3.7 Geology and Soils

This section of the Draft EIR (DEIR) describes the current geologic and soil conditions of the proposed project site and general vicinity and analyzes issues related to geology and soils. The types of soils that have been identified on the project site and their properties as they relate to the proposed project are also discussed in this section. Impacts associated with erosion during construction and operation of the proposed project are discussed in Section 3.9, Hydrology and Water Quality, of this Draft EIR.

3.7.1 SETTING

LOCAL GEOLOGY AND TOPOGRAPHY

The project site is located in the Sierra Nevada foothills, along the western edge of the Sierra Nevada geomorphic province (**Figure 3.7-1**). High elevations in this area are predominantly granitic and metamorphic rocks which transition into the low foothills, terraces, and alluvial-filled valleys in the Central Valley geomorphic province. Bedrock units that dip west toward the Central Valley characterize the area. Cenozoic Era (up to 65 million years old) sedimentary rocks, volcanic mudflow deposits, and young sediments comprise the uppermost 4,000 feet of Central Valley fill.

The site encompasses an area of approximately 215 acres. Elevations within the site range from approximately 1,300 feet above mean sea level (msl) near the Bear River to approximately 1,700 feet above msl on the eastern side of the site. Natural slopes consist of gently rolling hills, from less than 5:1 horizontal to vertical to 1.25:1 horizontal to vertical. The project site is primarily undeveloped, with the exception of a 14,000-square-foot single-family residence constructed in 2001 and located on a bluff in the site's southwestern corner overlooking the Bear River. Associated with this residence are auxiliary buildings, unpaved access roads, a garden area with raised planting beds, landscaping, and fencing. In addition, there is a golf driving range located at the northwestern corner of the site near its primary access point at Rincon Way. An unnamed tributary flows into a 3.25-acre pond located near the center of the site center that is retained by an approximately 30-foot-tall earthen dam. In addition, segments of two Nevada Irrigation District (NID) irrigation canals traverse the site; the Weeks Canal crosses the northwestern portion of the site and the Magnolia Ditch crosses the eastern portion of the site (**Figure 2.0-2** in Section 2.0, Project Description,). Portions of these canals are open and unlined while other segments are lined with gunite or are encased entirely and feature concrete and metal gates. The Bear River is located immediately south of the project site.

Vegetation on the site consists of moderately dense annual grasses and deciduous trees, such as live oaks and blue oaks. North-facing slopes support moderate to heavy underbrush and some evergreens. Riparian vegetation such as tall green grasses, reeds, blackberries, trees, and other bushes delineate the main south-flowing drainage and pond areas.

The project site is generally underlain by mafic metavolcanic rocks of the Paleozoic and Mesozoic ages (Lumos and Associates 2007, p. 3). The site is located in the Sierra Nevada Geomorphic Province of Northern California, which is characterized by a 40- to 100-mile-wide and nearly 400-mile-long west-dipping fault block with a long gentle dipping slope to the west and a gently sloping eastern slope. Its elevations vary from 400 feet to summits of more than 14,000 feet. This Province is also geologically complex, with a wide variety of igneous, metamorphic, and sedimentary rocks, as well as active or potentially active faults. Numerous rock outcrops are located throughout the site. Rock outcrops, as shown in **Figures 3.1-1b, 3.1-1c,** and **3.1-1d** in Section 3.1, Aesthetics, are indicative of massive unweathered rock that can present significant excavation difficulty during construction (e.g., grading and underground utility installation).

FAULTS AND SEISMICITY

The Sierra Nevada region, like most of California, is a seismically active region. Seismicity is due to complex regional tectonic processes that include movement along major crustal plates and uplift and volcanism in the Sierra Nevada rock. The Foothills fault system, a major zone faulting in basement rock in the western Sierra Nevada, is the major regional geologic feature in the area. It was formed during the Mesozoic era (225 to 65 million years ago) in response to the deformation in the Sierra Nevada.

Earthquakes are generally expressed in terms of intensity and magnitude. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. An earthquake's intensity varies from region to region, depending on the location of the observer with respect to the earthquake epicenter. **Table 3.7-1** provides a description and a comparison of intensity and magnitude.

The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli Intensity (MMI) Scale. This scale is composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction. The higher numbers of the scale are based on observed structural damage.

TABLE 3.7-1
MODIFIED MERCALLI INTENSITY SCALE FOR EARTHQUAKES

Mw	Modified Mercalli Scale	Effects of Intensity
1.0 – 3.0	I	I. Not felt except by a very few under especially favorable conditions.
3.0 – 3.9	II – III	II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 – 4.9	IV – V	IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably. V. Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
5.0 – 5.9	VI – VII	VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. VII. Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.

Mw	Modified Mercalli Scale	Effects of Intensity
6.0 – 6.9	VIII – IX	VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed. IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
7.0 and higher	X or higher	X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. XI. Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly. XII. Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.

Source: CGS 2002

By comparison, magnitude is based on the amplitude of the earthquake waves recorded on instruments which have a common calibration. The magnitude or strength of earth movement associated with seismic activity is typically quantified using the Richter scale. This scale is a measure of the strength of an earthquake or strain energy released by it, as determined by seismographic observations.

Local Seismic Activity

According to the Nevada County General Plan Environmental Impact Report (1995), the county has experienced 26 earthquakes at an MMI of VI or VII and 10 at an MMI of VIII since 1887. No major earthquakes at an MMI of X or greater have occurred in the Nevada County area (Nevada County 1995, p. 129). The latest earthquake to affect Nevada County was the Boca or Truckee earthquake of 1966, which had an estimated magnitude of 5.4 and an MMI of VII (Nevada County 1995, p. 134). The epicenter of the earthquake was thought to be Russell Valley in eastern Nevada County. Although damage was extensive in the area, it was minor in scale, occurring almost entirely in unconsolidated alluvium and fill. Bridges along Interstate 80 sustained slight damage. Minor damage was reported at both the Prosser and Boca earth-filled dams. The earthquake was also noticeably felt in the western portions of Nevada County.

Local Faults

The California State Mining and Geology Board defines an active fault as one that has had subsurface displacement within the past 11,000 years (Holocene). Potentially active faults are defined as those that have ruptured between 11,000 and 1.6 million years before the present (Quaternary). Faults are generally considered inactive if there is no evidence of displacement during the Quaternary.

In populated areas, the greatest potential for loss of life and property damage could come as a result of ground shaking from a nearby earthquake. The degree of damage depends on many interrelated factors. Among these are the Richter magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surficial deposits or bedrock, degree of consolidation of surficial deposits, presence of high groundwater, topography, and design, type, and quality of building construction.

The Alquist-Priolo Earthquake Fault Zone Map prepared by the California Geological Survey (CGS 2010) indicates that the project site is not located within a designated Alquist-Priolo Earthquake Fault Zone. However, Nevada County is underlain by faults related to the Foothills fault zone (Acacia CE 2011, p. 2). These faults are classified as Pre-Quaternary faults (i.e., older than 1.6 million years) and are defined as faults without recognized Quaternary displacement and showing no displacement during Quaternary time, but they are not necessarily inactive.

The site is situated between the Wok Creek fault zone and the Weimar fault zone, which are components of the Foothills fault system (Lumos and Associates 2007, p. 3). The Foothills fault system is a large fault system and is a dominant structural feature of the western Sierra Nevada. The steeply east-dipping to vertical component faults trend northwestward through an area about 200 miles long and 30 miles wide. Younger rocks overlap the faulted Paleozoic and Mesozoic rocks, and the total extent of the fault system is unknown. It is probably not limited to the western Sierra Nevada, but may extend north where it is buried by material of the Cascade Ranges. Faults are marked by belts as much as 4 miles wide of cataclysmically deformed and re-crystallized rocks and by truncated folds. Net displacement on some of the component faults exceeds 3,000 feet and may be measureable in miles (Lumos and Associates 2007, p. 3).

The geologic map of the Chico Quadrangle, California, also indicates an approximately located, north-trending fault on the project site (Lumos and Associates 2007, p. 3). To the south of the site, this fault juxtaposes Mesozoic age plutonic rocks against Paleozoic to Mesozoic age metavolcanic rocks. This fault is most likely associated with the Wolf fault zone to the west of the site (Lumos and Associates 2007, p. 3).

Faults in the immediate vicinity of the project site within the Foothills fault zone are generally considered inactive and are not considered a seismic source for the project site. Seismic sources that are likely to produce ground shaking at the site are located more than 40 miles away (Acacia CE 2011, p. 2).

LANDSLIDES

Landslide activity is a function of slope, soil type and depth, soil moisture, bedrock, and seismic activities. Landslides include a wide range of ground movement, such as rockfalls, deep failure of slopes, and shallow debris flows (mudflows).

The geologic substructure of Nevada County can be divided into three broad groups; Zone I is located in the western foothills and generally comprises metavolcanic (Mesozic Jura-Trias Metavolcanic) and granitic (Mesozoic Granitic) formations; Zone II is located in the central portion of the county and generally comprises sedimentary and metasedimentary (Paleozoic Marine Metasedimentary) and volcanic (Cenozoic Volcanic) formations; and Zone III is located in the eastern portion of the county and generally comprises volcanic (Cenozoic Volcanic) and granitic (Mesozoic Granitic) formations (Nevada County 1995, Section 4.2). The majority of Nevada County, which includes the project site, falls within Zone II, defined as an area of low landslide activity (Nevada County 1995, Figure 4.2-3).

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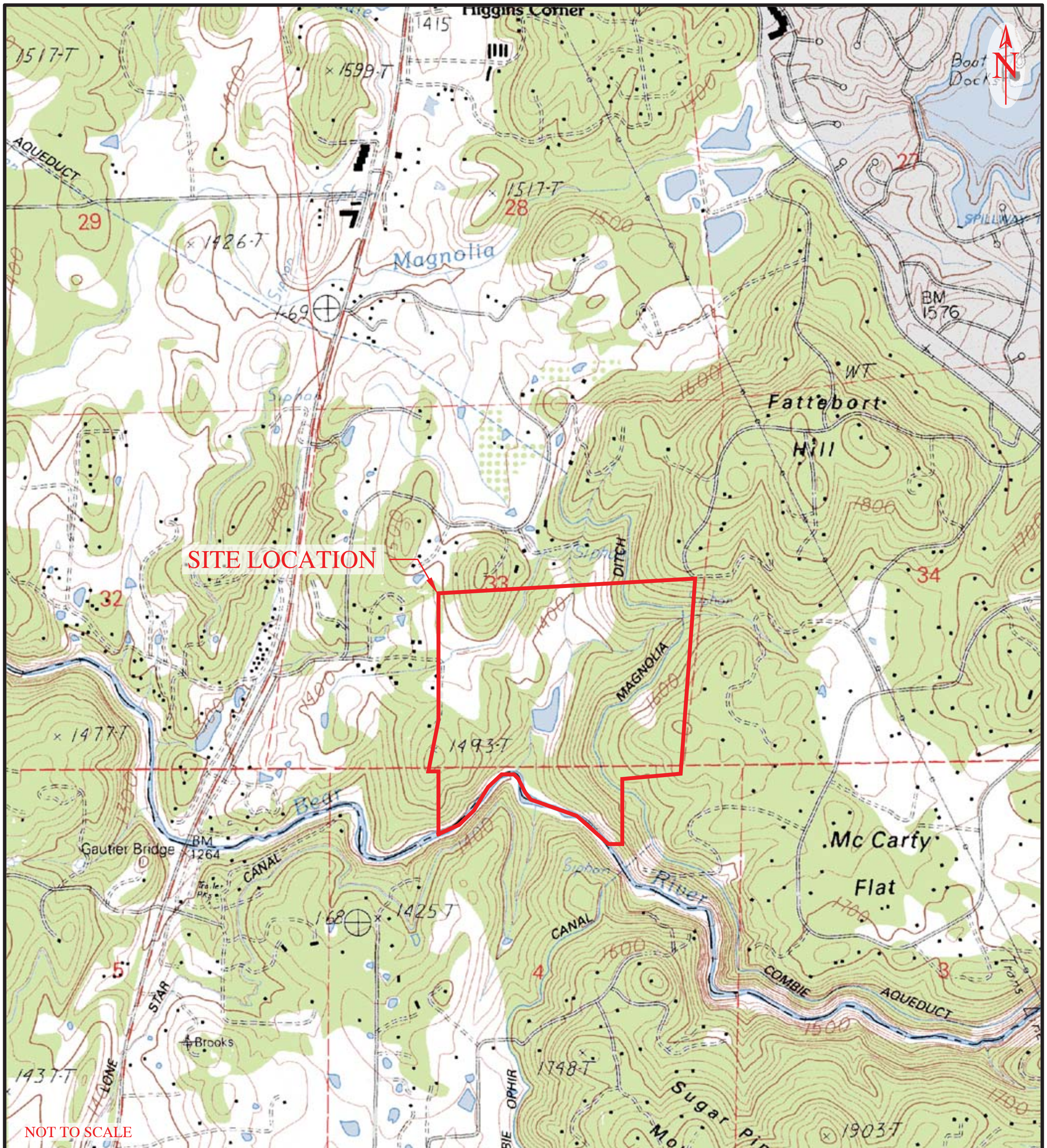

LAKE COMBIE QUADRANGLE 7.5 MINUTE TOPOGRAPHICAL MAP

Source: Acacia CE Consultants & Engineers

Figure 3.7-1

Topograhic Conditions

PMC

SOILS AND MINERAL RESOURCES

As shown in **Figure 3.7-2**, the project site is underlain by Boomer Loam, Boomer-Rock Outcrop, Sobrante Loam, and Chaix-Rock Outcrop (Lumos and Associates 2007, p. 4). **Table 3.7-2** shows the acreages of the soils present on the project site. The official soil series descriptions indicate the Boomer series consists of deep and very deep, well-drained soils that formed in material weathered from metavolcanic rock. These soils are well drained with slow to very rapid runoff and moderately slow permeability. The Sobrante series consists of moderately deep and well-drained soils that formed in material weathered from igneous and metamorphic rocks. The Chaix series consists of moderately deep, somewhat excessively drained soils that formed in material weathered from acid intrusive igneous rock, mainly granite or granodiorite (USDA-NRCS 2011).

TABLE 3.7-2
SOIL CHARACTERISTICS OF SOILS WITHIN THE PROJECT SITE

Soil Type	Acreage Within Project Site
Boomer-Rock Outcrop complex, 5 to 30 percent slopes	130
Boomer-Rock Outcrop complex, 30 to 50 percent slopes	31
Boomer Loam, 5 to 15 percent slopes	29
Sobrante Loam, 2 to 15 percent slopes	17
Chaix-Rock Outcrop complex, 30 to 75 percent slopes	8

Sources: USDA-NRCS 2011.

Expansiveness

Expansive soils are those soils that shrink or swell depending on the level of moisture they absorb. Expansive soils typically contain clay minerals that determine the ability of the soil to absorb and retain moisture. When structures are located on expansive soils, foundations have the tendency to rise during the wet season and sink during the dry season. This movement can create new stresses on various sections of the foundation and connected utilities and can lead to structural failure and damage to infrastructure.

The soils of the project site possess low to moderate expansion potential (Acacia CE 2011; USDA-NRCS 2011). The native clays are capable of exerting moderate expansion pressures on building foundations, interior floor slabs, and exterior flatwork.

Liquefaction

Liquefaction poses a hazard to engineered structures. Soil liquefaction occurs when ground shaking from an earthquake causes a sediment layer saturated with groundwater to lose strength and take on the characteristics of a fluid, thereby becoming similar to quicksand. Four types of ground failure or collapse of soil structures commonly result from liquefaction: lateral spread, flow failure, ground oscillation, and loss of bearing strength. Liquefaction potential is determined from a variety of factors including soil type, soil density, depth to the groundwater table, and the duration and intensity of ground shaking. Age is also a factor in the potential of soils to liquefy; Holocene deposits (those from approximately the last 11,000 years) are the most sensitive to liquefaction.

Loose sands and peat deposits are susceptible to liquefaction. Liquefaction is particularly likely where land has been reclaimed from inundated areas by filling with loose sand. Clayey silts, silty clays, and clays deposited in freshwater environments are generally stable under the influence of seismic ground shaking. Liquefaction is most likely to occur in deposits of water-saturated alluvium of areas of considerable artificial fill. Based on review of the soil conditions, the potential for liquefaction over the majority of the proposed development area of the project is considered low.

GROUNDWATER

Groundwater resources in western Nevada County, where the project site is located, are characterized as poorly defined and variable. The highly fractured characteristics of the subsurface geology, as well as a variety of other factors such as soil depth and percolation, combine to create highly variable and inconsistent groundwater characteristics (Nevada County 1995, Section 4.3). According to the Nevada Irrigation District's Urban Water Management Plan (NID 2010, p. 4-4), there is no defined groundwater aquifer in the county.

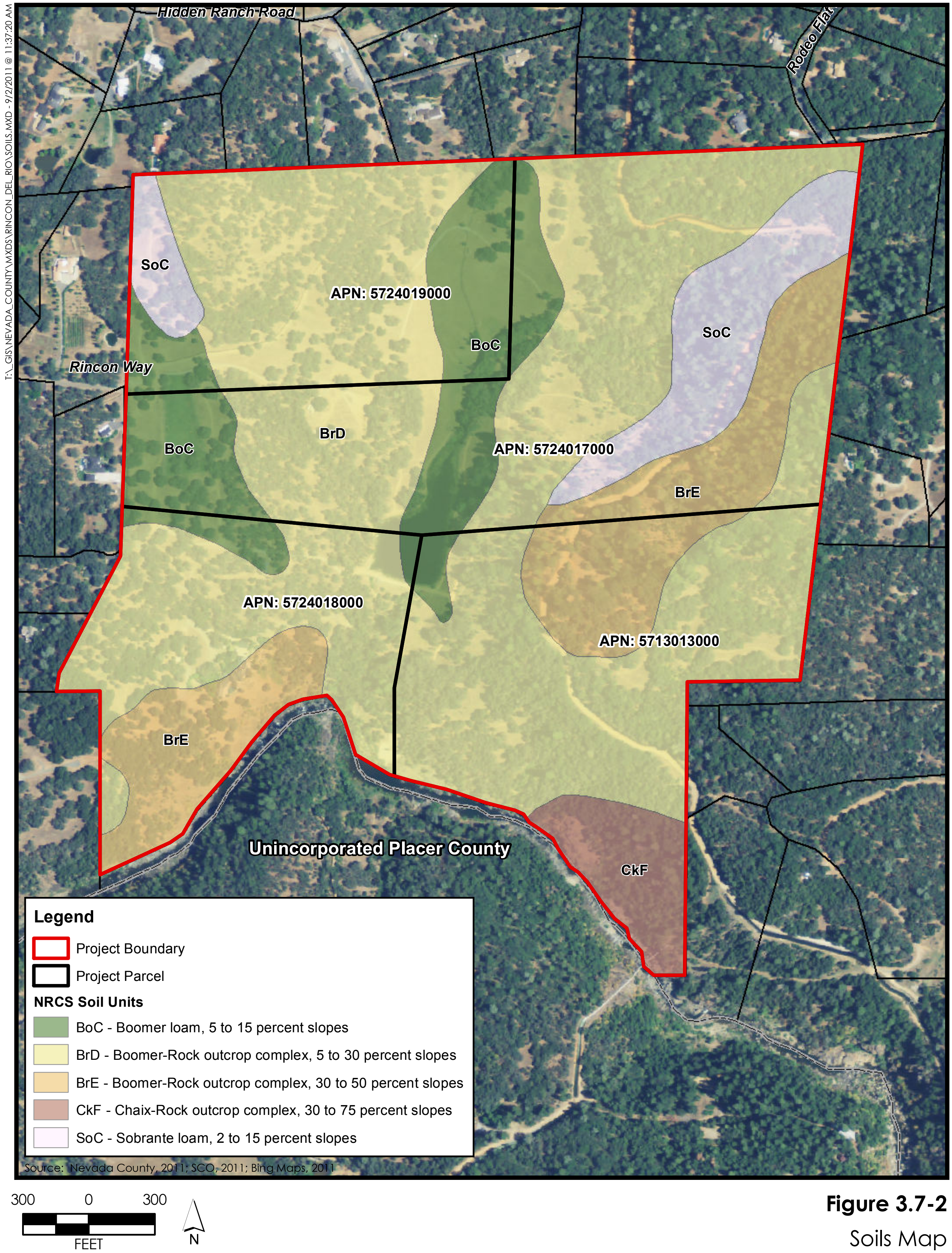

Figure 3.7-2

Soils Map

PMC®

3.7.2 REGULATORY FRAMEWORK

STATE

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 (originally enacted as the Alquist-Priolo Special Studies Zones Act and renamed in 1994) and is intended to reduce the risk to life and property from surface fault rupture during earthquakes. The main purpose of the law is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. There are no Earthquake Fault Zones subject to the Alquist-Priolo Earthquake Fault Zoning Act in the area of the project site (CGS 2010).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act addresses nonsurface fault rupture earthquake hazards, including liquefaction and seismically induced landslides. Passed by the State Legislature in 1990, this law was codified in the California Public Resources Code as Division 2, Chapter 7.8A, and became operative in April 1991. The Seismic Hazards Mapping Act resulted in a mapping program that is intended to reflect areas which have the potential for liquefaction, landslide, strong earth ground shaking, or other earthquake and geologic hazards. There are no areas in the project site subject to the Seismic Hazard Mapping Act (CGS 2006).

California Building Standards Code

The State of California provides minimum standards for building design through the California Building Standards Code (CBSC [California Code of Regulations, Title 24]). The CBSC is based on the Uniform Building Code (UBC), which is used widely throughout the United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for conditions in California. State regulations and engineering standards related to geology, soils, and seismic activity are reflected in the CBSC requirements. Through the CBSC, the State of California provides a minimum standard for building design and construction. The CBSC contains specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. It also regulates grading activities, including drainage and erosion control. The County enforces the CBSC through its Land Use and Development Code. The County Building Code (Nevada County Land Use and Development Code, Chapter V) incorporates the CBSC including recent changes (Nevada County 2010).

LOCAL

Nevada County General Plan

The Nevada County General Plan serves as the overall guiding policy document for the unincorporated areas of Nevada County. **Appendix 3.0-A** summarizes the proposed project's consistency with applicable General Plan policies related to geologic hazards and seismic activity. While this Draft EIR analyzes the project's consistency with the General Plan pursuant to CEQA Section 15125(d), the Nevada County Board of Supervisors makes the ultimate determination of consistency with the General Plan.

Nevada County Land Use and Development Code

Section L-II 4.3.8 – Earthquake Faults & Seismically Sensitive Areas

The Nevada County Land Use and Development Code, Section L-II 4.3.8, minimizes the impact of earthquakes and seismic hazards on people and development by requiring all projects in a seismic hazard area to have a management plan prepared by a certified engineering geologist or civil engineer that minimizes safety impacts associated with the project.

Section L-II 4.3.13 – Steep Slopes/High Erosion Potential

The Nevada County Land Use and Development Code, Chapter II, Article, 4.0, Section L-II 4.3.13, includes standards to preserve the natural, topographic, and aesthetic characteristics of steep slopes. Standards are also included to minimize soil erosion, water quality impacts, earth movement and disturbance, and the adverse impact of grading activities, while providing for reasonable use of private property. The standards include requirements for grading permits, limited development on steep slopes, and an erosion and sediment control plan.

Chapter V, Article 19 – Grading

The Nevada County Land Use and Development Code, Chapter V, Article 19, sets forth rules and regulations to control excavation, grading and earthwork construction, including fills and embankments; establishes standards of required performance in preventing or minimizing water quality impacts from storm water runoff; establishes the administrative procedure for issuance of permits; and provides for approval of plans and inspection of grading construction, drainage, and erosion and sediment controls at construction sites.

3.7.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

The impact analysis provided below is based on the following State CEQA Guidelines Appendix G thresholds of significance, which indicate that the project would have a significant impact if it would:

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 California Geological Survey (formerly Division of Mines and Geology) Special Publication 42.

    ii) Strong seismic ground shaking.

    iii) Seismic-related ground failure, including liquefaction.

    iv) Landslides.

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

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.

4) 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.

5) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

METHODOLOGY

The analysis in this section is based on review of the Nevada County General Plan, the Nevada County General Plan EIR, the Geotechnical Feasibility Study (Lumos and Associates 2007), and the Geotechnical Review (Acacia CE 2011) for the proposed project. Both the Geotechnical Feasibility Study and the Geotechnical Review for the project can be found in **Appendix 3.7-A** of this Draft EIR.

Impacts associated with erosion and loss of topsoil (Standard of Significance 2 from the above list) are discussed in Section 3.9, Hydrology and Water Quality. The project would tie into the existing sewer system of the Nevada County Sanitation District, rather than use septic systems. Since septic systems are not being implemented, impacts associated with soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems would not impact the project site. Therefore, Standard of Significance 5 will not be addressed further in the Draft EIR.

PROJECT IMPACTS AND MITIGATION MEASURES

Impacts Associated with Fault Rupture and Strong Seismic Ground Shaking (Standards of Significance 1-i and 1-ii)

Impact 3.7.1 The potential for the project site to be exposed to hazards associated with fault rupture or strong seismic ground shaking is considered unlikely. Therefore, this impact is considered **less than significant**.

As discussed in the Setting section above, there are no Alquist-Priolo Special Earthquake Study Zones on or near the project site (CGS 2010). However since there are numerous fault structures present within the region that surrounds the project site, there is a high probability the region would experience a seismic event that could result in shaking of the ground surface.

Consistent with the requirements of the County's General Plan Policies GH 10.2.1.2 and GH 10.2.1.3, the proposed project would be designed in accordance with CBSC requirements that address structural seismic safety. The CBSC includes design criteria for seismic loading and other geologic hazards, including design criteria for geologically induced loading that govern sizing of structural members and provide calculation methods to assist in the design process. Thus, while shaking impacts would be potentially damaging, the CBSC includes provisions for buildings to structurally survive an earthquake without collapsing and includes measures such as anchoring to the foundation and structural frame design.

Therefore, through compliance with the CBSC, impacts associated with ground rupture of a known earthquake fault are considered **less than significant**.

Mitigation Measures

None required.

Exposure to Seismic-Related Ground Failure, including Liquefaction and Unstable Soils (Standards of Significance 1-iii and 3)

Impact 3.7.2 The project site includes soils that may be subject to seismic-related ground failure, including liquefaction. This impact is considered **less than significant**.

Liquefaction is generally determined by three factors: loose granular soils, groundwater, and strong ground motion. Liquefaction is most likely to occur in deposits of water-saturated alluvium in areas of considerable artificial fill. Based on review of the soil conditions on the project site, the potential for liquefaction in the majority of the proposed development envelope area of the project site is considered low. However, a portion of the project would be constructed near the existing pond, and it is possible that the site may experience strong ground motion. Based on these factors, the potential exists for seismically induced liquefaction to occur in the vicinity of the pond area.

Both the geotechnical feasibility study (Lumos and Associates 2007) and geotechnical review (Acacia CE 2011) recommend a design-level geotechnical investigation be prepared including soil borings and/or test pits, seismic survey, laboratory testing, and analysis. Geotechnical investigation is required by Chapter 18, Section 1803.2 of the CBSC, which would apply to the proposed project. Per Section 1803.3, the geotechnical investigations are required to be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration. The geotechnical investigations are also required to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness. Section 1803.6 (5) requires that the geotechnical investigations include recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads. These requirements would reduce the potential for project-site residents and structures, including those in the vicinity of the pond, to experience loss, injury or death resulting from seismic-related ground failure to a **less than significant** level.

Mitigation Measures

None required.

Impacts Associated with Landslides (Standard of Significance 1-iv)

Impact 3.7.3 The project site is located in a region designated as an area of low landslide activity. This impact is considered **less than significant**.

Landslide activity is a function of slope, soil type and depth, soil moisture, bedrock, and seismic activities. Landslides include a wide range of ground movement, such as rockfalls, deep failure of slopes, and shallow debris flows (mudflows). As discussed in the Setting subsection, the geologic substructure of Nevada County can be divided into three broad groups, of which the project site falls within Zone II, defined as an area of low landslide activity (Nevada County 1995, Figure 4.2-3). Further, elevations within the site range from approximately 1,300 feet above mean sea level (msl) near the Bear River to approximately 1,700 feet above msl on the eastern side of the site. Natural slopes consist of gently rolling hills, and soils on the project site are deep to very deep, well-drained soils with low to moderate soil expansion capability and low potential for liquefaction. Therefore, the threat from landslides on the site is considered to be a **less than significant** impact.

Mitigation Measures

None required.

Expansive Soils (Standard of Significance 4)

Impact 3.7.4 The project site includes soils that may be subject to expansion potential. This impact is considered **less than significant**.

Expansive soils are those soils that shrink or swell depending on the level of moisture they absorb. Expansive soils typically contain clay minerals that determine the ability of the soil to absorb and retain moisture. When structures are located on expansive soils, foundations have the tendency to rise during the wet season and sink during the dry season. This movement can create new stresses on various sections of the foundation and connected utilities and can lead to structural failure and damage to infrastructure.

As stated above, the soils of the project site possess low to moderate expansion potential (Acacia CE 2011; USDA-NRCS 2011). The native clays are capable of exerting moderate expansion pressures on building foundations, interior floor slabs, and exterior flatwork. Section 1803.2 of the CBSC would require additional site investigation, laboratory testing, and engineering analysis to determine the full and exact extent of the potential for soil instability, including soil expansion potential. Typical methods of addressing the potential for shrink/swell can include over excavating footings, adding lime to the soil, providing clean non-expansive fill, increasing the size and type of footing and providing for additional soil drainage in the vicinity of the structure. The report required by Section 1803.2 of the CBSC will be based on the type of construction anticipated and actual soils analysis at the point of construction may result in more refined methods of addressing this impact. As the impact potential is well known and the potential methods of addressing the issue part of standard construction techniques, with implementation Section 1803.2 of the CBSC, impacts associated with expansive soils would be reduced to a level that is considered **less than significant**.

Mitigation Measures

None required.

3.7.4 CUMULATIVE SETTING, IMPACTS, AND MITIGATION MEASURES

CUMULATIVE SETTING

Geotechnical impacts tend to be site-specific rather than cumulative in nature. For example, seismic events may damage or destroy a building on the project site, but the construction of a development project on one site would not cause any adjacent parcels to become more susceptible to seismic events, nor can a project affect local geology in such a manner as to increase risks regionally. Impacts regarding surficial deposits, namely erosion and sediment deposition, however, can be cumulative in nature within a watershed. See Section 3.9, Hydrology and Water Quality, of this Draft EIR for a discussion of cumulative water quality impacts from soil erosion.

CUMULATIVE IMPACTS AND MITIGATION MEASURES

Cumulative Soil Stability and Seismic Impacts

Impact 3.7.5 Implementation of the proposed project, in combination with existing, approved, proposed, and reasonably foreseeable development in nearby areas of Nevada County, would not contribute to cumulative geologic and soils impacts. The proposed project's incremental contribution would be **less than cumulatively considerable**.

Proposed CCRC Development

Impacts associated with fault rupture and strong seismic ground shaking, seismic-related ground failure, including liquefaction and unstable soils, landslides, and expansive soils are based on site-specific conditions. These inherent conditions are an end result of natural events that occur through vast periods of geologic time and are not based on cumulative development. With proper evaluation of these conditions, compliance with existing codes and standards, such as Section 1803.2 of the CBSC, the proposed project's contribution to significant impacts related to the area's geology would be **less than cumulatively considerable.**

General Plan and Zoning Ordinance Text Amendments

As discussed in further detail in Section 4.0, Cumulative Impacts Summary, the proposed General Plan and Zoning Ordinance text amendments are policy actions that would not directly result in geologic and soils impacts in the cumulative setting. Although CCRCs would be permitted in either a PD (Planned Development) or SDA (Special Development Area) land use designation with approval of a zone change after implementation of the proposed project, such rezoning applications would be subject to further CEQA analysis of project-specific impacts (proposed Zoning Ordinance amendment Section L.II 2.7.11(C)(4)), including geologic and soils impacts. At a programmatic level, the environmental impacts associated with development of all PD and SDA designated areas in the county were analyzed in the Nevada County General Plan Environmental Impact Report, Volume I, SCH #1995102136 (1995). Future site-specific CEQA analysis would result in project-specific mitigation to address impacts. Therefore, cumulative geologic and soils impacts associated with the proposed General Plan and Zoning Ordinance text amendments are considered **less than cumulatively considerable**.

Mitigation Measures

None required.

REFERENCES

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