Appendix F

Geology and Soils
For
The Preserve
Grant Line Road and Raymer Way
Rancho Cordova, California

Project No. E17440.001
June 2019

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35 YEARS

Project E17440.001
26 June 2019

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Attention: Mr. George Carpenter

Subject: **THE PRESERVE, GRANT LINE ROAD AND RAYMER WAY**
Rancho Cordova, California
Geology and Soils for Environmental Impact Report

References: (at end of document)

Dear Mr. Carpenter:

With your authorization of 25 April 2019, Youngdahl Consulting Group, Inc. has completed an evaluation of potential impacts detailed on the Geology and Soils section of the California Environmental Quality Act Appendix G Environmental Checklist Form. Section VI of this forms starts with the statement "Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving" and then lists categories ranging from fault rupture to soils inadequate for septic systems. This document addresses each item on this list pertaining to geology and soils as well as mineral resources. This report does not address paleontological resources.

If you have any questions regarding this information, please contact us.

Very truly yours,
Youngdahl Consulting Group, Inc.

CERTIFIED ENGINEERING GEOLOGIST
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STATE OF CALIFORNIA

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Geology and Soils
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Rancho Cordova, California

1.0 Geology and Soils

This report identifies existing soil and geologic conditions and analyzes the potential for the proposed project to affect these resources. Information presented in the discussion and subsequent analysis was primarily drawn from the following sources:

- Geotechnical Engineering Report, Grantline Properties, (Wallace-Kuhl & Associates, Inc. 2004).
- Regional geologic maps and fault maps prepared by the California Department of Conservation's California Geological Survey (formerly the Division of Mines and Geology), the United States Geological Survey, and the California Department of Water Resources.
- Soil maps and information provided by the United States Department of Agriculture, Natural Resources Conservation Service.

Specific reference information is provided in Section 3 of this report.

1.1 Regional Geologic Framework

The Preserve is located within the northern portion of the Sacramento Valley, which, together with the San Joaquin Valley, comprises the Great Valley geomorphic province (California Geological Survey, 2002). The Great Valley is a forearc basin composed of thousands of feet of sedimentary deposits that has undergone periods of subsidence and uplift over millions of years (USGS, 1990). The Great Valley basin began to form during the Jurassic period as the Pacific oceanic plate was subducted underneath the adjacent North American continental plate (Howard, 1979). The subduction zone and associated trench shifted 80 miles seaward to the present location of the Coast Ranges, and a new trench formed offshore; buckling at the edge of the new continent creating a forearc basin. In the western portion of the Great Valley, Upper Jurassic to Upper Cretaceous rock sequences rest on Upper Jurassic oceanic crust sequences (USGS, 1990). In contrast, the eastern portion of the Great Valley is composed of shallow Pleistocene nonmarine deposits. These deposits overly Cenozoic deposits that cover a layer of Cretaceous marine/deltaic deposits, which in turn rests on the metamorphic and igneous rocks of the Sierra Nevada—the western edge of the continental margin (California Geological Survey, 1987).

During the Jurassic and Cretaceous periods of the Mesozoic era, the area of the Great Valley existed as a marine depositional environment. By the end of the Mesozoic, the northern portion of the Great Valley began to fill with considerable granitic debris as tectonic forces caused uplift of the basin (Howard, 1979).

The following formations were deposited in the Cenozoic Era:

The Ione Formation was deposited in the Eocene Age at the edge of an inland sea. In the Micoene, depositions of the Mehrten Formation (mostly dark andesitic sands, occasional conglomerate lenses, and reworked ash beds) occurred in the Sacramento Valley. Deposition of the Mehrten Formation continued into the early Pliocene era (Howard, 1979).

The Laguna Formation was deposited in the Sacramento Valley starting in the Pliocene era, continuing into the early Pleistocene era (Howard, 1979). The Laguna is composed of tan to brown, volcanic rich sediments, with grain sizes ranging from clay to silt and sand; with minor granitic and metamorphic input. The Fair Oaks Formation is composed of light brown granitic sands rich in quartz and biotite with some silt and clay present north of the American River, deposited from Pliocene into the early Pleistocene eras, on top of the Laguna Formation.

The Arroyo Seco Gravels are rounded gravels with a red matrix derived from granite, and with clasts that are mainly metamorphic and andesitic pebbles and cobbles; this unit was deposited in the Pleistocene era and forms a caprock in the Sacramento area (Department of Water Resources, 1974). The California Geological Survey classifies these materials as Turlock Lake Formation. The Victor Formation, unconsolidated gravel, sand, silt and clay from a granitic source was deposited (DWR, 1974). The Modesto Formation, consisting of unconsolidated gravels, sand, silt, and clay from a granitic source was deposited largely near stream channels in the late Pleistocene Era (Association of Engineering Geologists, 2001).

In the Holocene era, after the last glaciation, stream flows dropped and streams became undersized compared to the valleys, with alluvium consisting of unconsolidated gravel, sand, silt, and clay, deposited along stream channels (Shlemon, et al, 2000).

Most of the surface of the Great Valley is covered with Holocene and Pleistocene-age alluvium. This alluvium is composed of sediments from the Sierra Nevada to the east and the Coast Range to the west, which were carried by water and deposited on the valley floor. Siltstone, claystone, and sandstone are the primary types of sedimentary deposits.

1.2 Geologic Setting

The California Geological Survey has the Preserve area mapped as being underlain by the Pliocene Age Laguna Formation and some Quaternary Age Alluvium (California Geological Survey, 2011).

1.3 Project Area Topography

The topography of the Preserve is generally flat with elevations ranging from approximately 220 feet above mean sea level, where Morrison Creek leaves the property, to approximately 255 feet at the high point along the north boundary.

1.4 Project Area Geology

The Preserve is underlain by the aforementioned Cretaceous Period marine/deltaic deposits, the Ione Formation, the Mehrten Formation, and the Laguna Formation, with some alluvium. The Department of Water Resources (DWR, 1974) provides a geologic cross section just south of the Preserve presenting the aforementioned formations and water bearing zones, with Arroyo Seco Gravels indicated in the topmost 20 to 50 feet. The Arroyo Seco Gravels are not shown on the California Geological Survey Map of 2011.

1.5 Soils

1.5.1 Surface Soils

The soils in the area have been mapped by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) and are described in their online web-based database (websoilsurvey.sc.egov.usda.gov) accessed on 7 June 2019. Soils in the Preserve are shown on the soil map in Appendix A, which contains the Custom Soil Resource Report. These soil characteristics are summarized on Table 1.

According to the Soil Resource Report, there are four individual soil map units within the Preserve area. These include the Hicksville gravely loam, 0-2 percent slopes comprising approximately 21.4 percent of the project area; the Red Bluff loam, 2 to 5 percent slopes and comprises approximately 7.2 percent of the project area; the Red Bluff-Redding complex, 0 to 5 percent slopes and comprises about 38.3 percent of the project area,; and the Redding gravely loam, 0 to 8 percent slopes and comprises approximately 33.1 percent of the project area.

The Hicksville gravelly loam, 0 to 2 percent slopes, extends to a depth of approximately 65 inches and is moderately well drained. Its parent material is alluvium. Typically, the surface layer is gravelly loam about 13 inches thick. The subsoil is gravelly clay loam from 13 to 43 inches, and stratified very gravelly sandy loam to clay loam, from 43 to 65 inches.

The Red Bluff loam, 2 to 5 percent slopes, extends to a depth of approximately 68 inches and is well drained. Its parent material is alluvium. Typically, the surface layer is loam about 8 inches thick. The subsoil is clay loam from 8 to 43 inches and gravely clay loam from about 43 to 68 inches.

The Red Bluff-Redding complex, 0 to 5 percent slopes, extends to a depth of approximately 68 inches and is well drained. Typically, the surface layer is loam about 8 inches thick. The subsoil is clay loam from approximately 8 to 43 inches, and is gravelly clay loam from about 43 to 68 inches.

The Redding gravelly loam, 0 to 8 percent slopes, extends to a depth of approximately 35 inches and is moderately well drained. The surface layer is typically gravelly loam about 8 inches in thickness. The subsoil is gravelly loam from about 8 to 19 inches, clay from approximately 19 to 22 inches, and cemented gravelly material from around 22 to 35 inches.

Table 1 – Soil Characteristics

Soil Map Unit	Map Unit Symbol	Shrink-Swell Potential[1]	Permeability[2]	Water Erosion Hazard (Factor K)[3]	Wind Erosion Hazard[4]	Runoff Rating[5]	Concrete Corrosivity	Steel Corrosivity	Limitations for buildings and Roads
Hicksville gravely loam, 0 – 2 percent slopes	159	0.31	Moderately High	0.17	7	C/D	Low	High	Very limited, flooding, shrink-swell
Red Bluff Loam, 2 to 5 percent slopes	192	0.50	Moderately High	0.37	6	C	Moderate	High	Somewhat limited, shrink-swell
Red Bluff-Redding complex, 0 to 5 percent slopes	193	0.50	Moderately High	0.37	6	C	Moderate	High	Somewhat limited, shrink-swell
Redding gravelly loam, 0 to 8 percent slopes	198	0.99	Moderately High	0.28	6	D	Moderate	High	Somewhat limited, depth to saturated zone

[1] The NRCS online soil database uses 0 – 1 values to describe factors such as shrink-swell potential with 0 being very low and 1.0 being very high.
[2] NRCS Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water based on NRCS class limits.
[3] Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). 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.
[4]A wind erodibility group (WEG) consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.
[5] Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows: Group A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. Group B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Group C soils have a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission. Group D soils have a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

1.5.2 Subsurface Conditions

Based on a subsurface exploration program conducted by Wallace-Kuhl & Associates (2004), subsurface soil conditions in the Preserve area consisted of a heterogenous mixture of materials. Soils were observed to consist of clayey silty sands, clayey sands, clayey sandy silts, and silty sandy clays (as categorized using the Unified Soil Classification versus the United States Department of Agriculture Classification used by the NRCS) containing varying amounts of gravel from the surface to a depth of about two to four feet below the existing ground surface. In some areas, these soils extended to depths of as much as 10 feet. Underlying these relatively fine-grained soils were clayey and silty, gravel and cobbles to maximum 11-foot depth of exploration.

According to the California Department of Water Resources Water Data Library Web Site, the ground elevation in Well 385707N1211868W001 located approximately ½-mile southeast of the Preserve area was at an elevation of approximately 76 feet above mean sea level, about 185 below the ground surface, in April of 2019.

1.5.3 Soil Corrosion Potential

Wallace-Kuhl & Associates (2004) submitted two soil samples for corrosivity analyses that included determination of the soil pH, minimum resistivity, and chloride and sulfate concentrations. Their findings were that the native soils are not unusually corrosive to steel reinforcement properly embedded within Portland cement concrete but may be potential corrosive to buried metal pipe. They concluded that, based upon the chloride and sulfate concentrations, ordinary Type I/II Portland cement is considered to be suitable for use on this project, assuming minimum concrete cover is maintained over steel reinforcement.

1.5.4 Naturally Occurring Asbestos

The California Code of Regulations, Section 93105, regulates construction and mining in materials containing naturally occurring asbestos. The Sacramento Metropolitan Air Quality Management District has designated parcels in Eastern Sacramento County to be in a zone subject to this regulation based upon geologic mapping by the California Geological Survey. The Preserve area is **not** within one of these mapped zones and is therefore not subject to regulations regarding naturally occurring asbestos.

1.6 Seismicity and Faults

Primary Seismic Hazards

<u>Surface Rupture and Faulting</u>

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) is to regulate development near active faults to mitigate the hazard of surface rupture. Faults in an Alquist-Priolo Zone are typically active faults. The Alquist-Act defines an active fault as one that has exhibited surface displacement within the Holocene epoch (the last 11,000 years; a late Quaternary fault as one that has had surface displacement within the past 700,000 years, a Quaternary fault (age undifferentiated) is a fault that has shown surface displacement at some point during quaternary time (the past 1.6 million years); and pre-Quaternary fault is one that has had surface displacement before the Quaternary period (California Geological Survey, 2018).

According to the California Geological Survey (2010), there are no mapped faults within or near the Preserve area. Wallace-Kuhl & Associates, Inc. (2004) did not address the seismicity of the Preserve area.

The nearest mapped potentially active and active faults pertinent to the site are summarized in the following table.

Table 2: Local Active and Potentially Active Faults within a 100-Kilometer Radius of the Preserve Area

Status	Fault Name	Distance, Direction	
Active	Dunnigan Hills	62 km	NW
Active	Green Valley Fault	95 km	W
Active	Cordelia Fault	92 km	W
Late Quaternary	Bear Mountains Fault Zone - West	15 km	E
Late Quaternary	Bear Mountains Fault Zone - East	23 km	E
Quaternary (age undifferentiated)	Maidu Fault	28 km	NE
Late Quaternary	Melones - West	28 km	E
Late Quaternary	Melones - East	31 km	E

km = kilometer, W = west, E = east, NE = northeast

A total of eight faults and/or fault zones were identified as potential seismic sources within a 100-kilometer (km) radius of the Preserve area. The ones expected to have the greatest impact due to their proximity to the Preserve area are faults associated with the Foothills fault system. The foothills Fault System is located along the western flank of the Sierra Nevada. The most recent event on the Foothills fault system was the 1975 Oroville earthquake (magnitude 5.6 on the moment magnitude scale).

1.6.1 Ground Shaking Hazard

The intensity of ground shaking resulting from an earthquake is a function of the size (energy release) of the earthquake, the duration of the energy release, the distance from the subject location, and the ability of the geologic materials to transmit the energy. In general, the greater the energy release and the closer the center of release (epicenter) to the site, the greater the intensity of the ground shaking. Different soils will respond differently ground shaking; with strong enough ground shaking, buildings can be damaged, slopes can fail, and when saturated sands are present, liquefaction can occur.

Earthquake magnitude is generally expressed as Richter Magnitude for earthquakes less than 4.0 magnitude and Moment Magnitude for earthquakes greater than 4.0 magnitude. Earthquake size, as measured by the Richter Scale is a well-known, but not well understood, concept (USGS website, accessed 11 June 2019). The idea of a logarithmic earthquake magnitude scale was first developed by Charles Richter in the 1930's for measuring the size of earthquakes occurring in southern California using relatively high-frequency data from nearby seismograph stations. This magnitude scale was referred to as ML, with the L standing for local. This is what was to eventually become known as the Richter magnitude.

As more seismograph stations were installed around the world, it became apparent that the method developed by Richter was strictly valid only for certain frequency and distance ranges. In order to take advantage of the growing number of globally distributed seismograph stations, new magnitude scales that are an extension of Richter's original idea were developed. These include body wave magnitude (Mb) and surface wave magnitude (Ms). Each is valid for a particular frequency range and type of seismic signal. In its range of validity, each is equivalent to the Richter magnitude.

Because of the limitations of all three magnitude scales (ML, Mb, and Ms), a new, more uniformly applicable extension of the magnitude scale, known as moment magnitude, or Mw, was developed. In particular, for very large earthquakes, moment magnitude gives the most reliable estimate of earthquake size.

Moment is a physical quantity proportional to the slip on the fault multiplied by the area of the fault surface that slips; it is related to the total energy released in the earthquake. The moment can be estimated from seismograms (and also from geodetic measurements). The moment is then converted into a number similar to other earthquake magnitudes by a standard formula. The result is called the moment magnitude. The moment magnitude provides an estimate of earthquake size that is valid over the complete range of magnitudes, a characteristic that was lacking in other magnitude scales.

Ground shaking is described using two methods: ground acceleration as a fraction of the acceleration of gravity, expressed in units of "g", and the Modified Mercalli scale, which is a descriptive method using 12 levels of intensity denoted by Roman Numerals. Modified Mercalli intensities range from I (shaking that is not felt), to XII (total damage).

The Preserve area is in a region of California characterized by low historical seismic activity and a low ground-shaking hazard. The 2017 amended County of Sacramento General Plan Safety element shows the project to be in an area of nearly the lowest ground shaking potential. The California Office of Statewide Planning and Health Development (OSHPD) online calculator accesses Unite States Geological Survey data to estimate ground motions and provided an estimated maximum credible earthquake (MCE) ground acceleration of 0.161 g for the Preserve area assuming a site class of D for stiff soils (Appendix B).

Secondary Seismic Hazards

<u>Liquefaction and Associated Hazards</u>
Liquefaction is the sudden loss of soil shear strength and sudden increase in porewater pressure caused by shear strains, as could result from an earthquake. Research has shown that saturated, loose to medium-dense sands with a silt content less than about 25 percent and located within the top 40 feet are most susceptible to liquefaction and surface rupture/lateral spreading.

The Preserve area is not in a mapped liquefaction zone. The 2017 Amended County of Sacramento General Plan Safety Element (County of Sacramento, 2017) shows the Preserve to be in an area with a medium to high potential for subsidence, but this includes impacts from groundwater extraction as well as from shaking.

Due to the absence of permanently elevated groundwater table and the relatively low seismicity of the area, the potential for seismically induced damage due to liquefaction, surface ruptures, and settlement is considered minimal.

Seismically induced and Static Slope Failures
The topography of the Preserve Area is gently rolling to flat. The project is not in a mapped landslide zone. There are no significant slopes that could fail.

Other Hazards
Other geologic hazards (volcanic activity, tsunami, seiche, and mudflow) that could be experienced in the larger region are not likely to affect the Preserve.

1.7 Minerals

Under the Surface Mining and Reclamation Act (SMARA), the State Mining and Geology Board may designate certain mineral deposits as being regionally significant to satisfy future needs. The Board's decision to designate an area is based on a classification report prepared by CGS and on input from agencies and the public. The Preserve lies within the designated Sacramento-Fairfield Production-Consumption Region for Portland cement concrete aggregate, which includes all designated lands within the marketing area of the active aggregate operations supplying the Sacramento-Fairfield urban center.

In compliance with SMARA, the California Division of Mines and Geology (CDMG, 1988, 1999) has established the classification system shown in Table 3 to denote both the location and significance of key extractive resources.

Table 3 - California Division of Mines and Geology Mineral Land Classification System

Classification	Description
MRZ-1	Areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence.
MRZ-2	Areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists.
MRZ-3	Areas containing mineral deposits, the significance of which cannot be evaluated from existing data
MRZ-4	Areas where available data are inadequate for placement in any other mineral resource zone
Note: MRZ = Mineral Resource Zone Source: Dupras 1988	

The Preserve area is classified as MRZ-3 for Portland Cement-grade aggregate—an area where the significance of mineral deposits cannot be evaluated from existing data. The California Division of Mines and Geology (1984, 1988, 1999) indicates that the Preserve is classified as either MRZ-3 or MRZ-4 for Placer gold, copper, zinc, and industrial minerals (i.e., carbonate rock, clay, sand, lignite, talc, asbestos). The Preserve is zoned MRZ-1 (no known deposits) for chromite. According to the City of Rancho Cordova General Plan (2006) the Preserve area is not listed as a locally-important mineral resource recovery site.

2.0 Environmental Impacts

Methods of Analysis - Geology, Soils, and Seismicity
Impacts related to geology, soils, and seismicity were evaluated based available data (maps, soil surveys, reports), and professional judgement. This analysis focuses on the proposed project's potential to result in the risk of personal injury, loss of life, and damage to property as a result of existing geologic and geotechnical conditions within the project area.

This analysis of impacts assumes that the project applicant would conform to the latest stormwater pollution prevention requirements, County and other plan policies, standards, and ordinances. This analysis also assumes that geotechnical investigations would be performed to evaluate the potential for the presence of soft and/or loose soils, unstable slopes, surface fault rupture, ground shaking, liquefaction hazard, slope stability, and expansive soils. Additional site-specific analysis would occur prior to final design.

Methods of Analysis - Minerals
The proposed projects potential to affect mineral resources was evaluated by examining the project footprint in comparison to resource locations mapped by the California Geological Survey.

2.1 Thresholds of Significance

In accordance with Appendix G of the State of California's CEQA Guidelines, the proposed project would be considered to have a significant effect if it would result in any of the following conditions:

1) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: (1) rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to division of Mines and Geology Special Publication 42.
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 Chapter 18 of the California Building Code (2016), creating substantial risks to life and property?
5) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?
6) Result in the loss of availability of a known mineral resource that would be of value to regions and the residents of the state?
7) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

2.2 Impacts and Mitigation Measures

Impact GEO-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: (1) rupture of a known

earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42; (2) Strong seismic ground shaking; (3) seismic-related ground failure, including liquefaction; and (4) Landslides (less than significant).

The project area is not identified as being within an Alquist-Priolo Zone. There is no evidence of recent (i.e., Holocene) faulting with the project area and no active faults are mapped at or near the project area (California Geological Survey 2010). This impact would be less than significant.

The project area is an area of low ground shaking hazard. However, a large earthquake on a nearby fault could cause minor ground shaking in the vicinity of the project, potentially resulting in an increased risk of structural loss, injury, or death. Liquefaction and related hazards such as lateral spreading and differential settlement have the potential to compromise the structural integrity of proposed new facilities and cause injury. The construction of the project will fall under the requirements of the California Building Code and any additional requirements of the City of Rancho Cordova. A preliminary geotechnical engineering evaluation has been completed (Wallace-Kuhl & Associates, Inc., 2004) but does not meet the requirements of Chapter 18 of the California Building Code for geotechnical investigations. Detailed geotechnical investigations meeting the requirements of the California Building Code will be required. The investigations will provide foundation design recommendations that will mitigate these impacts. Additionally, the design of structures must consider projected ground accelerations due to earthquakes and must follow California Building Code requirements. Therefore, the impact for ground shaking hazard to result in loss, injury, or death due to liquefaction, dynamic compaction, seismically induced settlement, or lateral spreading is considered to be less than significant.

There are no significant natural slopes in the project area. Slopes may be constructed (i.e. stormwater basins). Slopes will be designed according to California Building Code requirements so the potential for seismically induced slope instability is considered to be negligible. This impact would be less than significant.

To summarize, due to the relatively low seismicity of the area, the requirement to design foundations, structures, and embankments according to California Building Code requirements, which takes into account the projected seismicity, and the lack of significant natural slopes, the potential for seismically induced damage is considered negligible.

Impact GEO-2: Result in substantial soil erosion or the loss of topsoil (less than significant).

Grading, excavation, removal of vegetation cover and loading activities associated with construction could temporarily increase erosion, runoff, and sedimentation. Construction activities could also result in soil compaction and wind erosion effects that could adversely affect soils and reduce the revegetation potential at construction sites and staging areas.

However, requirements under Section 402 of the Federal Clean Water Act, the Construction Activities Storm Water Construction General Permit (Order No. 2009-009-DWQ as amended by 2010-0014-DWQ and 2012-006-DWQ), a Stormwater Pollution Prevention Plan (SWPPP) would be developed by qualified stormwater developers and practitioners and implemented during construction. The SWPPP would be kept onsite during construction activity and made available upon request to representatives of the City or Rancho Cordova, the County of Sacramento, and the Central Valley Regional Water Quality Control Board. The SWPPP would identify pollutant sources that may affect the quality of stormwater associated with construction activity, and identify stormwater pollution prevention measures to be implemented to reduce pollutants in stormwater discharges during and after construction. Therefore, the SWPPP would also include a description of potential pollutants and hazardous materials present on site during construction (including vehicle and equipment fuels). The SWPPP would include details of how the sediment and erosion control practices (best management practices or BMPs) would be implemented. Implementation of the SWPPP would comply with county, state, and federal water quality requirements.

In addition to the SWPPP, adherence to the Sacramento Stormwater Quality Partnership Municipal Stormwater Permit (MS4) would minimize any effects from erosion, runoff, and sedimentation. Accordingly, this impact would be less than significant.

Impact GEO-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 an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse (less than significant).

The topography of the project area is gentle, with no significant slopes. The potential for lateral spreading, subsidence, liquefaction, or collapse will be evaluated by geotechnical studies; these studies will make recommendations for engineering design to mitigate these potential conditions. This impact would be less than significant.

Impact GEO-4: Be located on expansive soil, as defined in Chapter 18 of the California Building Code, creating substantial risks to life or property (less than significant).

The preliminary geotechnical evaluation (Wallace-Kuhl & Associates, Inc., 2004), reported the presence of clay with a moderately high expansion potential and recommend that the proper handling of clay soils will be an important aspect of site development. The NRCS reports soil shrink-swell potentials for the project area to range from 0.31 to 0.99 using a scale of 0 to 1.0 where 1.0 represents a high potential. Expansive soils have the potential to compromise the structural integrity of project features, which could be a significant impact. However, in order to meet California Building Code Chapter 18 requirements, the project applicant's geotechnical engineer will be responsible for conducting final geotechnical evaluations of the on-site soils to further determine the extent of soils with adverse-shrink swell properties prior to grading and construction activities. Based on subsurface conditions, the project applicant's geotechnical engineers will make recommendations for project elements designs to accommodate for the effects of expansive soils. Corrective actions may include excavation of potentially problematic soils during construction and replacement with engineered backfill, ground treatment processes, and direction of surface water away from foundation soils. The projected applicants will select one or more of these measures in consultation with qualified engineers before grading activities begin, ensuring that this impact would be less than significant.

Impact GEO-5: Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater (no impact).

The project would be connected to sewer lines of the local wastewater systems, not septic systems. Therefore, there would be no impact. No mitigation is required.

Impact GEO-6: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state (less than significant).

The Preserve area is classified as MRZ-3 for Portland Cement-grade aggregate—an area where the significance of mineral deposits cannot be evaluated from existing data. The California Division of Mines and Geology (1984, 1988, 1999) indicates that the Preserve is classified as either MRZ-3 or MRZ-4 for Placer gold, copper, zinc, and industrial minerals (i.e., carbonate rock, clay, sand, lignite, talc, asbestos). The Preserve is zoned MRZ-1 (no known deposits) of chromite. According to the City of Rancho Cordova General Plan (2006) the Preserve area is not listed as a locally-important mineral resource recovery site. There are no existing or potential mineral resources identified that would be of value to the region or the residents of the state, and the impact would be less than significant.

Impact GEO-7: Result in the loss of availability of a locally important mineral resource site delineated on a local general plan, specific plan, or other land use plan (no impact).

The City of Rancho Cordova General Plan does not identify any locally important mineral resources within the Preserve area. Also, the project area does not contain any mineral resources that have not been considered in the City of Rancho Cordova General Plan. Since there are no locally important mineral resources or recovery sites identified in this plan there would be no impact.

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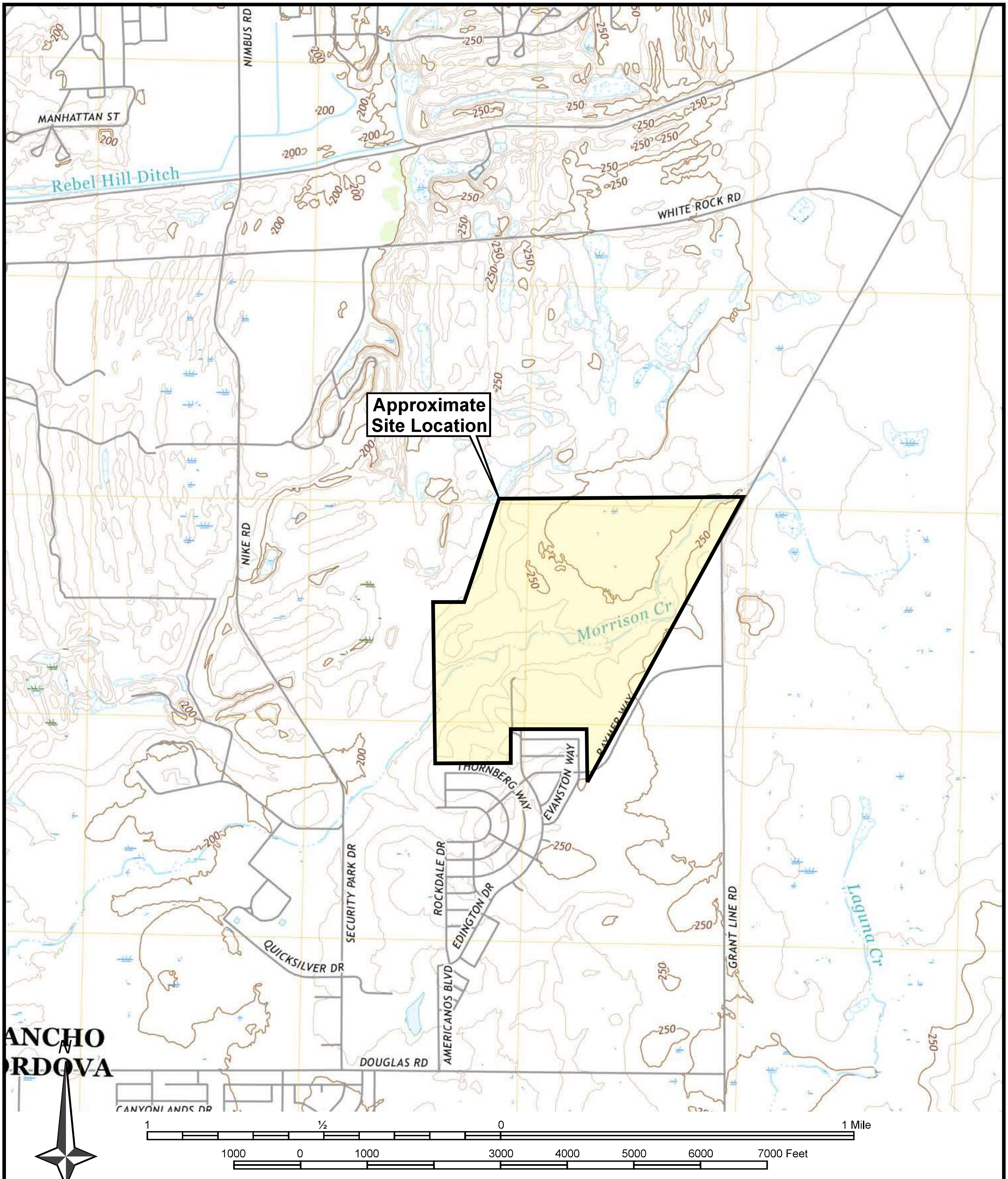
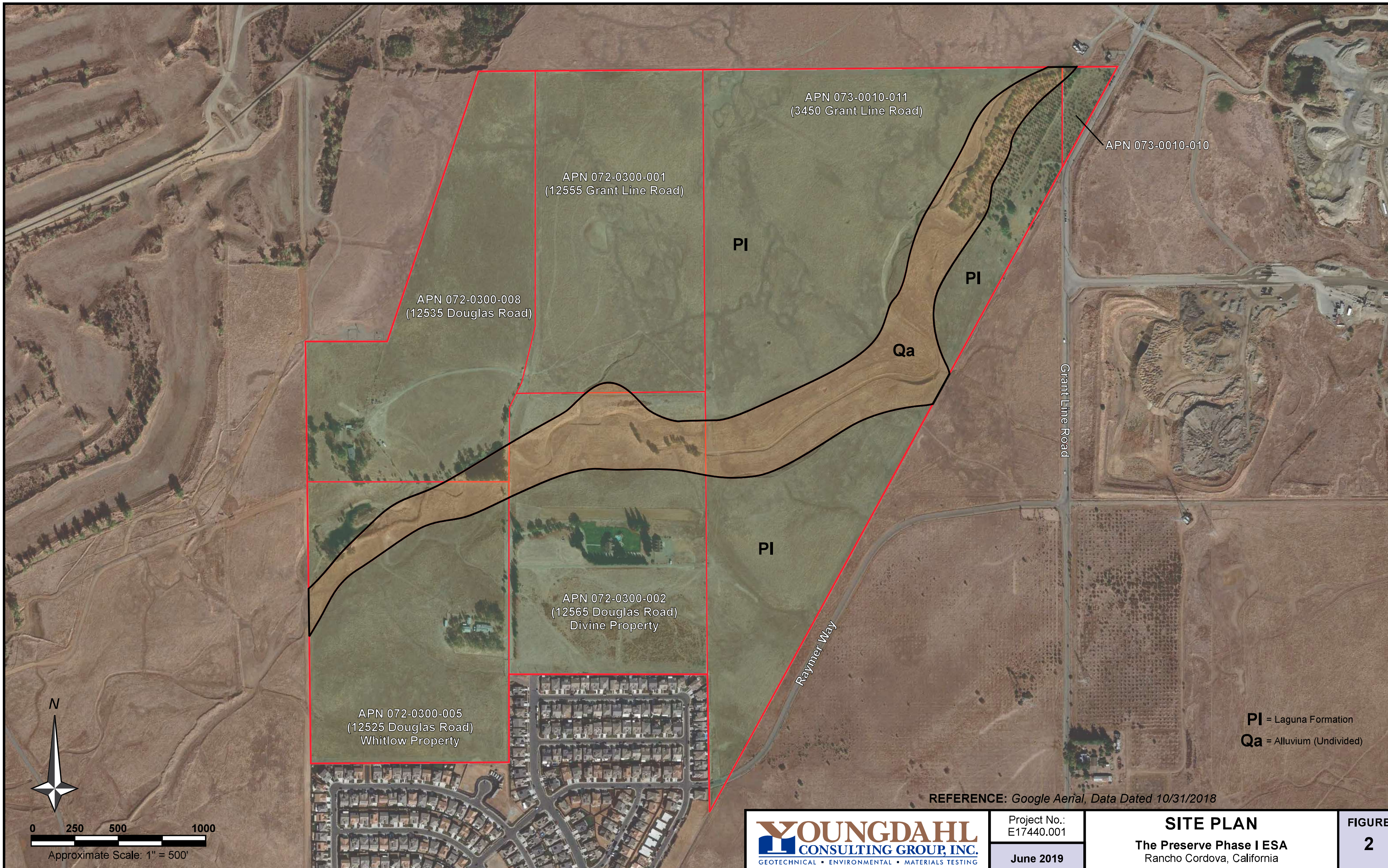
Figures



Scale: 1:24,000

BASE MAP REFERENCE: *U.S.G.S. 7.5 Minute Topographic Series, Buffalo Circle Quadrangle, Dated 2018*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: E17440.001 **June 2019**	**VICINITY MAP** **The Preserve Phase I ESA** Rancho Cordova, California	**FIGURE** **1**



REFERENCE: *Google Aerial, Data Dated 10/31/2018*

YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING

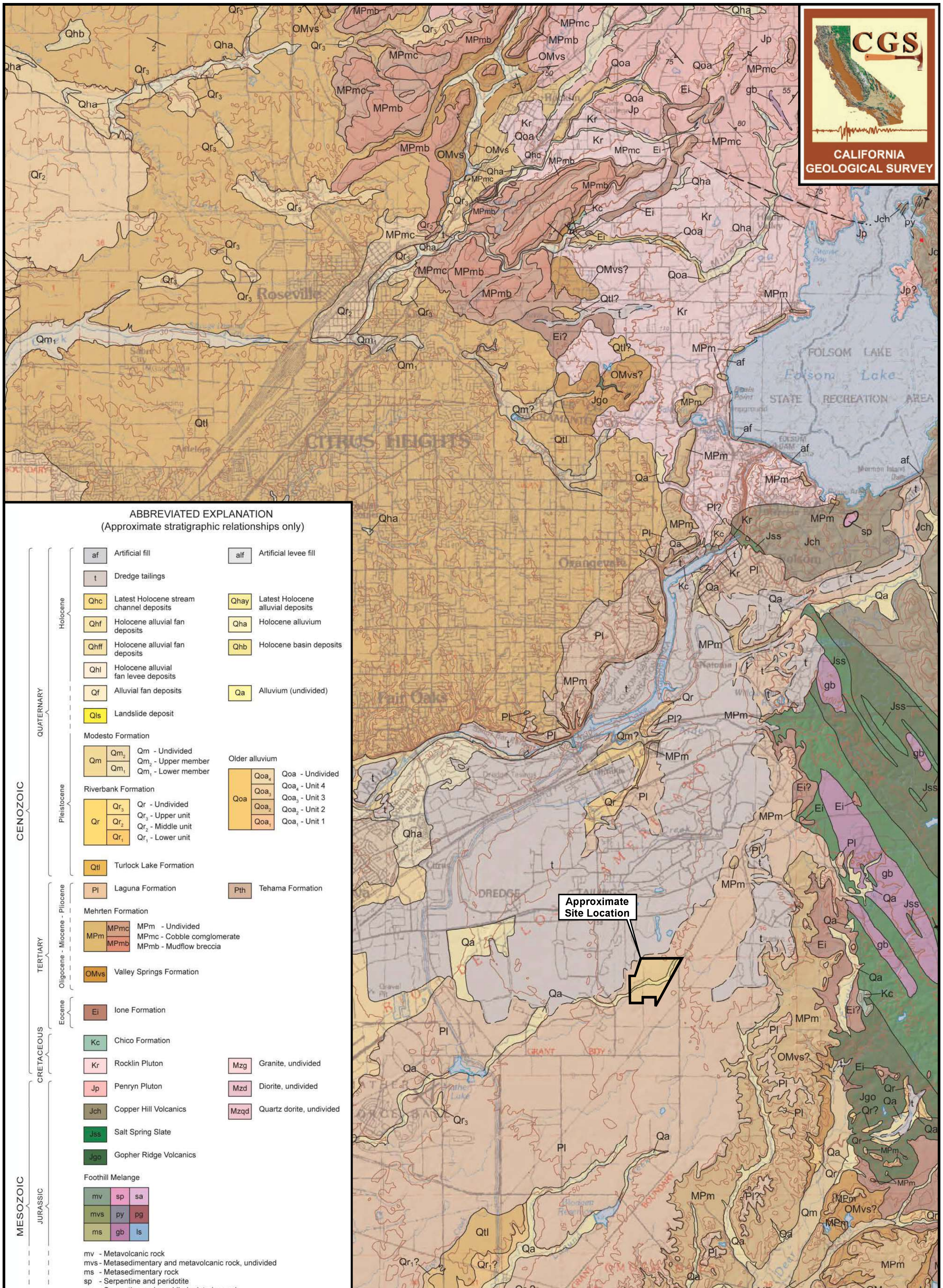
Project No.: E17440.001

June 2019

SITE PLAN

The Preserve Phase I ESA
Rancho Cordova, California

FIGURE 2



ABBREVIATED EXPLANATION
(Approximate stratigraphic relationships only)

CENOZOIC – QUATERNARY – Holocene

- af – Artificial fill
- alf – Artificial levee fill
- t – Dredge tailings
- Qhc – Latest Holocene stream channel deposits
- Qhay – Latest Holocene alluvial deposits
- Qhf – Holocene alluvial fan deposits
- Qha – Holocene alluvium
- Qhff – Holocene alluvial fan deposits
- Qhb – Holocene basin deposits
- Qhl – Holocene alluvial fan levee deposits
- Qf – Alluvial fan deposits
- Qa – Alluvium (undivided)
- Qls – Landslide deposit

Pleistocene

Modesto Formation
- Qm – Undivided
- Qm_2 – Upper member
- Qm_1 – Lower member

Riverbank Formation
- Qr – Undivided
- Qr_3 – Upper unit
- Qr_2 – Middle unit
- Qr_1 – Lower unit

Older alluvium
- Qoa – Undivided
- Qoa_4 – Unit 4
- Qoa_3 – Unit 3
- Qoa_2 – Unit 2
- Qoa_1 – Unit 1

- Qtl – Turlock Lake Formation

TERTIARY – Oligocene - Miocene - Pliocene

- Pl – Laguna Formation
- Pth – Tehama Formation

Mehrten Formation
- MPm – Undivided
- MPmc – Cobble comglomerate
- MPmb – Mudflow breccia

- OMvs – Valley Springs Formation

Eocene

- Ei – Ione Formation

MESOZOIC – CRETACEOUS

- Kc – Chico Formation
- Kr – Rocklin Pluton
- Mzg – Granite, undivided

JURASSIC

- Jp – Penryn Pluton
- Mzd – Diorite, undivided
- Jch – Copper Hill Volcanics
- Mzqd – Quartz dorite, undivided
- Jss – Salt Spring Slate
- Jgo – Gopher Ridge Volcanics

Foothill Melange

mv	sp	sa
mvs	py	pg
ms	gb	ls

- mv - Metavolcanic rock
- mvs - Metasedimentary and metavolcanic rock, undivided
- ms - Metasedimentary rock
- sp - Serpentine and peridotite
- sa - Serpentine and amphibole, interlayered
- py - Pyroxenite and metapyroxenite
- pg - Pyroxenite and gabbro
- gb - Gabbro and metagabbro
- ls - Limestone

SCALE 1:100,000

2 0 2 4 6 Miles

2 0 2 4 6 Kilometers

N

REFERENCE: *Preliminary Geological Map of the Sacramento Quadrangle, California, California Department of Conservation, Carlos I. Gutierrez, Dated 2011*

Contour Interval: 20 meters (approximately 66 feet)
Supplementary Contour Interval: 10 meters (approximately 33 feet)

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E17440.001	**REGIONAL GEOLOGY MAP**	**FIGURE**
	June 2019	**The Preserve Phase I ESA** Rancho Cordova, California	**3**

Appendix A
Custom Soil Resources Report for Sacramento County, California

United States Department of Agriculture

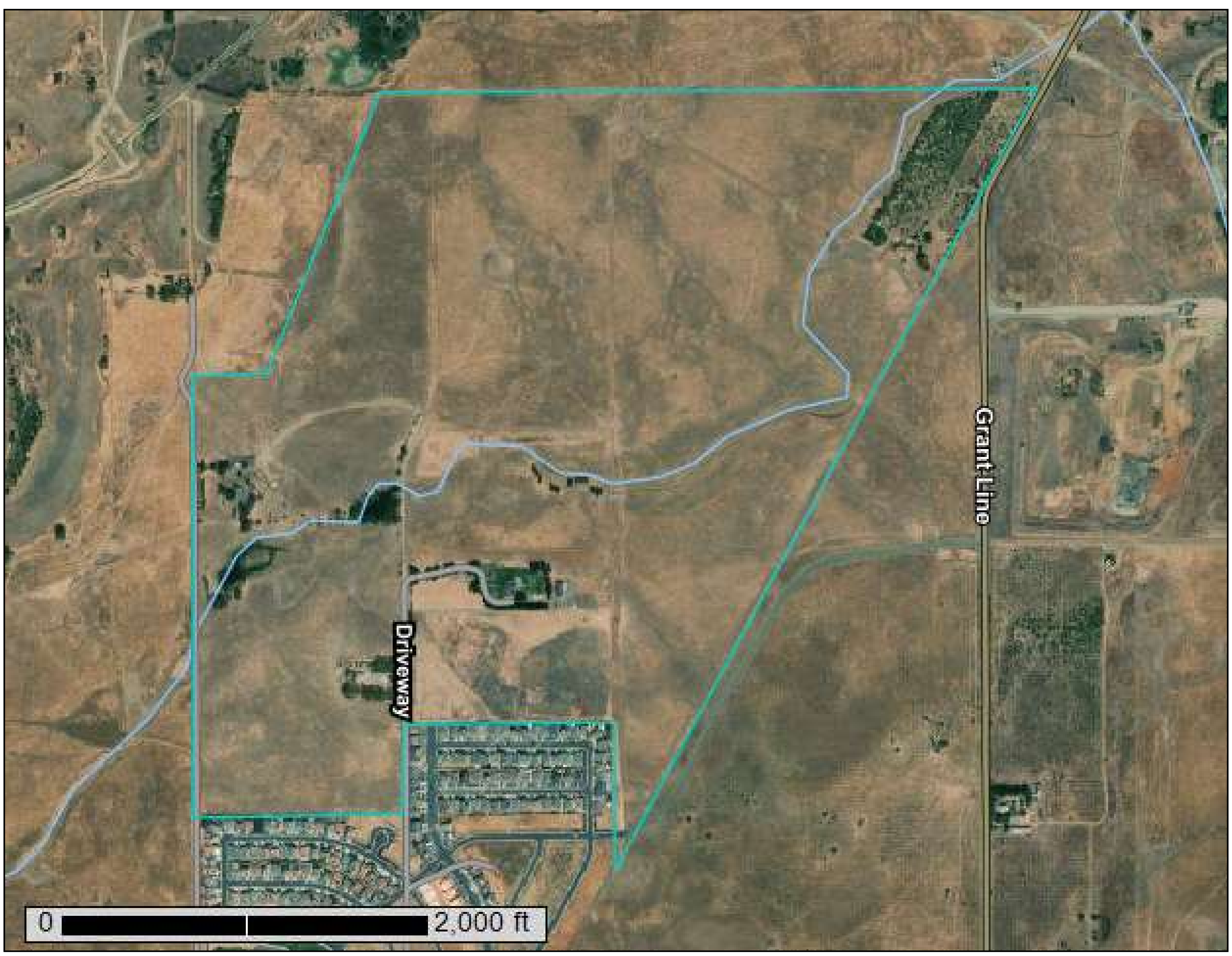
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Sacramento County, California



June 7, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


121° 12' 29" W
121° 10' 50" W
38° 35' 2" N
38° 34' 11" N
656200
656400
656600
656800
657000
657200
657400
657600
657800
658000
658200
658400
4272100
4271900
4271700
4271500
4271300
4271100
4270900
4270700
193
198
192
159
193
192
Grant Line Rd
Grant Line
Driveway
Morrison Creek
Soil Map may not be valid at this scale.
Map Scale: 1:11,000 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 150 300 600 900
Feet
0 500 1000 2000 3000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Sacramento County, California
Survey Area Data: Version 17, Sep 14, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Aug 8, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
159	Hicksville gravelly loam, 0 to 2 percent slopes, occasionally fl ooded	60.4	21.4%
192	Red Bluff loam, 2 to 5 percent slopes	20.4	7.2%
193	Red Bluff-Redding complex, 0 to 5 percent slopes	108.0	38.3%
198	Redding gravelly loam, 0 to 8 percent slopes, MLRA 17	93.4	33.1%
Totals for Area of Interest		**282.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Sacramento County, California

159—Hicksville gravelly loam, 0 to 2 percent slopes, occasionally fl ooded

Map Unit Setting

National map unit symbol: hhn3
Elevation: 80 to 230 feet
Mean annual precipitation: 17 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 250 to 275 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hicksville and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hicksville

Setting

Landform: Terraces, terraces, hills
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Crest, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 13 inches: gravelly loam
H2 - 13 to 43 inches: gravelly clay loam
H3 - 43 to 65 inches: stratified very gravelly sandy loam to clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: LOAM STREAM TERRACE (R017XD081CA)
Hydric soil rating: No

Minor Components

Corning

Percent of map unit: 3 percent

Hydric soil rating: No

Creviscreek

Percent of map unit: 3 percent
Hydric soil rating: No

Columbia

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Hydric soil rating: Yes

Cosumnes

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Hydric soil rating: Yes

Pentz

Percent of map unit: 2 percent
Hydric soil rating: No

Redding

Percent of map unit: 2 percent
Hydric soil rating: No

Unnamed, hardpan deeper depths

Percent of map unit: 1 percent
Hydric soil rating: No

192—Red Bluff loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hhp5
Elevation: 200 to 800 feet
Mean annual precipitation: 30 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 250 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Red bluff and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Red Bluff

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 8 inches: loam
H2 - 8 to 25 inches: clay loam
H3 - 25 to 43 inches: clay loam
H4 - 43 to 68 inches: gravelly clay loam

Properties and qualities
Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: LOAMY (R017XD045CA)
Hydric soil rating: No

Minor Components

Redding
Percent of map unit: 7 percent
Hydric soil rating: No

Xerorthents
Percent of map unit: 7 percent
Hydric soil rating: No

Unnamed
Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Unnamed, hardpan soil
Percent of map unit: 2 percent
Hydric soil rating: No

Unnamed, steeper slopes
Percent of map unit: 2 percent
Hydric soil rating: No

193—Red Bluff-Redding complex, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: hhp6
Elevation: 100 to 1,500 feet
Mean annual precipitation: 14 to 30 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 230 to 320 days
Farmland classification: Not prime farmland

Map Unit Composition

Red bluff and similar soils: 45 percent
Redding and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Red Bluff

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 25 inches: clay loam
H3 - 25 to 43 inches: clay loam
H4 - 43 to 68 inches: gravelly clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: LOAMY (R017XD045CA)
Hydric soil rating: No

Description of Redding

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Typical profile

H1 - 0 to 7 inches: gravelly loam
H2 - 7 to 20 inches: gravelly loam
H3 - 20 to 28 inches: gravelly clay loam
H4 - 28 to 66 inches: indurated

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: About 20 inches to abrupt textural change; 28 to 66 inches to duripan
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: C
Ecological site: GRAVELLY LOAMY (R017XD090CA)
Hydric soil rating: No

Minor Components

Corning

Percent of map unit: 5 percent
Hydric soil rating: No

Hicksville

Percent of map unit: 4 percent
Hydric soil rating: No

Xerorthents

Percent of map unit: 4 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Unnamed, hardpan below 40 inches

Percent of map unit: 1 percent
Hydric soil rating: No

198—Redding gravelly loam, 0 to 8 percent slopes, MLRA 17

Map Unit Setting

National map unit symbol: 2w8bl
Elevation: 20 to 420 feet
Mean annual precipitation: 19 to 28 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 230 to 320 days
Farmland classification: Not prime farmland

Map Unit Composition

Redding and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Redding

Setting

Landform: Fan remnants
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from igneous, metamorphic and sedimentary rock over clayey alluvium derived from igneous, metamorphic and sedimentary rock over cemented alluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

A1 - 0 to 8 inches: gravelly loam
A2 - 8 to 15 inches: gravelly loam
A3 - 15 to 19 inches: gravelly loam
Bt - 19 to 22 inches: clay
2Bqm1 - 22 to 24 inches: cemented gravelly material
2Bqm2 - 24 to 35 inches: cemented gravelly material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: About 19 inches to abrupt textural change; 20 to 39 inches to duripan
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 15 to 39 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0

Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: GRAVELLY LOAM (R015XD090CA)
Hydric soil rating: No

Minor Components

Keyes

Percent of map unit: 10 percent
Landform: Depressions
Hydric soil rating: No

Corning

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 2 percent
Landform: Fan remnants
Microfeatures of landform position: Vernal pools
Hydric soil rating: Yes

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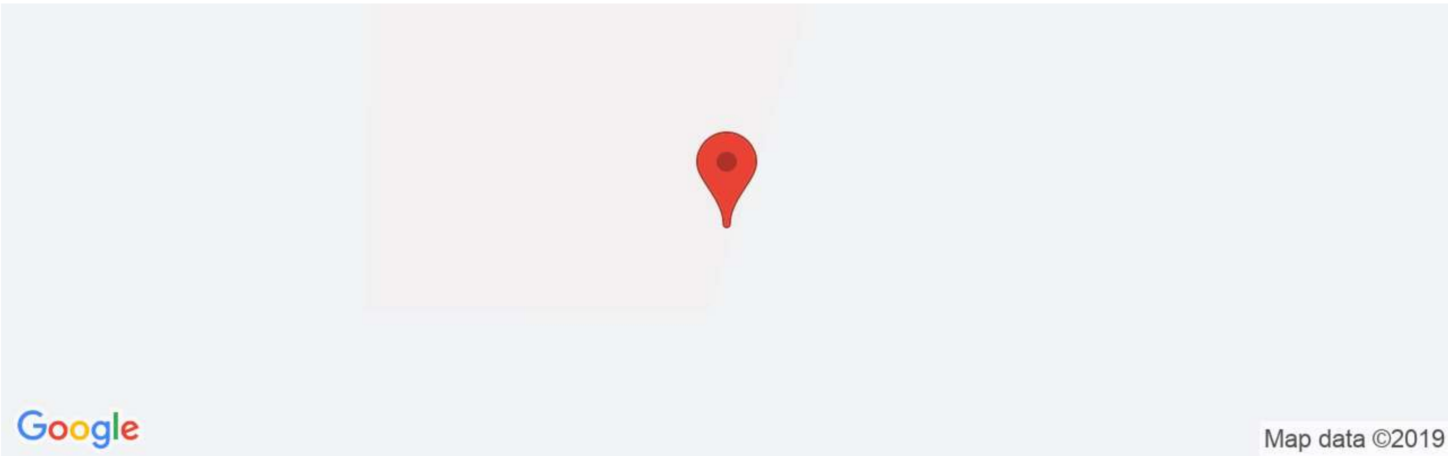
Appendix B
Seismic Ground Motion for the Preserve
From USGS Seismic Design Maps accessed 11 June 2019

The Preserve

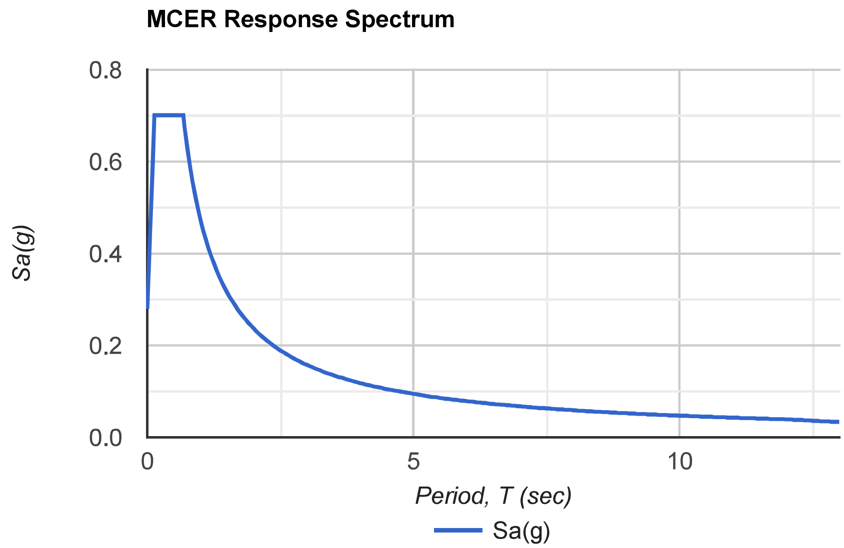
Latitude, Longitude: 38.579129, -121.194832

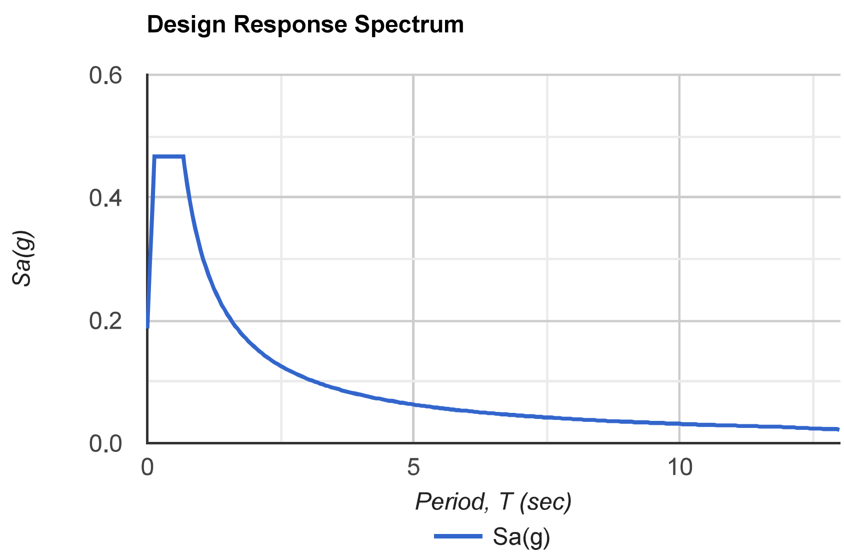


Date	6/11/2019, 1:59:19 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.501	MCE_R ground motion. (for 0.2 second period)
S_1	0.249	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.701	Site-modified spectral acceleration value
S_{M1}	0.473	Site-modified spectral acceleration value
S_{DS}	0.467	Numeric seismic design value at 0.2 second SA
S_{D1}	0.315	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.399	Site amplification factor at 0.2 second
F_v	1.903	Site amplification factor at 1.0 second
PGA	0.161	MCE_G peak ground acceleration
F_{PGA}	1.479	Site amplification factor at PGA
PGA_M	0.238	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.501	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.426	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.249	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.217	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	1.175	Mapped value of the risk coefficient at short periods
C_{R1}	1.146	Mapped value of the risk coefficient at a period of 1 s





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Project No. E9150-04-01
March 24, 2020

Raney Planning & Management, Inc.
1501 Sports Drive, Suite A
Sacramento, California 95834

Attention: Mr. Rod Stinson

Subject: THE PRESERVE
GRANT LINE ROAD AND RAYMER WAY
RANCHO CORDOVA, CALIFORNIA
GEOTECHNICAL PEER REVIEW

References: *Geology and Soils for The Preserve, Grant Line Road and Raymer Way, Rancho Cordova, California,* prepared by Youngdahl Consulting Group, Inc., dated June 2019 (YCG Project No. E17440.001).

Dear Mr. Stinson:

In accordance with your authorization of our proposal dated April 8, 2019, we have prepared this correspondence to present the results of our geotechnical peer review for the subject residential development in Rancho Cordova.

Our peer review was performed to provide a professional opinion on the appropriateness and adequacy of the referenced geotechnical report with respect to project conditions, regulatory requirements, and industry standards of practice. Our scope of geotechnical services consisted of:

- Performing a site visit to observe current site conditions.
- Reviewing the referenced geotechnical report and published documents, geologic maps and other geological and geotechnical literature pertaining to the site to aid in evaluating soil and geologic conditions.
- Preparing the correspondence.

SITE AND PROJECT DESCRIPTION

The site is comprised of six adjacent parcels (Sacramento County APN 072-0300-001, -002, -005, -008, -010 and -011) totaling approximately 285 acres on the western side of Raymer Way and Grant Line Road. The irregularly shaped site abuts the north and northeastern sides of the Somerset Ranch residential development. WGS 84 (Google Earth) site coordinates are N 38.5766°, W -121.1956°. Site topography generally consists of rolling hills and seasonal drainages. Morrison Creek enters near the northeast corner of the site and flows offsite near the middle of the western boundary. Three residences with associated ancillary structures are present in the southwest portion of the site – two on the southern side of Morrison Creek and one on the northern side.

Geologic mapping by the California Geological Survey (CGS) and United States Geological Survey (USGS) indicates the site is underlain by Tertiary age Laguna formation, an older consolidated alluvial deposit, and is located outside of the mapped area of dredge tailings that covers much of Rancho Cordova. The Morrison Creek drainage is mapped as Quaternary age alluvium. Artificial fills related to development of the existing residential properties, roadways and small stock ponds are also present.

We understand the project will rezone the property from agricultural and industrial land use to residential. The planned development will include 434 single-family lots, parks, 180 acres of nature preserve, and all related infrastructure including a municipal sanitary sewer system. The nature preserve will ultimately be transferred to a third-party conservation entity.

DISCUSSION

The referenced report was prepared to evaluate potential soils and geologic impacts from the planned project, as outlined in the Environmental Checklist Form in California Environmental Quality Act (CEQA) Appendix G for initial studies. The report also evaluates the potential loss of mineral resources based on mapping by the California Division of Mines and Geology (now CGS) and the City of Rancho Cordova General Plan.

We have reviewed the referenced report and conducted a site reconnaissance. Our observations at the site generally supported the above-described geologic conditions and those outlined in the referenced report. Based on our observations at the site and our subsequent review, it is our opinion that the report adequately addresses the soils, geologic and mineral resources items in the Environmental Checklist Form.

LIMITATIONS AND CLOSURE

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices used in the site area at this time. No warranty is provided, express or implied.

Should you have any questions regarding this correspondence, or if we may be of further service, please contact the undersigned at your convenience.

Sincerely,

GEOCON CONSULTANTS, INC.

DRAFT

Shane Rodacker, GE
Senior Engineer

(1/e-mail) Addressee