# 5.6 GEOLOGY AND SOILS

This section of the Draft Environmental Impact Report (DEIR) evaluates the potential for implementation of the Rancho San Gorgonio Specific Plan project to impact geological and soil resources in the City of Banning and its Sphere of Influence (SOI). The analysis in this section is based in part on the following technical report(s):

- *Geotechnical Investigation for Proposed Rancho San Gorgonio Master Planned Community, Banning, CA*, RMA Geosciences, November 8, 2012.
- *Response to Geotechnical Review Letter, Rancho San Gorgonio Specific Plan, Banning, California*, RMA Geosciences, July 14, 2015.[1]

Complete copies of these studies are included in the Technical Appendices of this Draft EIR (Volume II, Appendix K).

Two individuals had verbal comments during the scoping meeting related to geology and soils. One commenter stated that soils onsite are sandy and not adequate to excavate or build upon. Another commenter was generally concerned about seismic issues onsite. A geotechnical investigation was prepared for the project, which included field surveys and boring samples. Findings related to nearby faults, site soil types and potential hazards (e.g., seismic activity, expansive soils, corrosive soils, collapsible soils, erosion, etc.) are analyzed below in Section 5.6.1.2 and 5.6.3.

## 5.6.1 Environmental Setting

### 5.6.1.1 REGULATORY BACKGROUND

State laws, regulations, plans, or guidelines that are potentially applicable to the proposed project are summarized below.

#### Federal

##### *Clean Water Act*

The federal Water Pollution Control Act (also known as the Clean Water Act [CWA]) is the principal statute governing water quality. The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and gives the US Environmental Protection Agency the authority to implement pollution control programs, such as setting wastewater standards for industry. The statute's goal is to end all discharges entirely and to restore, maintain, and preserve the integrity of the nation's waters. The CWA regulates both direct and indirect discharge of pollutants into the nation's waters. The CWA sets water quality standards for all contaminants in surface waters and makes it unlawful to discharge any pollutant from a point source into navigable waters unless a permit is obtained under its provisions. The CWA mandates

[1] This document was prepared in response to a Summary of Geotechnical Document Review & Feasibility Assessment, Rancho San Gorgonio Project, City of Banning, Riverside County, California, by Aragon Geotechnical, dated July 1, 2015.

permits for wastewater and stormwater discharges and requires states to establish site-specific water quality standards for navigable bodies of water. The CWA also recognizes the need for planning to address nonpoint sources of pollution.

## State

### *California Alquist-Priolo Earthquake Fault Zoning Act*

The Alquist-Priolo Earthquake Fault Zoning Act was signed into state law in 1972, and its primary purpose is to mitigate the hazard of fault rupture by prohibiting structures for human occupancy across the trace of an active fault. The act requires the State Geologist to delineate "earthquake fault zones" along faults that are "sufficiently active" and "well defined." The act also requires that cities and counties withhold development permits for sites in an earthquake fault zone until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. Pursuant to this act, structures for human occupancy are not allowed within 50 feet of the trace of an active fault.

### *Seismic Hazard Mapping Act*

The Seismic Hazard Mapping Act was adopted by the state in 1990 to protect the public from the effects of nonsurface-fault-rupture earthquake hazards, including strong ground shaking, liquefaction, seismically induced landslides, or other ground failure caused by earthquakes. The goal of the act is to minimize loss of life and property by identifying and mitigating seismic hazards. The California Geological Survey prepares and provides local governments with maps of seismic hazard zones that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures.

### *California Building Code*

Current law states that every local agency enforcing building regulations, such as cities and counties, must adopt the provisions of the California Building Code (CBC) within 180 days of its publication. The publication date of the CBC is established by the California Building Standards Commission, and the code is also known as Title 24, Part 2, of the California Code of Regulations. Local jurisdictions often adopt local, more restrictive amendments that are based on local geographic, topographic, or climatic conditions. These codes provide minimum standards to protect property and public safety by regulating the design and construction of excavations, foundations, building frames, retaining walls, and other building elements to mitigate the effects of seismic shaking and adverse soil conditions. The CBC contains provisions for earthquake safety based on factors including occupancy type, the types of soil and rock onsite, and the strength of ground shaking with a specified probability at a site. The 2013 CBC took effect on January 1, 2014.

#### ***Requirements for Geotechnical Investigations***

Requirements for geotechnical investigations for subdivisions requiring tentative and final maps and for other types of structures are in California Health and Safety Code, Sections 17953 to 17955, and in Section 1802 of the CBC. Testing of samples from subsurface investigations is required, such as from borings or test pits. Studies must be done as needed to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on load-bearing capacity, compressibility, liquefaction, differential settlement, and expansiveness.

#### *Storm Water Pollution Prevention Plans*

Pursuant to the CWA, in 2012, the State Water Resources Control Board issued a statewide general National Pollutant Discharge Elimination System (NPDES) Permit for stormwater discharges from construction sites (NPDES No. CAS000002). Under this Statewide General Construction Activity permit, discharges of stormwater from construction sites with a disturbed area of one or more acres are required to either obtain individual NPDES permits for stormwater discharges or be covered by the General Permit. Coverage by the General Permit is accomplished by completing and filing a Notice of Intent with the State Water Resources Control Board and developing and implementing a Storm Water Pollution Prevention Plan (SWPPP). Each applicant under the General Construction Activity Permit must ensure that a SWPPP is prepared prior to grading and is implemented during construction. The SWPPP must list best management practices (BMPs) implemented on the construction site to protect stormwater runoff and must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a monitoring plan if the site discharges directly to a water body listed on the state's 303(d) list of impaired waters.

### Local

#### *City of Banning Municipal Code*

The City of Banning Municipal Code identifies land use categories, development standards, and other general provisions that ensure consistency between the City's general plan and proposed development projects. The following provision addresses geologic hazards:

- **Chapter 18.06 (Grading Application Requirements).** Project applicants are required to submit a grading application to obtain a grading permit. The application shall be supplemented by a geotechnical report/seismicity report to determine the surface and subsurface geologic conditions of the project site.

## 5.6.1.2 EXISTING CONDITIONS

### Regional Setting

The site is in the San Gorgonio Pass, an elongated east-west-trending valley between the San Bernardino and San Jacinto mountains. This valley is part of the major drainage divide between the Pacific Ocean and Salton Trough and is filled with alluvial deposits that are mainly derived from the San Bernardino Mountains. San Gorgonio Pass slopes downward to the east until it merges with the alluvial-filled Coachella Valley. To the west the valley merges with older alluvial soils of the Beaumont Plain.

San Gorgonio Pass marks the boundary between two geomorphic provinces: the Peninsular Ranges Geomorphic Province to the south and the Transverse Ranges Geomorphic Province to the north. The Peninsular Ranges Geomorphic Province is a series of northwest-trending mountain ranges and valleys that

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includes the San Jacinto Mountains; the Transverse Ranges Geomorphic Province is an east-west-trending series of steep mountain ranges and valleys that includes the San Bernardino Mountains.

### *Regional Faults*

Active faults are those showing evidence of surface displacement within the last 11,000 years, that is, in the Holocene Epoch. Faults in the project region are mapped on Figure 5.6-1, *Fault Map*.

#### *San Andreas Fault*

The San Andreas fault zone within San Gorgonio Pass breaks into several different segments, but the relationship of each segment to the entire San Andreas fault is not clear. In the project region the San Andreas fault divides into two branches, the southern branch and the northern branch. The southern branch projects into the Banning and San Gorgonio Pass fault zones, which are more than one mile north of the site. The northern branch passes through the San Bernardino Mountains approximately six miles to the north of the site and is known as the Mission Creek fault. The San Andreas fault, classified as active, is the largest known fault in California, extending some 750 miles from the Salton Sea in the south to Point Arena in the north.

#### *Banning Fault*

The Banning fault, which is about three miles to the north of the site at its nearest point, is a strike-slip fault that extends about 50 miles from the Indio Hills in the Coachella Valley to the San Jacinto fault in Loma Linda. The Banning fault was apparently abandoned by the San Andreas system in early Pliocene time; the Pliocene Epoch extends from 5.3 million years before present (mybp) to 23 mybp. Within the San Gorgonio Pass, the Banning fault is obscured by Quaternary-age sedimentary deposits and has been modified by Quaternary faults of the San Gorgonio Pass fault zone and is thus not considered active; the Quaternary Period extends from 1.8 mybp to the present.

#### *San Gorgonio Pass Fault Zone*

The San Gorgonio Pass fault zone, which is considered active, consists of a series of faults with a distinctive zigzag pattern extending from Whitewater to Calimesa on the north side of San Gorgonio Pass. Movements of the San Gorgonio Pass fault zone have occurred during late Quaternary time. The nearest trace of the San Gorgonio Pass fault zone is more than one mile north of the site.

### *Seismic Hazards*

#### *Ground Shaking*

The energy released by an earthquake is measured as moment magnitude. The moment magnitude scale is logarithmic; therefore, each one-point increase in magnitude represents a tenfold increase in amplitude of the waves as measured at a specific location and a 32-fold increase in energy. Therefore, magnitude 7 earthquake produces 100 times (10 x 10) the ground motion amplitude of a magnitude 5 earthquake.

#### *Historic Earthquakes in the Region*

Earthquakes of magnitude 6.0 and greater within 50 miles of the project site within the last 100 years are listed in Table 5.6-1.

**Table 5.6-1 Notable Historical Earthquakes in the Region**

| Earthquake | Date | Magnitude | Fault |
|---|---|---|---|
| Big Bear | June 28, 1992 | 6.4 | ? |
| Landers | June 28, 1992 | 7.3 | Several |
| Joshua Tree | April 22, 1992 | 6.1 | Eureka Peak (?) |
| Desert Hot Springs | December 4, 1948 | 6.0 | South Branch San Andreas fault [Banning fault][1] |
| North San Jacinto Fault Earthquake | July 22, 1923 | 6.3 | San Jacinto |
| San Jacinto | April 21, 1918 | 6.8 | San Jacinto |
| Elsinore | May 15, 1910 | 6 | Elsinore |

Source: SCEDC 2014.
1 South Branch San Andreas fault and Banning fault are two names for the same fault.

## Project Site

### *Topography*

The majority of the project site consists of gentle rolling hills, valleys, and incised drainage courses. Four major drainage courses cross the project site: Smith Creek, Pershing Creek, Montgomery Creek, and Gilman Home Channel. There is a rugged bedrock knob in the southeast corner of the site. Elevations range from approximately 2,200 to 2,400 feet above sea level. The site slopes downwards to the east-southeast with an average grade of about 2 percent.

### *Rock and Soil Types*

The geotechnical investigation of the site included 15 exploratory borings, excavation of 41 exploratory trenches, three soil infiltration tests using a double ring infiltrometer, and testing of samples from borings and trenches. Borings were up to 51.5 feet below ground surface (bgs); most trenches ranged from 4 to 9.5 feet bgs. Figure 5.6-2, *Geologic Map*, illustrates the rock and soil types identified onsite.

#### *Artificial Fill (No Map Symbol)*

Artificial fills have been placed along the contours of rolling hills in the site, apparently to control erosion. These fills appear to have been derived from onsite older alluvial soils composed of silty sands and sandy silts. In addition, backfill was placed over the 36-inch-diameter gas pipeline that crosses the center of the site and the water main in the southwest corner of the site.

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#### *Wash Deposits (Map Symbol Qw)*

Wash deposits occur in active drainage courses on the site, namely Smith Creek, Pershing Creek, Montgomery Creek, and Gilman Home Channel. These deposits consist primarily of gray-white fine- to coarse-grained sands. Exploratory excavations were not made in these drainage courses because of jurisdictional issues.

#### *Alluvium (Map Symbol Qal)*

Alluvial deposits occur in valley areas and tributary drainage courses within the site. These deposits are typically composed of grayish brown and brown sandy silts, silty sands with some sand layers. At the time of our study, the deposits ranged from dry to moist and from loose to medium dense.

#### *Older Alluvium (Map Symbol Qoal)*

Older alluvial deposits underlie the higher elevations of the site and younger geologic units. This Pleistocene-age deposit occurs as rolling hills and flattop mesas in the site. These deposits consist primarily of reddish brown silty sand with some layers of sand. The deposit was typically found to be dense to very dense and moist. The soil profile developed over this unit was found to be clayey in some areas.

#### *Granitic and Metamorphic Bedrock (Map Symbol Kqd-ms)*

Granitic and metamorphic bedrock consisting of Cretaceous quartz diorite and Paleozoic metasedimentary rocks underlie the hill in the southeast corner of the site. The two rock types are clearly visible within the knob and hillsides to the south. For simplicity, the two bedrock types are grouped into one geologic unit. Quartz diorite is an igneous rock similar to granite. Metasedimentary rocks are metamorphic rocks derived from sedimentary rocks. The Cretaceous Period extends from 65.5 mybp to 146 mybp, and the Paleozoic Era extends from 542 mybp to 251 mybp.

### *Faults*

The following faults and potential faults on and near the site are mapped on Figure 5.6-1, *Fault Map*.

#### *McMullen Fault*

The McMullen fault was originally mapped by the US Geological Survey as a bedrock fault within the crystalline bedrock of the San Jacinto Mountains south of the site. Several geologic maps do not show the McMullen Fault passing through the project site, and the fault is not shown on regional geologic maps. The City of Banning General Plan shows the McMullen fault extending from the San Jacinto Mountains northwesterly into the San Gorgonio Pass and through the site. The general plan map shows that the portion of the McMullen fault within San Gorgonio Pass and the site is concealed by younger and older alluvial deposits. The McMullen fault is not included in the limits of City of Banning or County of Riverside fault hazard rupture zones, and it is not included within the limits of a California Alquist-Priolo Earthquake Fault Zone for fault rupture hazards.

The potential impact of the McMullen fault on site development was further evaluated by analysis of aerial photographs, geologic field mapping, and a geophysical survey.

# Figure 5.6-1 - Fault Map
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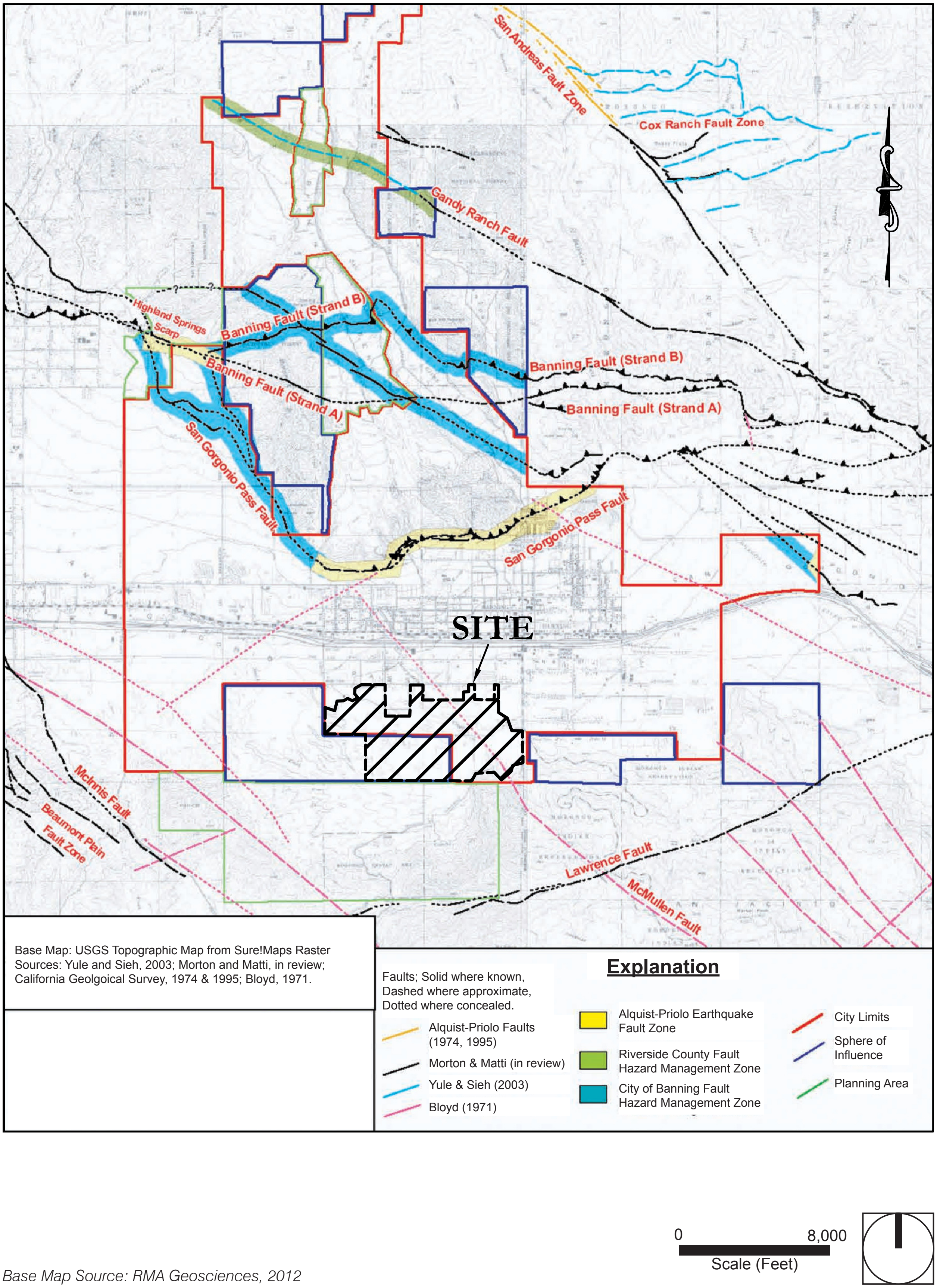


*Base Map Source: RMA Geosciences, 2012*

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# Figure 5.6-2 - Geologic Map

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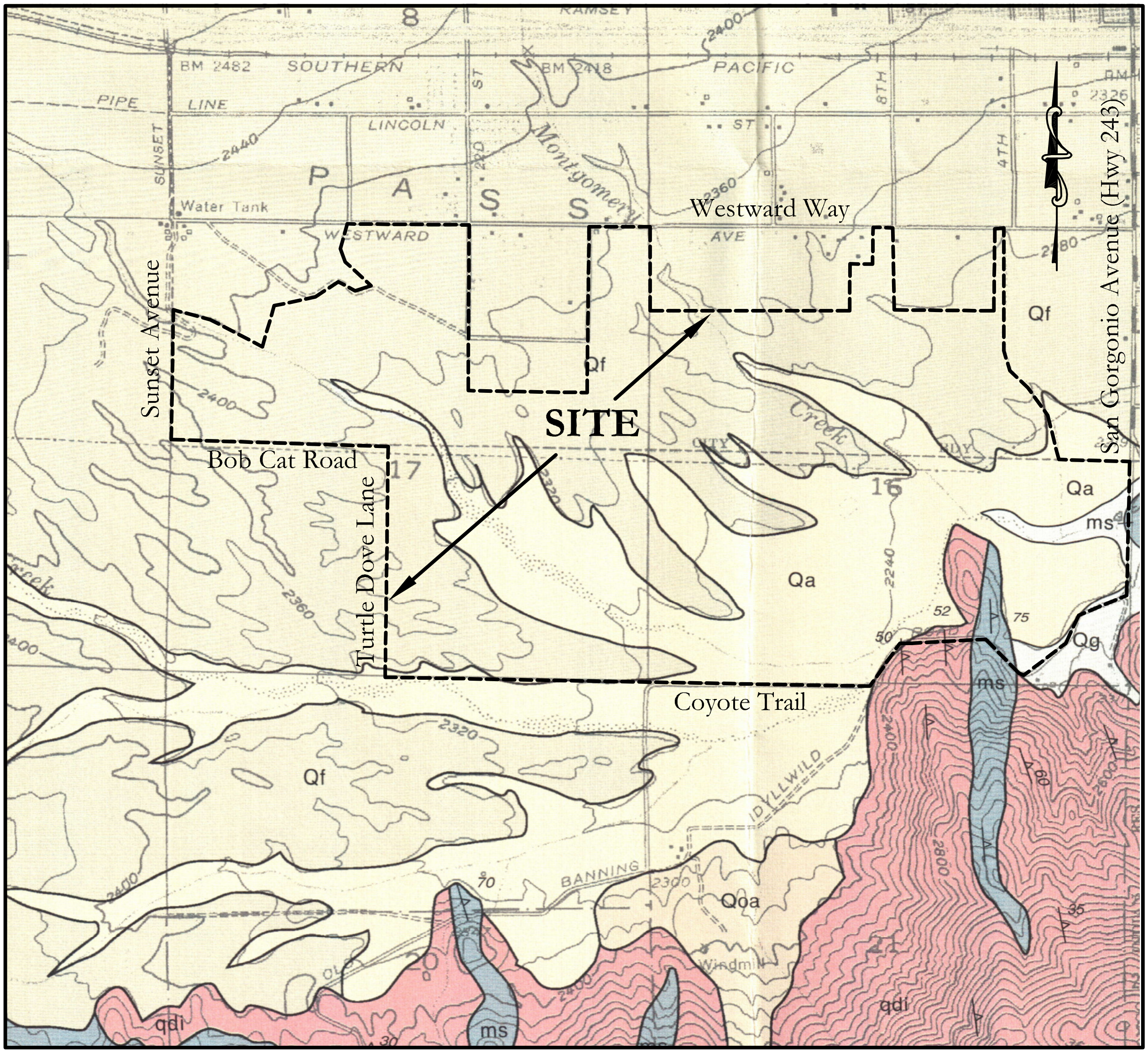


**Partial Legend**

Qg - Stream channel alluvium (Holocene)
Qa - Flood plain alluvium (Holocene)
Qf - Alluvial fan deposits (Pleistocene)
Qoa - Older alluvial fan deposits (Pleistocene)
qdi - Granitic bedrock, mostly tonalite (Cretaceous)
ms - Metasedimentary bedrock, Mica schist-phyllite (Paleozonic)

0 2,000
Scale (Feet)

*Base Map Source: RMA Geosciences, 2012*

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Aerial photographs from Google Earth, Historicaerials.com, and the Riverside County Flood Control District were examined for topographic, vegetation, and tonal lineaments that might indicate near surface faulting.[2] Two tonal lineaments are visible on 1948 aerial photographs from the Riverside County Flood Control District. One of the lineaments is in an alluvial area south of the site between the San Jacinto Mountains and Old Idyllwild Road. This lineament is about 450 feet long and was also observed on 1996, 2003, 2004, 2005, and 2011 Google Earth aerial photographs, but not on 2002, 2006, 2009, and 2012 Google Earth aerial photographs. The lineament projects south into rugged mountainous terrain and does not extend north of Old Idyllwild Road into the site. A flat-top mesa of Pleistocene-age older alluvium crosses the projected trend of the lineament to the north. The lineament appears to be the result of land clearing and discing for weed control. A second tonal lineament was observed on the 1948 aerial photograph from the Riverside County Flood Control District. This lineament is about 800 feet long and occurs between two bedrock knobs in the southeast portion of the site, west of the other lineament. This lineament was not observed on any other aerial photographs. It projects to the south into rugged mountainous terrain underlain by granitic bedrock. The lineament does not extend north of Smith Creek.

No landforms along lineaments or their projected trends suggestive of faulting—such as scarps or offset drainage courses or vegetation patterns—were observed during field investigation.

No abrupt changes in the contact between underground geologic units—interpreted as alluvium and crystalline bedrock—were identified in seismic refraction studies measuring the location of the contact using the elapsed time for seismic waves produced by a sledgehammer to return to sensors on the ground surface.

The concealed McMullen fault, if present within the site, has no near-surface expression and is covered by both younger and older (Pleistocene age) alluvium. Thus, measures to mitigate the potential for future surface fault rupture along the postulated trace of the McMullen fault are not required for planning and development of the site.

***Central Banning Barrier Fault***

There may be multiple buried groundwater barriers, referred to as the Banning Barrier faults, in the San Gorgonio Pass area. These potential barriers are L-shaped faults, similar to the zigzag fault pattern of the San Gorgonio Pass fault zone. However, Banning Barrier faults have no surface expression and are not an extension of the San Gorgonio Pass faults. The postulated Central Banning Barrier fault has not been zoned as a surface fault rupture hazard by the City of Banning, County of Riverside, or State of California.

One of these postulated features, the Central Banning Barrier fault, has been mapped through the northwestern portion of the site. The Central Banning Barrier fault is overlain by approximately 300 feet of unfaulted older alluvial deposits. The older alluvial soils are shown as Pleistocene in age on multiple geologic maps. Consequently, the fault, if present, would be classified as not active. The Barriers faults are shown to offset very old (early Pleistocene age) alluvium.

[2] Tonal lineaments are linear or near-linear surface features that could express faults or other lines of weakness. Tonal lineaments may reflect differences in vegetation, moisture content, and/or soil or rock composition across such a surface feature.

No lineaments or scarps suggesting the presence of near-surface faulting were identified onsite. The groundwater barrier effect ends more than 200 feet below the ground surface. Therefore, the Central Banning Barrier fault, if present, is a deep subsurface fault that does not reach the ground surface and thus is not a surface fault rupture hazard on the site.

### *Strong Ground Shaking*

The peak ground acceleration onsite from an earthquake is estimated at 0.4 g, where g is the acceleration of gravity. Ground acceleration of 0.4 g correlates with intensity VIII on the Modified Mercalli Intensity (MMI) Scale (Wald 1999), a subjective scale of how earthquakes are felt by people and the effects of earthquakes on buildings. The MMI Scale ranges from Intensity I, at which earthquakes are generally not felt by people, to Intensity XII, at which earthquake damage is total and objects are thrown into the air.

In an Intensity VIII earthquake, damage is slight in specially designed structures, but considerable damage occurs in ordinary substantial buildings with partial collapse, and damage is great in poorly built structures. Chimneys, factory stacks, columns, monuments, and walls fall, and heavy furniture is overturned (USGS 2012).

### *Other Geologic Hazards*

#### ***Expansive Soils***

Expansion testing was performed on three samples of site soils. The test results indicate that these soils have a very low expansion potential. It appears that some surface soils overlying older alluvial deposits may be expansive. However, these soils account for only a small portion of the soils that underlie the site.

#### ***Corrosive Soils***

Soils underlying the site appear to have a low corrosion potential.

#### ***Collapsible Soils***

Hydro-collapsible soils onsite can settle upon wetting causing deformation of overlying improvements such as structures, paving and pipelines.

#### ***Erosion and Sedimentation***

Erosion is the transport of soil by water or wind; sedimentation is the deposit of transported soil particles. Erosion and sedimentation are natural processes; however, soil-disturbing activities can dramatically increase erosion and sedimentation if effective control measures are not used.

## 5.6.2 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would:

G-1 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 fault. (Refer to Division of Mines and Geology Special Publication 42.)

ii) Strong seismic ground shaking.

iii) Seismic-related ground failure, including liquefaction.

iv) Landslides.

G-2 Result in substantial soil erosion or the loss of topsoil.

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

G-4 Be located on expansive soil, as defined in Table 18-1B of the Uniform building Code (1994), creating substantial risks to life or property.

G-5 Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

The Initial Study, included as Appendix A, substantiates that impacts associated with the following thresholds would be less than significant:

- Thresholds G-1.i, G-1.iii, G-1.iv, and G-5

These impacts will not be addressed in the following analysis.

## 5.6.3 Environmental Impacts

Approximately 683 acres, or about 82 percent of the project site would be graded (i.e., the entire site except creeks, creek edge linear parks, and the proposed natural open space in the southeast part of the site). Estimated mass grading quantities are approximately 4.2 million cubic yards of cut grading and 4.2 million cubic yards of fill grading (see Figure 5.1-3b, *Conceptual Mass Grading Plan*). Cut, fill, and remedial grading are intended to be balanced, and no soil import or export is anticipated as part of basic grading operations. A limited amount of special materials (sands, gravels, and clays) would need to be imported for construction of portions of the road beds.

The Specific Plan would permit development of up to 3,133 residential units, 9.3 acres of neighborhood commercial uses, and a variety of other land uses, including parks, open space, public facility, school, and roadways.

The following impact analysis addresses thresholds of significance for which the Initial Study disclosed potentially significant impacts. The applicable thresholds are identified in brackets after the impact statement.

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**Impact 5.6-1: Development of the proposed project could expose people and structures to strong seismic ground shaking. [Threshold G-1.ii])**

***Impact Analysis:*** Future development that would be accommodated by the proposed Specific Plan would expose increased numbers of persons and structures to strong ground shaking. Located in southern California, the project area is in a seismically active region. Therefore, strong ground shaking is very likely to occur onsite during the design lifetimes of the structures and other improvements that would be developed pursuant to Specific Plan buildout. Seven earthquakes in the region of magnitude six or greater within the last 100 years are described above in Table 5.6-1. However, seismic shaking is a risk throughout southern California, and the project site is not at greater risk of seismic activity or impacts than other areas of California.

Additionally, state and local jurisdictions regulate development in California through a variety of tools that reduce hazards from earthquakes and other geologic hazards. For example, the state regulations protecting human-occupied structures from geoseismic hazards are provided in the most recent (2013) CBC (California Code of Regulations, Title 24, Part 2) and CRC (California Code of Regulations, Title 24, Part 2.5). The CBC and CRC (adopted by reference in Chapter 15.08 [Construction Codes] of the City's Municipal Code) contain provisions to safeguard against major structural failures or loss of life caused by earthquakes or other geologic hazards. The CBC contains provisions for earthquake safety based on factors including occupancy type, the types of soil and rock onsite, and the strength of ground motion with specified probability of occurring at the site. The design and construction of the future development projects that would be accommodated by the Rancho San Gorgonio Specific Plan would be required to adhere to the provisions of the CBC and CRC. Compliance with these state regulations would reduce hazards from strong seismic ground shaking.

Furthermore, future development projects that would be accommodated by the proposed Specific Plan would be required to have a site-specific geotechnical investigation report prepared by the project applicant's/developer's geotechnical consultant, in accordance with Appendix J Section J104 (Engineered Grading Requirements) of the CBC; such investigation would determine seismic design parameters for the site and the proposed building type per CBC requirements. Compliance with the design parameters and recommendations of the geotechnical investigation report would be required as a condition of a grading permit and/or building permit. Thus, impacts resulting from strong ground shaking are anticipated to be less than significant.

**Impact 5.6-2: Buildout of the Specific Plan would disturb and expose large quantities of soil that may result in substantial soil erosion or loss of topsoil. [Threshold G-2]**

***Impact Analysis:*** Future development that would be accommodated by the proposed project would involve excavation, grading, and construction activities that disturb soil and leave exposed soil on the ground surface. Grading temporarily increases the potential for erosion by removing protective vegetation, changing natural drainage patterns, and constructing slopes. Common means of soil erosion from construction sites include water, wind, and being tracked offsite by vehicles. These activities could result in soil erosion if effective erosion-control measures are not used.

Estimated mass grading quantities are approximately 4.2 million cubic yards of cut grading and 4.2 million cubic yards of fill grading. Future development would be subject to local and state codes and requirements for erosion control and grading during construction. For example, project development is required to comply with standard regulations, including South Coast Air Quality Management District Rules 402 and 403, which would reduce construction erosion impacts. Rule 403 requires that fugitive dust be controlled with best available control measures so that the presence of such dust does not remain visible in the atmosphere beyond the property line of the emissions source. Rule 402 requires dust suppression techniques be implemented to prevent dust and soil erosion from creating a nuisance offsite. For example, control measures to reduce erosion during grading and construction activities include stabilizing backfilling materials when not actively handling, stabilizing soils during clearing and grubbing activities, and stabilizing soils during and after cut-and-fill activities.

Additionally, the Construction General Permit (CGP) issued by the State Water Resources Control Board (SWRCB), regulates construction activities to minimize water pollution, including sediment. Future development projects would be subject to NPDES permitting regulations, including the development and implementation of a SWPPP for each development project. The development project's construction contractor would be required to prepare and implement an SWPPP and associated best management practices (BMP) in compliance with the CGP during grading and construction. Types of BMPs that are incorporated in SWPPPs and would help minimize impacts from soil erosion are outlined in Table 5.6-2.

### Table 5.6-2 Construction BMPs

| Category | Purpose | Examples |
|---|---|---|
| Erosion Controls and Wind Erosion Controls | Cover and/or bind soil surface, to prevent soil particles from being detached and transported by water or wind | Mulch, geotextiles, mats, hydroseeding, earth dikes, swales |
| Sediment Controls | Filter out soil particles that have been detached and transported in water. | Barriers such as straw bales, sandbags, fiber rolls, and gravel bag berms; desilting basin; cleaning measures such as street sweeping |
| Tracking Controls | Minimize the tracking of soil offsite by vehicles | Stabilized construction roadways and construction entrances/exits; entrance/outlet tire wash. |
| Non-Storm Water Management Controls | Prohibit discharge of materials other than stormwater, such as discharges from the cleaning, maintenance, and fueling of vehicles and equipment. Conduct various construction operations, including paving, grinding, and concrete curing and finishing, in ways that minimize non-stormwater discharges and contamination of any such discharges. | BMPs specifying methods for: paving and grinding operations; cleaning, fueling, and maintenance of vehicles and equipment; concrete curing; concrete finishing. |
| Waste Management and Controls (i.e., good housekeeping practices) | Management of materials and wastes to avoid contamination of stormwater. | Spill prevention and control, stockpile management, and management of solid wastes and hazardous wastes. |

Source: CASQA 2003.

Adherence to the BMPs in the SWPPP would reduce, prevent, or minimize soil erosion from future project-related grading and construction activities. Additionally, the future project-related grading activities would be required to adhere to the provisions of the City's grading ordinances and CBC. Thus, impacts from soil erosion or loss of topsoil would be less than significant.

**Impact 5.6-3: Future development within the project site could subject persons or structures to hazards arising from unstable soils or geologic units. [Thresholds G-3]**

***Impact Analysis:*** Buildout of the proposed project may result in hazards from landslide, lateral spreading and liquefaction, and subsidence. Each potential hazard is analyzed below.

### *Landslide*

No large landslides were encountered during the field investigation and none were apparent on aerial photographs. The majority of the site is generally not susceptible to landsliding due its low gradient. However, the City of Banning General Plan indicates that the bedrock knob in the southeast portion of the site near Planning Area (PA) 17 has a low to moderate potential for seismically induced landsliding. The landsliding potential is related to the possibility of rock falls and rolling of boulder outcrops. Under the proposed land use plan, PA-17 is proposed for open space, which would buffer onsite development from potential offsite rock falls. Additionally, the hazard is expected to be limited areas near the toe of slopes, and no boulders were found in alluvial areas beyond the toes of slopes. Thus, potential impacts from landslides and seismically induced rock falls are less than significant.

Soils along and adjacent to some drainage course have been eroded by water and there have been some failures of channel banks. However, these areas are restricted to the immediate channel areas, which are not proposed for development and would remain in their natural state. Thus, impacts from potential landslides within the channel banks are less than significant.

### *Lateral Spreading and Liquefaction*

Lateral spreading is the finite, lateral movement of gently to steeply sloping, saturated soil deposits caused by earthquake-induced liquefaction. According to the City of Banning and Riverside County General Plans, the site is located within an area of low to moderate liquefaction potential. Additionally, since the depth to groundwater water onsite is on the order of 240 feet or more, the potential for liquefaction within the site is nil. Thus, impacts from lateral spreading and liquefaction are less than significant.

### *Subsidence*

Ground subsidence is a gradual settling or sinking of the ground surface that is typically associated with oil, gas or groundwater extraction. According to the Riverside County General Plan, the site is located in an area that is susceptible to regional land subsidence. However, the City of Banning General Plan indicates that subsidence has not been observed within the City. There are also no oil or gas fields within or near the site. Consequently, regional land subsidence due to extraction of oil or gas is not a hazard at the site.

Alluvial sediments beneath could be susceptible to land subsidence if proper groundwater management practices are not followed. However, groundwater extraction would not occur onsite; therefore, potential hazards from land subsidence related to groundwater extraction would be less than significant.

Subsidence can also occur as an effect of soil shrinkage, which is the decrease in volume of soil upon removal and recompaction expressed as a percentage of the original in-place volume. Subsidence occurs as natural ground is densified to receive fill. Alluvium and existing fills are expected to have fairly high shrinkage, perhaps on the order of 10 to 20 percent. Because of its granular nature, the shrinkage of wash deposits is expected to be less, approximately on the order of 5 to 10 percent. Older alluvial soils are fairly dense, thus its shrinkage is expected to be less than alluvium, approximately 5 to 10 percent for surficial older alluvium and 0 to 5 percent for deeper older alluvium. The estimates of soil shrinkage and subsidence are based on a small sample size when the size of the property is considered. Therefore, soil shrinkage and subsidence potential should be studied in greater detail to refine these estimates. The degree to which fill soils are compacted and variations in the density of existing soils will influence earth volume changes. Consequently, some adjustments in grades near the completion of grading could be required to balance the earthwork.

Potential differential settlement risks in the transition zones between a dense material (such as older alluvium) and compacted fill or younger alluvium are typically mitigated by overexcavation of the denser material. It is common practice to compact portion of fills below a depth of 50 feet to a minimum of 95 percent relative compaction. This is typically performed to minimize the amount of fill settlement and to reduce settlement monitoring times. Settlement monuments are typically installed in deep fill areas at the conclusion of rough grading with monuments being surveyed to the nearest 0.001 feet on a monthly basis. Construction of permanent improvements and structures is typically delayed until the anticipated settlement remaining settlement is less than one-half inch and the recorded change in elevation over two consecutive 30-day periods does not exceed 0.005 feet. The need for specific compaction criteria related to deep fills and recommendations settlement monitoring shall be determined during future site-specific geotechnical investigations. Additionally, recommendations for soil removal would be planned in more detail by a certified geotechnical engineer or engineering geologist when grading plans for individual development projects pursuant to the Specific Plan are developed. Therefore, potential hazards from land subsidence related to soil shrinkage would be less than significant.

### *Collapsible Soils*

As stated above, hydro-collapsible soils onsite can settle when wet and cause deformation of overlying infrastructure improvements. Preliminary estimates of removal depths were provided in RMA Geoscience's 2012 geotechnical report based on limited subsurface data. More detailed removal estimates would be needed during future geotechnical investigations performed after grading plans are developed. At that time, additional information about subsurface conditions and grade changes can be incorporated into evaluations of removal requirements. In areas underlain by shallow younger alluvium resting on dense older alluvial deposits, it is anticipated that all younger alluvium shall be removed down to dense older alluvium. However, in broad canyons and valley areas where younger alluvial deposits are thick, detailed analysis of removal depths would need to be conducted to identify soil density, static and dynamic settlement, hydro-collapse potential and other factors.

At this stage in planning the proposed project, it is a generalization that all younger alluvium shall be overexcavated and replaced as compacted fill. Likewise, it is premature to recommend use of post-tensioned/stiffened slabs in conjunction with removals of unsuitable soils. Subsequent detailed geotechnical investigation would need to be prepared. Additionally, mitigation is provided to minimize impacts of collapsible soils to less than significant levels. Mitigation Measure 6-1 details soil removal and overexcavation requirements for specific geologic units. Overall, impacts of development in accordance with the proposed Specific Plan related to unstable soils or geologic units are less than significant with the exception of collapsible soils. Additionally, future development projects would be required to have a site-specific geotechnical investigation report prepared by a geotechnical consultant, in accordance with Appendix J Section J104 (Engineered Grading Requirements) of the CBC; such investigation would assess hazardous soil conditions onsite and would provide recommendations as needed to minimize these potential soils hazards. Compliance with the recommendations of the geotechnical reports is required as a condition of a grading permit and/or building permit.

**Impact 5.6-4: Surficial soils onsite may be expansive and could cause substantial hazards to persons or structures. [Threshold G-4]**

***Impact Analysis:*** Specific Plan buildout could result in hazards to people and structures from expansive soils. Expansion testing was performed on three soil samples that were collected within the site. The test results indicate that these soils have a very low expansion potential. Based on visual observation, it appears that some surficial soils overlying older alluvial deposits may be expansive. However, these soils account for only a small portion of the soils that underlie the site and are therefore are expected to have little or no impact on site development upon completion of grading.

Since expansion testing was performed on only a small portion of the soils within the site and since site grading would redistribute soils, additional testing of the expansive properties of soils should be performed during future geotechnical investigations of the project site and near the completion of rough grading in each development area. Such projects would be required to comply with the aforementioned recommendations. Impacts would be less than significant.

## 5.6.4 Cumulative Impacts

Geology and soils impacts are site-specific and generally do not combine to result in cumulative impacts. Cumulative development projects would be required to have site-specific geotechnical investigations prepared by future project developers and to comply with recommendations in the geotechnical investigation report, as well as comply with the provisions of the CBC. In consideration of the preceding factors, the project's contribution to cumulative geology and soils impacts would be rendered less than significant, and therefore, project impacts would not be cumulatively considerable.

## 5.6.5 Existing Regulations

### Federal

- United States Code, Title 33, Sections 1251 et seq.: Clean Water Act
- Code of Federal Regulations Title 40 Parts 122 et seq.: National Pollutant Discharge Elimination System (NPDES)

### State

- California Public Resources Code Sections 2621 et seq.:Alquist-Priolo Earthquake Fault Zoning Act
- California Public Resources Code Section 2695: Seismic Hazard Mapping Act
- California Code of Regulations Title 24, Part 2: 2013 California Building Code
- California Health and Safety Code Sections 17953-17955: Requirements for Geotechnical Investigations
- State Water Resources Control Board Order No. 2012-0006-DWQ: Statewide General Construction Permit

## 5.6.6 Level of Significance Before Mitigation

Upon implementation of regulatory requirements and standard conditions of approval, the following impacts would be less than significant: 5.6-1, 5.6-2, and 5.6-4.

Without mitigation, the following impacts would be potentially significant:

- **Impact 5.6-3** Collapsible soils onsite could adversely impact overlaying infrastructure improvements.

## 5.6.7 Mitigation Measures

### Impact 5.6-3

6-1 All vegetation, trash and debris shall be cleared from the grading area and removed from the site. Prior to placement of compacted fills, all non-engineered fills and loose, porous, or compressible soils shall be removed down to competent ground. Depths of removals will be dependent upon the nature of the underlying soils and proposed land use. In general, it is anticipated that the following removals are required for areas to receive fill or support structures:

- Artificial fills (No Map Symbol): Complete removal of artificial fills to competent natural ground is anticipated.

- Wash deposits (Map Symbol Qw): Complete removal to underlying competent alluvial or older alluvial deposits. Depth of removal shall be determined after jurisdictional drainage issues are resolved and anticipated grades have been established.
- Alluvium (Map Symbol Qal): The in situ density of alluvial soils within the site varies laterally and with depth. Removals of alluvium typically need to extend to a minimum depth of five feet with deeper removals in some areas, possibly extending up to maximum depth of 20 to 30 feet. Alluvial removals will need to be evaluated in greater detail when grading plans are developed.
- Older alluvium (Map Symbol Qoal): Removals of older alluvium are expected to be on the order of two to five feet, depending upon the nature of the proposed development and near surface weathering of the older alluvial soils, although deeper removals might be needed in some areas.
- Granitic and Metamorphic Bedrock (Map Symbol Kqd-ms): No grading is currently proposed within the bedrock hill in the southeast corner of the site. Consequently, removal requirements for bedrock are not applicable at this time. Specific recommendations shall be developed if grading is proposed within the hill at a later date.

More detail evaluation of removals and overexcavation recommendations shall be developed once grading plans are available. Typically, footing areas that are not in deep fill areas are undercut, moistened, and compacted to a minimum of 90 percent relative compaction to a depth equal to the width of the footing below the bottom of the footing or to a depth of three feet below the bottom of the footing, whichever is less. Footing areas are typically defined as extending from the edge of the footing for a distance of five feet. Floor slabs, concrete flatwork and paved areas are typically underlain by a minimum of 12 inches of soil compacted to a minimum of 90 percent relative compaction. Removal and overexcavation depths shall be confirmed or adjusted, if necessary, at the time of grading.

## 5.6.8 Level of Significance After Mitigation

Impacts would be less than significant.

## 5.6.9 References

California Stormwater Quality Association (CASQA). 2003, January. Stormwater Best Management Practice Handbook: Construction.

Southern California Earthquake Data Center (SCEDC). 2013, May 14. Significant Earthquakes and Faults: Chronological Earthquake Index. http://www.data.scec.org/significant/chron-index.html.

US Geological Survey (USGS). 2012, July 24. The Modified Mercalli Intensity Scale. http://earthquake.usgs.gov/learn/topics/mercalli.php.

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# 5. Environmental Analysis
## GEOLOGY AND SOILS

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