3.5 - Geology, Soils, and Seismicity

3.5.1 - Introduction

This section describes the existing geology, soils, and seismicity setting and potential effects from project implementation on the site and its surrounding area. Descriptions and analysis in this section are based on the Preliminary Soil Investigation prepared by Raney Geotechnical and included in this Draft Environmental Impact Report (Draft EIR) as Appendix E.

3.5.2 - Environmental Setting

Regional Geology

Solano County is situated in the Great Valley Geomorphic Province of California. This province is characterized as a relatively undeformed sedimentary basin bounded by highly deformed rock units of the Coastal Ranges to the west and by the gently sloping western foothills of the Sierra Nevada Mountain Range to the east. The Sacramento Valley, which forms the northern portion of the Great Valley Province, is composed of unconsolidated and recent-age alluvial sediments. The underlying bedrock is thought to be composed of early tertiary marine deposits.

Seismicity

The term seismicity describes the effects of seismic waves that are radiated from an earthquake as it ruptures. 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. The probability of one or more earthquakes of magnitude 6.7 (Richter scale) or higher occurring in the project area has been evaluated by the United States Geological Survey (USGS). Based on the results of the USGS evaluation, there is a 63 percent likelihood that such an earthquake event will occur in the Bay Area between 2007 and 2036. The faults with the greater probability of movement with a magnitude of 6.7 or higher earthquake are the Hayward Fault at 27 percent, the San Andreas Fault at 21 percent, and the Calaveras Fault at 11 percent. To understand the implications of seismic events, a discussion of faulting and seismic hazards follows.

Faulting

Faults form in rocks when stresses overcome the internal strength of the rock, resulting in a fracture. Large faults develop in response to large, regional stresses operating over a long time, such as those stresses caused by the relative displacement between tectonic plates. According to the elastic rebound theory, these stresses cause strain to build up in the Earth's crust until enough strain has built-up to exceed the strength along a fault and cause a brittle failure. The slip between the two stuck plates or coherent blocks generates an earthquake. Following an earthquake, strain will build once again until the occurrence of another earthquake. The magnitude of slip is related to the maximum allowable strain that can be built-up along a particular fault segment. The greatest buildup in strain that is due to the largest relative motion between tectonic plates or fault blocks over the longest period of time will generally produce the largest earthquakes. The distribution of these earthquakes is a study of much interest for both hazard prediction and the study of active deformation of the earth's crust. Deformation is a complex process, and strain caused by tectonic forces is not only accommodated through faulting but also by folding, uplift, and subsidence, which can be gradual or in direct response to earthquakes.

Faults are mapped to determine earthquake hazards, since they occur where earthquakes tend to recur. A historic plane of weakness is more likely to fail under stress and strain than a previously unbroken block of crust. Faults are, therefore, a prime indicator of past seismic activity, and faults with recent activity are presumed to be the best candidates for future earthquakes. However, since slip is not always accommodated by faults that intersect the surface along traces, and since the orientation of stresses and strain in the crust can shift, predicting the location of future earthquakes is complicated. Earthquakes sometimes occur in areas with previously undetected faults or along faults previously thought inactive.

The Kirby Hills, Cordelia, and Concord-Green Valley Fault Zones are the closest faults to Suisun City. These faults and their characteristics are summarized in Table 3.5-1. The Kirby Hills Fault is located in the Potrero Hills south of the project site, while the Cordelia Fault and Concord-Green Valley Fault are located within the Cordelia area of Fairfield.

Table 3.5-1: Fault Summary

Fault Name	Type	Status	Relationship to Project Site		Maximum Credible Earthquake (Magnitude)	Alquist-Priolo Zoned?
			Direction	Distance (Miles)		
Kirby Hills	N/A	Inactive	South	< 1	6.75	No
Cordelia	Strike-Slip	Active	West	10	6.50	Yes
Concord-Green Valley	Right-Lateral Strike-Slip	Active	West	11	6.75	Yes

Notes:
The Kirby Hills Fault is also referred to as the "Vaca-Kirby Hills Fault." There is disagreement among geologists whether the Kirby Hills Fault has connectivity to the Vaca Fault.
Source: FCS, 2021.

Seismic Hazards

Seismicity describes the effects of seismic waves that are radiated from an earthquake as it ruptures. 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. To understand the implications of seismic events, a discussion of faulting and seismic hazards is provided below.

Seismic hazards pose a substantial danger to property and human safety and are present because of the risk of naturally occurring geologic events and processes impacting human development. Therefore, the hazard is influenced as much by the conditions of human development as by the frequency and distribution of major geologic events. Seismic hazards present in California include ground rupture along faults, strong seismic shaking, liquefaction, ground failure, landsliding, and slope failure.

Fault Rupture

Fault rupture is a seismic hazard that affects structures sited above an active fault. The hazard from fault rupture is the movement of the ground surface along a fault during an earthquake. Typically, this movement takes place during the short time of an earthquake, but it also can occur slowly over many years in a process known as creep. Most structures and underground utilities cannot accommodate the surface displacements of several inches to several feet commonly associated with fault rupture or creep.

Ground Shaking

The severity of ground shaking depends on several variables such as earthquake magnitude, epicenter distance, local geology, thickness, seismic wave-propagation properties of unconsolidated materials, groundwater conditions, and topographic setting. Ground shaking hazards are most pronounced in areas near faults or with unconsolidated alluvium.

Based on observations of damage from recent earthquakes in California (e.g., San Fernando 1971, Whittier-Narrows 1987, Landers 1992, Northridge 1994), ground shaking is responsible for 70 to 100 percent of all earthquake damage. The most common type of damage from ground shaking is structural damage to buildings, which can range from cosmetic stucco cracks to total collapse. The overall level of structural damage from a nearby large earthquake would likely be moderate to heavy, depending on the characteristics of the earthquake, the type of ground, and the condition of the building. Besides damage to buildings, strong ground shaking can cause severe damage from falling objects or broken utility lines. Fire and explosions are also hazards associated with strong ground shaking.

During the 2014 South Napa Earthquake, USGS instrument readings at monitoring sites in Napa and Vallejo reported peak ground acceleration values ranging from 19.8 to 40.7 percent of gravity, which corresponds to “strong” and “very strong” ground shaking. Following the earthquake, more than 200 persons sought treatment at local hospitals, more than 150 buildings were “red tagged,”[1] and numerous utility lines experienced ruptures or leaks that disrupted service.

Ground Failure

Ground failure includes liquefaction and the liquefaction-induced phenomena of lateral spreading, and lurching.

Liquefaction is a process by which sediments below the water table temporarily lose strength during an earthquake and behave as a viscous liquid rather than a solid. Liquefaction is restricted to certain geologic and hydrologic environments, primarily recently deposited sand and silt in areas with high groundwater levels. The process of liquefaction involves seismic waves passing through saturated granular layers, distorting the granular structure, and causing the particles to collapse. This causes the granular layer to behave temporarily as a viscous liquid, resulting in liquefaction.

Liquefaction can cause the soil beneath a structure to lose strength, which may result in the loss of foundation-bearing capacity. This loss of strength commonly causes the structure to settle or tip.

[1] A red-tagged building is considered uninhabitable without further assessment or repair under the California Building Standards Code.

Loss of bearing strength can also cause light buildings with basements, buried tanks, and foundation piles to rise buoyantly through the liquefied soil.

Lateral spreading is lateral ground movement, with some vertical component, caused by liquefaction. In effect, the soil rides on top of the liquefied layer. Lateral spreading can occur on relatively flat sites with slopes less than 2 percent, under certain circumstances, and can cause ground cracking and settlement.

Lurching is the movement of the ground surface toward an open face when the soil liquefies. An open face could be a graded slope, stream bank, canal face, gully, or other similar feature.

Landslides and Slope Failure

Landslides and other forms of slope failure form in response to the long-term geologic cycle of uplift, mass wasting, and disturbance of slopes. 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, 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.

Geologists classify landslides into several different types that reflect differences in the type of material and type of movement. The four most common types of landslides are translational, rotational, earth flow, and rock fall. Debris flows are another common type of landslide similar to earth flows, except that the soil and rock particles are coarser. Mudslide is a term that appears in non-technical literature to describe a variety of shallow, rapidly moving earth flows.

Subsurface Exploration

Raney Geotechnical conducted a subsurface investigation of the project site in November 2015. Test borings revealed soils that are derived from the Tehama Formation. The Tehama Formation includes partially cemented clays, silts, and sands that are characterized by light orange, yellow, tan, and white colors and are derived from volcanic sources. The upper 8 to 10 inches of the borings were observed to consist of light brown clayey, fine, sandy, silts. Patches of dark gray and gray-brown silty clays were noted elsewhere on the site surface. These surface materials appear to have been amended for agricultural purposes.

Underlying the immediate surface and extending to the 15-foot-depth drilled in most borings, interlayered, stiff to very stiff, mottled light yellow-brown, orange-brown, and tan silty to very silty clays and clayey silts were observed. A few isolated lenses of medium dense, yellow-to-range brown silty to clayey fine to coarse sands were also observed. Clays dominated the upper 3 to 7 feet of the soil profile. Most clays appear to be of low plasticity. However, the clays within about the upper 2 feet often appear darker and of moderate plasticity.

Below a depth of 15 feet and extending to the 50-foot depth drilled in the deepest boring, interlayered, very stiff to hard yellow, orange, and tan clays and silts similar to those observed in the upper 15 feet were noted.

Groundwater was measured at depths ranging from 6 to 9 feet below ground surface.

Soils

The United States Department of Agriculture, Natural Resources Conservation Service indicates that the project site contains mostly Antioch-San Ysidro complex, 0 to 2 percent soils, with small areas of Solano loam and Pescadero clay loam soils. Table 3.5-2 summarizes the properties of the soils that underlie the project site.

Table 3.5-2: Soil Properties Summary

Soil Type	Drainage Class	Landform	Parent Material	Prime Agricultural Soil?
Antioch-San Ysidro complex, 0 to 2 percent	Moderately well drained	Terraces	Alluvium derived from sedimentary rock	No
Solano loam	Moderately well drained	Terraces	Alluvium derived from sedimentary rock	No
Pescadero clay loam	Somewhat poorly drained	Basin floors	Alluvium derived from sedimentary rock	No
Source: Natural Resources Conservation Service. 2021.				

Groundwater

As previously mentioned, Raney Geotechnical found that groundwater levels within the project site range from 6 to 9 feet below the ground surface. Groundwater flow is expected to follow the prevailing grade, which is generally southerly toward Hill Slough. In addition, the groundwater in the project vicinity is tidally influenced.

Paleontological Resources

The often-unseen records of past life buried in the sediments and rocks below the ground surface are among natural resources deserving conservation and preservation. These records are often under the pavement, buildings, soils, and vegetation that are covered by developed areas, but are also found in undeveloped areas that are either in their natural condition or under agricultural use. These records–fossils and their geologic context–can exist in large quantities below the surface in many areas in Solano County, and span millions of years in age of origin. Fossils constitute a nonrenewable resource, meaning once they are lost or destroyed, the exact information they contained can never be reproduced.

Paleontology is the science that attempts to unravel the meaning of these fossils in terms of the organisms they represent, the ages and geographic distribution of those organisms, how they interacted in ancient ecosystems and responded to past climatic changes, and the changes through time of all of these aspects.

The sensitivity of a given area or body of sediment with respect to paleontological resources is a function of both the potential for the existence of fossils and the predicted significance of any fossils which may be found there. The primary consideration in the determination of paleontological sensitivity of a given area, body of sediment, or rock formation is its potential to include fossils. Information that can contribute to assessment of this potential includes: (1) direct observation of fossils within the project area; (2) the existence of known fossil localities or documented absence of fossils in the same geologic unit (e.g., "Formation" or one of its subunits); (3) descriptive nature of sedimentary deposits (such as size of included particles or clasts, color, and bedding type) in the area of interest compared with those of similar deposits known elsewhere to favor or disfavor inclusion of fossils; and (4) interpretation of sediment details and known geologic history of the sedimentary body of interest in terms of the ancient environments in which they were deposited, followed by assessment of the favorability of those environments for the preservation of fossils.

The most general paleontological information can be obtained from geologic maps, but geologic cross-sections (slices of geologic layers to view the third dimension) must be reviewed for an area in question (i.e., if such resources are discovered). These usually accompany geologic maps or technical reports. Once it can be determined which formations may be present in the subsurface, the question of paleontological resources must be addressed. Even though a formation is known to contain fossils, they are not usually distributed uniformly throughout the many square miles the formation may cover. If the fossils were part of a marine environment when they died, perhaps a scattered layer of shells will be preserved over large areas, or possibly a fossil bone only in one small area of less than a few hundred square feet. Other resources to be considered in the determination of paleontological potential are regional geologic reports, site records on file with paleontological repositories and site-specific field surveys.

Paleontologists consider all vertebrate fossils to be of significance. Fossils of other types are considered significant if they represent a new record, a new species, an oldest occurring species, the most complete specimen of its kind, a rare species worldwide, or a species helpful in the dating of formations. However, even a previously designated low potential site may yield significant fossils.

Geologic mapping indicated that the project site is entirely underlain by Pleistocene-age alluvial deposits. While not mapped at the surface at the project site, the Pleistocene-age Montezuma Formation and the Pliocene-age Tehama Formation are mapped in the project vicinity (approximately 5.8 miles southeast and approximately 3.3 miles northwest, respectively) and both could occur in the subsurface.[2]

A review of the University of California Museum of Paleontology (UCMP) online fossil locality database indicates that there are nine fossil localities (two invertebrate and seven vertebrate) recorded in unnamed Pleistocene-age deposits within Solano County. The exact localities are not provided through the online database; however, the locations can be inferred by the locality name (i.e., Suisun Slough (V2703) and Suisun Creek (V65183).[3] Suisun Slough and Suisun Creek are approximately 2.2 miles southwest and 6.7 miles west of project site, respectively.

[2] Graymer, R.W., D.L. Jones, and E.E. Brabb. 2002. Geologic map and map database of northeastern San Francisco Bay region, California – most of Solano County and parts of Napa, Marin, Contra Costa, San Joaquin, Sacramento, Yolo, and Sonoma counties. Miscellaneous Filed Studies Map MF-2403. United states Geological Survey. Map. Scale 1:100,000.

[3] University of California Museum of Paleontology (UCMP). 2024. UC Museum of Paleontology Localities – results for Pleistocene-age localities within Solano County.

The UCMP fossil locality database was also searched for fossil localities from the Montezuma and Tehama formations. The results revealed three vertebrate localities within Solano County from the Montezuma Formation, near Montezuma Hills (V5510) and Putah Creek (V69182 and V69184).[4] There is one Tehama Formation locality from Solano County, in Vacaville (V4546); however, there are 42 vertebrate fossil localities from Colusa, Glenn, Tehama, and Yolo counties from the Tehama Formation.[5]

The localities at Putah Creek represent ground sloth (*Glossotherium harlani*) and mammoth (*Mammuthus columbi*) specimens recovered from localities along Putah Creek, near Stevenson Bridge (approximately 21 miles northeast of the project site).[6]

Another locality approximately 12 miles southeast of the project site (near Stratton Lane in Collinsville) produced a cotton rat (*Sigmodon lindsayi*) fossil, which provided a unique record of the genus (*Sigmodon*). This specimen was recovered from Pleistocene-age deposits along the southern flank of the Montezuma Hills but is not attributed to the Montezuma Formation.[7]

In general, Pleistocene-age alluvial deposits have a moderate to high potential to contain significant paleontological resources, given the extensive vertebrate fossils that have been recovered from such deposits throughout California. Based on the Pleistocene-age fossil localities within Solano County, and throughout California, the Pleistocene-age alluvial deposits underlying the project site are considered to have a moderate to high potential to contain significant paleontological resources.

Based on the various fossil discoveries from the Montezuma and Tehama formations, these formations are considered to have a high potential to contain significant paleontological resources.

3.5.3 - Regulatory Framework

Federal

National Earthquake Hazards Reduction Program

The National Earthquake Hazards Reduction Program (NEHRP) was established by the United States 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:

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4 University of California Museum of Paleontology (UCMP). 2024. UC Museum of Paleontology Localities – results for Pleistocene-age localities within Solano County.

5 University of California Museum of Paleontology (UCMP). 2024. UC Museum of Paleontology Localities – results for localities associated with the Tehama Formation throughout California.

6 Dundas, Robert G., and Laura M. Cunningham. 1993. Harlan's Ground Sloth (*Glossotherium harlani*) and a Columbian Mammoth (*Mammuthus columbi*) from Stevenson Bridge, Yolo County, California. *PaleoBios* 15(3). May 24, 1993.

7 Bell, Christopher J., and C. Bruce Hanson. 1995. A Fossil *Sigmodon* (Mammalia: Rodentia) from the San Francisco Bay Area, Solano Co., California, with Comments on Additional Fossil Material from Kern Co., California. *PaleoBios* 16(4), pp. 9-12. December 8, 1995.

- 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
- United States Geological Survey (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.

State Regulations

California Building Standards Code

The 2019 California Building Code is another name for the body of regulations known as the California Code of Regulations, Title 24, Part 2, which is a portion of the California Building Standards Code (CBC). The CBC incorporates by reference the International Building Code requirements with necessary California amendments. Title 24 is assigned to the California Building Standards Commission, which, by law, is responsible for coordinating all building standards.

Compliance with the CBC requires that (with very limited exceptions) structures for human occupancy be designed and constructed to resist the effects of earthquake motions. The Seismic Design Category for a structure is determined in accordance with either CBC Section 1613–Earthquake Loads or the American Society of Civil Engineers Standard No. 7-05, Minimum Design Loads for Buildings and Other Structures. In brief, based on the engineering properties and type of soils at a project site, the site is assigned a Site Class ranging from A to F. The Site Class is then combined with Spectral Response (ground acceleration induced by earthquake) information for the location to arrive at a Seismic Design Category ranging from A to D, of which D represents the most severe conditions. The classification of a specific site and related calculations must be determined by a qualified Geotechnical Engineer and are site-specific.

Finally, the CBC requires that a geotechnical investigation be prepared for all new buildings that are 4,000 square feet or larger, as well as for smaller buildings if they meet certain criteria. The geotechnical investigation must be prepared by a California Registered Geotechnical Engineer and address the classification and investigation of the soil, including requirements for geotechnical designs necessary to meet standards for reducing exposure to geological hazards.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code [PRC] Sections 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, typically at a scale of 1 inch to 2,000 feet. Earthquake Fault Zones vary in width, although they are often 0.75-mile wide. 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 §§ 2690–2699.6), 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."

State Laws Pertaining to Paleontological Resources

Section 5097.5 of the California Public Resources Code prohibits "knowing and willful" excavation, removal, destruction, injury, and defacement of any "vertebrate paleontological site, including fossilized footprints," on public lands, except where the agency with jurisdiction has granted express permission. "As used in this section, 'public lands' means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof." Section 30244 of the California Public Resources Code requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands.

Section 4307–4309 of the California Code of Regulations relating to the California Department of Parks and Recreation (DPR) affords protection to geologic features, "paleontological features" and objects of archaeological, or historical interest or value, and grants the DPR the power to grant a permit to "remove, treat, disturb, or destroy plants or animals or geological, historical, archaeological or paleontological materials." (California Code of Regulations, Title 14, Section 4307–4309).

Local

City of Suisun City

General Plan

The Suisun City General Plan sets forth the following goal, objective, and policies relevant to geology, soils, and seismicity:

Goal PHS-14 Reduce risks to people and property from geologic hazards and soils conditions.

Objective PHS-14 Avoid risks to property and life through the implementation of City policies, programs, and standards related to geologic and soils hazards.

Policy PHS-14.1 The City will implement State and local building code requirements, including those related to structural requirements and seismic safety criteria, in order to reduce risks associated with seismic events and unstable and expansive soils.

Policy PHS-14.2 The City will require the preparation of a geotechnical site investigation for new development projects, which will be required to implement recommendations to reduce the potential for ground failure due to geologic or soil conditions.

Policy PHS-14.3 The City will require new developments that could be adversely affected by geological and/or soil conditions to include project features that minimize these risks.

City Code

Suisun City has adopted the 2019 California Building Code pursuant to Chapter 15.04 of the City Code; as such, all new construction within the city limits is required to adhere to its seismic safety standards. The Suisun City Development Services Department is responsible for the administration and enforcement of the Building Code.

3.5.4 - Methodology

This analysis in this section is based on the Preliminary Soil Investigation prepared by Raney Geotechnical. The complete report is provided in Appendix E.

Raney Geotechnical drilled borings on the project site in November 2015. Seven borings were drilled, with the deepest to 50 feet below ground surface. The soil attributes of the borings were recorded, including moisture, density, and unconfined compressive strength. One sample was subjected to sieve analyses. Raney subsequently laboratory tested the samples to determine additional attributes including plasticity index and R-value. Although the Preliminary Soil Investigation was more than 5 years old at the date of Notice of Preparation issuance, its conclusions are still considered valid because no substantial changes have occurred to the project site's surface or subsurface conditions since the report was prepared.

FCS also obtained information about faults and seismic hazards from sources including the USGS, the United States Department of Agriculture, and Suisun City General Plan.

3.5.5 - Thresholds of Significance

CEQA Guidelines Appendix G is a sample Initial Study checklist that includes a number of factual inquiries related to the subject of geology and soils, in addition to a series of other environmental topics. Notably, lead agencies are under no obligation to use these inquiries in fashioning thresholds of significance for these subjects, or on any subject addressed in the checklist. (*Save Cuyama Valley v. County of Santa Barbara* (2013) 213 Cal.App.4th 1059, 1068). Rather, with few exceptions, "CEQA grants agencies discretion to develop their own thresholds of significance." (*Id*.) Even so, it is a common practice for lead agencies to take the language from the inquiries set forth in Appendix G and to use that language in fashioning thresholds. The City has done so here. Thus, for purposes of this EIR, a significant impact would occur if implementation of the proposed project would:

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. (Refer to Section 7, Effects Found not to be Significant).

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

It is noteworthy that, in *California Building Industry Association v. Bay Area Air Quality Management District* (2015) 62 Cal.4th 369, 377 ("CBIA"), the California Supreme Court held that "agencies subject to CEQA generally are not required to analyze the impact of existing environmental conditions on a project's future users or residents." (Italics added). For this reason, the court found the following language from CEQA Guidelines Section 15126.2, subdivision (a), to be invalid: "[A]n EIR on a subdivision astride an active fault line should identify as a significant effect the seismic hazard to future occupants of the subdivision. The subdivision would have the effect of attracting people to the location and exposing them to the hazards found there." (Id. at p. 390).

The court did not hold that CEQA never requires consideration of the effects of existing environmental conditions on the future occupants or users of a proposed project. But the circumstances in which such conditions may be considered are narrow: "when a proposed project risks exacerbating those environmental hazards or conditions that already exist, an agency must analyze the potential impact of such hazards on future residents or users. In those specific instances, it is the project's impact on the environment—and not the environment's impact on the project—that compels an evaluation of how future residents or users could be affected by exacerbated conditions." (Id. at pp. 377-378, italics added). Because this exception to the general rule would presumably never apply to existing seismic hazards, the court concluded that this particular topic was outside the ambit of CEQA. (Id. at p. 390). The court also recognized that, within the entirety of CEQA, certain very specific statutes require consideration of existing conditions on project occupants; and the court treated these statutes as exceptions to the general rule it announced. (Id. at pp. 391-392).

In light of the CBIA decision, the City is not required by CEQA to address the extent to which existing seismic hazards–in the form of possible earthquakes, ground shaking, liquefaction, or subsidence–could affect future occupants or users of lands that might be developed in the future. Even so, the City believes that such issues are important from a public policy standpoint, and intends to address them under its police power, as opposed to under CEQA. (See Cal. Const., Art. XI, § 7; *Associated Home Builders, Inc. v. City of Livermore* (1976) 18 Cal.3d 582, 600-601; *Candid Enterprises, Inc. v. Grossmont Union High School District* (1985) 39 Cal.3d 878, 875; *DeVita v. County of Napa* (1995) 9 Cal.4th 763, 782). Thus, readers should treat the discussions below of potential impacts on future project residents and users as being beyond the scope of CEQA and provided to the public on a voluntary basis in the interests of full disclosure.

3.5.6 - Project Impacts and Mitigation Measures

This section discusses potential impacts associated with the proposed project and provides mitigation measures where necessary.

Seismic Hazards

Impact GEO-1:	**The proposed project may expose people or structures to potential substantial adverse effects associated with seismic hazards.**

Impact Analysis

This impact evaluates potential exposure to seismic hazards, including fault rupture, strong ground shaking, ground failure and liquefaction, and landslides. Each issue is discussed separately.

Fault Rupture

The Kirby Hills Fault Zone is located less than 1 mile from the project site, but it does not extend into the site. Moreover, the Kirby Hills Fault is inactive and is not zoned pursuant to the Alquist-Priolo Earthquake Fault Zoning Act. For these reasons, the proposed project would not be subject to fault rupture during a seismic event. Impacts in this regard would be less than significant.

Strong Ground Shaking

The project site is located in a seismically active region of California and is susceptible to strong ground shaking during a seismic event.

A design-level geotechnical report for the proposed project would be prepared by the time building permits are sought. Such a report would provide recommendations on the appropriate level of soil engineering and building design necessary to minimize ground shaking hazards. These design recommendations are not necessary to prevent the proposed project from exacerbating any existing seismic hazards, but rather are only necessary to protect future project occupants and users from existing hazards. Thus, under the approach required under the CBIA decision, the proposed project will not cause, or contribute to the causation of, any direct or indirect substantial adverse effects involving the risk of loss, injury, or death. Even so, Mitigation Measure (MM) GEO-1 is proposed in order to protect those future project occupants and users. In a sense, MM GEO-1 is not a true CEQA mitigation measure, in that it is not necessary to reduce the severity of a potentially significant environmental effect caused by the proposed project. Rather, it is imposed as a matter of good planning and engineering. MM GEO-1 requires the applicant to submit a design-level geotechnical study to Suisun City for review and approval. Standard soil engineering and building design practices would include standards for foundations and structural support of buildings to ensure that they withstand strong ground shaking during a seismic event. The implementation of this mitigation measure would ensure that the proposed project is not exposed to strong ground shaking hazards.

Ground Failure and Liquefaction

The project vicinity is underlain by partially cemented clays, silts, and sands characterized as stiff and very stiff. The Preliminary Soil Investigation determined that these soils are cohesive and not susceptible to liquefaction. Thus, the proposed project would not be susceptible to ground failure, liquefaction, or liquefaction-related phenomena. Impacts would be less than significant.

Landslides

The project site contains flat relief. There are no slopes near the project site that may be susceptible to landsliding during a seismic event. This precludes the possibility of the proposed project being susceptible to landsliding. Impacts would be less than significant.

Level of Significance Before Mitigation

Less than significant impact.

Mitigation Measures

MM GEO-1 Prior to the issuance of a grading permit for each structure, the project applicant shall submit a design-level Geotechnical Investigation to the City of Suisun City for review and approval. The investigation shall be prepared by a qualified engineer and identify grading and building practices necessary to achieve compliance with the latest adopted edition of the California Building Standards Code (CBC) geologic, soils, and seismic requirements, including abatement of expansive soil conditions. The report shall also determine the final design parameters for walls, foundations, foundation slabs, and surrounding related improvements (e.g., utilities roadways, parking lots, and sidewalks). The measures identified in the approved report shall be incorporated into the project plans and all applicable construction-related permits.

Level of Significance After Mitigation

Less than significant impact.

Erosion

Impact GEO-2: The proposed project may result in substantial soil erosion or the loss of topsoil.

Impact Analysis

The proposed project would involve grading, building construction, paving, and utility installation activities that may cause erosion and sedimentation. This includes construction activities associated with the proposed project. Left unabated, the accumulation of sediment in downstream waterways could result in the blockage of flows, potentially causing increased localized ponding or flooding. As such, MM HYD-1a in Section 3.8, Hydrology and Water Quality, would require the implementation of stormwater quality control measures during construction activities to prevent pollutants from entering downstream waterways. Standard stormwater pollution prevention measures would include implementing structural and nonstructural control measures within and around disturbed areas to prevent soil and pollutants from leaving the project site. Impacts would be less than significant after mitigation.

Level of Significance Before Mitigation

Potentially significant impact.

Mitigation Measures

Implement MM HYD-1a.

Level of Significance After Mitigation

Less than significant impact.

Unstable Geologic Location

Impact GEO-3: The proposed project would not be located on an unstable geologic unit or soil.

Impact Analysis

The stability of the underlying geologic units and soils are functions of their constituents. For example, soils with high organic or fill content would generally be considered unsuitable to support urban development. Likewise, soils that are composed of well-compacted alluvium would generally be considered suitable to support urban development.

The project site is underlain by partially cemented clays, silts, and sands characterized as stiff and very stiff. The Preliminary Soil Investigation determined that these soils are cohesive and not susceptible to liquefaction. As such, the proposed project would not be susceptible to or cause landslides, lateral spreading, collapse, ground failure, liquefaction, or liquefaction-related phenomena. Impacts would be less than significant.

Level of Significance Before Mitigation

Less than significant impact.

Mitigation Measures

No mitigation is necessary.

Level of Significance After Mitigation

Less than significant impact.

Expansive Soil

Impact GEO-4:	**The proposed project may create substantial risks to life or property as a result of expansive soil conditions on the project site.**

Impact Analysis

The Preliminary Soil Investigation found that the project site is underlain by soils with high clay content and are therefore capable of being expansive. The design-level Geotechnical Investigation required by MM GEO-1 would outline standard grading and soil engineering practices which would abate these potential hazards. Standard grading and soil engineering practices would include replacing native soils with engineered fill that would not possess expansive characteristics. As with Impact GEO-1, reliance on, and implementation of, standard grading and soil engineering practices are not necessary to prevent the proposed project from exacerbating any existing environmental hazards. Rather, they are only necessary to protect future project occupants and users from existing hazards associated with expansive soil conditions. Thus, under the approach required under the CBIA decision, the proposed project will not cause, or contribute to the causation of, any direct or indirect substantial risks to life and property associated with expansive soil conditions. Even so, MM GEO-1 is proposed in order to protect those future project occupants and users. In a sense, as noted earlier, MM GEO-1 is not a true CEQA mitigation measure, in that it is not necessary to reduce the severity of a potentially significant environmental effect caused by the proposed project. Rather, it is imposed as a matter of good planning and engineering.

Level of Significance Before Mitigation

Less than significant impact.

Mitigation Measures

Implement MM GEO-1.

Level of Significance After Mitigation

Less than significant impact.

Paleontological Resources or Unique Geologic Features

Impact GEO-5:	**The proposed project may directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.**

Impact Analysis

The Suisun City General Plan indicates that Pleistocene alluvium is paleontologically sensitive, and Policy OSC-5.3 indicates that the City shall include training, notification, and recovery procedures for fossils for development sites underlain by this formation.

Accordingly, MM GEO-5 requires that paleontological monitoring be conducted during the initial phase of ground disturbance and inadvertent discovery procedures be implemented if fossils are encountered during ground-disturbing activities. The implementation of these procedures would ensure that significant paleontological resources are treated appropriately and documented for posterity. Impacts would be less than significant after mitigation.

Level of Significance Before Mitigation

Potentially significant impact.

Mitigation Measures

MM GEO-5 Prior to the initial ground disturbance phases, a professional Paleontologist acceptable to the City of Suisun City's Development Services Director or the Director's designee shall provide training to construction personnel regarding paleontological resources. During the initial ground disturbance phases, the professional Paleontologist shall be present to spot check excavations for paleontological resources. If fossils with the potential to qualify as unique paleontological resources are discovered during project implementation, all earthwork or other types of ground disturbance within 100 feet of the find shall stop immediately until a qualified professional Paleontologist can assess the nature and importance of the find (i.e., whether the fossils actually do qualify as unique paleontological resources). A unique paleontological resource means a paleontological resource about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets one of the two following criteria: (1) contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information; or (2) has a special and particular quality such as being the oldest of its type or the best available example of its type. The Paleontologist shall report his or her findings to the City of Suisun City. If the fossils are determined to be unique paleontological resources, the Paleontologist shall either record the find and recommend that the City of Suisun City allow work to continue or recommend salvage and recovery of the fossil. The City shall implement the recommended measures if the City determines that they are feasible in light of project design, logistics, and cost considerations. The Paleontologist, if requested by the City, may also propose modifications to the stop-work radius based on the nature of the find, site geology, and the activities occurring on the site. If treatment and salvage are required, recommendations will be consistent with Society of Vertebrate Paleontology guidelines and currently accepted scientific practice. If required, treatment for fossil remains shall include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection, and, if required, shall also include preparation of a report for publication describing the finds.

Level of Significance After Mitigation

Less than significant impact.

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