for the proposed Project (Hushmand Associates, Inc., 2018). This is likely because soil boring depths for the Viaduct Replacement Project, which varied from 3 to 200 feet bgs, were deeper than the boring depths for the proposed Project, which vary from 5.67 to 39.08 feet bgs (Earth Mechanics, Inc., 2015; Hushmand Associates, Inc., 2018). In addition, groundwater may fluctuate due to factors such as seasonal variation, nearby construction, irrigation, or other man-made and natural influences (Earth Mechanics, Inc., 2015).

3.6.2.7 Liquefaction Potential

Soil liquefaction occurs when a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress

condition, causing it to behave like a liquid. Other types of ground failure resulting from seismic activities include collapsible soils, subsidence (the gradual caving in or sinking of an area of land), landslides, and lateral spreading (landslides that commonly form on gentle slopes and that have rapid fluid-like flow movement). According to the most recent seismic hazards zones map, the proposed Project is not located in a liquefaction zone (see **Figure 3.6-1**, Seismic Hazards) (California Department of Conservation, 1999).

3.6.2.8 Paleontological Resources

To determine the paleontological sensitivity of geologic units underlying the Project Area, published geologic maps were reviewed. In November 2017, a records search was conducted by the Los Angeles County Museum of Natural History of known fossil localities in the area. Published reports on the regional geology and paleontology of the area were also reviewed (Norris & Webb, 1976; Springer et al., 2009; Yerkes & Campbell, 2005; U.S. Geological Survey, 1965).

Based on the literature review and museum records search results, the paleontological sensitivity was determined for the Project Area in accordance with the Society of Vertebrate Paleontology (SVP) (2010) sensitivity scale (Society of Vertebrate Paleontology, 2010). The near-surface Holocene-age alluvial deposits in the Project Area are likely too young to contain fossilized material. As such, these deposits are determined to have a low paleontological resource potential. Therefore, shallow excavations are unlikely to impact paleontological resources and further paleontological resource management is not recommended.

However, should Project-related ground-disturbance extend deeper into sensitive Pleistocene alluvial deposits or Pliocene rock formations buried at unknown depths within the Project Area and exposed at the ground surface nearby, further paleontological resource consultation may be required.

3.6.3 Environmental Impact Analysis

3.6.3.1 Screening Analysis

Several impacts and corresponding thresholds of significance in the following section were eliminated from further analysis in this EIR. Topics were eliminated if the Initial Study for the proposed Project concluded there would be "No Impact," or if impacts were identified to be "Less Than Significant… and will not be discussed further in the EIR." Therefore, only the topics described in the section below were determined to require further analysis in this EIR. A copy of the Initial Study, which contains the eliminated topics, is provided in **Appendix A**.

3.6.3.2 Thresholds of Significance

According to Appendix G of the State CEQA Guidelines and the *L.A. CEQA Thresholds Guide*, the proposed Project would have a significant impact on Geology and Soils if it would:

VII(b) Result in substantial soil erosion or the loss of topsoil.

VII(c) 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?

VII(f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

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Figure 3.6-1: Seismic Hazards

D.1 *Paleontological Resources.* The determination of significance shall be made on a case-by-case basis, considering the following factors:

- Whether, or the degree to which, the project might result in the permanent loss of, or loss of access to, a paleontological resource; and
- Whether the paleontological resource is of regional or statewide significance.

3.6.3.3 Construction Impacts

VII(b): Would the project result in substantial soil erosion or the loss of topsoil?

Soil excavation would be required during the construction of the proposed Project. Throughout the Project Area, excavation depths are expected to range up to 5 feet for general earthwork, 10 feet for construction of retaining walls, 15 feet for utility trenching, and 22 feet for the removal of portions of the existing LA River Access Tunnel and existing Viaduct foundations. Because artificial fill makes up the top 5 to 20 feet of topsoil, as described in the Geotechnical Site Investigation, a substantial loss of topsoil is not expected to occur.

During site preparation and other construction activities, the proposed Project could result in soil erosion. Standard Best Management Practices (BMPs), such as fiber rolls and silt fencing, would be implemented during construction to ensure that substantial erosion or the loss of topsoil would not occur, and that construction activities would not result in impacts to the LA River. All grading activities would comply with permits from the Department of Building and Safety, and with the provisions of the City's Building Code (Municipal Code Chapter IX, Article 1). With implementation of BMPs, impacts would be less than significant and no mitigation is required.

VII(c): 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?

Because the proposed Project is located in an area with little or no swelling clay, substantial risks to life or property are not anticipated. However, the Project Area is underlain with fill material which could expand when saturated. Hazards would be reduced by following standard engineering practices, as well as the recommendations identified in the Geotechnical Site Investigation (Hushmand Associates, Inc., 2018). The report recommends that backfill soils would be moisture-conditioned and recompacted to meet American Section of the International Association for Testing Materials (ASTM) standards to counteract the potential adverse effects of soil expansiveness. In addition, the report recommends that if import soils are used, the import soil should not exhibit an Expansion Index greater than 20 or contain more than 35 percent fines (i.e., fine-grained soils), and should be screened by the geotechnical engineer to meet ASTM International standards (Hushmand Associates, Inc., 2018). By following these recommendations, impacts would be less than significant and no mitigation is required.

VII(f): Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Results of the paleontological assessment indicate there are no significant resources that would be affected by the construction of the Project as presently proposed.

In the event that an unanticipated fossil discovery is made during proposed Project construction, in accordance with SVP (2010) guidelines, a qualified professional Paleontologist should be retained to examine the find and to determine if further paleontological resources mitigation is warranted (Society of Vertebrate Paleontology, 2010). The following management recommendation measures have been used by professional paleontologists for many years and have proven to be effective in reducing or eliminating adverse impacts to paleontological resources to a less than significant level pursuant to the requirements of CEQA. Prior to the start of construction within a given development site within the Project Area, all field personnel should be briefed regarding the types of fossils that could be found and the procedures to follow should paleontological resources be encountered. Specifically, the training should provide a description of the fossil resources that may be encountered, outline steps to follow when a fossil discovery is made and provide contact information for the Qualified Paleontologist and on-site monitor(s). The training should be developed by the Qualified Paleontologist and provided as hand-outs or a Power Point Presentation that can be presented concurrently with other environmental training (e.g., cultural and natural resources awareness training, safety training, etc.). As determined by the Qualified Paleontologist, construction Monitoring would not be required in the Project Area because of previous disturbance or the shallow, younger alluvial deposits.

With compliance with SVP (2010) guidelines (see **BMP-PAL-1** and **BMP-PAL-2**), impacts to paleontological resources would be less than significant and no mitigation measures are required.

3.6.3.4 Operational Impacts

VII(b): Would the project result in substantial soil erosion or the loss of topsoil?

The proposed Project would feature changes in elevation; however much of the 13-acre site would be a mix of vegetation, hardscape and park amenities. In the LA River channel, reinforced concrete planted terraces would be anchored into the existing slope liner on the west and east banks. Because the topography of the Project Area is relatively flat, and open spaces would be landscaped or hardscaped, substantial soil erosion and loss of topsoil are not anticipated. Therefore, impacts would be less than significant and no mitigation is required.

VII(c): 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?

See Section 3.6.3.3 above for a discussion of impacts related to expansive soils.

VII(f): Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

Operation of the proposed Project would not involve any ground-disturbing activities. Therefore, there would be no potential to disturb, damage, or degrade a paleontological resource or its setting. No operational impacts on paleontological resources would occur and no mitigation measures are required.

3.6.4 Best Management Practices

BMP-GEO-1: Erosion Control

The contractor shall implement standard BMPs, such as the use of fiber rolls and silt fencing, to reduce the amount of dust and dirt from leaving the construction area.

BMP-GEO-2: Geotechnical Site Investigation Recommendations

The Geotechnical Site Investigation report for the proposed Project includes recommendations to ensure that the Project Area is suitable for construction, and to ensure that appropriate measures are taken to reduce impacts during earthwork, excavation, utility trenching, backfilling, and other construction activities (Hushmand Associates, Inc., 2018). Backfill soils shall be moisture-conditioned and recompacted to meet ASTM International standards to counteract the potential adverse effects of soil expansiveness. If import soils are used, the import soil shall not exhibit an Expansion Index greater than 20 or contain more than 35 percent fines (i.e., fine-grained soils), and shall be screened by the geotechnical engineer to meet ASTM International standards.

BMP-PAL-1: Paleontological Sensitivity Training

Prior to the start of construction, all field personnel shall be briefed regarding the types of fossils that could be found and the procedures to follow should paleontological resources be encountered. Specifically, the training shall provide a description of the fossil resources that may be encountered, outline steps to follow when a fossil discovery is made, and provide contact information for a qualified paleontologist. The training shall be developed by a qualified paleontologist and provided as hand-outs or a PowerPoint Presentation that may be presented concurrently with other pre-construction training.

BMP-PAL-2: Unanticipated Paleontological Resource Discoveries

In the event that an unanticipated fossil discovery is made during construction, a qualified professional paleontologist shall be retained to examine the find and to determine whether further paleontological resource mitigation is warranted in accordance with SVP (2010) guidelines.

3.6.5 Mitigation Measures

Impacts related to Geology and Soils would be less than significant; therefore, mitigation measures are not required.

3.6.6 Significant Unavoidable Adverse Impacts

There are no significant unavoidable adverse impacts on Geology and Soils resulting from the implementation of the proposed Project.

3.6.7 Cumulative Impacts

Impacts related to Geology and Soils would be localized to the Project Area. Construction of other development projects in the Project Area listed in **Table 1-1**, could result in Geology and Soils impacts; however, these impacts are not expected to be cumulative because they would be site-specific.

The proposed Project and related projects would not change the geologic properties of the area and would not increase seismic or other geologic risks in the region. Like the proposed Project, all proposed development projects would be subject to seismic standards, safety requirements, standard design practices, and BMPs to minimize potential risks from seismic or other geologic hazards. Projects would also be required to implement standard engineering practices and BMPs to minimize the potential for erosion or loss of topsoil. In addition, all grading activities would be required to comply with the LA City Department of Building and Safety Permits, which would include the provisions of the City's Building Code. Therefore, the proposed Project would not result in cumulative impacts related to Geology and Soils.

In the event that potentially significant buried paleontological materials are encountered within the Project Area, all work in the vicinity must be halted until a qualified paleontologist can visit the site of discovery and assess the significance of the paleontological resource. Impacts to paleontological resources would be less than significant. It is expected that related projects and other future development would also be required to comply with applicable regulatory requirements and include similar best management practices. Therefore, the proposed Project would not result in cumulative impacts on paleontological resources.