The purpose of this section is to disclose and analyze the potential impacts associated with the geology of the Project region and general vicinity, and to analyze issues such as the potential exposure of people and property to geologic hazards, landform alteration, and erosion. This section is based in part on the following:

- *Rancho Cordova General Plan* (City of Rancho Cordova, Adopted June 26, 2006);
- *Rancho Cordova General Plan Draft Environmental Impact Report* (City of Rancho Cordova, March 2006);
- *Preliminary Geotechnical Engineering Report – Jaeger Ranch Property* (Wallace-Kuhl & Associates, September 2016);
- *Web Soil Survey (*United States Department of Agriculture Natural Resources Conservation Service, 2018); and
- *Soil Survey of Sacramento County, California* (USDA, 1993).

One comment was received during the public review period or scoping meeting for the Notice of Preparation regarding this topic from the following: Cordova Recreation & Park District (August 3, 2018). The comment related to this topic is addressed within this section.

3.5.1 ENVIRONMENTAL SETTING

REGIONAL GEOLOGY

The Project site is located near the center of the Sacramento Valley, approximately 16 miles southeast of the confluence of the American and Sacramento Rivers. The Sacramento Valley is bordered by the Coast Ranges and Delta on the west and the foothills of the Sierra Nevada to the east.

The Sacramento Valley has been filled over time with up to a six-mile thick sequence of interbedded clay, silt, sand, and gravel deposits. The sediments range in age from more than 144 million years old (Jurassic Period) to less than 10,000 years (Holocene). The most recent sediments consist of coarse-grained (sand and gravel) deposits along river courses and fine-grained (clay and silt) deposits located in low-lying areas or flood basins and are referred to as alluvial deposits. These deposits are loose and not well consolidated soils.

Older alluvial deposits underlie the edges of the Valley. The older alluvial deposits are exposed in the foothill regions in the eastern portion of the county. The alluvial deposits, which slope gradually toward the center of the Valley, contain most of the groundwater supplies in region. The foothills of the coast ranges to the west of the Project site are underlain by alluvial deposits and older marine sediments deposited during the Tertiary Period when an inland sea occupied the Great Valley.

Great Valley Geomorphic Province

The Great Valley is an alluvial plain, about 50 miles wide and 400 miles long, between the Coast Ranges and Sierra Nevada. The Great Valley is drained by the Sacramento and San Joaquin rivers, which join and enter San Francisco Bay. The eastern border is the west-sloping Sierran bedrock surface, which continues westward beneath alluvium and older sediments. The western border is underlain by east-dipping Cretaceous and Cenozoic strata that form a deeply buried synclinal trough, lying beneath the Great Valley along its western side.

City of Rancho Cordova

The geological formations underlying the majority of the City of Rancho Cordova General Plan Planning Area consist mostly of Cenozoic Quaternary gravelly alluvial and glacial deposits from the ancestral channel of the American River, which date back to the mid Pleistocene age or approximately 600,000 years. These formations are typically found north of Douglas Road and east of Sunrise Boulevard. The geologic structure east of Grant Line Road consists primarily of Cenozoic Tertiary Mehrten formations of andesitic conglomerate, sandstone, and breccia. The youngest geomorphic features in the Planning Area are low floodplains, which are found primarily along the American River and Cosumnes River. These features include natural levees, alluvial plains, and many smaller channels along both river corridors. Bar and channel topography is evident on the low floodplains adjacent to these river corridors. The floodplains along the Cosumnes River are not protected by levees or dams and are frequently inundated during the rainy season.

The majority of the soils in the City's General Plan Planning Area are the result of alluvial deposits, or river and lake deposits on various geomorphic surfaces. The U.S. Department of Agriculture (USDA) Soil Conservation Service produces maps classifying soil groups based on physical, hydrologic, and chemical properties. According to the USDA Soil Survey of Sacramento County (Soil Survey), the Planning Area contains 59 separate soil types.

SITE GEOLOGY

Soil Survey

A Custom Soil Survey was completed for the Project site using the Natural Resources Conservation Service (NRCS) Web Soil Survey program. The NRCS Soils Map is provided in Figure 3.5-1. Table 3.5-1 identifies the type and range of soils found in the Project site.

TABLE 3.5-1: PROJECT SITE SOILS

UNIT SYMBOL	*NAME*	*ACRES IN PROJECT SITE*	*PERCENT OF PROJECT SITE*
145	Fiddyment fine sandy loam, 1-8% slopes	2.60	0.5%
159	Hicksville gravelly loam, 0-2% slopes	12.41	2.4%
193	Red Bluff-Redding complex, 0-5% slopes	85.18	16.2%
197	Redding loam, 2-8% slopes	54.90	10.5%
198	Redding gravelly loam, 0-8% slopes, MLRA 17	370.39	70.5%

SOURCE: NRCS CUSTOM SOIL SURVEY 2018.

Fiddyment. The Fiddyment series consists of moderately deep, well drained soils formed in material weathered from consolidated sediments of mixed rock sources. Fiddyment soils are on nearly level to rolling low terraces and hills. This soils series is well drained, has slow to medium runoff, and very slow permeability. Water perches above the claypan for short periods after periods of high rainfall in December through April. The soil is used for rangeland, non-irrigated small grain crops, and urban development. Some areas are used for irrigated pasture. Natural vegetation is annual grasses and forbs such as soft chess, oats, and filaree and a few scattered oaks.

Hicksville. The Hicksville series consists of deep and very deep, moderately well drained soils that formed in alluvium derived from mixed rock sources. Hicksville soils are on low stream terraces and alluvial flats along drainageways of terraces and hills. This soils series is moderately well drained, has very slow to slow runoff, and moderately slow permeability. These soils are used for livestock grazing. A few areas are used for irrigated hay and pasture and irrigated row and orchard crops. Natural vegetation is soft chess, wild oats, ripgut brome, needlegrass and filaree.

Red Bluff. The Red Bluff series consists of very deep, well drained soils formed in old mixed alluvium. Red Bluff soils are on terraces. This soils series is well drained, has slow to medium runoff, and moderately slow permeability. Small grains and pasture are grown where dry farmed. Row crops, pasture and a few orchards are grown under irrigation. Native vegetation consists of blue oak, live oak, manzanita, soft chess, wild oats, and annual forbs. In lower rainfall areas, oaks and brush are absent.

Redding. The Redding series consists of moderately deep to duripan, well or moderately well drained soils that formed in alluvium derived from mixed sources. They are on nearly level or dissected fan remnants. This soils series is well or moderately well drained, has very low to high runoff, except for local ponding in intermound areas, and very slow to slow permeability. These soils are used for rangeland and dryland small grain. A few areas are used for irrigated pasture. Natural vegetation is annual grasses and forbs.

Groundwater

The Central Area groundwater subbasin (i.e., the Central Basin) corresponds to the South American Sub-Basin (California Department of Water Resources [DWR] Basin Number 5-21.65) and is located between the American River and the Cosumnes River. Zone 40 is located within the Central Basin.

Groundwater in the Central Basin is classified as occurring in a shallow aquifer zone (Laguna or Modesto Formation) or in an underlying deeper aquifer zone (Mehrten Formation). Within Zone 40, the shallow aquifer extends to approximately 200 to 300 feet below the ground surface; in general, the water quality in this zone is considered good, except for the occurrence of low levels of arsenic in some locations. The shallow aquifer is typically used for private domestic wells and requires no treatment unless naturally occurring arsenic is encountered.

The deep aquifer is semiconfined by and separated from the shallow aquifer by a discontinuous clay layer. The base of the deep aquifer averages approximately 1,400 feet below the ground surface. Water at the base of the deep aquifer has higher concentrations of total dissolved solids.

Iron and manganese typically found in the deep aquifer are at levels requiring treatment. Groundwater used in Zone 40 is supplied from both the shallow and deeper aquifer systems.

Groundwater in central Sacramento County moves from sources of recharge to areas of discharge. Recharge to the aquifer system occurs along river and stream channels where extensive sand and gravel deposits exist, particularly along the American, Cosumnes, and Sacramento River channels. Additional recharge occurs along the eastern boundary of Sacramento County at the transition point from the consolidated rocks of the Sierra Nevada to the alluvial deposited basin sediments. This typically occurs through fractured granitic rock that makes up the Sierra Nevada foothills. Other sources of recharge within the areas include deep percolation from applied surface water, precipitation, and small streams.

Groundwater elevations through much of the Central Basin generally declined from the 1950s to about 1980 by about 20 to 30 feet. From 1980 to 1983, water levels recovered by about 10 feet and remained stable until 1987, which was the beginning of the 1987–1992 droughts. From 1987 to 1995, water levels declined by about 15 feet. From 1995 to 2003, most water levels recovered to higher levels than before the 1987–1992 drought. Much of this recovery can be attributed to increased use of surface water in the Central Basin and the fallowing of previously irrigated agricultural lands for development of urban uses.

According to the Geotechnical Engineering Report prepared for the Project site (Wallace-Kuhl, 2016) (Appendix E of this Draft EIR), groundwater was not encountered in the test pits excavated at the site in August of 2016. Based on groundwater depth observations taken from 2008 to 2012 in nearby wells (e.g. Wells EX-20, EX-21, EX-22, and EX-27 from Central Valley Regional Water Quality Control Board Case Number SL205493018) permanent groundwater is anticipated to vary between 150 and 240 feet below existing surface grades.

However, perched seasonal groundwater is anticipated to occur at this site. Surface water features observed during site exploration activities included vernal ponds and ephemeral streams/washes. Based on these surface features, and the underlying geology, we anticipate the perched groundwater conditions are likely to occur at the site with potential for significant surface water flows. Perched groundwater conditions should be expected after heavy rainfall or during the wetter seasons of the year.

FAULTS AND SEISMICITY

Faults

A fault is a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. A fault trace is the line on the earth's surface defining the fault. Displacement of the earth's crust along faults releases energy in the form of earthquakes and in some cases in fault creep. Most faults are the result of repeated displacements over a long period of time.

Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Surface ruptures have been known to extend up to 50 miles with displacements of an inch to 20 feet. Fault rupture almost always follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking.

The State of California designates faults as active, potentially active, and inactive depending on how recent the movement that can be substantiated for a fault. Table 3.5-2 presents the California fault activity rating system.

TABLE 3.5-2: FAULT ACTIVITY RATING

FAULT ACTIVITY RATING	*GEOLOGIC PERIOD OF LAST RUPTURE*	*TIME INTERVAL*
Active (A)	Holocene	Within last 11,700 Years
Potentially Active (PA)	Quaternary	Age Undifferentiated
Inactive (I)	Pre-Quaternary	Greater than 1.6 Million Years

SOURCE: CALIFORNIA DEPARTMENT OF CONSERVATION, FAULT ACTIVITY MAP OF CALIFORNIA (2010).

No known faults traverse through the Rancho Cordova Planning Area. However, the site does lie within a seismically active region, as California has numerous faults that are considered active. Generally, a fault is considered active if it has ruptured within the Holocene epoch (11,700 years before present). Mapped, active regional faults within the vicinity of the Project site range from 14 to 50 miles away.

Fault Systems

Seismicity is directly related to the distribution of fault systems within a region. Depending on activity patterns, faults and fault-related geologic features may be classified as active, potentially active, or inactive.

The Quaternary Faults are illustrated on Figure 3.5-2. There are no Alquist-Priolo Earthquake Fault Zones in the region. With the exception of the Dunnigan Hills fault, located in the Woodland area, the Sacramento Valley has generally not been seismically active in the last 11,000 years (Holocene time). Faults with known or estimated activity during the Holocene are generally located in the San Francisco Bay Area to the west, or in the Lake Tahoe area to the east.

Seismicity

The amount of energy available to a fault is determined by considering the slip-rate of the fault, its area (fault length multiplied by down-dip width), maximum magnitude, and the rigidity of the displaced rocks. These factors are combined to calculate the moment (energy) release on a fault. The total seismic energy release for a fault source is sometimes partitioned between two different recurrence models, the characteristic and truncated Gutenberg-Richter (G-R) magnitude-frequency distributions. These models incorporate our knowledge of the range of magnitudes and relative frequency of different magnitudes for a particular fault. The partition of moment and the weights for multiple models are given in the following summary.

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. By comparison, magnitude is based on the amplitude of the earthquake waves recorded on instruments, which have a common calibration. The Richter scale, a logarithmic scale ranging from 0.1 to 9.0, with 9.0 being the strongest, measures the magnitude of an earthquake relative to ground shaking. Table 3.5-3 provides a description and a comparison of intensity and magnitude.

The California Building Standards Code (CBSC) places all of California in the zone of greatest earthquake severity because recent studies indicate high potential for severe ground shaking.

TABLE 3.5-3: MODIFIED MERCALLI INTENSITY SCALE FOR EARTHQUAKES

RICHTER MAGNITUDE	*MODIFIED MERCALLI SCALE*	*EFFECTS OF INTENSITY*
0.1 – 0.9	I	Earthquake shaking not felt
1.0 – 2.9	II	Shaking felt by those at rest.
3.0 – 3.9	III	Felt by most people indoors, some can estimate duration of shaking.
4.0 – 4.5	IV	Felt by most people indoors. Hanging objects rattle, wooden walls and frames creak.
4.6 – 4.9	V	Felt by everyone indoors, the duration of shaking can be estimated by most people. Standing autos rock. Crockery clashes, dishes rattle and glasses clink. Doors open, close and swing.
5.0 – 5.5	VI	Felt by all who estimate duration of shaking. Sleepers awaken, liquids spill, objects are displaced, and weak materials crack.
5.6 – 6.4	VII	People frightened and walls unsteady. Pictures and books thrown, dishes and glass are broken. Weak chimneys break. Plaster, loose bricks and parapets fall.
6.5 – 6.9	VIII	Difficult to stand. Waves on ponds, cohesionless soils slump. Stucco and masonry walls fall. Chimneys, stacks, towers, and elevated tanks twist and fall.
7.0 – 7.4	IX	General fright as people are thrown down, hard to drive. Trees broken, damage to foundations and frames. Reservoirs damaged, underground pipes broken.
7.5 – 7.9	X	General panic. Ground cracks, masonry and frame buildings destroyed. Bridges destroyed, railroads bent slightly. Dams, dikes and embankments damaged.
8.0 – 8.4	XI	Large landslides, water thrown, general destruction of buildings. Pipelines destroyed, railroads bent.
8.5 +	XII	Total nearby damage, rock masses displaced. Lines of sight/level distorted. Objects thrown into air.

SOURCE: UNITED STATES GEOLOGICAL SURVEY.

Alquist-Priolo Special Stud y Zone

The California legislature passed the Alquist-Priolo Special Studies Zone Act in 1972 to address seismic hazards associated with faults and to establish criteria for developments for areas with identified seismic hazard zones. The California Geologic Survey (CGS) evaluates faults with available geologic and seismologic data and determines if a fault should be zoned as active, potentially active, or inactive. If CGS determines a fault to be active, then it is typically incorporated into a Special Studies Zone in accordance with the Alquist-Priolo Earthquake Hazard Act. Alquist-Priolo Special Study Zones are usually one-quarter mile or less in width and require site-specific evaluation of fault location and require a structure setback if the fault is found traversing a Project site. The Project site is not within an Alquist-Priolo Special Study Zone.

SEISMIC HAZARDS

Seismic Ground Shaking

The potential for seismic ground shaking is expected in California. As a result of the foreseeable seismicity in California, the State requires special design considerations for all structural improvements in accordance with the seismic design provisions in the California Building Code. These seismic design provisions require enhanced structural integrity based on several risk parameters. Seismic ground shaking on the Project site is expected during the life of the Project.

Fault Rupture

A fault rupture occurs when the surface of the earth breaks as a result of an earthquake, although this does not happen with all earthquakes. These ruptures generally occur in a weak area of an existing fault. Ruptures can be sudden (i.e. earthquake) or slow (i.e. fault creep). The Alquist-Priolo Fault Zoning Act requires active earthquake fault zones to be mapped and it provides special development considerations within these zones. The Project site does not have surface expression of active faults and fault rupture is not anticipated.

Liquefaction

Liquefaction typically requires a significant sudden decrease of shearing resistance in cohesionless soils and a sudden increase in water pressure, which is typically associated with an earthquake of high magnitude. The potential for liquefaction is highest when groundwater levels are high, and loose, fine, sandy soils occur at depths of less than 50 feet. Based on a review of geologic maps and Natural Resources Conservation Service (NRCS) soil data, it is unlikely that soils on the Project site would be subject to liquefaction in the event of an earthquake because the Project site is underlain by relatively stable Pleistocene-age soils, the potential seismic sources are a relatively long distance away, and the groundwater table is at least 100 feet below the ground surface.

According to the Geotechnical Engineering Report prepared for the Project site (Wallace-Kuhl, 2016), groundwater at the site is greater than 50 feet below grade, and saturated soils were not encountered during site exploration activities. Soils will likely remain unsaturated during the majority of the year, and are thus not considered susceptible to liquefaction. The silty sands and sands are susceptible to seismic compression. Therefore, liquefaction potential at the site is considered very low.

Lateral Spreading

Lateral spreading typically results when ground shaking moves soil toward an area where the soil integrity is weak or unsupported, and it typically occurs on the surface of a slope, although it does not occur strictly on steep slopes. Oftentimes, lateral spreading is directly associated with areas of liquefaction. Areas in the region that are susceptible to this hazard are located along creeks or open water bodies, or within the foothills to the west. According to the City's General Plan Draft EIR, the potential for lateral spreading throughout the General Plan Planning Area to occur during or after seismic events is considered to be low due to the distance of active faults.

Landslides

Landslides include rockfalls, deep slope failure, and shallow slope failure. Factors such as the geological conditions, drainage, slope, vegetation, and others directly affect the potential for landslides. One of the most common causes of landslides is construction activity that is associated with road building (i.e. cut and fill). The potential for landslides is considered remote in the Sacramento Valley floors due to the lack of significant slopes. For this reason, the probability of landslides occurring on the Project site is low.

NON-SEISMIC HAZARDS

Expansive Soils

Expansive soils can undergo significant volume change with changes in moisture content. They shrink and harden when dried and expand and soften when wet. If structures are underlain by expansive soils, it is important that foundation systems be capable of tolerating or resisting any potentially damaging soil movements. In addition, it is important to limit moisture changes in the surficial soils by using positive drainage away from buildings as well as limiting landscaping watering. As shown in Figure 3.5-3, the expansive potential of the Project site soils is generally low. According to the Geotechnical Engineering Report prepared for the Project site (Wallace-Kuhl, 2016), laboratory test results performed on Project site soil samples collected in the upper two to three feet indicate that these soils typically have a plasticity index of less than 15 and can be considered to have a low expansion potential. The soils beneath about two feet typically have a plasticity index of greater than 15, and should be considered to have a low to moderate expansion potential.

Erosion

Erosion naturally occurs on the surface of the earth as surface materials (i.e. rock, soil, debris, etc.) is loosened, dissolved, or worn away, and transported from one place to another by gravity. Two common types of soil erosion include wind erosion and water erosion. The steepness of a slope is an important factor that affects soil erosion. Erosion potential in soils is influenced primarily by loose soil texture and steep slopes. Loose soils can be eroded by water or wind forces, whereas soils with high clay content are generally susceptible only to water erosion. The potential for erosion generally increases as a result of human activity, primarily through the development of facilities and impervious surfaces and the removal of vegetative cover. According to the City's General Plan Draft EIR and the SunCreek Specific Plan Draft EIR, the erosion potential for the Project area is low to moderate.

The *Custom Soils Report* identified the erosion potential for the soils in the Project site. This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. Soil property data for each map unit component includes the hydrologic soil group, erosion factor "K" for the surface horizon, erosion factor "T", and the representative percentage of sand, silt, and clay in the surface horizon.

Erosion factor "K" indicates the susceptibility of a soil to sheet and rill erosion by water. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Within the Project site, the erosion factor Kf varies from 0.32 to 0.49, which is considered a moderate potential for erosion.

Subsidence

Land subsidence is the gradual settling or sinking of an area with little or no horizontal motion due to changes taking place underground. It is a natural process, although it can also occur (and is greatly accelerated) as a result of human activities. Common causes of land subsidence from human activity include: pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils. Sacramento County is affected by five causes of land subsidence: 1) compaction of unconsolidated soils from earthquakes; 2) compaction by heavy structures; 3) erosion of peat soils; 4) peat oxidation; and 5) groundwater withdrawal. Minor land subsidence was observed and recorded in the County between 1912 and the mid-1960s for all groundwater basins underlying the County. However, subsidence did not exceed 0.40-feet during this time frame.

The Project site contains creek banks, and areas of low soil bearing strength. According to the City's General Plan EIR, the likeliness of subsidence in the City's Planning Area is considered very low.

3.5.2 REGULATORY SETTING

STATE

The State of California has established a variety of regulations and requirements related to seismic safety and structural integrity, including the California Building Code, the Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act.

California Building Standards Code

The CBSC is included in Title 24 of the California Code of Regulations (CCR) and includes the California Building Code. Under state law, all building standards must be centralized in Title 24 or they are not enforceable.

The CBSC is a compilation of three types of building criteria from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes;
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions; and
- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns.

Through the CBSC, the state 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.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 sets forth the policies and criteria of the State Mining and Geology Board, which governs the exercise of governments' responsibilities to prohibit the location of developments and structures for human occupancy across the trace of active faults. The policies and criteria are limited to potential hazards resulting from surface faulting or fault creep within Earthquake Fault Zones, as delineated on maps officially issued by the State Geologist. Working definitions include:

- Fault – a fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side;
- Fault Zone – a zone of related faults, which commonly are braided and sub parallel, but may be branching and divergent. A fault zone has a significant width (with respect to the scale at which the fault is being considered, portrayed, or investigated), ranging from a few feet to several miles;
- Sufficiently Active Fault – a fault that has evidence of Holocene surface displacement along one or more of its segments or branches (last 11,000 years); and
- Well-Defined Fault – a fault whose trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The geologist should be able to locate the fault in the field with sufficient precision and confidence to indicate that the required site-specific investigations would meet with some success.

"Sufficiently Active" and "Well Defined" are the two criteria used by the State to determine if a fault should be zoned under the Alquist-Priolo Act.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically-induced landslides. Under the Act, seismic hazard zones are to be mapped by the State Geologist to assist local governments in land use planning. The program and actions mandated by the Seismic Hazards Mapping Act closely resemble those of the Alquist-Priolo Earthquake Fault Zoning Act (which addresses only surface fault-rupture hazards) and are outlined below:

The State Geologist is required to delineate the various "seismic hazard zones."

- Cities and Counties, or other local permitting authority, must regulate certain development "projects" within the zones. They must withhold the development permits for a site within a zone until the geologic and soil conditions of the site are investigated and appropriate mitigation measures, if any, are incorporated into development plans.

- The State Mining and Geology Board provides additional regulations, policies, and criteria, to guide cities and counties in their implementation of the law. The Board also provides guidelines for preparation of the Seismic Hazard Zone Maps and for evaluating and mitigating seismic hazards.
- Sellers (and their agents) of real property within a mapped hazard zone must disclose that the property lies within such a zone at the time of sale.

National Pollutant Discharge Elimination System (NPDES)

National Pollutant Discharge Elimination System (NPDES) permits are required for discharges of pollutants to navigable waters of the United States, which includes any discharge to surface waters, including lakes, rivers, streams, bays, the ocean, dry stream beds, wetlands, and storm sewers that are tributary to any surface water body. NPDES permits are issued under the Federal Clean Water Act, Title IV, Permits and Licenses, Section 402 (33 USC 466 et seq.)

The Regional Water Quality Control Board (RWQCB) issues these permits in lieu of direct issuance by the Environmental Protection Agency, subject to review and approval by the Environmental Protection Agency Regional Administrator. The terms of these NPDES permits implement pertinent provisions of the Federal Clean Water Act and the Act's implementing regulations, including pre-treatment, sludge management, effluent limitations for specific industries, and anti- degradation. In general, the discharge of pollutants is to be eliminated or reduced as much as practicable so as to achieve the Clean Water Act's goal of "fishable and swimmable" navigable (surface) waters. Technically, all NPDES permits issued by the RWQCB are also Waste Discharge Requirements issued under the authority of the California Water Code.

These NPDES permits regulate discharges from publicly owned treatment works, industrial discharges, stormwater runoff, dewatering operations, and groundwater cleanup discharges. NPDES permits are issued for five years or less, and are therefore to be updated regularly. The rapid and dramatic population and urban growth in the Central Valley Region has caused a significant increase in NPDES permit applications for new waste discharges. To expedite the permit issuance process, the RWQCB has adopted several general NPDES permits, each of which regulates numerous discharges of similar types of wastes. The SWRCB issues general permits for stormwater runoff from construction sites statewide. Stormwater discharges from industrial and construction activities in the Central Valley Region can be covered under these general permits, which are administered jointly by the SWRCB and RWQCB.

In accordance with the NPDES General Construction Permit requirements, a Storm Water Pollution Prevention Plan (SWPPP) is required for projects that disturb at least one acre of soil. The SWPPP must be submitted to the RWQCB.

LOCAL

Rancho Cordova General Plan

The Rancho Cordova General Plan contains the following goals and policies that are relevant to geotechnical aspects of the proposed Project:

SAFETY ELEMENT

Goal S.3: Reduce the risk of adverse effects to residents or businesses as a result of geologic or seismic instability.

Policy S.3.1: Support efforts by federal, State, and local jurisdictions to investigate local seismic and geologic hazards and support those programs that effectively mitigate these hazards.

Policy S.3.2: Ensure that new structures are protected from damage caused by geologic and/or soil conditions to the greatest extent feasible.

NATURAL RESOURCES ELEMENT

Goal NR.5: Protect the quantity and quality of the City's water resources.

Policy NR.5.5: Minimize erosion to stream channels resulting from new development in urban areas consistent with State law.

City of Rancho Cordova Municipal Code

Chapter 16.04, Building Code, provides minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, installation, quality of materials, use and occupancy, location and maintenance of all buildings and structures within this jurisdiction, and certain equipment. Section 16.030 of this chapter adopts the 2016 California Building Code.

Chapter 16.44, Land Grading and Erosion Control, establishes administrative procedures, a minimum standard of review, and implementation and enforcement procedures for controlling erosion, sedimentation, and other pollutant runoff from new development projects. The ordinance also addresses grading, filling, land excavation, construction activities, and drainage as they relate to a particular project. The ordinance applies to any development project resulting in the excavation of 350 cubic yards of soil or more. Grading and erosion control permits, and amendments thereto, are subject to the requirements of the California Environmental Quality Act (CEQA) if they have not been addressed in a previous environmental document. Individual project applicants are required to furnish a copy of the permit application to the City for review and approval. The City reviews all grading and erosion control permits and geotechnical studies and reports in accordance with the Ordinance to ensure geologic and soil stability have been properly addressed.

3.5.3 IMPACTS AND MITIGATION MEASURES

THRESHOLDS OF SIGNIFICANCE

Consistent with Appendix G of the CEQA Guidelines, the Project will have a significant impact on geology, soils, and minerals if it will:

- Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:
    - 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;
    - Strong seismic ground shaking;
    - Seismic-related ground failure, including liquefaction; and/or
    - Landslides;
- Result in substantial soil erosion or the loss of topsoil;
- 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;
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property; and/or
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

As discussed in the Initial Study prepared for the Project (see Appendix A), there would be ***no impact*** regarding mineral resources and ***no impact*** associated with the use of septic tanks or alternative wastewater disposal systems. These issues will not be addressed further.

IMPACTS AND MITIGATION MEASURES

Impact 3.5-1: Project implementation would not directly or indirectly cause potential substantial adverse effects involving strong seismic ground shaking or seismic related ground failure (Less than Significant)

The Project site is not within an Alquist-Priolo Special Study Zone. There are no known faults (active, potentially active, or inactive) that traverse through the City.

With the exception of the Dunnigan Hills fault, located in the Woodland area, the Sacramento Valley has generally not been seismically active in the last 11,000 years (Holocene time). Faults with known or estimated activity during the Holocene are generally located in the San Francisco Bay Area to the west, or in the Lake Tahoe area to the east. The CBSC places all of California in the zone of greatest earthquake severity because recent studies indicate high potential for severe ground shaking.

There will always be a potential for groundshaking caused by seismic activity anywhere in California, including the Project site. In order to minimize potential damage to the buildings and site improvements, all construction in California is required to be designed in accordance with the latest seismic design standards of the California Building Code. Design in accordance with these standards would reduce any potential impact to a ***less than significant*** level. Refer to Impact 3.5-3 for a discussion of impacts related to landslides, lateral spreading, subsidence, and liquefaction.

Impact 3.5-2: Project construction and implementation has the potential to result in substantial soil erosion or the loss of topsoil (Less than Significant with Mitigation)

According to the *Custom Soils Report* prepared for the Project site, the erosion potential for the soils on the Project site is moderate, with the erosion factor Kf varying from 0.32 to 0.49. There is always the potential for human caused erosion associated with construction activities or through the operational phase of a Project.

Grading, excavation, removal of vegetation cover, and loading activities associated with construction activities could temporarily increase runoff, erosion, and sedimentation. Construction activities also could result in soil compaction and wind erosion effects that could adversely affect soils and reduce the revegetation potential at construction sites and staging areas. Mitigation Measure 3.5-1 requires an approved SWPPP that includes best management practices for grading and preservation of topsoil. The SWPPP will be designed to control storm water quality degradation to the extent practicable using best management practices during and after construction. The Project applicant will submit the SWPPP with a Notice of Intent to the RWQCB to obtain a General Permit. The RWQCB is an agency responsible for reviewing the SWPPP with the Notice of Intent, prior to issuance of a General Permit for the discharge of storm water during construction activities.

Additionally, there is the potential for erosion associated with stormwater runoff throughout the operational phase of the Project. The potential for erosion is associated with the design of the improvements, structures, and landscaping. Mitigation Measure 3.5-2 requires the Project to incorporate design measures that treat stormwater runoff in accordance with the standards of the California Stormwater Best Management Practice New Development and Redevelopment Handbook and Section E.12 of the Phase II Small MS4 General Permit. This includes the drainage design from all paved surfaces, including streets, parking lots, driveways, and roofs, as well as landscaping.

The California Stormwater Best Management Practice New Development and Redevelopment Handbook addresses potential water quality impacts from completed development that can include the following:

- Urban activities can result in the generation of new dry-weather runoff that may contain many of the following pollutants: sediment, nutrients, bacteria and viruses, oil and grease, metals, organics, pesticides, and trash;

- Impervious surfaces associated with development, such as streets, rooftops, and parking lots, prevent runoff infiltration and increase the rate and volume of stormwater runoff that may increase downstream erosion potential and associated potential water quality impairment;
- Urban activities and increased impervious surfaces which can increase the concentration and/or total load of many of the pollutants listed above in wet weather stormwater runoff.

Practices that reduce erosion and help retain water on-site include incorporating organic amendments into disturbed soils after construction, retaining native vegetation, covering soil during revegetation, providing street trees, drainage basin maintenance, and more. Compliance with the California Stormwater Best Management Practice New Development and Redevelopment Handbook would ensure that the storm drain system does not increase flooding and erosion potential.

With the implementation of the following mitigation measures, the Project would have a ***less than significant*** impact relative to this topic.

MITIGATION MEASURE(S)

Mitigation Measure 3.5-1: *Prior to any site disturbance, the Project proponent shall submit a Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP) to the RWQCB in accordance with the NPDES General Construction Permit requirements. The SWPPP shall be designed to control pollutant discharges utilizing Best Management Practices (BMPs) and technology to reduce erosion and sediments. BMPs may consist of a wide variety of measures taken to reduce pollutants in stormwater runoff from the Project site. Measures shall include temporary erosion control measures (such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover) that will be employed to control erosion from disturbed areas. Final selection of BMPs will be subject to approval by the City of Rancho Cordova and the RWQCB. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the RWQCB.*

Impact 3.5-3: The Project has the potential to be located on a geologic unit or soil that is unstable, or that would become unstable as a result of Project implementation, and potentially result in landslide, lateral spreading, subsidence, liquefaction or collapse (Less than Significant with Mitigation)

The on-site soils include: Fiddyment fine sandy loam, 1-8% slopes; Hicksville gravelly loam, 0-2% slopes; Red Bluff-Redding complex, 0-5% slopes; Redding loam, 2-8% slopes; and Redding gravelly loam, 0-8% slopes, MLRA 17. These soils are well or moderately well drained with very slow to slow permeability. According to the NRCS Web Soil Survey, these soils are rated as “somewhat limited” for development of dwellings and commercial buildings.

LANDSLIDES

Landslides include rockfalls, deep slope failure, and shallow slope failure. Factors such as the geological conditions, drainage, slope, vegetation, and others directly affect the potential for landslides. One of the most common causes of landslides is construction activity that is associated with road building (i.e. cut and fill). The potential for landslides is considered remote in the Sacramento Valley floors due to the lack of significant slopes. For this reason, the probability of landslides occurring on the Project site is low.

LATERAL SPREADING

Lateral spreading typically results when ground shaking moves soil toward an area where the soil integrity is weak or unsupported, and it typically occurs on the surface of a slope, although it does not occur strictly on steep slopes. Oftentimes, lateral spreading is directly associated with areas of liquefaction. Areas in the region that are susceptible to this hazard are located along creeks or open water bodies, or within the foothills to the west. The potential for lateral spreading to occur during or after seismic events is considered to be low due to the distance of active faults from the Project site.

SUBSIDENCE

Sacramento County is affected by five causes of land subsidence: 1) compaction of unconsolidated soils from earthquakes; 2) compaction by heavy structures; 3) erosion of peat soils; 4) peat oxidation; and 5) groundwater withdrawal. Minor land subsidence was observed and recorded in the County between 1912 and the mid-1960's for all groundwater basins underlying the County. However, subsidence did not exceed 0.40-feet during this time frame. The Project site contains creek banks, and areas of low soil bearing strength. According to the City's General Plan EIR, the likeliness of subsidence in the City's Planning Area is considered very low.

LIQUEFACTION

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sands. It is unlikely that soils on the Project site would be subject to liquefaction in the event of an earthquake because the Project site is underlain by relatively stable Pleistocene-age soils, and the potential seismic sources are a relatively long distance away.

According to the Geotechnical Engineering Report prepared for the Project site (Wallace-Kuhl, 2016), groundwater at the site is greater than 50 feet below grades, and saturated soils were not encountered during site exploration activities. Soils will likely remain unsaturated during the majority of the year, and are thus not considered susceptible to liquefaction. The silty sands, and sands are susceptible to seismic compression. While liquefaction potential at the site is considered very low, there is the potential for some limited settlement associated with the potential for low to moderate ground shaking that could occur at the site. The Preliminary Geotechnical Engineering Report recommended that the expected total and differential settlements of soil be evaluated in more detail in the final geotechnical engineering report.

CORROSIVITY

The California Department of Transportation Corrosion and Structural Concrete Field Investigation Branch, 2012 Corrosion Guidelines, considers a site to be corrosive to foundation elements if one or more of the following conditions exists for the representative soil and/or water samples taken: has a chloride concentration greater than or equal to 500 parts per million (ppm), sulfate concentration greater than or equal to 2000 ppm, or a pH of 5.5 or less (Caltrans, 2012). The Preliminary Geotechnical Engineering Report prepared for the Project identified soil corrosivity testing results for the Project site, which included a pH of 5.22 for the soil sample tested. While the chloride and sulfate levels (6.5 and 1.9 ppm, respectively) were well below the levels identified for corrosivity concerns, the pH of the Project site is considered potentially corrosive based on the California Department of Transportation 2012 Corrosion Guidelines.

CONCLUSION

While the potential for landslides, lateral spreading, subsidence, and liquefaction are low at the site, the potential for soils instability associated with settlement to occur associated with potential groundshaking and the corrosivity is a potentially significant impact. Mitigation Measure 3.5-2 below would be required to address this impact once design-level details (i.e., foundation planning and lot layouts) are available for future phases of the Project. This mitigation measure would mitigate this potential impact related to unstable soils because the design-level geotechnical engineering report would include compaction and subgrade specifications for the site-specific soil conditions. The soil and groundwater conditions would be determined through laboratory test data and exploration data to be completed by a licensed Geotechnical Engineer. Overall, it was determined that the Project site was suitable for the proposed types of development, and with implementation of the following mitigation measure, the proposed Project would have a ***less than significant*** impact relative to this topic.

MITIGATION MEASURE(S)

Mitigation Measure 3.5-2*: Prior to final design approval and issuance of building permits for each phase of the Project, the Project applicant shall submit to the City of Rancho Cordova Building and Safety Division, for review and approval, a design-level geotechnical engineering report produced by a California Registered Civil Engineer or Geotechnical Engineer. The design-level report shall address, at a minimum, the following:*

- *Compaction specifications and subgrade preparation for onsite soils;*
- *Structural foundations, including concrete design that addresses potential soils corrosivity;*
- *Grading practices; and*
- *Expansive/unstable soils.*

The design-level geotechnical engineering report shall include a summary of the site, soil, and groundwater conditions, seismicity, laboratory test data, exploration data and a site plan showing exploratory locations and improvement limits. The report shall include borings/test pits for park sites and include recommendations for park site development, including the potential to amend soils, if necessary, during the preliminary grading of the Project site during the first phase of *construction activities. The report shall be signed by a licensed California Geotechnical Engineer. Design-level recommendations shall be included in the foundation and improvement plans and approved by the City of Rancho Cordova Public Works Department prior to issuance of any building permits.*

Impact 3.5-4: The Project would not be located on expansive soil creating substantial risks to life or property (Less than Significant)

Expansive soils are those that undergo volume changes as moisture content fluctuates; swelling substantially when wet or shrinking when dry. Soil expansion can damage structures by cracking foundations, causing settlement and distorting structural elements. Expansion is a typical characteristic of clay-type soils. Expansive soils shrink and swell in volume during changes in moisture content, such as a result of seasonal rain events, and can cause damage to foundations, concrete slabs, roadway improvements, and pavement sections.

As shown in Figure 3.5-3, the expansive potential of the Project site soils is low. According to the Geotechnical Engineering Report prepared for the Project site (Wallace-Kuhl, 2016), laboratory test results performed on Project site soil samples collected in the upper two to three feet indicate that these soils typically have a plasticity index of less than 15 and can be considered to have a low expansion potential. The soils beneath about two feet typically have a plasticity index of greater than 15, and should be considered to have a low to moderate expansion potential. Additional testing of the clay and silty/clay should be conducted to confirm the expansive potential of this soil layer prior to final design. These soils were typically encountered in the northwestern area of the property, with the presence of these soils less prominent to the south and east.

Implementation of Mitigation Measure 3.5-2 requires submittal of a design-level geotechnical engineering report which will include geotechnical recommendations to address the potential effects of the expansive clays present on the Project site. Implementation of the Mitigation Measure 3.5-2 would ensure that the Project would have a ***less than significant*** impact relative to this topic.

Impact 3.5-5: Project implementation has the potential to directly or indirectly destroy a unique paleontological resource (Less than Significant with Mitigation)

The field surveys conducted for the Project did not reveal any surface evidence of paleontological resources on the Project site. The Project site is not expected to contain subsurface paleontological resources; however, it is possible that undiscovered paleontological resources could be encountered during ground-disturbing activities.

Damage to or destruction of a paleontological resource would be considered a potentially significant impact under local, state, or federal criteria. Implementation of Mitigation Measure 3.5-3 would ensure steps would be taken to reduce impacts to paleontological resources in the event that they are discovered during construction. This mitigation measure would reduce this impact to a ***less-than-significant*** level.

MITIGATION MEASURE(S)

Mitigation Measure 3.5-3: *If any paleontological resources are found during grading and construction activities, all work shall be halted immediately within a 200-foot radius of the discovery until a qualified paleontologist has evaluated the find.*

Work shall not continue at the discovery site until the paleontologist evaluates the find and makes a determination regarding the significance of the resource and identifies recommendations for conservation of the resource, including preserving in place or relocating on the Project site, if feasible, or collecting the resource to the extent feasible and documenting the find with the University of California Museum of Paleontology.

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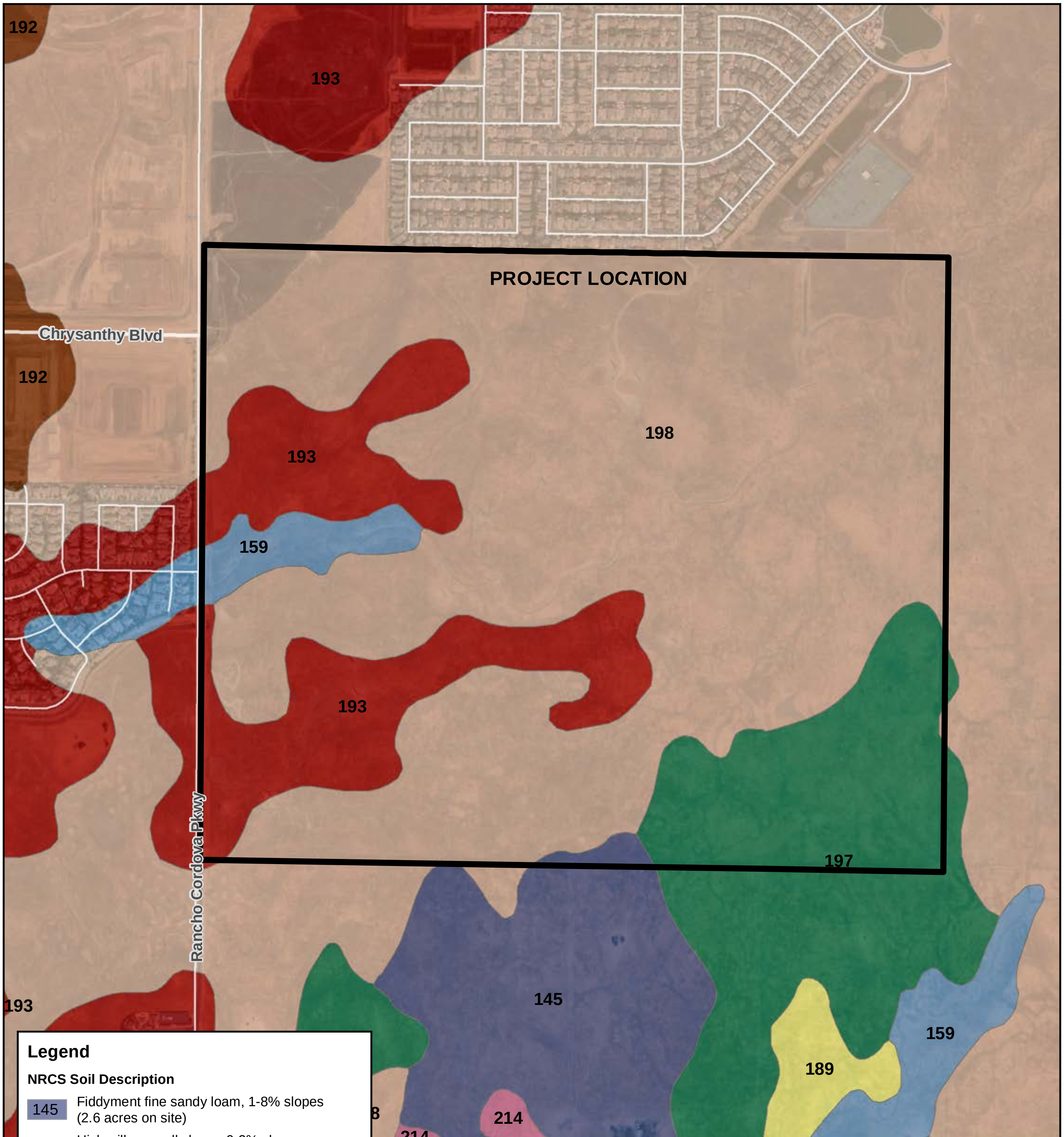

Legend

NRCS Soil Description

145	Fiddyment fine sandy loam, 1-8% slopes (2.6 acres on site)
159	Hicksville gravelly loam, 0-2% slopes, occasionally flooded (12.41 acres on site)
189	Peters clay, 1-8% slopes
192	Red Bluff loam, 2-5% slopes
193	Red Bluff-Redding complex, 0-5% slopes (85.18 acres on site)
197	Redding loam, 2-8% slopes (57.90 acres on site)
198	Redding gravelly loam, 0-8% slopes, MLRA 17 (370.39 acres on site)
214	San Joaquin silt loam, 0-3% slopes

Data sources: Sacramento County GIS; ArcGIS Online World Imagery Map Service. NRCS Web Soil Survey, Sacramento County, California (CA067). Map date: July 16, 2018.

0 400 800
Feet
1:12,000

THE RANCH
SACRAMENTO COUNTY, CALIFORNIA

Figure 3.5-1. Project Site Soils

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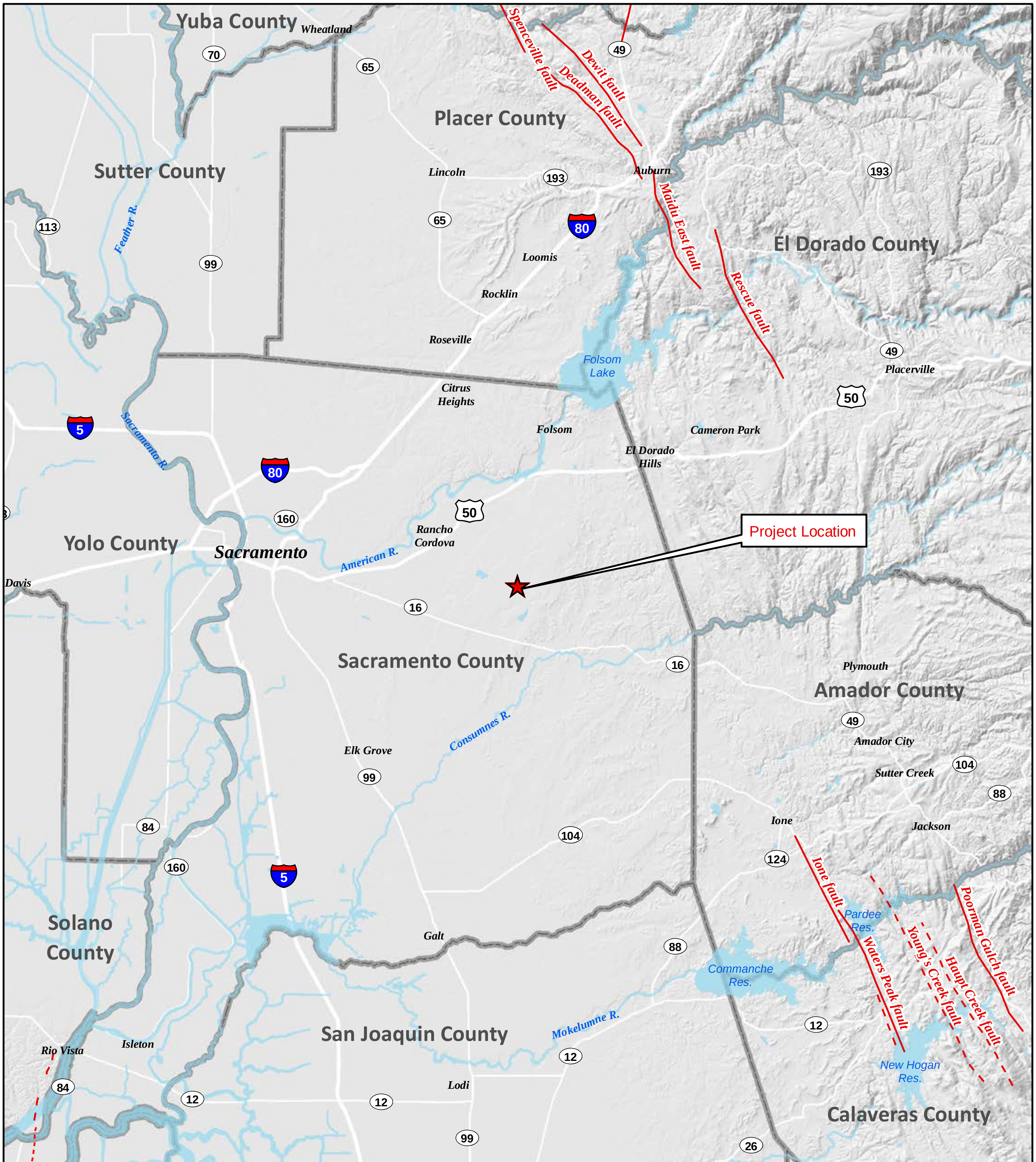

Legend

Quaternary Faults

Well-constrained

Moderately-constrained

Inferred

N

0 2½ 5

Miles

Data sources: US Geologic Survey; CalAtlas; Open Streets. Map date: July 16, 2018.

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Figure 3.5-2. Known Faults in the Project Area

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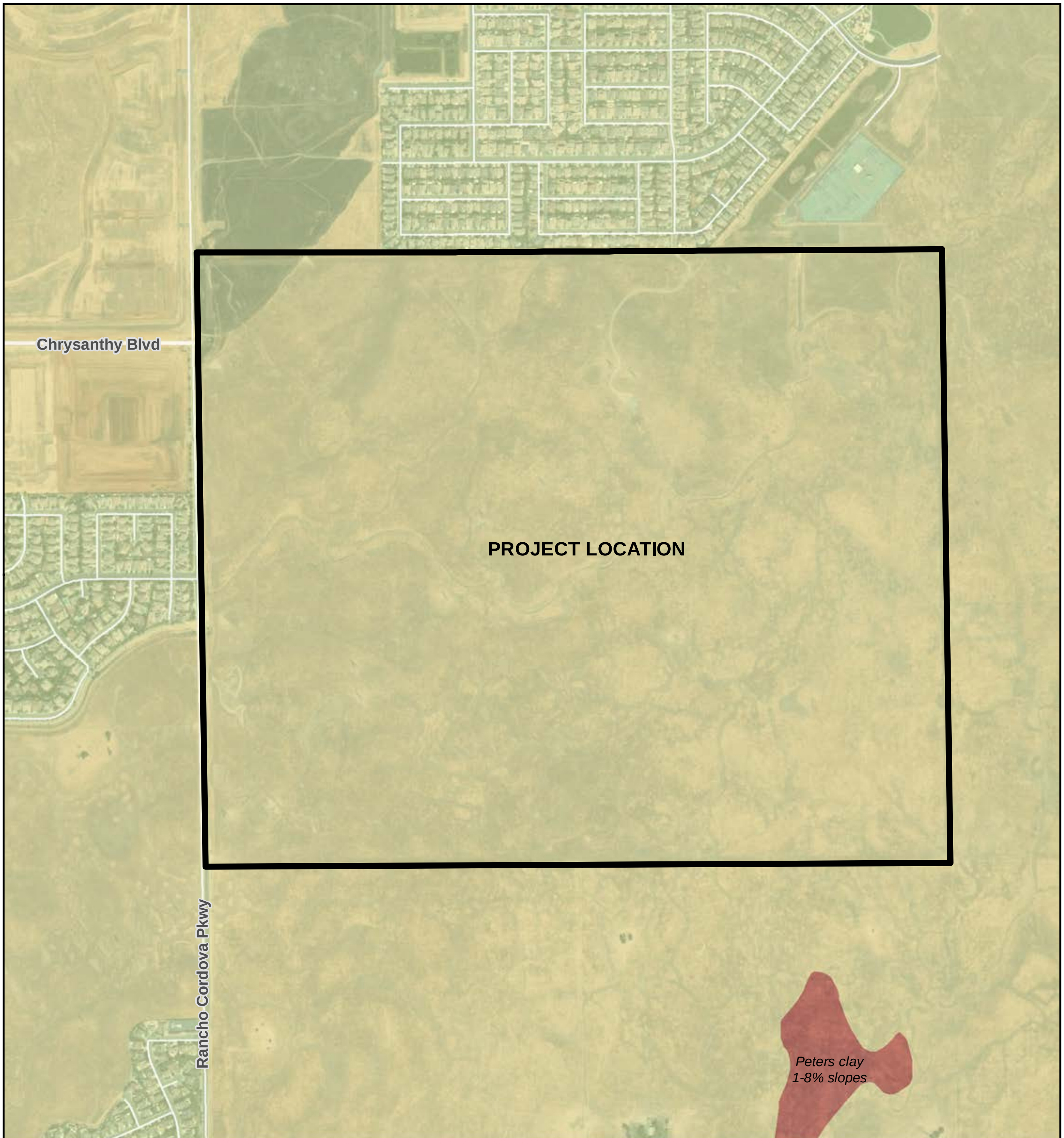

Legend

Shrink-Swell Potential*

Low Potential

High Potential

**Shrink-Swell Potential is determined by linear extensibility. Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Soils are considered to have low potential when the linear extensibility is less than 3%, moderate if 3-6%, high if 6-9%, and very high if greater than 9%.*

Data sources: Sacramento County GIS; ArcGIS Online World Imagery Map Service. NRCS Web Soil Survey, Sacramento County, California (CA067). Map date: July 16, 2018.

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Figure 3.5-3. Shrink-Swell Potential of Soils

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