3.6 - Geology and Soils

3.6.1 - Introduction

This section describes existing conditions related to geology and soils in the region and project area as well as the relevant regulatory framework. This section also evaluates the possible impacts related to geology and soils that could result from implementation of the project. Information included in this section is based on the Preliminary Geotechnical Report and Paleontological Records Search, which are included in Appendix D as well as the Contra Costa County General Plan and the United States Geological Survey (USGS). During the Environmental Impact Report (EIR) scoping period no comments were received related to geology and soils.

3.6.2 - Environmental Setting

Geologic Setting

Contra Costa County Area

Contra Costa County is situated in the Coast Ranges geomorphic province of California. The Coast Ranges have experienced a complex geological history characterized by Late Tertiary folding and faulting that has resulted in a series of northwest-trending mountain ranges and intervening valleys. Bedrock in the Coast Ranges consists of igneous, metamorphic and sedimentary rocks that range in age from Jurassic to Pleistocene. The present physiography and geology of the Coast Ranges are the result of deformation and deposition along the tectonic boundary between the North American plate and the Pacific plate. Plate boundary fault movements are largely concentrated along the well-known fault zones, which in the area include the San Andreas Fault, Hayward Fault, and Calaveras Fault, as well as other lesser-order faults.

The geology of Contra Costa County is dominated by several northwest trending fault systems that divide the County into large blocks of rock. For example, the Briones Hills are bounded by the Hayward Fault on the west and elements of the Franklin-Calaveras fault system on the east. Within a particular block the rock sequence consists of: (1) a basement complex of broken and jumbled pre-Tertiary sedimentary, igneous and metamorphic rocks; (2) a section of younger Tertiary sedimentary rocks and some volcanic rocks (flows and tuffs) which locally intertongue with and overlie the sedimentary section; and, (3) surficial deposits including stream alluvium, colluvium (slopewash deposits at the foot of steeper slopes), slides, alluvial fans, and Bay Plain deposits.[1]

Project Site

The project site is located in Contra Costa County adjacent to the City of Walnut Creek. The project site is relatively flat with no major changes in elevation occurring on-site. According to the published geologic map covering the site by Nilsen (1975), the project site is underlain by Holocene alluvial deposits. Mapping by Dibblee (2005) indicates the site is underlain alluvium (Qa), specifically alluvial gravels. Helley and Graymer (1994) further classifies the Holocene alluvial deposits at the site as being

[1] Contra Costa County General Plan, page 10-4.

floodplain deposits (Qhfp), consisting of sandy to silty clay, with lenses of coarser material, and alluvial deposits (Qhaf), consisting of gravelly sand which grades to silty clay near the edges of the deposit.[2]

Existing Soils

Corrosive soils are a geologic hazard, because they react with concrete and ferrous metals, which can cause damage to foundations and buried pipelines. Expansive soils are a geologic hazard, because an increase in soil volume can exert forces on structures and, thus, damage building foundations, walls, and floors. In general, areas are susceptible to differential settlement if underlain by compressible sediments, such as poorly engineered artificial fill or loose unconsolidated alluvial sediments. When these soils dry out and shrink, structural damage can occur.

Contra Costa County Area

The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) has characterized the majority of native, undisturbed soils in the Contra Costa County area according to three soil associations: (1) nearly level to strongly sloping, somewhat excessively drained to very poorly drained soils on Valley fill, basin, low terraces, flood plains, and alluvial fans; (2) nearly level, poorly drained and very poorly drained souls on the Delta, flood plains, and saltwater marshes and tidal flats; and (3) nearly level to very steep, moderately well drained to excessively drained soils on terraces and mountainous uplands.[3]

Project Site

A custom soil survey of the project site based on NRCS data indicates that the underlying soils are clear lake clay.[4] These soils are characterized as "poorly drained," which means that they do not allow water to percolate through them. Poorly drained soils can result in rainwater ponding on-site or flowing off-site as stormwater. Soils at the project site have the potential to undergo settlement under new building loads. Additionally, expansive soils are present on the project site. Expansive soils are susceptible to shrinking and swelling during rain events, which can cause building foundations to crack, potentially resulting in building structural failure. These types of clayey soils are not susceptible to liquefaction because they do not contain clean, loose, saturated, or fine sand below the groundwater table. Liquefaction occurs when loosely packed, water saturated soils at or near the ground surface loses their strength during seismic ground shaking and essentially function as a liquid. When soils experience liquefaction, buildings and structures can experience major damage and result in significant loss of life and property. Table 3.6-1 further summarizes the soils located on the project site as designated by NRCS.

[2] ENGEO. Preliminary Geotechnical Report, April 6, 2018.
[3] United States Department of Agriculture (USDA), Natural Resources Conservation Service. General Soil Map of Contra Costa County, California. Accessed February 14, 2019. Website: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA013/0/maps/gsm.pdf.
[4] United States Department of Agriculture (USDA), Natural Resources Conservation Service. Web Survey Soil Map. Accessed February 14, 2019. Website: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.

Table 3.6-1: Project Site Soil Properties Summary

Soil	Parent Material	Drainage Class
Clear Lake Clay, 0 to 15 percent slopes	Clayey alluvium derived from metamorphic and sedimentary rock	Poorly Drained
Source: United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS). 2014. Web Soil Survey: Soil Map-Contra Costa County, California. Website: http://websoilsurvey.nrcs.usda.gov/app/. Accessed November 15, 2018.		

Seismicity

The term seismicity describes the effects of seismic waves that are radiated from an earthquake fault in motion. While most of the energy released during an earthquake results in the permanent displacement of the ground, as much as 10 percent of the energy may dissipate immediately in the form of seismic waves. Seismicity can result in seismic-related hazards such as fault rupture, ground shaking, and liquefaction. Faults form in rocks when stresses overcome the internal strength of the rock, and fault rupture occurs when movement on a fault breaks through to the surface and can result in damage to infrastructure and persons. Ground movement during an earthquake can vary depending on the overall magnitude, distance to the fault, focus of earthquake energy, and type of geologic material. The composition of underlying soils, even those relatively distant from faults, can intensify ground shaking. Strong ground shaking from an earthquake can result in damage, with buildings shifted off their foundations and underground pipes broken. Liquefaction occurs when an earthquake causes ground shaking that result in saturated soil to lose shear strength, deform, and act like a liquid. When liquefaction occurs, it can result in ground failure that can result in damage to roads, pipelines, and buildings.

Contra Costa County Area

Seismic risk is assumed by every occupant and developer in Contra Costa County, because the County is within an area of high seismicity; the San Francisco Bay Region has been impacted by more than 10 severe earthquakes during historic time.

The County has been subjected to numerous seismic events, originating both on faults within the County and in other parts of the region. Six major Bay Area earthquakes have occurred since 1800 that affected the County, and at least two of the faults that produced them run through or into the County. These earthquakes and the originating faults include the 1836 and 1868 earthquakes on the Hayward Fault, and the 1861 earthquake on the Calaveras Fault. Two earthquakes, in 1838 and 1906, originated on the San Andreas Fault, west of the County near San Francisco or to the south, while one earthquake (with two major shocks) that caused some damage in the County occurred in 1872 and was centered north of Contra Costa County in the Vacaville-Winters area of Solano County. These latter events likely occurred on a thrust fault and are not known to have been accompanied by surface fault rupture. A smaller earthquake, centered near Collinsville in Solano County on a fault of uncertain identity, occurred in 1889.

Using the available data and information, an earthquake probability estimate has been developed for Contra Costa County and is shown in Table 3.6-2 (Table 10-4 of the Contra Costa County General Plan 2025).

Table 3.6-2: Approximate Probability of Occurrence of Earthquake on Bay Area Faults

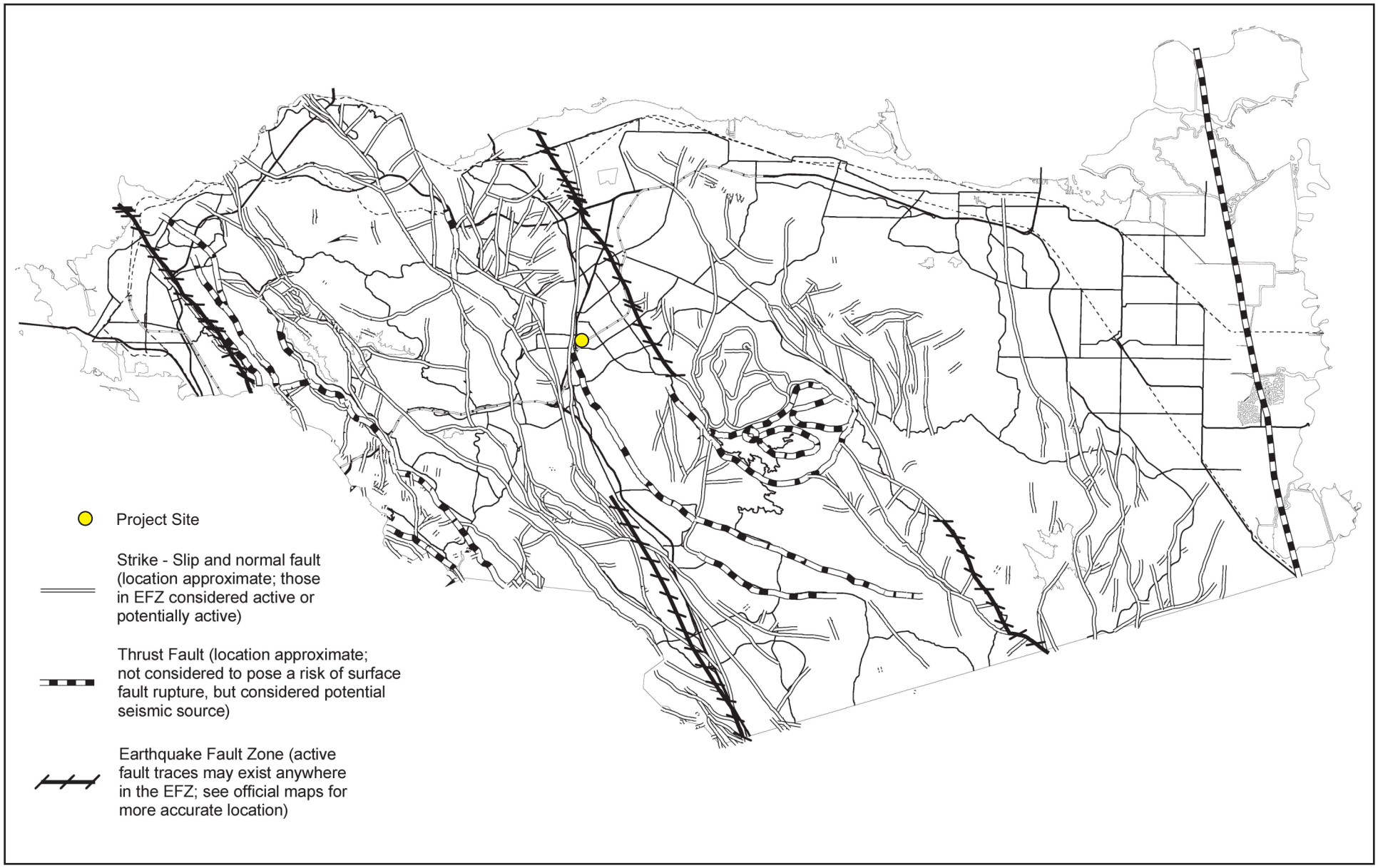
Causative Fault	Magnitude	Approximate Probability of Occurrence (over a 50-year period)
San Andreas	7.0–8.0	Likely[1]
	8.0–8.5	Intermediate[2]
Hayward	6.0–7.0	Likely
	7.0–7.5	Intermediate
Calaveras	6.0–7.0	Likely
	7.0–7.5	Intermediate-Low[3]
Concord	5.0–6.0	Likely
	6.0–7.0	Intermediate-Low
Antioch	5.0–6.0	Likely
	6.0–7.0	Intermediate-Low

Notes:
[1] Greater than 50 percent probability of occurrence
[2] A 15-50 percent probability of occurrence
[3] Less than 15 percent probability of occurrence
Source: Contra Costa County Conservation and Development Department estimates.

Project Site

The project site is not located within a State of California Earthquake Fault Hazard Zone for active faults, and no known faults cross the site.[5] An active fault is defined by the State Mining and Geology Board as one that has had surface displacement within Holocene time (about the last 11,000 years). The nearest known active fault surface trace is the Green Valley Connected Fault, which is mapped approximately 2.2 miles east of the project site.[6] In addition, other active faults near the project are: Mount Diablo Thrust Fault (3.7 miles to the south); Calaveras Fault (8.1 miles to the south); Hayward-Rogers Fault (11.2 miles to the east); Greenville Connected Fault (12.4 miles to the southeast); and West Napa Fault (19.2 miles to the northwest).[7] Exhibit 3.6-1 depicts the location of fault lines in Contra Costa County.

[5] ENGEO. Preliminary Geotechnical Report, page 6. April 6, 2018.
[6] ENGEO. Preliminary Geotechnical Report, April 6, 2018.
[7] *Ibid*.



Source: U.S. Geological Survey (Graymer, Jones and Brabb, 1994; and Earthquake Fault Zone Maps (California Geological Survey)

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Exhibit 3.6-1
Regional Fault Map

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Slope Disturbance

Slope disturbance from long-term geologic cycle of uplift, mass wasting, intense precipitation or wind, and gravity can result in slope failure in the form of mudslides and rock fall. The project area is seismically active with known faults; however, the project area does not contain active faults that would cause geologic uplifting. Mass wasting refers to a variety of erosional processes from gradual downhill soil creep to mudslides, debris flows, landslides, and rock fall—processes that are commonly triggered by intense precipitation or wind, which varies according to climactic shifts. Often, various forms of mass wasting are grouped together as landslides, which are generally used to describe the downhill movement of rock and soil. Soil creep is a long-term, gradual downhill migration of soil under the influence of gravity and is generally about a fraction of an inch per year. However, this movement accumulates over the years and can result in several inches of lateral and vertical movement over the life of improvement placed over creeping soils.

Contra Costa County Area

The major geologic hazards in Contra Costa County, aside from earthquake rupture and direct effects of ground shaking, are unstable hill slopes and reclaimed wetlands and marsh fill areas. Slopes may suffer landslides, slumping, soil slips, and rockslides. Reclaimed wetlands, whether filled or not, experience amplified lateral and vertical movements, which can be damaging to structures, utilities, and transportation routes and facilities.

The Contra Costa County General Plan recognizes that major slope areas in excess of 26 percent are "not readily developable" and "undevelopable," recognizing the cost and engineering difficulties of grading steep slopes as well as their inherent unsuitability.[8] Figure 10-6 of the Contra Costa County General Plan shows Landslide Hazards in Contra Costa County.

Project Site

The project site is relatively flat, with no slopes or varied topography that could be susceptible to slope failure, landslides, or soil creep. According to Figure 10-6 of the Contra Costa County General Plan, the project site is not located on a site susceptible to landslides or an area where landslides previously occurred. Figure 10-5 of the County General Plan indicates that the southwest half of the site is classified "Generally High" liquefaction potential and the remainder of the site is classified "Generally Moderate to Low" liquefaction potential. It is pertinent to note that the classification "Generally High" does not imply the presence of liquefiable sands on a parcel. According to the County Peer Review Geologist, the classification "Generally Moderate to Low" does not imply that liquefaction risks are less than significant.

Paleontological Resources

No known paleontological resources are located within the project site boundaries. The surface area of the project sites consists of Holocene alluvium deposits, which are too young to contain important fossil resources. Only Pleistocene alluvium has the potential to yield significant paleontological resources in the project vicinity, however, none is located within, or in close proximity to, the project site.[9]

[8] Contra Costa County General Plan, page 10-22.
[9] Dr. Kenneth Finger, PhD. Paleontological Records Search: Del Hombre Project. October 1, 2018.

3.6.3 - Regulatory Framework

Federal

National Earthquake Hazards Reduction Program

The National Earthquake Hazards Reduction Program (NEHRP) was established by the U.S. Congress when it passed the Earthquake Hazards Reduction Act of 1977, Public Law 95–124. In establishing the NEHRP, Congress recognized that earthquake-related losses could be reduced through improved design and construction methods and practices, land use controls and redevelopment, prediction techniques and early warning systems, coordinated emergency preparedness plans, and public education and involvement programs. The four basic goals remain unchanged:

- Develop effective practices and policies for earthquake loss reduction and accelerate their implementation.
- Improve techniques for reducing earthquake vulnerabilities of facilities and systems.
- Improve earthquake hazards identification and risk assessment methods, and their use.
- Improve the understanding of earthquakes and their effects.

Several key federal agencies contribute to earthquake mitigation efforts. There are four primary NEHRP agencies:

- National Institute of Standards and Technology of the Department of Commerce
- National Science Foundation
- USGS of the Department of the Interior
- Federal Emergency Management Agency (FEMA) of the Department of Homeland Security

Implementation of NEHRP priorities is accomplished primarily through original research, publications, and recommendations to assist and guide state, regional, and local agencies in the development of plans and policies to promote safety and emergency planning.

National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) permit program, authorized by Section 402(p) of the federal Clean Water Act, controls water pollution by regulating point sources, such as construction sites and industrial operations that discharge pollutants into waters of the United States. A Storm Water Pollution Prevention Plan (SWPPP) is required to control discharges from a project site, including soil erosion, to protect waterways. A SWPPP describes the measures or practices to control discharges during both the construction and operational phases of the project. A SWPPP identifies project design features and structural and nonstructural Best Management Practices (BMPs) that will be used to control, prevent, remove, or reduce stormwater pollution from the site, including sediment from erosion.

Society of Vertebrate Paleontology Guidelines

The Society of Vertebrate Paleontology (SVP 1995; 1996), a national scientific organization of professional vertebrate paleontologists, has established standard guidelines that outline acceptable

professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, specimen preparation, analysis, and curation. Most practicing professional paleontologists in the nation adhere to the Society of Vertebrate Paleontology's assessment, mitigation, and monitoring requirements, as specifically spelled out in its standard guidelines.

State

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code [PRC] §§ 2621 to 2630) was passed in 1972 to provide a Statewide mechanism for reducing the hazard of surface fault rupture to structures used for human occupancy. The main purpose of the Act is to prevent the siting of buildings used for human occupancy across the traces of active faults. It should be noted that the Act addresses the potential hazard of surface fault rupture and is not directed toward other earthquake hazards, such as seismically induced ground shaking or landslides.

The law requires the State Geologist to identify regulatory zones (known as Earthquake Fault Zones or Alquist-Priolo Zones) around the surface traces of active faults, and to depict these zones on topographic base maps, at a scale of 1 inch to 2,000 feet. Earthquake Fault Zones vary in width, although they are typically one-quarter-mile wide, but wider when subparallel or branching traces are inferred to be present. Once published, the maps are distributed to the affected cities, counties, and State agencies for their use in planning and controlling new or renewed construction. With the exception of single-family wood-frame and steel-frame dwellings that are not part of a larger development (i.e. four units or more), local agencies are required to regulate development within the mapped zones. In general, construction within 50 feet of an active fault zone is prohibited.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act (PRC §§ 2690 to 2699.6), which was passed in 1990, addresses earthquake hazards other than surface fault rupture. These hazards include strong ground shaking, earthquake-induced landslides, liquefaction, or other ground failures. Much like the Alquist-Priolo Earthquake Fault Zoning Act discussed above, these seismic hazard zones are mapped by the State Geologist to assist local government in the land use planning process. The Act states, "It is necessary to identify and map seismic hazard zones in order for cities and counties to adequately prepare the safety element of their general plans and to encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety." The Act also states, "Cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard."

California Building Code

The State of California provides minimum standards for building design through the California Building Standards Code (CBC) (California Code of Regulations [CCR] Title 24). Where no other building codes apply, Chapter 29 regulates excavation, foundations, and retaining walls. The CBC applies to building design and construction in the State and is based on the federal Uniform Building Code (UBC) used widely throughout the country (generally adopted on a state-by-state or district-by-

district basis). The CBC has been modified for California conditions with more detailed and/or more stringent regulations.

The State earthquake protection law (California Health and Safety Code [HSC] § 19100 *et seq*.) requires that structures be designed to resist stresses produced by lateral forces caused by wind and earthquakes. The intent of the CBC is to enable structures to (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some non-structural damage, and (3) resist major earthquakes without collapse but with some structural as well as non-structural damage. Specific minimum seismic safety and structural design requirements are set forth in Chapter 16 of the CBC. The CBC identifies seismic factors that must be considered in structural design.

The CBC contains specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. It also regulates grading activities, including drainage and erosion control (Chapter 18, Appendix J). The 2016 CBC has been adopted by Contra Costa County according to Chapter 74-4 of Contra Costa Municipal Code.

Local

Contra Costa County General Plan

The Contra Costa County General Plan 2025 serves as the overall guiding policy document for Contra Costa County. The following is a list of applicable Contra Costa County General Plan policies most pertinent to the project with respect to geology and soils.

General Plan Safety Element

- **Goal 10-A:** To protect human life and reduce the potential for serious injuries from earthquakes; and to reduce the risks of property losses from seismic disturbances, which could have severe economic and social consequences for the County as a whole.
- **Goal 10-B:** To reduce to a practical minimum injuries and health risks resulting from the effects of earthquake ground shaking on structures, facilities and utilities.
- **Goal 10-D:** To reduce to a practical minimum the potential for life loss, injury and economic loss due to liquefaction-induced ground failure, levee failure, large lateral land movements toward bodies of water, and consequent flooding; and to mitigate the lesser consequences of liquefaction.
- **Policy 10-2:** Significant land use decisions (General Plan amendment, rezoning, etc.) shall be based on a thorough evaluation of geologic-seismic and soils conditions and risk.
- **Policy 10-3:** Because the region is seismically active, structures for human occupancy shall be designed to perform satisfactorily under earthquake conditions.
- **Policy 10-6:** Structures for human occupancy, and structures and facilities, whose loss would substantially affect the public safety or the provision of needed services, shall not be erected in areas where there is a high risk of severe damage in the event of an earthquake.
- **Policy 10-8:** Ground conditions shall be a primary consideration in the selection of land use and in the design of development projects.
- **Policy 10-13**: In areas where active or inactive earthquake faults have been identified, the location and/or design of any proposed buildings, facilities, or other development shall be modified to mitigate possible danger from fault rupture or creep.

- **Policy 10-14:** Preparation of a geologic report shall be required as a prerequisite before authorization of public capital expenditures or private development projects in areas of known or suspected faulting.
- **Policy 10-18:** This General Plan shall discourage urban or suburban development in areas susceptible to high liquefaction dangers and where appropriate subject to the policies in 10-20 below, unless satisfactory mitigation measures can be provided, while recognizing that there are low intensity uses such as water-related recreation and agricultural uses that are appropriate in such areas.
- **Policy 10-20:** Any structures permitted in areas of high liquefaction danger shall be sited, designed and constructed to minimize the dangers from damage due to earthquake-induced liquefaction.
- **Policy 10-21:** Approvals to allow the construction of public and private development projects in areas of high liquefaction potential shall be contingent on geologic and engineering studies, which define and delineate potentially hazardous geologic and/or soils conditions, recommend means of mitigating these adverse conditions; and on proper implementation of the mitigation measures.

Contra Costa County Ordinance Code

Building and Construction

Contra Costa County Ordinance Code, Chapter 74-4.002, adopts the 2016 CBC, with amendments, as the County's Building Code. As such, all new construction within the County is required to adhere to its seismic safety standards. The County of Contra Costa Department of Conservation and Development is responsible for the administration and enforcement of the CBC.

Grading, Soils, and Erosion Control Ordinances

Ordinance Code Division 716 contains the County's grading ordinance, which sets forth regulations for control of excavation, grading, earthwork construction, including fills or embankments and related work. Division 716-4.202 requires that a grading permit be obtained for on property on which a subdivision or development requirement approval of a tentative map is proposed, such as the project, and that such a permit shall not be issued until reviewed by the Public Works Department for compliance with the requirements of Title 9, Subdivisions. As indicated in Title 9, Section 94-4.420, Soil Report, a preliminary soil investigation report is required and must be reviewed by a building inspector or designated representative. If the report is deemed complete in that the recommended action and procedures contained in the report are likely to prevent damage, the recommended actions and procedures contained in the report shall become a condition of approval and shall be incorporated in the development of the subdivision.

3.6.4 - Impacts and Mitigation Measures

Significance Criteria

According to 2019 California Environmental Quality Act (CEQA) Guidelines, Appendix G Environmental Checklist, to determine whether impacts to geology and soils are significant environmental effects, the following questions are analyzed and evaluated. Would the project:

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury or death involving:
   i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.
   ii. Strong seismic ground shaking?
   iii. Seismic-related ground failure, including liquefaction?
   iv. Landslides?

b) Result in substantial soil erosion or the loss of topsoil?

c) 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?

d) 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?

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

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Approach to Analysis

Impacts related to geology and soils were determined by reviewing information contained in the Preliminary Geotechnical Report and Paleontological Records Search prepared for the project site, which is provided in Appendix E.

ENGEO performed field explorations on March 14 and 15, 2018, as part of the Geotechnical Investigation. ENGEO did not collect samples in the field during the exploration. In addition, ENGEO retained a subcontractor with a Cone Penetration Testing (CPT) rig to advance five cone penetration tests to depth of up to 70 feet below ground surface. Pore pressure dissipation tests were performed in 1-CPT1, 1-CPT3, 1-CPT4, 1-CPT5 to measure the approximate subsurface phreatic surface. Published geologic and geotechnical information that summarized the site conditions were also reviewed.

Additional evaluations of potential geologic and soil impacts of the project were based on review of available documentation, including the Contra Costa County General Plan; USGS “Shake Map” webpage; the USDA NRCS Web Soil Survey; and Association of Bay Area Governments, California Geological Survey, and USGS data and publications.

Impacts to paleontological resources were determined by reviewing the Paleontological Records Search prepared for the project site by Consulting Paleontologist, Dr. Kenneth Finger. Dr. Finger performed a records search on the University of California Museum of Paleontology database for the project site.

Specific Thresholds of Significance

For purposes of this analysis, the following thresholds are used to evaluate the significance of geology and soils impacts resulting from implementation of the project.

- Place structures on or within the State designated zone of a known earthquake fault.
- Place structures where seismic ground shaking of a Strong level or greater according to the Mercalli Scale could occur.
- Place structures on soils prone to any level of liquefaction.
- Place structures on slopes greater than 15 percent or soils susceptible to failure as defined by the USGS.
- Place structures in areas without impervious surfaces or vegetation, or on slopes greater than 15 percent.
- Place structures on a geologic unit or soil that is unstable or that could become unstable.
- Place structures on expansive soil that has an expansion index greater than 20 as defined in Table 18-1-B of the UBC (1994).
- Place septic tanks or alternative wastewater disposal systems on soils incapable of supporting the use.
- Physically damage or destroy paleontological deposits.

Earthquakes

Impact GEO-1: **The project could directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury or death involving:**

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.

ii) Strong seismic ground shaking.

iii) Seismic-related ground failure, including liquefaction.

iv) Landslides.

Construction

Impacts related to risks associated with seismic-related hazards are limited to operational impacts. No respective construction impacts would occur.

Operation

i) Based on the project-specific geotechnical report (Appendix E) prepared for the project site, the potential for ground rupture is low. There are no known active faults directly crossing the project site, and the project site is not located within a designated Alquist-Priolo Earthquake Fault Zone. In addition, the closest fault to the project site is the Green Valley

Connected Fault, which is mapped approximately 2.2 miles east of the project site.[10] As such, it is unlikely for ground rupture to occur at the site. Thus, the project would not expose people or structures to substantial adverse effects associated with fault rupture. Therefore, no impacts related to fault rupture would occur.

ii) The ENGEO Geotechnical Exploration identified the Green Valley Connected Fault as the closest fault to the project site, approximately 2.2 miles to the east. The project site and its residential occupants could experience strong to violent ground shaking due to an earthquake occurring along the Green Valley Connected Fault, Mount Diablo Thrust Fault, Calaveras Fault, or Hayward Fault. The intensity of ground shaking would vary with the distance and magnitude of the earthquake causing the ground shaking. According to the Modified Mercalli Intensity Shaking Severity Level, the project site would experience "Very Strong" shaking during an earthquake along these faults. This would represent a potentially significant impact related to strong seismic ground shaking.

Implementation of Mitigation Measure (MM) GEO-1 would ensure a design-level geotechnical investigation is performed. The project Geotechnical Engineer would review construction drawings to ensure all recommendations are implemented in project design. Design level geotechnical reports routinely include recommended geotechnical observation and testing services during construction. They allow the Geotechnical Engineer to (1) ensure geotechnical recommendations for the project are properly interpreted and implemented by contractors, (2) allow the Geotechnical Engineer to view exposed conditions during construction to ensure that field conditions match those that were the basis of the design recommendations in the approved report, and (3) provide the opportunity for field modifications of geotechnical recommendations based on exposed conditions.

This design-level geotechnical investigation would include subsurface exploration (borings), laboratory testing of selected samples, and engineering analysis of the data. In addition, the design-level recommendations shall address existing fill removal and fill compaction; consolidation settlement; foundation design; design of retaining walls required for construction of the building podium; shallow groundwater; temporary excavation; site drainage and landscaping irrigation; and pavement recommendations. Therefore, impacts related to strong seismic ground shaking would be less than significant with mitigation.

iii) The project-specific geotechnical report (Appendix E) concluded the risk of seismic-related ground failure in the form of liquefaction to be low, because the project site soils tested contained relatively dense clay and silty materials that were too cohesive to liquefy. Nevertheless, the report estimates that ground settlement would range from 0.2 to 0.5 inches. This assessment was based on limited data and needs to be re-evaluated by the design level report. The project geotechnical engineer, Engeo, Inc. indicates the report would include soil borings and laboratory testing of the project site's sand layers to more accurately estimate liquefaction related soil settlement. Implementation of MM GEO-1 would ensure all recommendations contained in the design-level geotechnical report are

[10] ENGEO. Preliminary Geotechnical Report, April 6, 2018.

included in project plans and designs. Therefore, impacts related to seismic-related ground failure, such as liquefaction, would be less than significant with mitigation incorporated.

iv) As discussed under Impact GEO-3 and in the project-specific geotechnical report (Appendix E), the project site is located on relatively flat relief and would not be susceptible to landslides. Therefore, impacts related to landslides would be less than significant.

Level of Significance Before Mitigation

Potentially Significant

Mitigation Measures

MM GEO-1 Submittal of a Design-Level Geotechnical Report

At least 60 days prior to issuance of construction permits or installation of utility improvements, the project applicant shall submit a design-level geotechnical report that provides geotechnical recommendations for the project based on adequate subsurface exploration, laboratory testing, and engineering analysis. The design-level geotechnical report shall address the following:

- Grading, including removal of existing undocumented fill
- Consolidation settlement
- Analysis of liquefaction potential, including estimating total settlement and differential settlement and surface manifestation of liquefaction
- Foundation design
- Measures to protect improvements from relatively shallow water table
- Further evaluation of expansive soils and corrosion potential of soils, including measures to protect improvements that are in contact with the ground from this hazard
- Exploration, testing, and engineering analysis to provide recommendations pertaining to foundation design, including retaining walls and pavement design
- Evaluation of the drainage design
- Address temporary shoring and support of excavations
- Provide updated California Building Code seismic parameters
- Outline recommended geotechnical monitoring

Prior to issuance of building permits, the project Geotechnical Engineer shall review construction drawings to ensure that the grading, drainage, and foundation plans are consistent with recommendations and specifications in the design level geotechnical report.

All grading, excavation and filling shall be conducted during the period of April 15 through October 15 only, and all areas of exposed soils shall be revegetated to minimize erosion and subsequent sedimentation. After October 15, only erosion control work shall be allowed by the grading permit. Any modification to the above schedule shall be subject to review by the Grading Inspection Section, and the

review and approval of the Department of Conservation and Development, Community Development Division.

A hold shall be placed on the "final" grading inspection, pending submittal of a report from the project Geotechnical Engineer that documents their observation and testing services during construction. Similarly, a hold shall be placed on the final building inspection until the Geotechnical Engineer submits a report documenting the monitoring services provided and implementation of all applicable recommendations. The final grading and construction plans for the project shall be reviewed by the project Geotechnical Engineer. Grading and construction activities shall meet the requirements of the recommendations included in the design-level geotechnical study.

Level of Significance After Mitigation

Less Than Significant with Mitigation

Soil Erosion or Topsoil Loss

Impact GEO-2: The project would not result in substantial soil erosion or the loss of topsoil.

Construction

The project site contains mostly pervious surfaces and is occupied by two residential structures. Since the project would disturb at least 1 acre of land during construction, it would be required to obtain a Construction General Permit from the California State Water Resources Control Board (State Water Board) consistent with the Contra Costa County's General Permit (No. CAS612008) and to comply with its conditions and requirements, which are designed to minimize potential erosion issues. Consistent with Section 1014-4.002 and .004, compliance with the County's NPDES permit would ensure that a stormwater control plan is prepared and BMPs are implemented that would prevent sediments and other pollutants from entering the stormwater system. Thus, with adherence to these existing requirements, impacts from project construction on the project site would not result in substantial soil erosion or loss of topsoil. Therefore, construction-related impacts related to soil erosion and loss of topsoil would be less than significant.

Operation

Impacts related to soil erosion or loss of topsoil are limited to construction impacts. No respective operational impacts would occur.

Level of Significance

Less Than Significant

Unstable Geologic Location

Impact GEO-3:	**The project could 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.**

Construction

Impacts related to risks associated with location on an unstable geologic unit or soil are limited to operational impacts. No respective construction impacts would occur.

Operation

As discussed under Impact GEO-1(iii), the full scope of the entire project site's susceptibility to liquefaction was based on limited data and needs to be re-evaluated by the design level geotechnical report, which is required by MM GEO-1. The site-specific geotechnical report determined that the risk from on- or off-site landslides or lateral spreading would be low due to the relatively flat topography of the project site. Therefore, impacts related to unstable soil or geologic unit risks would be less than significant with mitigation.

Level of Significance Before Mitigation

Potentially Significant

Mitigation Measures

Implement MM GEO-1

Level of Significance

Less Than Significant

Expansive Soil

Impact GEO-4:	**The project could 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.**

Construction

Impacts related to risks associated with location on expensive soil are limited to operational impacts. No respective construction impacts would occur.

Operation

The project-specific geotechnical report (Appendix E) identified expansive soils on the project site. These soils have the potential to shrink and swell as they gain moisture, which could cause building foundations to crack or heave resulting in substantial risks to life or property. As a result, project site soils could create a substantial risk to life or property. This would represent a potentially significant impact related to expansive soil risks.

However, implementation of MM GEO-1 would ensure recommendations contained in the design-specific geotechnical report are included in the project construction design. Therefore, impacts related to expansive soils would be less than significant with mitigation.

Level of Significance Before Mitigation

Potentially Significant

Mitigation Measures

Implement MM GEO-1

Level of Significance After Mitigation

Less Than Significant with Mitigation

Wastewater Disposal Systems

Impact GEO-5:	**The project would not have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.**

Construction

Impacts related to the project's use of septic tanks or alternative wastewater disposal systems are limited to construction. No respective operational impacts would occur.

Operation

The project site is located in a developed area of Contra Costa County, which is well-served by the municipal sanitary sewer system. The project would construct a 33-foot-long sanitary sewer line that would connect with the existing 30-inch sanitary sewer line along the west side of the project site within Del Hombre Lane. Central Contra Costa Sanitary District (Central San) does not allow 8-inch tee or wye connection directly to a 30-inch sewer main, and all connections would be made at one of two manholes: (1) the manhole located towards the southwest corner of the project site in Del Hombre Lane, or (2) the manhole at the intersection of Del Hombre Lane and Roble Road at the northwest corner of the project site.[11] Thus, the project would not use septic tanks or any alternative wastewater disposal system. Therefore, there would be no operational impact related to soil capability of supporting the use of alternative wastewater disposal systems.

Level of Significance

No Impact

Destruction of Paleontological Resource or Unique Geologic Feature

Impact GEO-6:	**The project could directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.**

Construction

The project-specific paleontological report (Appendix E) concluded that the project site is located on Holocene alluvium, which is too young to be fossiliferous and has low potential to yield paleontological resources. There are also no unique geological features located on the project site. However, Miocene strata of the Monterey Group extend from the south and partially into the search area 0.5-mile radius of the project site. The Miocene strata have the potential to yield significant

[11] BKF. 2018. Del Hombre Utility Due Diligence. May.

paleontological resources and could be impacted by project-related excavations should they continue beneath the Holocene deposits. Pleistocene vertebrate localities are also particularly abundant in the area. The project area should therefore be considered moderately sensitive for undiscovered paleontological resources. As such, sub-surface construction activities in excess of 10 feet in depth such as grading and trenching could result in a significant impact to unknown paleontological resources, such as fossils from mammoths, saber-toothed cats, rodents, reptiles, and birds, if encountered. This would represent of potentially significant impact related to destruction of paleontological resources.

However, implementation of MM GEO-6 would ensure a qualified paleontological monitor, as defined by the Society of Vertebrate Paleontology, is present during any ground disturbance activities that would penetrate Pleistocene (or older) deposits. If fossils or fossil-bearing deposits of Pleistocene age are discovered during construction, all excavation activity would cease within a 100-foot radius until a qualified paleontologist has the opportunity to evaluate the significance of the find and provide any recommendations deemed necessary to the County. This would reduce potential impacts to paleontological resources that may be discovered during project construction. Therefore, impacts related to destruction of paleontological resources or unique geologic features would be less than significant with mitigation.

Operations

Impacts related to the project's potential to cause substantial adverse change in the significance of a unique paleontological resource or unique geologic feature are limited to construction. No respective operational impacts would occur.

Level of Significance Before Mitigation

Potentially Significant

Mitigation Measures

MM GEO-6 Stop Construction Upon Encountering Paleontological Materials

A qualified paleontological monitor (as defined by the Society of Vertebrate Paleontology) retained by the project proponent shall be present during all phases of ground disturbance in excess of 15 feet below the existing ground surface or to the depth of Pleistocene deposits, whichever is greater. The role of the paleontological monitor shall be limited to monitoring of known or inferred Pleistocene deposits. This may be followed by regular periodic or "spot-check" paleontological monitoring during ground disturbance as needed, but full-time monitoring is not required at this time. In the event that Pleistocene fossils or fossil-bearing deposits are discovered during construction activities, excavations within a 100-foot radius of the find shall be temporarily halted or diverted. The applicant's construction contractor shall notify a qualified paleontologist to examine the discovery, and shall notify the Department of Conservation and Development within 24 hours of the discovery. The applicant shall include a standard inadvertent discovery clause in every construction contract to inform contractors of this

requirement. The paleontologist shall document the discovery as needed in accordance with Society of Vertebrate Paleontology standards and assess the significance of the find under the criteria set forth in CEQA Guidelines Section 15064.5. The paleontologist shall notify the appropriate agencies to determine procedures that would be followed before construction activities are allowed to resume at the location of the find. If the applicant determines that avoidance is not feasible, the paleontologist shall prepare an excavation plan for mitigating the effect of construction activities on the discovery. The plan shall be submitted to the Department of Conservation and Development, Community Development Division for review and approval prior to implementation. The applicant shall adhere to the recommendations in the approved plan.

Level of Significance After Mitigation

Less Than Significant with Mitigation

3.6.5 - Cumulative Impacts

Seismic-related Hazards

The geographic scope of the cumulative geology and soils analysis is the project vicinity. Adverse effects associated with geology and soils tend to be localized; therefore, the area near the project site would be the area most affected by project activities (generally within a 0.25-mile radius). The only cumulative projects within 0.25 mile of the project site are the Avalon Walnut Creek Village Project (Bay Area Rapid Transit [BART] Pleasant Hill Specific Plan, Block C) located directly across Del Hombre Lane. Development in the vicinity of the project site has not included any uses or activities that would result in geology or soils impacts.

Cumulative projects, including the project site, have the potential to experience strong to violent ground shaking from earthquakes. The other projects listed in Table 3-1 would be exposed to the same ground shaking hazards and likewise would be subject to the same requirements. Cumulative projects would adhere to the provisions of the CBC, policies of the Contra Costa County General Plan and Contra Costa County Municipal Code reducing potential hazards associated with seismic ground shaking and ground failure. As such, the project, in conjunction with other projects, would not have a cumulatively significant impact associated with seismic-related hazards.

Soil-related Hazards

Soil conditions associated with the project site, such as expansive soils, are specific to the project site and generally do not contribute to a cumulative effect. Some or all other cumulative projects may have similar conditions but they also would not contribute to a general geologic or soil cumulative effect. The project would be subject to all Contra Costa County General Plan policies, County code policies, and the CBC reducing soil-related hazard impacts. Other current and future development/redevelopment projects in the region would similarly be required to adhere to standards and practices that include stringent geologic and soil-related hazard mitigations. As such, the project, in conjunction with other projects, would not have a cumulatively significant impact associated with soil-related hazards.

Paleontological Resources and Unique Geologic Feature

The geographic scope of the cumulative paleontological resources and unique geologic features analysis is Contra Costa County, the City of Walnut Creek, and the City of Pleasant Hill. Construction activities associated with development cumulative projects in Contra Costa County, the City of Walnut Creek, and the City of Pleasant Hill may have the potential to encounter undiscovered geologic resources and paleontological resources. These cumulative projects would be required to mitigate for impacts through compliance with applicable federal and State laws governing geologic resources and paleontological resources. The likelihood of presence of geologic resources and paleontological resources on the cumulative project sites is very low, given the developed nature of the areas surrounding the cumulative project sites.

However, paleontological resources have been discovered in Contra Costa County, the City of Walnut Creek and the City of Pleasant Hill, and the potential exists that intact paleontological resources could be encountered during project implementation. This would be a significant contributing factor to an overall cumulative impact to paleontological resources within Contra Costa County, the City of Walnut Creek, and the City of Pleasant Hill. Implementation of MM GEO-6 requires a qualified paleontological monitor, as defined by the Society of Vertebrate Paleontology, to be present during any ground disturbance activities that would penetrate Pleistocene (or older) deposits. This mitigation measure would lessen the potential loss of paleontological resources to the community as a whole, and the cumulative impact to paleontological resources would be less than significant with mitigation.

With respect to development of the cumulative projects, although there is the possibility that previously undiscovered resources could be encountered by subsurface earthwork activities, the implementation of standard construction mitigation measures would ensure that undiscovered geologic resources and paleontological resources are not adversely affected by cumulative project-related construction activities, which would prevent the destruction or degradation of potentially significant paleontological resources. Given the low potential for disruption and the comprehensiveness of mitigation measures that would apply to the cumulative projects, the project, in conjunction with other planned and approved projects, would result in a less than significant with mitigation cumulative impact related to paleontological and geologic resources.

Level of Cumulative Significance Before Mitigation

Potentially Significant

Cumulative Mitigation Measures

Implement MM GEO-6

Level of Cumulative Significance After Mitigation

Less Than Significant with Mitigation

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