5.0 ENVIRONMENTAL IMPACT ANALYSIS

6. GEOLOGY AND SOILS

1. INTRODUCTION

This section of the Draft Environmental Impact Report (EIR) analyzes the Project's potential impacts with respect to geologic and geotechnical hazards associated with surface fault rupture, seismic ground-shaking, seismically induced flooding, liquefaction, slope stability, subsidence, erosion, expansive soils, and hydroconsolidation. The analysis is based on the following documents (collectively referred to herein as the Geotechnical Reports), all of which are included in **Appendix 5.6** of this Draft EIR as follows:[1]

- **Appendix 5.6A:** Geologic/Geotechnical Evaluation for Environmental Impact Report, Entrada South Project, Los Angeles County, California, for Newhall Land, dated October 31, 2013, prepared by R.T. Frankian & Associates;

- **Appendix 5.6B:** 100-Scale Plan Review, Vesting Tentative Tract Map No. 53295, Entrada South, Los Angeles County, California, for Newhall Land, dated September 16, 2013, prepared by R.T. Frankian & Associates;

- **Appendix 5.6C:** Geotechnical Review of the 40-Scale Bulk Grading Plan, Mission Village Tract 61105, Newhall Ranch, Los Angeles County, California, for Newhall Land, dated May 14, 2012, prepared by Leighton and Associates, Inc.;[2]

- **Appendix 5.6D:** Response to Los Angeles County, Department of Public Works, Geotechnical Review No. 2, Vesting Tentative Tract Map No. 53295, The Entrada Project, Valencia, California, for Newhall Land, dated January 16, 2008, and prepared by R.T. Frankian & Associates;

- **Appendix 5.6E:** Response to Los Angeles County, Department of Public Works, Geotechnical Review, Vesting Tentative Tract Map No. 53295, Valencia,

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[1] *Although many of the technical reports listed below reference Vesting Tentative Tract Map No. 53295 (VTTM 53295) in their title, each of these documents addresses the Project Site as a whole, including the External Map Improvements.*

[2] *Although prepared for the adjacent Mission Village project, this report includes information regarding liquefaction potential in the Project area and was therefore utilized in the analysis of the Entrada South Project.*

California for Newhall Land, dated April 6, 2007, and prepared by R.T. Frankian & Associates; and

- **Appendix 5.6F:** 100-Scale Plan Review, Vesting Tentative Tract Map No. 53295, Valencia, California, for Newhall Land, dated March 18, 2005, and prepared by R.T. Frankian & Associates.

2. ENVIRONMENTAL SETTING

a. Regulatory Setting

(1) State Regulations

(a) Seismic Hazards Mapping Act

The State of California passed the Seismic Hazards Mapping Act of 1990 (Public Resources Code Sections 2690–2699) to address the effects of strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events. Under this Act, the State Geologist is responsible for identifying and mapping seismic hazards zones (e.g., for strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events) as part of the California Geological Survey (CGS), formerly known as the California Division of Mines and Geology. The CGS zone maps are used by local governments for planning purposes. For projects within seismic hazards zones, the Seismic Hazards Mapping Act requires developers to conduct geological investigations and incorporate appropriate mitigation measures into project designs before building permits are issued.

State publications supporting the requirements of the Seismic Hazards Mapping Act include the CGS Special Publication (SP) 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* and CGS SP 118, *Recommended Criteria for Delineating Seismic Hazard Zones in California*. The objectives of SP 117 are to: (1) assist in the evaluation and mitigation of earthquake-related hazards for projects within designated zones where investigations are required; and (2) promote uniform and effective statewide implementation of the Seismic Hazards Mapping Act. SP 118 presents criteria to assist the State Geologist in fulfilling its obligation under the Seismic Hazards Mapping Act.

(b) Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621) addresses surface faulting hazards on structures for human occupancy. The primary purpose of the Act is to prevent the construction of habitable buildings on the surface traces of active faults. The Act is also intended to increase safety and minimize the loss of life during and immediately following earthquakes by facilitating seismic retrofitting to strengthen buildings against ground shaking. The Alquist-Priolo Earthquake Fault Zoning

Act requires the State Geologist to: (1) establish regulatory zones, known as earthquake fault zones, around the surface traces of active faults; (2) issue maps defining areas of potential surface rupture to assist cities and counties in planning, zoning, and building regulation functions; and (3) continually review new geologic and seismic data, revise existing zones, and delineate additional earthquake fault zones when warranted by new information. Local agencies must enforce the Alquist-Priolo Earthquake Fault Zoning Act in the development permit process by requiring 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, habitable structures must be set back a minimum of 50 feet. The Alquist-Priolo Earthquake Fault Zoning Act and its regulations are presented in CGS SP 42, *Fault-Rupture Hazard Zones in California*.

(c) California Building Code

The California Building Code (CBC), codified in the California Code of Regulations Title 24, Part 2 (California Building Standards Code), is a compilation of building standards, including seismic safety standards for new buildings. The CBC establishes minimum standards for safeguarding public health and safety through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all building and structures. The CBC applies to all occupancies in California, except where stricter standards have been adopted by local agencies. The State recently adopted the 2013 CBC, which became effective on January 1, 2014 and will continue through 2016.[3,4] Specific CBC building and seismic safety regulations have been incorporated by reference in the Los Angeles County Building Code (County Building Code) and the City of Santa Clarita Building Code, with local amendments, and are discussed below.

The California Building Standards Code, which includes the CBC as well as other related codes (e.g., California Electrical Code and California Plumbing Code, among others), is based on the International Building Code, with the addition of California amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standards 7-10. The California Building Standards Code establishes requirements for general structural design and methods for determining earthquake loads, as well as other loads (flood, snow, wind, etc.), for inclusion in building codes. The provisions of the

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[3] *California Building Standards Commission, California Building Standards Code (Title 24, California Code of Regulations), www.bsc.ca.gov/codes.aspx, accessed March 11, 2015.*

[4] *The 2011 CBC was in effect at the time LACDPW reviewed and approved the Geotechnical Reports, and thus reference to the 2011 CBC may be made herein. However, final design plans for the Project will be subject to the code in effect at the time of plan check/approval, as required.*

California Building Standards Code apply to the construction, alteration, movement, replacement, and demolition of every building or structure, and any connected appurtenances, throughout California.

Earthquake design requirements take into account the occupancy category of a structure, site class, soil classifications, and various seismic coefficients, which are used to determine the appropriate Seismic Design Category for a project. The Seismic Design Category is a classification system that combines occupancy categories with the level of expected ground motions at the site and ranges from Seismic Design Category A (very small seismic vulnerability) to Seismic Design Category E/F (very high seismic vulnerability and near a major fault). Design specifications for the structure are then determined according to the applicable Seismic Design Category.

(2) County Regulations

(a) County of Los Angeles General Plan

As discussed in greater detail in **Section 5.11**, Land Use and Planning, of this Draft EIR, the County of Los Angeles (County) General Plan directs future growth and development in the County's unincorporated areas and establishes goals, policies, and objectives that pertain to the entire County. The current General Plan, adopted in 1980, includes relevant policies that focus on the enforcement of standards and requirements that reduce seismic and geologic hazards as well as promoting seismically resistant lifelines that serve the County and connect to surrounding areas. Additional discussion of hillside management issues addressed in the General Plan is provided below under Los Angeles County Hillside Requirements.

As also discussed further in **Section 5.11**, Land Use and Planning, the County released a draft General Plan update, entitled Los Angeles County General Plan 2035 (Draft General Plan), in January 2014 and a Draft EIR addressing the Draft General Plan in June 2014. This Draft General Plan contains a new Safety Element that includes a section on seismic and geotechnical hazards with a stated goal of preventing or minimizing personal injury, loss of life, and property damage due to seismic and geotechnical hazards through an effective regulatory system.

The General Plan policy consistency analysis provided in **Section 5.11**, Land Use and Planning, of this Draft EIR, indicates the Project would be consistent with relevant General Plan polices related to geology and soils.

(b) Santa Clarita Valley Area Plan: One Valley One Vision 2012

As discussed in greater detail in **Section 5.11**, Land Use and Planning, of this Draft EIR, the recently updated Santa Clarita Valley Area Plan: One Valley One Vision 2012 (Area Plan) serves as a long-term guide for development over the next 20 years. The Area Plan ensures consistency between the General Plans of the County and the City of Santa Clarita (City) in order to achieve common goals and encourages the coordination of land use plans with public services and other departments or agencies. The Area Plan acknowledges the presence of several known active and potentially active earthquake faults and fault zones within and near the Santa Clarita Valley (Valley) Planning Area. In addition, the Area Plan notes much of the Planning Area consists of mountainous or hilly terrain in which conditions for unstable soils and landslides may be present, and areas underlain by unconsolidated alluvium (e.g., along the Santa Clara River (River) and tributary washes) may be prone to liquefaction.

Relevant polices within the Area Plan address the need to maintain maps of geologic hazards, implement the requirements of the Alquist-Priolo Earthquake Fault Zoning Act, and enforce seismic design and building techniques in the County Building Code. The Area Plan policy consistency analysis provided in **Section 5.11**, Land Use and Planning, indicates the Project would be consistent with applicable Area Plan polices related to geology and soils.

(c) County Development Monitoring System

The County General Plan includes provisions known as the Development Monitoring System (DMS) to give the County planning agency—the Regional Planning Commission and/or Department of Regional Planning (collectively referred to herein as the County Planning Agency)—information about new urban growth in the four major Urban Expansion Areas of the General Plan (Antelope Valley, Santa Clarita Valley, Malibu/Santa Monica Mountains, and East San Gabriel Valley).[5] The primary purpose of the DMS is to ensure that new development in Urban Expansion Areas will occur in a manner consistent with stated DMS policies and will pay for the expansion costs that it generates. Additionally, the DMS requires analysis of certain environmental factors associated with a development application. Specifically, the DMS requires each development application to determine whether or not it will have a significant environmental effect relative to geotechnical hazards. For further information with regard to the DMS, please see **Section 4.1**, Environmental and Regulatory Setting, of this Draft EIR.

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[5] *See Resolution of the Board of Supervisors of the County of Los Angeles Relating to Plan Amendment Case No. SP 86-173, adopted on April 21, 1987.*

(i) Project Subject to DMS

The Project is located within the Santa Clarita Valley, an Urban Expansion Area within the DMS, and includes a subdivision map application (Vesting Tentative Tract Map (VTTM) 53295). Therefore, the Project is subject to a DMS analysis or its equivalent.

(ii) DMS Access Provisions

As stated above, the DMS includes analysis of the access factors associated with a development project in an Urban Expansion Area. Under the DMS, where applicable, a project must be located within reasonable proximity to commercial development and job opportunities (generally within 5 miles) and served by an acceptable level of road service. If it is determined that the project is not located in proximity to commercial and employment facilities, mitigation measures set forth in the DMS must be considered and applied prior to any approval of the project.

As applied, the Project satisfies the DMS access requirements because the site is located nearly adjacent to Six Flags Magic Mountain, and within 0.25 mile from Castaic Junction and the Valencia Commerce Center, and approximately 0.25 mile from the Valencia Industrial Park. All of these existing development areas are served by County or other public services and provide substantial commercial services and job opportunities.

(iii) DMS Environment Provisions

The DMS states that "urban development is appropriate…where hazards to life or property are avoided or adequately mitigated…."[6] The Project Initial Study provided general information concerning geotechnical hazards and determined an EIR would be required. As previously indicated, the Geotechnical Reports in **Appendix 5.6** support this geology and soils section of this EIR. The Geotechnical Reports provide up-to-date information regarding potential geotechnical hazards, including site-specific conditions, as well as engineering recommendations to adequately mitigate such hazards.

(iv) DMS Environment Factors and Criteria

The DMS environmental factors and criteria to be considered when evaluating whether a project will have a significant effect with respect to geotechnical issues include whether the project is located on land having an active or potentially active fault zone, landslide, or high soil instability. While the use of DMS maps and data is called for in order

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[6] *County of Los Angeles Department of Regional Planning, A Plan Amendment To The Los Angeles County General Plan Dealing With Development Monitoring, Plan Amendment No. SP 86-173, p. 1.*

to conduct this analysis, the Geotechnical Reports prepared for the Project provide more current information regarding potential geotechnical hazards, including site-specific conditions, which is used herein. More specifically, preparation of the Geotechnical Reports included review of relevant literature and materials, field investigation including subsurface exploration, and laboratory testing to determine the characteristics of subsurface conditions at the Project Site. Recommendations regarding the design and construction of the proposed Project are based on these results. This information is used in lieu of DMS maps and data because:

(1) The data is considered current and the best available information from geotechnical experts and includes site-specific information;

(2) The data takes into account current regulatory requirements, including state regulations and County Code requirements, that are designed to ensure public safety and welfare; and

(3) The data is considered by County staff to be equivalent to the data called for in the DMS as it relates to geotechnical hazards.

Due to the site-specific nature of geological conditions (e.g., soils, geological features, seismic features, etc), geology impacts are typically assessed on a project-by-project basis, rather than on a cumulative basis. Therefore, the DMS analysis contained herein focuses on Project impacts.

Based on the information provided herein, the County Planning Agency shall apply the factors and criteria to the Project's location and determine whether or not the Project will have a significant impact on safety as it relates to geotechnical hazards.

(d) Los Angeles County Building Code

The 2014 County Building Code, effective January 1, 2014, is based on the 2013 CBC and the 2012 International Building Code.[7] Relevant provisions address 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 County

[7] *The 2011 County Building Code was in effect at the time LACDPW reviewed and approved the Geotechnical Reports, and thus reference to the 2011 County Building Code may be made herein. However, final design plans for the Project will be subject to the code in effect at the time of plan check/approval, as required.*

Department of Public Works (Public Works) Building and Safety Division is responsible for implementing the provisions of the County Building Code.

(e) Los Angeles County Tentative Map Reports

Geologic reports must be submitted to the Public Works Geotechnical and Materials Engineering Division by a Project Engineering Geologist and/or Project Geotechnical Engineer to demonstrate the feasibility of any development depicted on a tentative subdivision map. Each report must be based on the latest tentative map submitted to the County Department of Regional Planning and must contain sufficient geologic information to demonstrate that: (1) the site is suitable for proposed development as designed; (2) existing or potential geologic conditions have been identified and their effect on development determined; and (3) adequate mitigation measures have been provided.

(f) Los Angeles County Hillside Requirements

As discussed in greater detail in **Section 5.11**, Land Use and Planning, of this Draft EIR, much of the Project Site contains hillside land, defined as mountainous and hilly areas with 25 percent slopes or greater, and is designated for urban uses (H5—Residential 5).

The County sets forth development requirements for Hillside Management Areas in its Hillside Management Area Ordinance (County Code Section 22.56.215). The Ordinance does not preclude development within hillside areas, but rather ensures that development maintains, and where possible enhances, the natural topography, resources, and amenities of the hillside management areas. Residential developments meeting specified density thresholds in hillside areas require a conditional use permit (CUP), as well as preparation of geology and soil reports identifying active or potentially active faults at and near the proposed site and the stability of the area within various defined slope categories.

The County's current General Plan, as amended in conjunction with the 2012 adoption of the Santa Clarita Valley Area Plan, addresses hillside development with detailed information provided in Appendix A of the Land Use Element, which describes Hillside Management/Performance Review Procedures for development projects in hillside areas. Based on an overarching policy to "manage development in hillside areas to protect their natural and scenic character and to reduce risks from fire, flood, mudslide, erosion and landslide," the review process is intended to ensure site suitability, public safety, and resource protection, and to protect scenic and open lands and to ensure that development in hillside areas is safe, functionally and attractively designed, and compatible with

surrounding uses.[8] Residential development must avoid or mitigate public safety impacts and preserve distinct visual characteristics, and a variety of housing types of various price ranges is encouraged. General conditions for development are specified and address slope/density standards for residential uses, density transfers from steeper to more level land, and natural or open space standards.

(3) Previously Adopted Plans and Mitigation

(a) Newhall Ranch RMDP/SCP and EIS/EIR

The Project Site is included in the project area for the Applicant's Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan (RMDP/SCP), shown in **Figure 3-5**, RMDP/SCP Project Area, in **Section 3.0**, Project Description, of this Draft EIR, which covers certain aspects of resource management for the Project and other nearby developments. As discussed in greater detail in **Section 4.1**, Environmental and Regulatory Setting, the RMDP component of the Newhall Ranch RMDP/SCP project is a conservation, mitigation, and permitting plan for the long-term management of sensitive biological resources and development-related infrastructure in the River and tributary drainages within the 11,999-acre Newhall Ranch Specific Plan (Specific Plan) area and along the extension of Magic Mountain Parkway through the Project Site. The SCP component of the Newhall Ranch RMDP/SCP project is a conservation and management plan to permanently protect and manage a system of preserves designed to maximize the long-term persistence of the San Fernando Valley spineflower (*Chorizanthe parryi ssp. Fernandina*) (spineflower), a federal candidate and state-listed endangered plant species. The SCP encompasses the Specific Plan area, the Valencia Commerce Center planning area, and the Project Site, in order to conduct conservation planning and preserve design on the Project Applicant's land holdings in Los Angeles County that contain known spineflower populations.

The Newhall Ranch RMDP/SCP project was the subject of a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (SCH No. 2000011025) by the U.S. Army Corps of Engineers (Corps) and the California Department of Fish and Wildlife (CDFW).[9,10] At the time CDFW certified the EIR portion of the EIS/EIR in December 2010, it also adopted the Mitigation Monitoring and Reporting Plan (MMRP) for the RMDP/SCP project. This regulatory plan, required under CEQA, describes the mitigation measures,

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[8] *County of Los Angeles General Plan Land Use Element, Appendix A, page III-59.*

[9] *Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan, Final Joint Environmental Impact Statement and Environmental Impact Report, June 2010.*

[10] *The California Department of Fish and Game was officially renamed the California Department of Fish and Wildlife as of January 1, 2013.*

monitoring, and/or reporting plan for the Newhall Ranch RMDP/SCP project (including the Entrada South Project Site). The Newhall Ranch RMDP/SCP EIS/EIR determined that geology and soils impacts would be less than significant. Thus, no mitigation measures were required.

(i) Newhall Ranch Section 401 Water Quality Certification

On September 14, 2012, the Los Angeles Regional Water Quality Control Board (LA Regional Water Board) approved Order No. R4-2012-0139, which includes the Clean Water Act (CWA) Section 401 water quality certification and waste discharge requirements for the Newhall Ranch RMDP/SCP project.[11]

As part of both the Newhall Ranch Section 401 water quality certification requirements and the Newhall/California Coastal Conservancy Agreement (August 6, 2012) entered into in conjunction with the Section 401 process, the Applicant must meet a number of conditions, including to salvage and replace soils when on-site soils are conducive to restoration of temporary impact areas. Additionally, the Applicant must salvage soils to be used when on-site soils are conducive to the establishment of specific vegetation types or are critical to providing suitable channel substrate conditions. Furthermore, active construction sites shall comply with interim soil stabilization requirements of the Construction General Permit (Order No. 2009-0009-DWQ; NPDES No. CAS000002 adopted September 2, 2009; effective July 1, 2010), as amended or reissued, and applicable South Coast Air Quality Management District (SCAQMD) Rule 403 requirements. Finally, the Applicant or its designee must submit a workplan for Executive Officer approval that sets forth soil analysis/sampling criteria to be used in development areas within the RMDP that either presently or historically have been used for agricultural activities.

b. Existing Conditions

(1) Regional Geology

The Project Site is located in the eastern Ventura basin within the Transverse Ranges geomorphic province of California. The Ventura basin consists of a narrow, elongated sedimentary trough extending from the Santa Barbara Channel on the west to the San Gabriel fault on the east. The axis of the trough trends east-west, reflecting the overall east-west trend of the Transverse Ranges, and generally coincides with the Santa Clara River Valley and the Santa Barbara Channel. The Ventura basin has been an area

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[11] *See **Appendix 2E** of this Draft EIR for a copy of Newhall's final Section 401 water quality certification (September 2012).*

of subsidence and sediment accumulation since the beginning of the Tertiary period (65.0 million to 1.8 million years before present), with the present trough-like form developing near the beginning of the Miocene epoch (23.0 million to 5.3 million years ago). The structure of the basin is defined as a highly folded synclinorium (i.e., a broad regional syncline on which minor folds are superimposed) formed by north-south compressional forces and containing a maximum approximately 50,000 feet of marine and non-marine Tertiary through Quaternary age sediments. Two main periods of general deformation of the Ventura basin are indicated by the regional geologic structure: one in the middle to late Miocene epoch (represented by the deposition of the Modelo Formation), and the other during the Pleistocene epoch (2.6 million to 11,700 years before present), after deposition of the Plio-Pleistocene Saugus Formation. The flanks of the Ventura basin synclinorium are broken by a series of large reverse/thrust faults including the Santa Susana and Oak Ridge faults on the southern flank and the Red Mountain and San Cayetano faults on the northern flank. The San Gabriel fault, the dominant geologic feature in the Valley, forms the eastern Ventura basin boundary and separates the Ventura basin from the structurally similar Soledad basin.

Sedimentary rock units comprising the eastern Ventura basin include approximately 2,000 feet of undifferentiated middle to late Eocene age (56.0 million to 33.9 million years ago) rocks; approximately 1,000 feet of the middle Miocene age Topanga Formation; approximately 5,000 feet of the late Miocene age Modelo Formation; approximately 4,000 feet of the late Miocene to early Pliocene age (5.3 million to 2.6 million years ago) Towsley Formation; approximately 5,000 feet of the Pliocene age Pico Formation; and approximately 7,000 feet of the Plio-Pleistocene Saugus Formation. The undifferentiated Eocene units and the Topanga, Modelo, Towsley, and Pico Formations are composed of marine sediments; the Saugus Formation is composed of interfingering shallow-water marine, brackish water, and nonmarine units. These Tertiary period rock units rest unconformably on pre-Cretaceous age (145.0 million to 66.0 million years ago) metamorphic and igneous basement rocks of the San Gabriel Mountains.

Within the Valley, the primary sedimentary rock formations are the Pico and Saugus Formations. The Pico Formation outcrops along the northern flanks of the Santa Susana Mountains and in the Chiquita Canyon and Val Verde areas. The Saugus Formation overlies the Pico Formation and comprises most of the hills of the Valley between Newhall and Castaic. These two formations have been deformed into a series of closely spaced anticlines and synclines whose moderately to steeply dipping flanks are broken by the Holser fault and cut off diagonally by the San Gabriel fault. Other geologic materials exposed within the Valley include Pleistocene fanglomerate deposits exposed in the southern portion of the Valley, sporadic remnant terrace deposits of Pleistocene age, and Holocene age (11,700 years ago to present) alluvium mantling in the Valley floor.

(2) Project Site Location, Topography, and Existing Uses

The Project Site is depicted on the U.S. Geological Survey (USGS) Newhall, CA 7.5-minute topographic quadrangle map at Township 4 North, Range 16 West, Sections 19 and 20. The Project Site is an irregularly shaped parcel comprising 501.4 acres along the north margin of the Santa Susana Mountains, just south of the Santa Clara River.[12] In terms of developed uses, the Project Site is located west of I-5 and The Old Road and predominantly south of Six Flags Magic Mountain Theme Park (Six Flags Magic Mountain). Other surrounding uses include the City of Santa Clarita to the east across I-5, the community of Westridge to the south, and vacant land within the Newhall Ranch Specific Plan (Specific Plan) area to the west. The approved Specific Plan community of Mission Village (VTTM 61105) is located immediately west of the Project Site. Additionally, the proposed Legacy Village community is located to the southwest.

The topography of the Project Site varies, with elevations ranging from approximately 1,000 feet above mean sea level (AMSL) along the Santa Clara River to approximately 1,400 feet AMSL on the ridges in the southwestern portion of the Project Site. The Project Site includes four canyons: Magic Mountain Canyon along the western site boundary, Unnamed Canyon 1 within the western portion of the Project Site, Unnamed Canyon 2 within the central portion, and Unnamed Canyon 3 within the eastern portion, each of which drain to the north towards the Santa Clara River (refer to **Figure 5.9-1**, Tributary Drainages, in **Section 5.9**, Hydrology and Water Quality—Hydrology, of this Draft EIR for a graphic depiction). Existing uses include predominantly vacant land, some agricultural uses, a small plant nursery used by the adjacent Six Flags Magic Mountain, and abandoned oil wells and associated unpaved access roads. The former drill pads are generally flat and level and often consist of areas of cut and fill. In addition, the southern boundary of the Project Site is developed with Southern California Edison electric transmission lines and towers. Vegetation communities within the Project Site include California sagebrush scrub, California annual grasslands, valley oak/grass, alluvial scrub, Mexican elderberry scrub, Eriodictyon scrub, and land used for agricultural purposes, as discussed further in **Section 5.4**, Biological Resources.

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[12] *Within the Project Site, 382.3 acres are located within proposed Vesting Tentative Tract Map No. 53295 (VTTM 53295), where the majority of development is proposed, and the remaining 119.1 acres comprise an area of External Map Improvements, where grading, utility, roadway, drainage, and other infrastructure improvements are proposed. A portion of the External Map Improvements is located within the boundaries of Mission Village, within the Specific Plan area.*

(3) Geologic Structure and Earth Materials

(a) Geologic Units

Geologic units observed within and adjacent to the Project Site include the Saugus Formation, landslides, terrace deposits, alluvium, and engineered and non-engineered fill. The areal of extent of these various geologic units are shown in **Figure 5.6-1**, Geologic Map of the Project Site, on page 5.6-14. A description of each unit is provided below.

sf	Stockpile Fill
cef/af	Certified Engineered Fill/Artificial Fill
Qal	Alluvium
Qsf/Qls	Surficial Failure/Landslide Debris
Qt	Terrace Deposits
TQs	Saugus Formation

Geologic Contact; queried where inferred; dotted where concealed

Fault; dotted where concealed

Project Site Boundary

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Figure 5.6-1
Geologic Map of the Project Site

Source: R.T. Franklin & Associates, 2013.

(i) Saugus Formation (TQs)

The Plio-Pleistocene age Saugus Formation underlies the entire Project Site and is observed in outcrops in the eastern portion. The Saugus Formation consists of massive to well-bedded, fine to coarse sandstone interbedded with matrix-supported coarse sand and gravel conglomerate. Sandy siltstone is encountered locally. The friable Saugus Formation is generally moderately to weakly cemented with alkaline earth carbonates.

(ii) Terrace Deposits (Qt)

Pleistocene age terrace deposits cap the Saugus Formation over most of the western half of the Project Site. The terrace deposits consist of materials originally deposited as alluvial fans (known as fanglomerates) derived from the Santa Susana Mountains. Terrace deposits consist of massive to poorly bedded sand, gravel, and silt. Cobbles and boulders are common, with clast size ranging from 3 to 12 inches in diameter. The unit is loose and poorly consolidated.

The contact between the terrace deposits and Saugus Formation on-site is sometimes difficult to accurately define due to the similarity of the units, particularly the loosely consolidated gravel beds of the terrace deposits and the Saugus Formation conglomerates.

(iii) Alluvium (Qal)

Holocene age alluvial deposits are present in two northerly draining canyons within the Project Site. These alluvial deposits consist of loose and poorly consolidated mixtures of sand, silt, and gravel. Some alluvial areas have been disturbed by past farming activities, and these areas are designated as undifferentiated artificial fill and alluvium (depicted as af/Qal on the geologic map).

(iv) Landslides (Qls)

Evidence of past landslides is present within the External Map Improvements area, within the boundaries of Mission Village. The landslides were translational slides that failed along a weak, unsupported bedding surface within Saugus Formation units. The landslide deposits are generally composed of disturbed Saugus Formation units (i.e., sandstone, siltstone, and mudstone) that range from highly weathered/altered rock to relatively competent materials. Most of the landslides are believed to be pre-Holocene age (greater than 11,700 years old).

(v) Surficial Slope Failures (Qsf)

Numerous small, surficial slope failures have been mapped on the natural slopes within the Project Site, particularly along portions of the canyons. These failures include weathered bedrock, terrace deposits, and slope wash. They are limited in lateral extent and have a maximum thickness of 15 feet near the toe.

(vi) Artificial Fill (af)

Artificial fill associated with past agricultural and petroleum activities is present within the Project Site. The artificial fill is composed primarily of reworked Saugus Formation materials and terrace deposits.

(vii) Stockpile Fill (sf)

An existing stockpile fill is located in the southeastern portion of the Project Site. This stockpile fill was created on a former oil well pad to accommodate excess fill material generated during excavation for relocation of the off-site Chevron Service Station, located at the southwest corner of the intersection of Magic Mountain Parkway and The Old Road. Placement of the stockpile fill was observed and tested in accordance with the requirements of Public Works, including construction of a subdrain at the base of the fill and compaction of the fill materials to at least 85 percent relative compaction.

(viii) Residual Soil

Residual soil, which is not shown in the geologic map, has developed as a mantle over many of the natural slopes within the Project Site. The residual soil generally consists of silty sand/sandy silt to sandy and silty clay deposits.

(b) Geologic Structure

The Saugus Formation has been warped into a northwest-striking homoclinal structure with northeast dips between 4 and 20 degrees. Bedding within the terrace deposits is generally subparallel to the bedding in the underlying Saugus Formation, with northeasterly dips typically less than 10 degrees. Bedding planes within both the Saugus Formation and terrace deposits vary from diffuse and gradational to sharp and planar.

(4) Groundwater

The Project Site is located within the Eastern Hydrologic Subarea of the Upper Santa Clara River watershed. Within the Project Site, groundwater occurs in the alluvial deposits of the major tributary canyons and Saugus Formation aquifers.

There was previously one well within approximately 0.5 mile of the Project Site, near the intersection of The Old Road and Rye Canyon Road, that was established within the alluvial aquifer and was monitored by Public Works. Designated as Well No. 7076C, the highest observed water level was 8.0 feet below ground surface (corresponding to a water surface elevation of 1,215.0 feet AMSL), measured on April 8, 1986 and April 25, 1988. The most recently recorded water level was 39.4 feet (water surface elevation of 1,183.6 feet AMSL), measured on April 14, 1992. Well No. 7067C was reported destroyed in 1993.

Subsurface exploration was conducted within the Project Site to a maximum depth of 65 feet. The explorations indicate groundwater is generally deeper than 40 feet below ground surface within VTTM 53295, with the highest levels occurring within the External Map Improvements area, where groundwater was encountered at around 10 feet below ground surface in the northern portion of the Project Site near the Santa Clara River. At the time of field exploration, groundwater was not encountered in Magic Mountain Canyon and Unnamed Canyon 2. Nonetheless, during winter rains, these canyons may experience intermittent surface flow and associated higher groundwater elevations.

(5) Geologic and Geotechnical Hazards

Potential geologic and geotechnical hazards within and affecting the Project Site include, but are not limited to, primary earthquake hazards (ground shaking and ground rupture), secondary earthquake hazards from ground shaking (such as liquefaction), and landslides/slope instability. Earthquakes have the potential to inflict the greatest loss of life and property damage. Consequently, the proximity of a site to active or potentially active faults is a key element in assessing the potential for earthquake damage.

The major cause of earthquake damage is generally the result of strong ground shaking from movement along a fault or fault zone. Ground shaking can occur adjacent to the earthquake epicenter as well as for many miles in all directions. Damage due to actual fault displacement or ground rupture beneath a structure may also occur; however, fault ground rupture is much less common and typically confined to areas along, or immediately adjacent to, the fault surface trace.

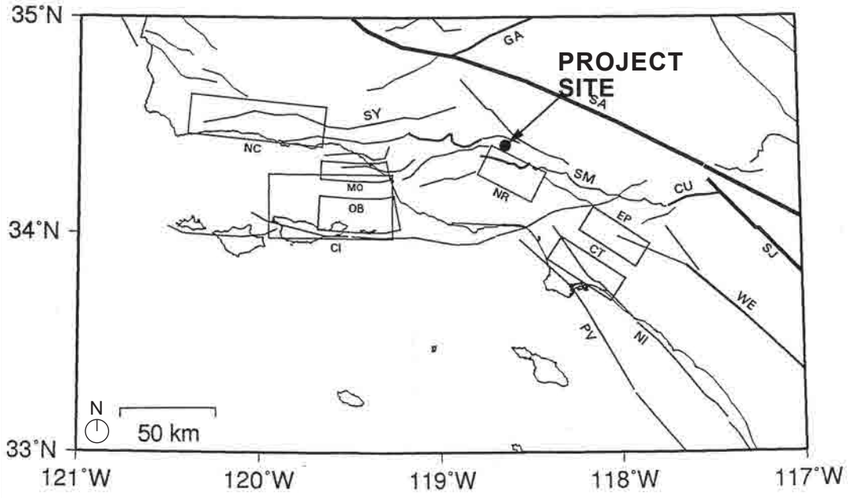
Landslides are common hazards in southern California, particularly in hillside areas underlain by sedimentary rock units. Landslides can occur in terrain ranging from vertical cliffs to slopes as gentle as one or two degrees. Materials on slopes that are subject to landsliding include rock, soil, artificial fill, or combinations of these materials.

(a) Faults

A fault is defined as a fracture along which rocks on one side have been displaced with respect to those on the other side. While earthquakes can result from volcanic activity, in California, earthquakes are commonly associated with faults or fault zones. In accordance with CGS criteria, a fault is considered active if it has demonstrated movement in the last 11,000 years (i.e., generally corresponding to the Holocene epoch). Faults that have demonstrated movement between 11,000 and 1.6 million years ago (i.e., during the Quaternary period), but lack strong evidence of Holocene movement, are classified as potentially active. Faults that have not moved since the beginning of the Quaternary period are deemed inactive. The seismically active southern California region is crossed by numerous active and potentially active faults and is underlain by several blind thrust faults, which are low angle reverse faults with no surface exposure.

The Project Site does not contain any known active faults and is not within an Alquist-Priolo Earthquake Fault Zone. The closest active fault to the Project Site is the San Gabriel fault, located approximately 1.4 miles to the northeast. Active and potentially active faults within the surrounding area are illustrated in **Figure 5.6-2**, Regional Fault Map, on page 5.6-19 and discussed further below.

Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION: ON LAND	DESCRIPTION: OFFSHORE
Quaternary	Late Quaternary	Historic				Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	200			Displacement during Holocene time	Fault offsets surficial sediments or strata of Holocene age
			10,000			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Pleistocene age.
	Early Quaternary	Pleistocene	700,000			Undivided Quaternary faults – most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
			1,600,000			Late Cenozoic faults within the Sierra Nevada, including parts of, but not restricted to, the Foothills fault system. These faults may have been active in Quaternary time.	
Pre-Quaternary			4.5 billion (Age of earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive. Pre-Quaternary faults not shown in Nevada and Oregon.	Fault cuts strata of Pliocene or older age.



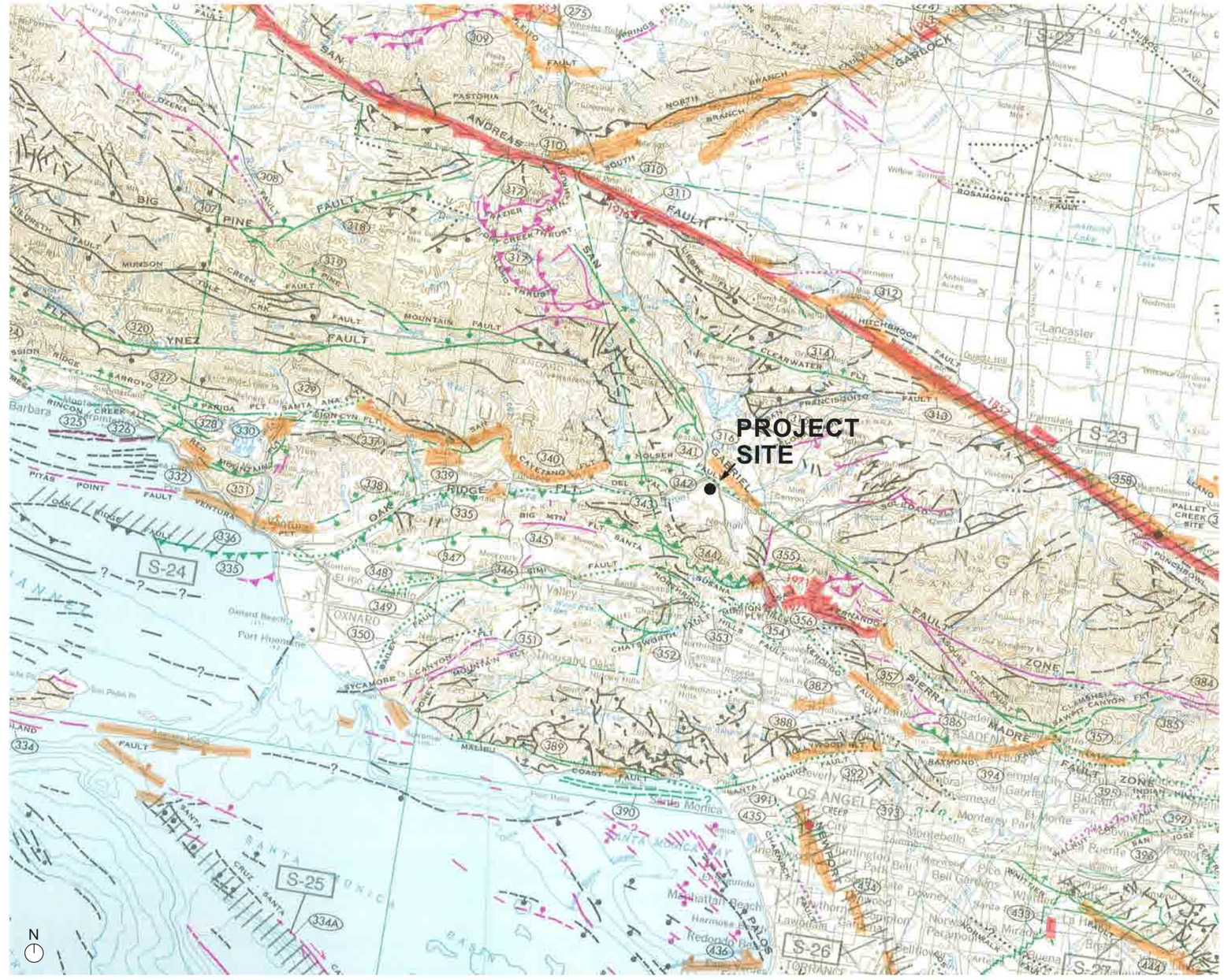


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Figure 5.6-2
Regional Fault Map

Source: R.T. Franklin & Associates, 2013.

(i) Active Faults

The general Project area may be subject to severe ground shaking due to the proximity of several active faults, including the San Gabriel, Oak Ridge, Santa Susana, and San Cayetano faults.

San Gabriel Fault

The nearest active fault is the San Gabriel fault, located approximately 1.4 miles northeast of the Project Site. The San Gabriel fault extends approximately 90 miles through the Transverse Ranges of southern California. The San Gabriel fault consists of a zone of imbricate, steep, north-dipping faults. Throughout most of its extent, the fault has strong geomorphic expression, with the faults comprising the zone characterized by displaced geologic units, deflected drainages, strike valleys, notched ridges, subparallel faulting, fracturing, and folding.

Within the Santa Clarita Valley, from Castaic Creek to the San Gabriel Mountains, the fault crosses the Castaic lowlands and the Santa Clara River, where its course is marked by a belt of braided small faults and steep dips in Pliocene and Pleistocene beds. Since most of the displacement within the fault zone took place before deposition of these geologically young beds, the fault's trend through this area is not nearly as conspicuous as within the rocks along the southwestern margin of the Ridge basin or in the basement rocks of the San Gabriel Mountains. The location of the fault, however, is somewhat defined by the steeply dipping and folded beds of the Plio-Pleistocene Saugus Formation, and the fault is exposed in cut slopes, roadcuts, and trenches. Based on the findings of a CGS Fault Evaluation Report, the State Geologist established an Alquist-Priolo Earthquake Fault Zone for the San Gabriel fault in 1987 within the Newhall Quadrangle.

Santa Susana Fault

The Santa Susana fault, located approximately 6.3 miles south of the Project Site, consists of a complex zone of primarily north-dipping thrust faults. The fault zone extends northeastward from the Santa Susana Mountains across San Fernando Pass and into the San Gabriel Mountains. A short segment of the Santa Susana fault ruptured during the 1971 San Fernando earthquake; however, the remainder of the fault zone has not demonstrated displacement since the late Pleistocene time.

Oak Ridge Fault

The Oak Ridge fault is a south-dipping reverse fault that forms a ridge to the south of its trace. The fault extends for a distance of approximately 56 miles from Piru west an offshore point about 20 miles south of Santa Barbara. The onshore segment

of the Oak Ridge fault is roughly parallel to both the Santa Clara River and State Highway 126. The offshore segment is associated with a definite zone of active seismicity; the only known Holocene surface rupture is found onshore, between the towns of Bardsdale and Fillmore.

At its eastern end, the Oak Ridge fault appears to be overthrust by the Santa Susana fault, becoming a blind thrust fault. The fault associated with the 1994 Northridge earthquake is likely associated with the Oak Ridge fault system. At its closest point, the Oak Ridge fault is situated approximately 6.7 miles west-southwest of the Project Site.

San Cayetano Fault

The San Cayetano fault is an east-west trending, north-dipping thrust fault that extends approximately 28 miles from the foothills north of Piru to the southeastern edge of Ojai Valley. Holocene fault activity is indicated by well-defined fault scarps and offset Holocene sediments. The San Cayetano fault is located approximately 8.6 miles west-northwest of the Project Site.

Other Active Faults

Other more distant, but significantly active faults include the San Fernando fault zone, located approximately 9.7 miles southeast of the Project Site, and the San Andreas fault zone, located approximately 20 miles to the northeast.

A growing body of geologic and seismologic data, supplemented by regional structural interpretations, suggests Pliocene to modern deformation in the Los Angeles basin is partly accommodated by developing basement-involved fold and thrust belts. The fold and thrust belts, which may be a source for future earthquakes, are expressed at the ground surface by elongate, low-lying anticlinal ridges. At the core of these anticlinal ridges are low-angle, blind-thrust faults rising off a basal detachment surface. Recognized blind-thrust faults in the Los Angeles and Ventura basins include the Elysian Park, Compton-Los Alamitos, Oak Ridge, and Northridge blind-thrust faults. The closest known blind-thrust to the site is the Northridge blind-thrust fault. The Project Site, however, is not underlain by any known blind-thrust fault.

(ii) Potentially Active Faults

Potentially active faults in close proximity to the Project Site include the Airport Mesa and Saddle faults of the Holser structural zone and the Holser fault.

Airport Mesa and Saddle Faults

Previous geologic mapping identified two faults extending east-west across an area known as Airport Mesa within the approved Mission Village community (VTTM 61105). A site-specific fault rupture hazard investigation was conducted in 1999 and 2000 for the two faults, which were identified as the Airport Mesa fault (on the north) and Saddle fault (on the south). Saugus Formation sedimentary rock units beneath Airport Mesa have been tectonically deformed, producing the two faults and several east-plunging folds. The area between the two faults has been uplifted as a block at least 40 feet as a result of folding and reverse faulting, and the terrace deposits overlying the Saugus Formation have also been deformed along the faults. The faults have demonstrated movement within the last 100,000 years but due to a lack of datable soil horizons, movement in the last 11,000 years has not been unequivocally established. By CGS definitions, the Airport Mesa and Saddle faults are considered potentially active. The eastern extremity of the Airport Mesa fault extends into the External Map Improvements area in the northern portion of the Project Site, while the Saddle fault lies approximately 1,700 feet to the west.

Holser Fault

The potentially active Holser fault is situated approximately 2 miles northwest of the Project Site. The Holser fault consists of a south-dipping, sharply folded reverse fault that trends east-southeast from near Piru Creek to at least Castaic Junction. The Holser fault post-dates deposition of the Pico Formation and is believed to be a backthrust of a subsurface thrust fault that represents the intersection of the San Cayetano and Santa Susana faults at depth. There is no clear evidence of Holocene activity along the Holser fault, but plentiful evidence that activity has occurred in the past 100,000 years. The last known movement on the Holser fault was approximately 40,000 to 100,000 years ago.

(b) Seismicity

(i) Historic Seismicity

Like most of California, the Project area is located within Seismic Zone 4, the highest level hazard zone designated by the UBC. As such, the Project Site may be subjected to future seismic shaking during earthquakes generated by any of the surrounding active faults. As discussed further in the Geotechnical Reports included in **Appendix 5.6** of this Draft EIR, searches were conducted for historic earthquakes within 100 miles of the Project Site for magnitude 4.0 (M4.0) or larger events between the years 1800 and 2005 and between 1932 and 2013. Significant historic earthquakes meeting these criteria are listed below. At least 15 events of M5.0 or greater have occurred within 15 miles of the Project Site between 1800 and 2005, the most recent of which are included below.

- Chino Hills earthquake (M5.39) on July 29, 2008, centered approximately 57 miles east of the Project Site.

- An earthquake (M4.0) on July 22, 1999, which resulted in a calculated ground motion at the Project Site of 0.148 gravity acceleration (g). This is the closest earthquake epicenter on record, at 1.6 miles from the Project Site.

- Northridge earthquake (M6.7) on January 17, 1994 along the Northridge thrust fault, which resulted in a calculated ground motion at the Project Site of 0.217 g.

- San Fernando earthquake (M6.4) on February 9, 1971, which resulted in a calculated site-specific ground motion of 0.234 g.

- An earthquake on April 4, 1893, centered approximately 8 miles south of the Project Site, near the Santa Susana fault trace. This event yielded the largest recorded ground motion at the Project Site, with an estimated ground motion of 0.244 g.

- Fort Tejon earthquake (M7.9) on January 9, 1857, centered approximately 92 miles from the Project Site along the San Andreas fault and resulting in an estimated site-specific ground motion of 0.077 g. This is the largest known earthquake occurring within 100 miles of the Project Site.

(ii) Seismic Hazard Zone Mapped Accelerations

The CGS has prepared a Seismic Hazard Zone report for the Newhall Quadrangle, which includes a map showing Peak Ground Accelerations (PGA) within alluvial soil conditions for an earthquake with a 10 percent probability of exceedance in 50 years.[13] For the Project Site, the PGA or maximum ground motion for a 10 percent earthquake occurrence in alluvial conditions is approximately 0.74 g (i.e., 0.74 times the acceleration of gravity). The average magnitude weighted pseudo-Peak Acceleration is approximately 0.58 g.

(iii) Seismically Induced Flooding, Seiche and Tsunami

Tsunamis are large ocean waves generated by sudden water displacement due to a submarine earthquake, landslide, or volcanic eruption. The Project Site is located

[13] *California Geological Survey, State of California Seismic Hazard Zones Newhall 7.5-Minute Quadrangle, 1997.*

approximately 41.5 miles from the Pacific Ocean and is not mapped as a tsunami inundation area.[14] Therefore, the Project Site would not be affected by a tsunami.

Other forms of inundation include structural failures of dams due to factors including earthquakes, which can result in the flooding of areas located downstream. Seiches are wave oscillations generated in enclosed bodies of water, which can be caused by ground shaking during an earthquake and can also result in inundation. The Project Site is not located downslope of any large impounded bodies of water. In addition, the General Plan Safety Element indicates the Project Site is not susceptible to inundation as a result of catastrophic failure of nearby dams. Therefore, the Project Site would not be affected by a seismically-induced inundation or by a seiche. Refer to **Section 5.9**, Hydrology and Water Quality—Hydrology, of this Draft EIR for a detailed discussion of flooding.

(c) Liquefaction and Related Ground Failure

Liquefaction is a form of earthquake-induced ground failure that occurs primarily in relatively shallow, loose, granular, water-saturated soils located below the groundwater table. Liquefaction can occur when these types of soils lose their inherent shear strength due to excess water pressure that builds up during repeated movement from seismic activity. A shallow groundwater table, the presence of loose to medium dense sand and silty sand, and a long duration and high acceleration of seismic shaking are factors that contribute to the potential for liquefaction. Liquefaction-related effects include loss of bearing strength, amplified ground oscillations, lateral spreading, and flow failures. Liquefaction typically results in horizontal and vertical movements from lateral spreading of liquefied materials and post-earthquake settlement of liquefied materials.

Lateral spreading is a failure within a nearly horizontal soil zone (possibly due to liquefaction) that causes the overlying soil mass to move toward a free face or down a gentle slope. Lateral spreading may occur along a slope or near a free-face earth retaining wall when there is a sufficiently continuous liquefiable layer on which the overlying soils can move laterally. Such conditions can result in ground cracking. Ground settlement may occur during seismic shaking due to liquefaction of loose granular soils or compaction of loose, cohesionless soils. Differential seismic settlement is most likely to occur in areas that transition between rock formations and more recently deposited alluvial soils or human-placed artificial fill. Such settlements are typically most damaging when settlements of a different nature cross the length of structures.

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[14] *California Department of Conservation, Los Angeles County Tsunami Inundation Maps, www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Inundation_Maps/LosAngeles/Pages/LosAngeles.aspx, accessed March 11, 2015.*

The Seismic Hazards Zone Map for the Newhall Quadrangle indicates portions of the Project Site, generally within the canyons, are considered potential liquefaction areas where further evaluation is needed, as shown in **Figure 5.6-3**, Seismic Hazard Zones in the Project Area, on page 5.6-26.[15] Site-specific evaluation was conducted and determined the liquefaction-prone horizons within the Project Site are limited, and the potential for liquefaction and associated differential settlement is relatively small. The maximum estimated settlement within VTTM 53295 is on the order of 0.6 inch, and differential seismic settlement may be 0.4 inch over a horizontal distance of 30 feet. The potential for lateral spreading is also considered low.

[15] *California Geological Survey, State of California Seismic Hazard Zones Newhall Quadrangle, 1997.*

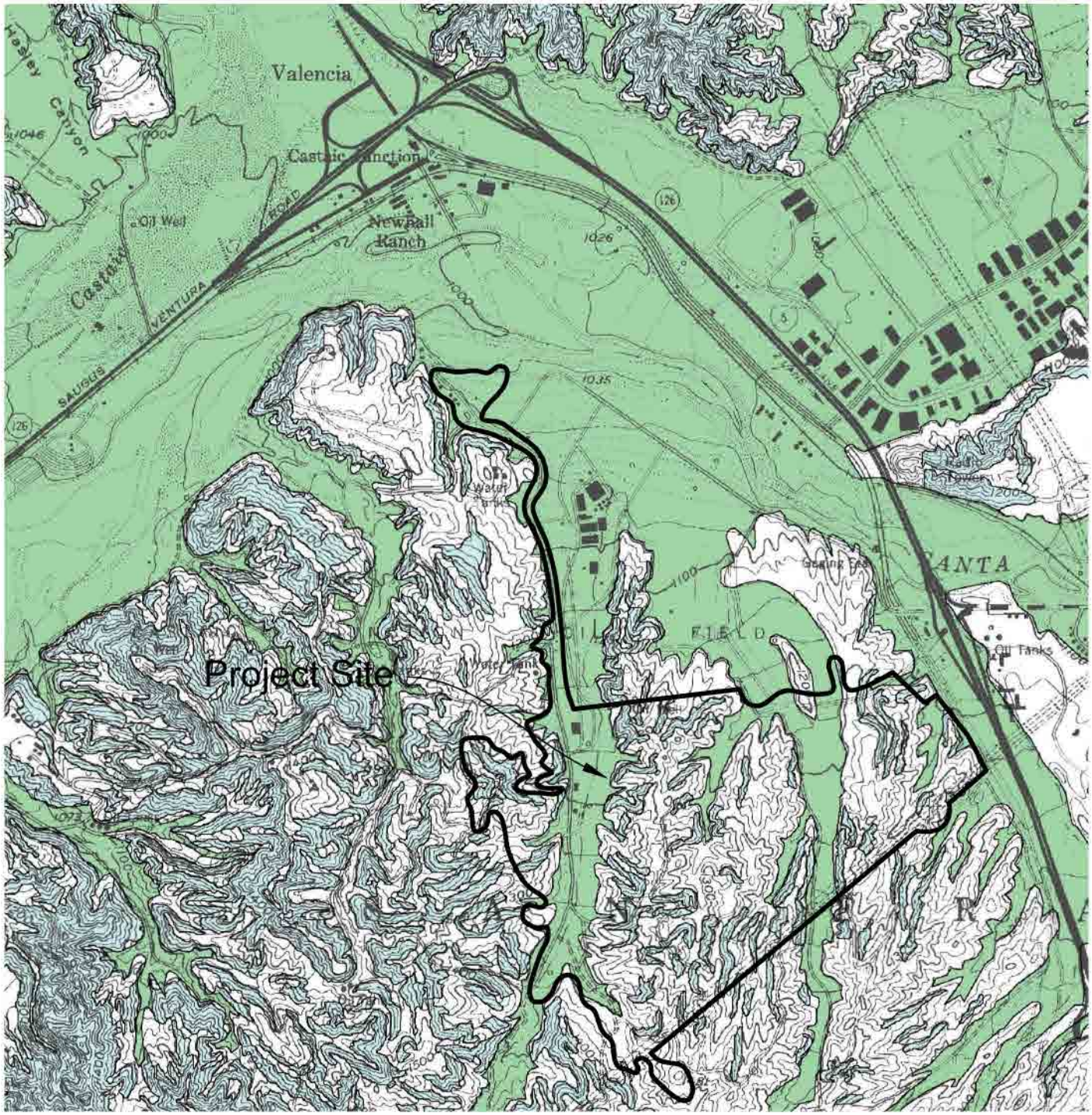

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Figure 5.6-3
Seismic Hazard Zones in the Project Area

Source: R.T. Franklin & Associates, 2013.

(d) Slope Stability

Slope stability considerations include future cut and fill slopes, slopes that will remain natural at the completion of grading, debris flows associated with natural slopes, and rockfall hazard.

(i) Cut Slopes

Existing cut slopes associated with past petroleum activities are present within the Project Site. These slopes are typically steeper than 1.5:1.

(ii) Debris Flow

The potential for a debris flow hazard exists anywhere that a moderate to thick accumulation of residual soil, slope wash, or weathered bedrock materials occurs on moderate to steep descending slopes that border future building pads. The southern portion of the Project Site is the most susceptible to debris flow hazard.

(iii) Rockfalls

The Project Site is not located directly downslope of any potential rockfalls. Therefore, rockfalls are not considered likely within the Project Site.

(e) Subsidence

The extraction of water or petroleum from sedimentary source rocks can cause the permanent collapse of the pore space previously occupied by the removed fluid. The compaction of subsurface sediments by fluid withdrawal can cause subsidence of the overlying ground surface. If the volume of water or petroleum removed is substantial, the amount of resulting subsidence may be sufficient to damage nearby structures.

The Project Site is not within an area of known subsidence associated with petroleum or groundwater withdrawal. Furthermore, the Project Site is not in an area of known peat deposits. Thus, the potential for ground subsidence within the Project Site due to fluid withdrawal or peat oxidation is considered be very low.

(f) Erosion Potential and Drainage

The bedrock, soil/alluvial material, and future fill materials located on the Project Site are susceptible to erosion if sheet flow drainage occurs. The degree of erosion is controlled by the degree of cementation or consolidation of the various materials; accordingly, areas with bedrock materials are less susceptible to erosion than areas with other materials.

(g) Rippability

The rippability of earth material is a measure of its ability to be excavated using conventional excavation equipment. A material may be classified as rippable, marginally rippable, or non-rippable. The bedrock at the Project Site is weakly to moderately cemented, which can likely be excavated with conventional grading equipment.

(h) Oversized Material

Cobbles and small boulders are common on the Project Site within the alluvium and terrace deposits, particularly near the base of the latter. Oversized material (i.e., larger than 8 inches in diameter) may present some difficulty during excavation with some types of equipment, but is not considered a substantial concern at the Project Site.

(i) Expansive Material

Expansive soils are fine-grained soils that swell when subjected to moisture and shrink when dried. Expansive soils are typically associated with clayey soils. Depending on the soil characteristics and design of building construction, expansive soils can cause extensive damage to building foundations. Fine-grained units (e.g., siltstone, mudstone, claystone units) within the Saugus Formation and terrace deposits at the Project Site may be expansive in nature. The clayey alluvial, slope wash, and artificial fill deposits may also be expansive. Engineered fills created from on-site earth materials are anticipated to have a low to medium expansion potential.

(j) Shrinking and Bulking

The weakly consolidated materials on the Project Site, such as artificial fill, slope wash deposits, and alluvium, have the potential to shrink in volume when excavated and then placed as engineered fill. Conversely, the terrace deposits and Saugus Formation units are likely to bulk. Estimates of shrinking and bulking for the on-site materials are summarized below:

- Artificial fill, slope wash, and alluvium: 15 to 20 percent shrinkage;
- Terrace deposits: 0 to 2 percent bulking; and
- Saugus Formation: 0 to 6 percent bulking.

(k) Corrosion

Soils can be corrosive due to aeration acidity and moisture content. Corrosion testing performed on soils within the adjacent community of Westridge to the south and the

approved Mission Village community to the west suggest that the soils within the Project Site may be corrosive to concrete and ferrous metals.

(l) Hydroconsolidation

Hydroconsolidation is the process by which dry alluvial soils with a high void ratio collapse under structural load in response to the application or introduction of water into the soils. Loose, dry alluvial soils, susceptible to hydrocompaction have been identified within the existing drainage courses on the Project Site.

(m) Oil Wells

As discussed in greater detail in **Section 5.8**, Hazards and Hazardous Materials, of this Draft EIR, 16 known abandoned oil wells are present within or immediately adjacent to the Project Site. The oil wells were abandoned in accordance with the regulations of the California Division of Oil, Gas and Geothermal Resources (DOGGR) in effect at the time of abandonment.

3. ENVIRONMENTAL IMPACTS

a. Methodology

To evaluate potential hazards relative to geology and soils, a number of Geotechnical Reports were prepared by R.T. Frankian & Associates and Leighton and Associates, as provided in **Appendix 5.6** of this Draft EIR. Preparation of the Geotechnical Reports included review of relevant literature and materials, field investigation including subsurface exploration, and laboratory testing to determine the characteristics of subsurface conditions at the Project Site. Recommendations regarding the design and construction of the proposed Project are based on these results.

b. Proposed Design Elements/Project Design Features

Project grading would require the removal and recompaction of approximately 7.8 million cubic yards of existing material in a balanced cut and fill operation. Mass grading would consist of rough grading operations that would: provide for major roads and infrastructure, including improvements outside of VTTM 53295 (i.e., the External Map Improvements); establish drainage patterns; and create building pads for the various land uses proposed within the Project Site. In addition, remedial grading of approximately 2.0 million cubic yards of material may be required depending upon site-specific soils and future geotechnical investigations. Additional fine and custom grading may also be required depending upon final building plans. Graded slopes would be landscaped and irrigated pursuant to County grading and erosion control requirements. The detailed subset

maps of VTTM 53295, provided within **Appendix 3** of this Draft EIR, depict the Project's grading plan and contours.

Included in the overall 7.8 million cubic yards of grading is approximately 1.4 million cubic yards of grading for the External Map Improvements, including the extension of Westridge Parkway and a portion of Commerce Center Drive, a water quality basin, debris basins, storm drain/flood control improvements, access roads, and an approximately 400,000-cubic yard borrow site within the External Map Improvements area from which 200,000 cubic yards would be imported into VTTM 53295. The remaining 200,000 cubic yards would be used as fill elsewhere within the External Map Improvements area. There would also be minor grading associated with reconstruction of the Six Flags Magic Mountain entrance and Media Center Lane. Collectively, Project-related earthwork activities would result in a balanced cut and fill condition on the Project Site.

While it is likely that the Project Site would be mass graded all at one time to allow for construction of secondary access and utilities, overall Project-related grading may occur in several phases, including partial grading within VTTM 53295. This phased grading would be protected from flooding and erosion in accordance with current County standards.

As currently designed, the Project grading plan calls for the removal or partial removal of all landslides on-site, the removal of all surficial slope failures, and the removal or re-grading of the existing cut slopes associated with past petroleum activities. Areas with natural slopes are anticipated to remain following Project completion, particularly throughout the southern portion of the Project Site, with gradients ranging from 1.5:1 to 3:1. Refer to the regulatory compliance measures and Project Design Features (PDF) below for further specifications related to grading. Proposed finished grades are depicted in the detailed subset maps of VTTM 53295 provided in **Appendix 3** of this Draft EIR.

In addition, based on the applicable regulations and requirements previously discussed, the following compliance measures would be implemented as part of the Project. It is noted that because the 2011 CBC and County Building Code were in effect at the time Public Works reviewed and approved the Geotechnical Reports, the 2011 codes are referenced in the compliance measures therein and below. However, final design plans for the Project will be subject to the codes in effect at the time of plan check/approval, as required.

- Project structures shall be designed in accordance with all applicable current codes and standards, utilizing appropriate geotechnical parameters to reduce seismic risk to an “acceptable level” as defined by CGS in SP 117a, Chapter 2. Refer to the seismicity mitigation table provided on page 17 of the Geologic/Geotechnical Evaluation for Environmental Impact Report, included as

Appendix 5.6A of this Draft EIR, which presents the applicable geotechnical parameters determined based on CBC Section 1613 Earthquake Loads, Design Code Reference Standards per ASCE 7-05 and ASCE 7-10, and USGS Seismic Design Maps.

- Prior to the issuance of a grading permit(s), the Applicant shall submit to Public Works for review and approval a final Geotechnical Investigation Report based on final Project designs prepared by a registered civil engineer and certified engineering geologist, in compliance with the County's codes and policies, including GS051.0 and GS063.0 of Public Works' Manual for Preparation of Geotechnical Reports, and consistent with the Geotechnical Reports provided in **Appendix 5.6** of this Draft EIR.

- Project design and construction shall comply with all applicable building codes and standards, including those established in CGS's SP 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*; the most current UBC as adopted by the County; state and County laws, ordinances, and Code requirements; and the recommendations set forth in the Geotechnical Reports approved by Public Works.

- Prior to issuance of a grading permit, the Project Applicant shall submit a grading plan to the Soils Section of Public Works for verification of compliance with applicable County codes and policies, including grading requirements set forth in Title 26, Appendix J.

- The proposed fill slopes shall be graded in compliance with the 2011 County Building Code.

- The standard building setback from ascending and descending natural slopes shall be in conformance with Section 1808.7 and Figure 1808.7.1 of the 2011 County Building Code.

- Once a 40-scale rough grading plan is developed for the Project Site, corrosion testing of the on-site soils shall be performed in compliance with the 2011 County Building Code. Final recommendations for concrete shall be in accordance with the latest CBC requirements, and a corrosion specialist shall provide design recommendations for potential corrosion of metals in contact with on-site soils.

- The expansion characteristics of any engineered fill exposed during rough grading activities shall be evaluated as required by the 2011 County Building Code, and final foundation designs shall be based on the results of the evaluation. Expansive materials shall be mitigated by utilizing special foundation and reinforcement.

- All habitable structures within the Project Site shall be constructed in conformance with Appendix J of the 2011 CBC.

- Graded slopes shall be planted and irrigated in conformance with the County of Los Angeles grading and erosion control requirements. Specifically, graded slopes shall be seeded with deep-rooting, drought-resistant vegetation to minimize erosion. Water shall not be allowed to pond on future graded areas or flow uncontrolled over natural or graded slopes. Surface drainage shall be directed to terrace drains or debris basins. Debris material generated from erosion shall be contained within the boundaries of the Project Site. All slope terrace drains shall be kept clear of debris to limit impounding of surface water.

- Project grading shall incorporate the following measures:
  - Maintenance of cut slope and fill slope inclinations no steeper than 2:1 (horizontal:vertical);
  - Keying and benching of fill slopes into competent natural material; and
  - Compaction of fill slope materials to 90 percent or greater relative to compaction.

Additional measures related to compliance with National Pollutant Discharge Elimination System (NPDES) permit requirements and implementation of Best Management Practices (BMPs) to reduce erosion and pollutants in stormwater discharges are discussed in **Section 5.10**, Hydrology and Water Quality—Water Quality, of this Draft EIR. The Project also would comply with SCAQMD Rule 403 regarding fugitive dust control, as discussed in **Section 5.3**, Air Quality, of this Draft EIR.

Furthermore, based on the foregoing and the engineering recommendations set forth in the Geotechnical Reports, the following PDFs have been incorporated into the Entrada South (ES) Project's design and will be included in the MMRP to ensure implementation.

PDF ES 5.6-1: Project grading shall incorporate the following measures:

- Partial or complete removal of landslides; and
- Construction of stability fill slopes in areas of adverse geologic structure.

PDF ES 5.6-2: Project grading adjacent to natural slopes shall be confined to the proposed grading limits and shall not undercut natural slopes located outside the grading limits.

PDF ES 5.6-3: Prior to grading, DOGGR shall review the original abandonment files for all oil wells within the grading footprint on-site. If required, re-abandonment of some or all oil wells to current DOGGR standards shall be handled properly.

c. Significance Thresholds

Based on Appendix G of the CEQA Guidelines and other relevant criteria, the Los Angeles County Department of Regional Planning has determined that a project would have a potentially significant impact related to geotechnical and soil resources based on the following criteria:

Threshold 5.6-1: Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

(i) 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 active fault trace? Refer to Division of Mines and Geology Special Publication 42.

(ii) Strong seismic ground shaking?

(iii) Seismic-related ground failure, including liquefaction and lateral spreading?

(iv) Landslides?

Threshold 5.6-2: Would the Project result in substantial soil erosion or the loss of topsoil?

Threshold 5.6-3: Would the Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

Threshold 5.6-4: Would the Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

Threshold 5.6-5: Would the Project have soils incapable of adequately supporting the use of onsite wastewater treatment systems where sewers are not available for the disposal of wastewater?

Threshold 5.6-6: Would the Project conflict with the Hillside Management Area Ordinance (L.A. County Code, Title 22, § 22.56.215) or hillside design standards in the County General Plan Conservation and Open Space Element?

Threshold 5.6-7: Would the Project be considered a sensitive use (school, hospital, public assembly site) located in close proximity to a significant geotechnical hazard?

Threshold 5.6-8: Would the Project entail substantial grading and/or alteration of topography including slopes of over 25 percent?

The Project would not include septic tanks or alternative water disposal systems. Thus, there would be no impact with respect to Threshold 5.6-5. No further discussion of this issue is necessary.

d. Project Impacts

Threshold 5.6-1: Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

(i) 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 active fault trace? Refer to CGS Special Publication 42.

(ii) Strong seismic ground shaking?

(iii) Seismic-related ground failure, including liquefaction and lateral spreading?

(iv) Landslides?

Threshold 5.6-3: Would the Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

Project impacts with respect to Thresholds 5.6-1 and 5.6-3 are addressed in the following combined analysis since these criteria relate to seismic hazards and geologic instability. The discussion that follows also supports the DMS analysis of geotechnical hazards.

(1) Fault Rupture

As previously discussed, the Project Site does not contain any known active faults and is not within an Alquist-Priolo Earthquake Fault Zone. No evidence of active faulting or ground rupture has been identified within the Project Site. As such, the probability of ground rupture due to active faulting on-site during the design life of the Project is considered to be very low to non-existent.

Similarly, no known potentially active faults are located within the boundaries of VTTM 53295. However, the eastern extremity of the potentially active Airport Mesa fault extends into the External Map Improvements area in the northern portion of the Project Site. Additionally, the potentially active Saddle fault lies approximately 1,700 feet west of

the External Map Improvements area. By definition, potentially active faults have not demonstrated movement within the last 11,000 years. As such, the probability of ground rupture associated with potentially active faults occurring on-site during the design life of the Project is considered to be very low. Therefore, the Project would not expose people or structures to potential substantial adverse effects related to fault rupture, and impacts would be less than significant.

(2) Seismic Ground Shaking

As previously discussed, most of southern California is potentially subject to strong ground motion from movement along a fault or fault zone. Ground shaking can occur in areas adjacent to an earthquake epicenter, as well as in more distant areas for many miles in all directions. Thus, impacts associated with seismic ground shaking could be potentially significant. However, strong ground shaking is common to southern California, and potential damage caused by seismic shaking is typically reduced through proper structural design and construction techniques that are required as part of compliance with state and local seismic regulations.

As with any new development in the State of California, Project building design and construction would be required to conform to the current seismic design provisions of the CBC. Implementation of the compliance measures previously discussed would ensure Project construction adheres to the seismic safety requirements contained in the state and County Building Codes and that site-specific engineering recommendations are implemented in accordance with a design-level geotechnical investigation. Therefore, the Project would not expose people or structures to potential substantial adverse effects related to seismic ground shaking, and impacts would be less than significant.

(3) Liquefaction

As previously discussed and as shown in **Figure 5.6-3**, Seismic Hazard Zones in the Project Area, the Project Site may be subject to liquefaction as some relatively thin liquefaction-prone zones exist at the Project Site at isolated depth intervals. In accordance with the Seismic Hazards Mapping Act, a liquefaction investigation would be conducted prior to issuance of a building permit for those portions of the Project Site that are in a liquefaction hazard zone, with appropriate mitigation measures implemented as necessary. Additionally, implementation of the compliance measures previously discussed would ensure Project construction adheres to the seismic safety requirements contained in the state and County Building Codes and that site-specific engineering recommendations are implemented in accordance with a design-level geotechnical investigation. Nonetheless, the Project would expose people or structures to potentially substantial adverse effects related to liquefaction, and impacts would be significant. Implementation of MM ES 5.6-2 (discussed below) would reduce this impact to a less-than-significant level.

(4) Landslides and Surficial Slope Failures

As previously discussed, several landslides are located within the External Map Improvements area (within the boundaries of Mission Village). Most of the landslides would be encountered during grading associated with the extensions of Magic Mountain Parkway and Commerce Center Drive and would be completely removed. Similarly, numerous surficial slope failures have been identified within the Project Site, all of which would be removed during Project grading. However, one large landslide located in the southwestern portion of the Project Site would not be completely removed. In addition, implementation of the grading measures specified in PDF ES 5.6-1 would promote slope stability. All grading would occur in compliance with regulatory requirements, including the CBC, and a design-level geotechnical investigation would be prepared per the compliance measures previously discussed. The final geotechnical investigation would set forth appropriate slope gradients, retaining wall design parameters, and other design measures, such as soil improvement or surficial stabilization, that would be implemented as necessary. Nonetheless, the Project would expose people or structures to potential substantial adverse effects related to landslides or surficial slope failures, and impacts would be significant. Implementation of MM ES 5.6-1 (discussed below) would reduce this impact to a less-than-significant level.

(5) Slope Stability

Slope stability considerations on-site include cut-and-fill slopes, slopes that remain in a natural condition at the completion of grading, and debris flows associated with natural slopes.

(a) Cut Slopes

As previously described, the Project grading plan calls for the grading of existing cut slopes on-site, with appropriate inclinations and terrace drains, as needed. Some of the cut slopes are expected to encounter adverse geologic conditions (e.g., unsupported geologic structure, weakly cemented and erosion-prone units, etc.) which could require the construction of stabilization fills. The Geotechnical Reports prepared for the Project indicate all cut slopes would be grossly stable if graded in accordance with the geotechnical recommendations related to cut slopes, as set forth in PDF ES 5.6-1. With compliance with regulatory requirements, adherence to grading plan specifications, and implementation of PDF ES 5.6-1, impacts with respect to cut slopes would be less than significant.

(b) Fill Slopes

Similarly, the proposed fill slopes would be graded with appropriate inclinations and terrace drains, as previously discussed. Additionally, all fill placement would adhere to applicable Code requirements. The Geotechnical Reports prepared for the Project indicate all fill slopes would be grossly stable if graded in accordance with the geotechnical recommendations related to fill slopes, as set forth in PDF ES 5.6-1. With compliance with regulatory requirements, adherence to grading plan specifications, and implementation of PDF ES 5.6-1, impacts with respect to cut slopes would be less than significant.

(c) Natural Slopes

As discussed previously, natural slopes would remain in portions of the Project Site following Project grading. In accordance with PDF ES 5.6-2, adjacent grading would be confined to the proposed grading limits and would not undercut natural slopes. In addition, the Project would comply with the standard setbacks for natural slopes set forth in the CBC. With compliance with regulatory requirements, adherence to grading plan specifications, and implementation of PDF ES 5.6-2, impacts with respect to natural slopes would be less than significant.

(d) Debris Flow

The southern portion of the Project Site is currently the most susceptible to debris flow hazard and would continue to be given the natural slopes that would remain. As discussed in **Section 5.10**, Hydrology and Water Quality—Water Quality, of this Draft EIR, debris basins are proposed throughout the Project Site. However, the Project would comply with regulatory requirements and adhere to grading plan specifications. Nonetheless, impacts with respect to debris flow would be significant. Implementation of MM ES 5.6-3 (discussed below) would reduce this impact to a less-than-significant level.

(6) Subsidence

As previously discussed, the Project Site is not within an area of known subsidence associated with petroleum or groundwater withdrawal, nor is it in an area of known peat deposits. The potential for ground subsidence in response to fluid withdrawal or peat oxidation within the Project Site is expected to be remote. Although oil production uses do exist within the surrounding area, current regulations prevent extraction that causes detrimental effects to overlying areas. With compliance with all regulatory requirements and implementation of the recommendations set forth in the Geotechnical Reports, subsidence is not anticipated to pose a significant hazard to the Project, and impacts with respect to subsidence would be less than significant.

(7) Rippability

As previously discussed, the bedrock at the Project Site is weakly to moderately cemented and can easily be excavated with conventional grading equipment. Heavy single shank ripping could be needed for massive conglomerate or well-cemented sandstone units. Accordingly, the rippability of on-site earth materials is not expected to pose any grading limitations. With compliance with all regulatory requirements and implementation of the recommendations set forth in the Geotechnical Reports, impacts would be less than significant.

(8) Oversized Material

As previously discussed, oversized earth material (i.e., larger than 8 inches in diameter) could present some difficulty during excavation with certain types of equipment, but is not considered a substantial concern. With compliance with all regulatory requirements and implementation of the recommendations set forth in the Geotechnical Reports, impacts with respect to oversized material would be less than significant.

(9) Shrinking and Bulking

As previously discussed, certain of the earth materials present on-site may be susceptible to shrinking and bulking. Accordingly, estimates of shrinking and bulking for the on-site materials have been taken into account in the Project grading plans. With compliance with all regulatory requirements and implementation of the recommendations set forth in the Geotechnical Reports, impacts with respect to shrinking and bulking would be less than significant.

(10) Corrosion

As previously discussed, corrosion testing performed off-site suggest the soils within the Project Site could be corrosive to concrete and ferrous metals. Corrosion testing would be performed, as required by the County Building Code, and final recommendations for concrete would be made in accordance with the latest CBC requirements. Additionally, a corrosion specialist would provide design recommendations for potential corrosion of metals in contact with on-site soils. With compliance with all regulatory requirements and implementation of the recommendations set forth in the Geotechnical Reports, impacts related to corrosion would be less than significant.

(11) Hydroconsolidation

As previously discussed, soils susceptible to hydrocompaction have been identified within the existing drainage courses on the Project Site. However, the Project would comply with regulatory requirements and adhere to grading plan specifications.

Nonetheless, impacts with respect to hydroconsolidation would be significant. Implementation of MM ES 5.6-4 (discussed below) would reduce this impact to a less-than-significant level.

(12) Conclusion

Based on the preceding analysis, the Project would not expose people or structures to potential substantial adverse effects involving: (1) rupture of a known earthquake fault; or (2) strong seismic ground shaking. As such, these impacts would be less than significant. However, the Project would expose people or structures to potential substantial adverse effects involving: (1) seismic-related ground failure; and (2) landslides. In addition, the Project would be located on a geologic unit that is unstable, and soils susceptible to hydrocompaction have been identified on-site. As such, these impacts would be potentially significant. Implementation of MM ES 5.6-1 through MM ES 5.6-4 (discussed below) would reduce these impacts to less-than-significant levels.

(13) County Development Monitoring System

The above analysis is consistent with the DMS environment criteria as it relates to geotechnical hazards. Specifically, with compliance with applicable regulatory requirements, including County Code and hillside management requirements (discussed further below), as well as implementation of the proposed mitigation measures, the analysis herein shows that impacts related to geotechnical hazards would be less than significant. Accordingly, the Project is consistent with DMS policies as they relate to geotechnical hazards.

Threshold 5.6-2: Would the Project result in substantial soil erosion or the loss of topsoil?

(1) Construction

Impacts related to sedimentation and erosion could occur as a result of exposed soils during Project construction. However, construction activities would occur in accordance with erosion control requirements, including grading and dust control measures, imposed by the County pursuant to grading permit regulations. As previously discussed, compliance measures to be implemented would include the planting of graded slopes, the prevention of ponding on graded areas, controlled surface drainage, debris containment, and proper cleaning/maintenance of terrace drains.

Additionally, as discussed in detail in **Section 5.10**, Hydrology and Water Quality—Water Quality, of this Draft EIR, the Project would be required to have a Storm Water Pollution Prevention Plan (SWPPP) pursuant to NPDES permit requirements. As part of

the SWPPP, BMPs would be implemented during construction to reduce sedimentation and erosion levels to the maximum extent possible. The following types of BMPs would be implemented as needed during construction:

- Erosion Control: Measures would be employed to prevent the movement of soil by wind or water during construction, such as physical or vegetative stabilization, containment of stockpiled materials, and the application of water or other dust palliatives.

- Sediment Control: Measures would be employed to trap or filter sediment already mobilized, such as storm drain inlet protection, sediment capture and drainage control through sediment traps and sediment basins, and velocity reduction through outlet protection/velocity dissipation devices or other means.

- Waste and Materials Management: In addition to measures to manage a variety of wastes, stockpiles of soil and landscaping/construction materials would be protected with covers, the application of water or soil binders, and perimeter control measures.

- Non-Stormwater Management: Measures would be employed to reduce or limit materials from entering stormwater flows, including water conservation practices, vehicle and equipment cleaning and fueling practices, and street sweeping.

- Training and Education: Individuals responsible for SWPPP implementation and permit compliance would be properly trained, and appropriate signage would be provided on-site.

- Inspections, Maintenance, Monitoring, and Sampling: Routine site inspections would be conducted before, during, and after storm events, Rain Event Action Plans would be implemented, routine maintenance and repairs of BMPs would be performed, and discharge sampling would be performed for qualifying storm events.

The County of Los Angeles, as part of normal project approval and construction practice, monitors compliance with these requirements. The Project also would comply with SCAQMD Rule 403, which requires the implementation of best available fugitive dust control measures during active construction periods capable of generating fugitive dust emissions from on-site earth-moving activities, construction/demolition activities, and construction equipment travel on paved and unpaved roads, as discussed in **Section 5.3**, Air Quality, of this Draft EIR. With compliance with regulatory requirements and implementation of appropriate BMPs, impacts with respect to soil erosion and the loss of topsoil would be less than significant.

(2) Operation

Project operations could result in a limited degree of soil erosion from vegetated areas. However, as discussed further in **Section 5.10**, Hydrology and Water Quality—Water Quality, of this Draft EIR, the Project would be required to have a Standard Urban Stormwater Mitigation Plan (SUSMP) in place during the operational life of the Project in compliance with NPDES permit requirements. The SUSMP would include BMPs developed, in part, based on the County's Low Impact Development (LID) Standards Manual, which would reduce on-site erosion from vegetated areas within the Project Site. With compliance with these requirements, impacts with respect to sedimentation and erosion during operation would be less than significant.

In addition, County regulations require certain projects to mitigate off-site drainage impacts caused by hydromodification (i.e., the potential to cause erosion, siltation, or channel instability) and associated changes to water quality, flow velocity, flow volume, and depth/width of flow. As discussed in greater detail in **Section 5.10**, Hydrology and Water Quality—Water Quality, although the Project would be exempt from hydromodification control requirements per the Los Angeles County Municipal Separate Storm Sewer System (MS4) Permit, the Project's potential hydromodification impacts to the Santa Clara River were evaluated as part of the water quality study prepared for the Project. A number of hydrologic source controls would be implemented, including site design elements and LID BMPs, to reduce runoff volumes from the Project Site. Energy dissipaters at all storm drain outlets to the Santa Clara River also would be provided to reduce runoff rates and provide erosion protection. Collectively, these measures would protect the stability of the Santa Clara River. Accordingly, Project operations would not have a significant impact with respect to downstream sedimentation.

Threshold 5.6-4: Would the Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

As previously discussed, some of the on-site earth materials may be expansive, while the engineered fills created from on-site materials are anticipated to have a low to medium expansion potential. As set forth in the compliance measures previously discussed, a design-level geotechnical investigation would be conducted to ensure the Project is designed in accordance with regulatory requirements. This final geotechnical investigation would determine site- and building-specific design measures to be implemented, such as the use of select grading measures, structures designed for expansive or cohesionless soils, and/or soil improvement. Further, the engineered fill exposed at rough grade would be evaluated as required by the County Building Code, and the final foundation designs would be based on the results of the evaluation. With

implementation of relevant compliance measures, impacts with respect to expansive soil would be less than significant.

Threshold 5.6-6: Would the Project conflict with the Hillside Management Area Ordinance (L.A. County Code, Title 22, § 22.56.215) or hillside design standards in the County General Plan Conservation and Open Space Element?

Threshold 5.6-8: Would the Project entail substantial grading and/or alteration of topography including slopes of over 25 percent?

Project impacts with respect to Thresholds 5.6-6 and 5.6-8 are addressed in the following combined analysis since these criteria relate to hillside requirements and hillside grading.

As previously discussed, much of the Project Site contains hillside land and is designated for urban uses (H5—Residential 5). As prescribed under the Hillside Management Area Ordinance, a CUP for hillside development would be required. In accordance with the ordinance, the Geotechnical Reports prepared for the Project, included in **Appendix 5.6** of this Draft EIR, address all relevant issues regarding faults and slope stability. Additionally, as discussed in detail in **Section 5.11**, Land Use and Planning, of this Draft EIR, the Project would comply with the hillside requirements set forth in the County's General Plan and Zoning Code. In particular, public safety impacts would be avoided or mitigated to the extent possible, as discussed in the analyses provided throughout various sections of this Draft EIR. As such, impacts related to compliance with Hillside Management Area Ordinance or other hillside design standards would be less than significant.

As previously discussed, the Project Site contains distinct and prominent topographic features, including four canyons. Project grading would require the removal and recompaction of approximately 7.8 million cubic yards of existing material. Much of the earthwork activity would occur within hillside areas of the Project Site, although areas with natural slopes are anticipated to remain, particularly throughout the southern portion of the Project Site. All earthwork activities would occur in accordance with County requirements, as specified in the County Building Code and through the grading plan review and approval process. Accordingly, while substantial grading and alteration of topography would occur, including on slopes of over 25 percent, compliance with applicable grading requirements would minimize any hazards associated with hillside grading. As such, impacts would be less than significant.

Threshold 5.6-7: Would the Project be considered a sensitive use (school, hospital, public assembly site) located in close proximity to a significant geotechnical hazard?

The Project would include a 9.4-acre elementary school, which is considered a sensitive use. As previously discussed, the Project Site is located in an area susceptible to various geological hazards. However, the Project would comply with all applicable codes and standards and implement PDF ES 5.6-1 and PDF ES 5.6-2 to prevent or minimize personal injury, loss of life, and property damage due to seismic and geotechnical hazards. Nonetheless, impacts with respect to locating a sensitive use in close proximity to a significant geotechnical hazard would be significant. Implementation of MM ES 5.6-1 through MM ES 5.6-4 would reduce this impact to a less-than-significant level.

4. CUMULATIVE IMPACTS

Due to the site-specific nature of geological conditions (e.g., soils, geological features, seismic features, etc), geology impacts are typically assessed on a project-by-project basis, rather than on a cumulative basis. None of the Project Site's physical characteristics are unique or more likely to involve or induce geologic or geotechnical impacts than other physical features throughout the surrounding area. Nonetheless, cumulative growth through 2024 would cumulatively expose a greater number people to seismic hazards. However, like the Project Applicant, the proponents of the related projects and all other future development projects in the area would be required to comply with applicable local, regional, state, and federal regulations pertaining to geology and soils, including CBC and County Building Code requirements (or City of Santa Clarita Building Code requirements, as appropriate). As these regulatory requirements are intended to minimize risks associated with seismic and geotechnical hazards, with compliance, cumulative impacts with respect to geology and soils would be less than significant.

5. MITIGATION MEASURES

a. Newhall Ranch RMDP/SCP Mitigation Measures

The Newhall Ranch RMDP/SCP EIS/EIR determined that geology and soils impacts would be less than significant, thus no mitigation measures were required.

b. Entrada South Project-Level Mitigation Measures

The following mitigation measures (MMs) are proposed as part of Entrada South (ES), based on the engineering recommendations provided in the Geotechnical Reports, to address the Project-specific impacts indentified above:

MM ES 5.6-1: The landslide mass in the southwestern portion of the Project Site shall be partially removed to establish a stable configuration.

MM ES 5.6-2: Project grading shall include a combination of ground modification and/or structural mitigation in areas subject to liquefaction to reduce the risk to an acceptable level (as defined by CGS in Special Publication 117a, Chapter 2, or as superseded by CGS guidance in effect at the time of implementation of this measure). Ground modification shall consist of the removal of some of the soil material subject to liquefaction and/or elevating the site grades over the material subject to liquefaction. The recommended depth of removal for mitigation of liquefaction ranges from 5 to 20 feet. Structures shall be designed to resist the anticipated static and seismic total and differential settlements.

MM ES 5.6-3: In order to minimize, capture, and manage debris flows, the Project shall incorporate a combination of the following measures:

- Remove loose surficial material;
- Construct diverter slough walls;
- Construct impact walls;
- Construct debris basins (refer to **Section 5.10**, Hydrology and Water Quality—Water Quality, of this Draft EIR for a description of the debris basins proposed throughout the Project Site);
- Construct stabilization fill slopes;
- Control run-off water; and/or
- Plant selective deep-rooting vegetation.

MM ES 5.6-4: Alluvial soils susceptible to hydroconsolidation shall be removed to competent natural material during Project grading. The depth of removal to mitigate soils susceptible to hydroconsolidation ranges from 5 to 20 feet.

6. LEVEL OF SIGNIFICANCE AFTER MITIGATION

With compliance with all regulatory requirements as summarized in the aforementioned compliance measures, implementation of the proposed PDFs, and adherence to all engineering recommendations set forth in the Geotechnical Reports including grading plan specifications, Project-level impacts related to the rupture of a known earthquake fault, strong seismic ground shaking, soil erosion, expansive soil, and hillside requirements and grading would be less than significant. With implementation of MM ES 5.6-1 through MM ES 5.6-4, Project-level impacts to seismic related ground failure, landslides, slope stability, hydrocompaction, and the location of a sensitive use in close proximity to a significant geotechnical hazard would be reduced to a less-than-significant level. In addition, cumulative impacts would be less than significant.