4.5 GEOLOGY AND SOILS

This section of the Environmental Impact Report (EIR) describes the affected environment and regulatory setting related to geology and soils within the proposed project site and other regional geologic conditions that may affect the proposed project. It also describes the impacts on geology and soils that would result from near sea implementation of the proposed project and mitigation measures that would reduce these impacts. The following analysis of the potential environmental impacts related to geology and soils is also derived from the sources listed below. The geotechnical report is attached as Appendix F to the EIR.

- Propel Vallejo 2040 General Plan.
- Propel Vallejo 2040 General Plan EIR.
- ENGEO Incorporated. 2017. Preliminary Geotechnical Report for Cooke Property.

4.5.1 ENVIRONMENTAL SETTING

This section presents information on geology and soils conditions in the project area. The current soils condition was used as the baseline against which to compare potential impacts of the project.

PROJECT SETTING

Topography

The project site is currently undeveloped, vacant land. It is square-shaped on the north, east, and southern boundaries, with the western side angled to the southwest following the alignment of the undeveloped City right-of-way adjacent to Admiral Callaghan Lane.

The topography of the City of Vallejo and its Sphere of Influence (SOI) is varied. The environment along Mare Island and parts of the east margin of the Napa River includes gently sloping terrain in the central part of the City (especially the area flanking I-80 north of Curtola Parkway), hillier terrain that dominates the east-central and northeast parts of the City and include the East Bay Hills and Briones Hills to the southwest, the Vaca Mountains and Napa Valley to the north, and the Diablo Ranges to the southeast. Elevations range from near sea level on the shores of the Carquinez Strait to nearly 1,000 feet above mean sea level along the crest of Sulphur Springs Mountain in the northeast part of the City.

Geology

The City is located in southern Solano County in the Coast Ranges geomorphic province, which is characterized as northwest trending ridges and valleys. The shallowest alluvium (and youngest geologic deposits) in the project area consist of unconsolidated sediments as well as the adjacent alluvium, described as Holocene-age younger alluvium and coarse-grained alluvium, that occurs in relict stream courses. These sediments are composed of unconsolidated, poorly sorted gravel, silt, sand, and clay and organic matter and typically found in active drainage channels and small alluvial fans.

Soils

The U.S. Department of Agriculture (USDA) Soil Conservation Survey and California Soil Resource Laboratory's web soil mapping data was used to identify the major soil types in the Vallejo area. The identified soils within approximately 12 percent of the proposed project area include Clear Lake clay with 0 to 2 percent slopes; approximately 55 percent Dibble- Los Osos loams with 2 to 9 percent slopes; and approximately 33 percent Dibble-Los Osos clay loams with 9 to 30 percent slopes. Clear Lake clay soils generally drain poorly and its soil profile is made up of clay ranging from 0 to 60 inches in depth. Typical soil profiles for Dibble loams include loam from 0 to 13 inches, clay loam from 13 to 30 inches, and weathered bedrock from 30-34 inches in depth. Los Osos loams include loam from 0 to 7 inches, clay loam from 7 to 25 inches, weathered bedrock from 25 to 59 inches in depth.

Regional Faulting, Seismicity, and Related Seismic Hazards

Seismicity is the geographic and historical distribution of earthquakes, including their frequency, intensity, and distribution. Geologic hazards include surface rupture, ground shaking, liquefaction, landslides, subsidence, expansive soils, and soil erosion. Earthquakes are classified by their magnitude, a measure of the amount of energy released during an event. During a seismic event, the project site may be subjected to high levels of ground shaking because of its proximity to active faults.

The project site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. The five closest faults to the project site are shown in *Table 4.5-1: Regional Faults and Seismicity*.

Table 4.5-1: Regional Faults and Seismicity

Fault Name	Approximate Distance from Project Site	Maximum Characteristic Magnitude
West Napa	2.7	6.7
Green Valley Connected	6.3	6.8
Hayward Rodgers Creek RC+HN+HS	11.1	7.5
Great Valley 5, Pittsburg Kirby Hills	16.5	6.7
Great Valley 4b, Gordon Valley	18.6	6.8

Source: ENGEO, 2017

Groundshaking

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.

In 2003, the United States Geological Survey (USGS) estimated a 62 percent probability of a magnitude 6.7 or greater earthquake to occur in the Bay Area in the next 30 years (USGS, 2018). Seismic forecasts presented on the Association of Bay Area Government's (ABAG) website suggest that most parts of Vallejo are expected to experience "very strong" shaking" (ABAG, 2014).

Landslides

In steep areas, strong ground shaking could activate landslides on hillsides, slope failures on creek banks (lurch cracking), and tension cracking in areas underlain by loose, low-density soils. Debris flows are a type of landslide than can develop as a result of saturation of unconsolidated soils by heavy rainfall, forming dense sediment flows that contain large boulders and debris and can travel long distances from the source areas. Debris flows typically form on steep slopes and can be channeled into existing drainages to areas. The project site is relatively flat and is not located adjacent to any areas with steep slopes but has two small hills in the westerly portion of the project site.

Liquefaction

Liquefaction is the phenomenon in which saturated granular sediments temporarily lose their shear strength during periods of earthquake-induced strong ground shaking. Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow bearing foundations. In order to determine the liquefaction susceptibility of a region, three major factors must be analyzed: (1) density and textural characteristics of the alluvial sediments; (2) intensity and duration of ground shaking; and (3) depth to groundwater. Liquefaction can only occur in saturated soil layers, often in areas of shallow groundwater.

Unstable Geologic Units

Expansive soils can undergo significant volume change with changes in moisture content. In general, expansive soils shrink and harden when dried, and swell and soften when wet. Such changes can cause distress to building foundations and structures, slabs on grade, pavements, and other surface improvements. Expansive soils are also generally a major contributing factor to soil creep on slopes. The USDA Soil Conservation Survey and California Soil Resource Laboratory's web soil mapping data and ENGEO's laboratory testing results identified soil complexes in the project area with moderate to high shrink-swell potential with variations in moisture content. Soils with high shrink-swell potential often represent a local hazard, varying property to property.

Paleontological Setting

Paleontological resources (i.e., fossils) are the remains and/or traces of prehistoric plant and animal life. Although typically it is assumed that fossils must be older than approximately 10,000 years (i.e., the generally accepted end of the last glacial interval of the Pleistocene Epoch), organic remains of the early Holocene age can also be considered to represent fossils because they are part of the record of past life. Fossil remains such as bones, teeth, shells, leaves, wood, burrows, and trackways are found in the geologic deposits (rock formations) within which they were originally buried (Department of Paleo Services, 2012).

According to the City's General Plan EIR, a search of the UC Museum of Paleontology at Berkeley was completed for the City to assess the probable existence, sensitivity, and distribution of significant paleontological resources within the project area (inclusive of the project site). Paleontological resources include fossils – the remains or traces of once-living organisms preserved in sediments or sedimentary rocks – and the geologic context in which they occur. By convention, paleontological resources do not include human remains, artifacts (objects created by humans), or other evidence of past human activities. According to the General Plan EIR, there are no known significant fossil deposits in the City's Planning Area, inclusive of the project site.

4.5.2 REGULATORY SETTING

FEDERAL REGULATIONS

Earthquake Hazards Reduction Act

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 (P.L.) 95–124. At the time of its creation, Congress' stated purpose for NEHRP was "to reduce the risks of life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards reduction program." 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. Since NEHRP's creation, it has become the federal government's coordinated long-term nationwide program to reduce risks to life and property in the United States that result from earthquakes. Four basic NEHRP goals are as follows:

- 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.
- Congress has recognized that several key federal agencies can contribute to earthquake mitigation efforts. Today, there are four primary NEHRP agencies:

- Federal Emergency Management Agency (FEMA) of the Department of Homeland Security.
- National Institute of Standards and Technology (NIST) of the Department of Commerce (NIST is the lead NEHRP agency).
- National Science Foundation (NSF).
- USGS of the Department of the Interior.

Congress completed a review of NEHRP, resulting in the NEHRP Reauthorization Act of 2004, PL 108–360. PL 108–360 directed that NEHRP activities be designed to develop effective measures for earthquake hazard reduction; promote the adoption of earthquake hazards reduction measures by government agencies, standards and codes organizations, and others involved in planning and building infrastructure; improve the understanding of earthquakes and their effects through interdisciplinary research; and, develop, operate, and maintain both the Advanced National Seismic System and the George E. Brown, Jr. Network for Earthquake Engineering Simulation. PL 108–360 also directed that NEHRP support development and application of performance-based seismic design.

California Health and Safety Code

Section 19100 et seq. of the California Health and Safety Code establishes the State's regulations for earthquake protection. This section of the code requires structural designs to be capable of resisting likely stresses produced by phenomena such as strong winds and earthquakes.

STATE REGULATIONS

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) was passed in 1972 to regulate development and construction of buildings intended for human occupancy to avoid the hazard of surface fault rupture. Under the Alquist-Priolo Act, the California State Geologist identifies areas that are at risk of surface fault rupture. The primary purpose of the Alquist-Priolo Act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. An active fault is defined by the State Mining and Geology Board as one which has "had surface displacement within Holocene time (about the last 11,000 years)." The California Geological Survey (CGS), previously known as the California Division of Mines and Geology, has compiled Special Publication 42 – Fault Rupture Hazard Zones (California Geological Survey [CGS], 2018), which delineates and defines active fault traces and zones that require specific studies to address rupture hazards with respect to "structure[s] for human occupancy." Any project that involves the construction of buildings or structures for human occupancy is subject to the Alquist-Priolo Act, and any structures for human occupancy must be located at least 50 feet from any active fault.

Seismic Hazards Mapping Act

In accordance with Public Resources Code, Chapter 7.8, Division 2, the CGS is directed to delineate Seismic Hazard Zones through the Seismic Hazards Zonation Program. The purpose of the Act is to reduce the

threat to public health and safety and to minimize the loss of life and property by identifying and mitigating seismic hazards, such as those associated with strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. Cities, counties, and State agencies are directed to use seismic hazard zone maps developed by CGS in their land-use planning and permitting processes. In accordance with the Seismic Hazards Mapping Act, site-specific geotechnical investigations must be performed prior to permitting most urban development projects within seismic hazard zones.

California Building Code (CBC 2016)

The State of California provides minimum standards for building design through the California Building Code (CBC). The CBC is based on the International Building Code (IBC), which is used widely throughout the United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for conditions within California. Starting in 1989, revised editions of the California Code of Regulations (CCR) Title 24 has been published every three years. The 2016 edition of the CBC is based on the 2015 IBC published by the International Code Council. The current version of the CBC became effective January 1, 2017. Local agencies must ensure that development in their jurisdictions complies with guidelines contained in the CBC. Cities and counties can adopt building standards beyond those provided in the code with the approval of the State based upon local conditions. Chapter 16 of the CBC contains definitions of seismic sources and the procedure used to calculate seismic forces on structures.

Paleontological Resources

Consideration of paleontological resources is required by CEQA (see Appendix G of the CEQA Guidelines). Other State requirements for paleontological resource management are found in PRC Chapter 1.7, Section 5097.5, Archaeological, Paleontological, and Historical Sites. This statute specifies that State agencies may undertake surveys, excavations, or other operations as necessary on State lands to preserve or record paleontological resources.

No State or local agencies have specific jurisdiction over paleontological resources. No State or local agency requires a paleontological collecting permit to allow for the recovery of fossil remains discovered as a result of construction-related earth moving on State or private land in a project site.

LOCAL PLANS AND REGULATIONS

Propel Vallejo 2040 General Plan (VGP)

The policies, goals, and implementation measures in the VGP's Nature and Built Environment Chapter applicable to geology and soils as related to the proposed project are provided below.

Goal NBE-5	Hazard Protection: Protect life and property from natural and human-made hazards.
Policy NBE-5.3	Health and Safety Codes. Enforce development regulations and building code requirements to protect residents, businesses, and employees from flooding, liquefaction, earthquakes, fires, and other hazards.

Action NBE-5.3B	Continue to require development to comply with building and safety codes and continue to route plans and drawings to all relevant City departments for review.
Policy NBE-5.4	Project Location and Design. Prohibit development in any area where it is determined that the potential risk from natural hazards cannot be mitigated to acceptable levels.
Action NBE-5.4B	Continue to require drainage and erosion control measures for landslide-prone or geologically hazardous hillside areas to minimize risks to downhill areas.
Action NBE-5.4C	Continue to use the development review process to ensure that development is planned and constructed to resist the encroachment of uncontrolled fire.

To help protect known and unknown resources, the General Plan includes goals, policies and action items to preserve sites as well as paleontological resources or artifacts that may remain buried. Those that would be applicable to the proposed project are as follows:

Policy NBE-1.9	Cultural Resources. Protect and preserve archaeological, historic, and other cultural resources.
Action NBE-1.9A	Continue to require that land use activities comply with State requirements and follow best practices to ensure that cultural resources are not impacted, and that appropriate agencies and technical experts are involved in the evaluation and protection of resources and sites.

City of Vallejo Municipal Code

Title 12, Section 12.40.070, Excavating, Grading, and Filling, of the Vallejo Municipal Code includes a Grading Ordinance that addresses hazards associated with erosion and land stability. The ordinance establishes requirements for grading permits including submittal and construction requirements. An erosion and sedimentation control plan is required with a grading permit application, along with drainage plan, and pollution control plan. Implementation of these plans would help ensure that the storm water runoff from a construction site meets applicable water quality standards.

4.5.3 STANDARDS OF SIGNIFICANCE

SIGNIFICANCE CRITERIA AND THRESHOLDS

The following criteria, included in Appendix G of the State CEQA Guidelines (14 CCR 15000 et seq.), is used to determine the significance of potential geology and soils impacts, including paleontological resources. Impacts would be significant if the proposed project would:

Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

- Rupture of a known earthquake fault, as delineated on the most recent Alquist–Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42;
- Strong seismic ground shaking;
- Seismic-related ground failure, including liquefaction; or
- Landslides.
- Result in substantial soil erosion or the loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse; or
- 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.
- 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.
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

4.5.4 PROJECT IMPACTS AND MITIGATION

WOULD THE PROPOSED PROJECT, DIRECTLY OR INDIRECTLY CAUSE POTENTIAL SUBSTANTIAL ADVERSE EFFECTS, INCLUDING THE RISK OF LOSS, INJURY, OR DEATH INVOLVING:

IMPACT GEO-1

a) 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

b) Strong seismic ground shaking

c) Seismic-related ground failure, including liquefaction

a) **Landslides**

(LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED)

a) 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.

As previously discussed, there are no mapped Alquist–Priolo Earthquake Fault Zones in Vallejo. Since there are no known faults crossing the project site and the property is not within an Earthquake Fault Specialty

Study Zone, the likelihood of primary ground rupture in the project area is considered low. In addition, the applicant would be required to conform to the California Building Standards Code and the California Health and Safety Code for all structures proposed as part of the project. The building and safety standards established by these codes have been developed to address structural integrity during a seismic event. Policy NBE-5.4 and Action NBE-5.4A in the General Plan would also ensure that the proposed project would not have an adverse impact on hazards associated with rupture of an active fault.

As a result, the proposed project would not expose people or structures to potential risk of loss or injury where there is high potential for earthquake-related ground rupture in the vicinity of major fault crossings. Any potential impacts would therefore be less than significant.

b) Strong seismic ground shaking

According to the 2017 ENGEO report, an earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the project site, similar to that which has occurred in the past. All structures would be required to be designed using sound engineering judgment and meeting the then-current CBC requirements. According to the 2017 ENGEO report, conformance to the current building code recommendations does not constitute that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, having a well-designed and well-constructed structure would lessen the chance of collapse or cause loss of life in a major earthquake. In addition, the project applicant would be required to submit a design-level geotechnical report to the City as part of MM GEO-1 and implement all remedial grading measures in the 2017 ENGEO report. The implementation of this measure would mitigate impacts to a less than significant level.

c) Seismic-related ground failure, including liquefaction

While there are no known active or potentially active faults crossing the project site, there are numerous faults in the region. Rupture of any of these faults could cause ground shaking, which may expose people or structures to adverse effects associated with a seismic event, including ground failure. According to the 2017 ENGEO report, the site is not located within a State of California Seismic Hazard Zone for areas that may be susceptible to liquefaction.

Nine test pits were drilled by ENGEO to depths ranging between 0 and 14 feet below existing ground surface. Except for one test pit (TP-5), the test pit explorations generally encountered stiff to hard lean clays and elastic silts underlain by weak to very strong, highly to slightly weathered siltstone, claystone, and sandstone. According to the 2017 ENGEO report, the risk of liquefaction at the project site is low based on the material types and densities of granular materials encountered in the test pits. The different types of ground failure associated with liquefaction often leaves geomorphic evidence after the event in the form of scarps, and open or unfilled groups cracks, and sand volcanoes. Due to the shallow bedrock at the project site, soil liquefaction and liquefaction are not a concern for development on the project site.

As discussed above, the applicant would be required to submit a geotechnical investigation report to the City as part of MM GEO-1 and implement all remedial grading measures in the 2017 ENGEO report. This would reduce any potential impacts associated with seismic-related ground failure and liquefaction.

d) Landslides

Lateral spreading and earthquake-induced landslides involve lateral ground movements caused by seismic shaking. According to the 2017 ENGEO report, the risk of subsidence and landslides is low based on ENGEO's review of topographic and lithologic data due to the shallow bedrock. The project site is relatively flat and is not located adjacent to any areas with steep slopes. However, as discussed above, the applicant would be required to submit a geotechnical investigation report to the City as part of MM GEO-1 and implement all remedial grading measures in the 2017 ENGEO report. This would reduce any potential impacts associated with landslides.

Mitigation Measure:

MM GEO-1: **Geotechnical Investigation.** Prior to construction, the project applicant shall prepare a design-level geotechnical investigation and a final geotechnical report with site-specific recommendations, which must be reviewed and approved by the City of Vallejo prior to issuance of any grading permit. All recommended remedial grading measures identified in the ENGEO reports dated April 17, 2017 shall be updated to reflect current building code requirements and be implemented unless alternative techniques developed by a certified geotechnical engineer or engineering geologist are identified as part of the final geotechnical report.

IMPACT 4.5-2	***WOULD THE PROPOSED PROJECT, RESULT IN SUBSTANTIAL SOIL EROSION OR THE LOSS OF TOPSOIL?*** ***(LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED)***

The proposed project site is generally flat but still has the potential for soil erosion. Buildout of the proposed project would involve construction-related activities and during the early stages of construction, topsoil would be exposed associated with grading activities. As a result, once grading is complete but prior to overlaying the ground surface with structures, the potential exists for wind and water erosion to occur which could affect project site soils causing a potentially significant impact.

Projects involving disturbance of one acre or more are required to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) that specifies how water quality would be protected during construction activities. The SWPPP would include best management practices (BMPs) to protect the quality of storm water runoff. Construction BMPs would include, but are not limited to, stabilization of construction entrances, straw wattles on embankments, and sediment filters on existing inlets. These measures would minimize erosion, protect exposed slope areas, control surface water flows over exposed soils, and require the implementation of a sediment monitoring plan. These measures would be further refined with the subsequent preparation of a SWPPP to ensure compliance with the erosion control

ordinances required by the City. In addition, the project applicant would be required to submit a geotechnical investigation report to the City as part of MM GEO-1. As a result, with implementation of MM GEO-1 and measures from the SWPPP, impacts associated with soil erosion and loss of topsoil would be less than significant.

IMPACT 4.5-3	***WOULD THE PROPOSED PROJECT 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?*** ***(LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED)***

As described in the 2017 ENGEO report, nine test pits were drilled by ENGEO on the project site in preparation for construction of the existing development. The test pits were drilled to depths ranging between 0 and 14 feet below existing ground surface. Except for one test pit (TP-5), the test pit explorations generally encountered stiff to hard lean clays and elastic silts underlain by weak to very strong, highly to slightly weathered siltstone, claystone, and sandstone. The test pit logs were logged in the field by a registered geologist of ENGEO.

Based on the results of these test pits, the potential risk of landslide, lateral spreading, subsidence, liquefaction, and collapse as a result of the proposed project are summarized below.

SUBSIDENCE, LANDSLIDES

According to the 2017 ENGEO report, the risk of subsidence and landslides is low based on ENGEO's review of topographic and lithologic data.

Liquefaction and Lateral Spreading

According to the 2017 ENGEO report, the risk of liquefaction at the project site is low based on the material types and densities of granular materials encountered in the test pits. The different types of ground failure associated with liquefaction often leaves geomorphic evidence after the event in the form of scarps, and open or unfilled groups cracks, and sand volcanoes. Due to the shallow bedrock at the project site, soil liquefaction and liquefaction are not a concern for development on the project site.

Collapse

As discussed above, an earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the project site, similar to that which has occurred in the past. To mitigate the shaking effects, all structures will be required to be designed using sound engineering judgment and the current CBC requirements, as a minimum. According to the 2017 ENGEO report, conformance to the current building code recommendations does not constitute that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, having

a well-designed and well-constructed structure will lessen the chance of collapse or cause loss of life in a major earthquake. In addition, the project applicant would be required to submit a design-level geotechnical report to the City as part of MM GEO-1 and implement all remedial grading measures in the 2017 ENGEO report. The implementation of this mitigation measure would ensure that any buildings constructed within the project is not exposed to strong ground shaking hazards and impacts would be less than significant.

IMPACT 4.5-4	***WOULD THE PROPOSED PROJECT, BE LOCATED ON EXPANSIVE SOIL, AS DEFINED IN TABLE18-1-B OF THE UNIFORM BUILDING CODE (1994), CREATING SUBSTANTIAL DIRECT OR INDIRECT RISKS TO LIFE OR PROPERTY?*** ***(LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED)***

According to the 2017 ENGEO report, soils in the vicinity of the project site were observed to be potentially expansive. Laboratory testing of the test pits indicates that these soils have moderate to high shrink/swell potential with variations in moisture content. Future development on the project site would be subject to existing CBC regulations and provisions, as adopted in Chapter 12.04 of the City of Vallejo Municipal Code and enforced by the City during plan review prior to building permit issuance.

In addition, the Solano County Public Health and Safety Chapter and City of Vallejo Nature and Built Environment Chapter for each agency in their respective General Plans, establishes policies and actions that are designed to protect people and structures from geologic hazards, including expansive soils. Implementation of MM GEO-1 (Geotechnical Report) and consistency with the General Plan policies and actions would require that a site-specific design-level geotechnical investigation be prepared by a licensed professional and submitted to the City for review and confirmation prior to construction. This design-level geotechnical investigation would identify the potential for damage related to expansive soils and non-uniformly compacted fill and engineered fill. If a risk is identified, design criteria and specification options may include removal of the problematic soils, and replacement, as needed, with properly conditioned and compacted fill material that is designed to withstand the forces exerted during the expected shrink-swell cycles and settlements.

Design criteria and specifications set forth in the design-level geotechnical investigation would ensure impacts from problematic soils are minimized. As a result, with implementation of MM GEO-1 (Geotechnical Report) and compliance with City ordinances and policies, impacts associated with expansive soils would be reduced to less-than-significant levels.

IMPACT 4.5-5	***WOULD THE PROPOSED PROJECT, 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?*** ***(NO IMPACT)***

The proposed project would involve disposal of wastewater through the City's existing sanitary sewer system for treatment of wastewater rather than septic systems, which is not allowed in the City. Therefore, no septic systems would be constructed as part of the project and no impacts would occur.

IMPACT 4.5-6	***WOULD THE PROPOSED PROJECT, DIRECTLY OR INDIRECTLY DESTROY A UNIQUE PALEONTOLOGICAL RESOURCE OR SITE OR UNIQUE GEOLOGIC FEATURE?*** ***(LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED)***

There are no known paleontological resources located in Vallejo's Planning Area, including the project site. However, development of the proposed project could result in the discovery and disturbance of previously unknown or undiscovered paleontological resources. While fossils are not expected to be discovered during construction, it is possible that significant fossils could be discovered during excavation activities, even in areas with a low likelihood of occurrence. Fossils encountered during excavation could be inadvertently damaged. If a unique paleontological resource is discovered, the impact to the resource could be substantial. MM GEO-2 would require that a qualified archeologist monitor grading and excavation activities, and a paleontologist be notified if paleontological resources are found. If any scientifically important large fossil remains are uncovered, the paleontologist would have the authority to divert heavy equipment away from the fossil site.

With implementation of MM GEO-2 and consistency with General Plan Action NBE-1.9A, impacts associated with paleontological resources would be less than significant.

Mitigation Measure:

MM GEO-2: **Paleontological Monitor.** Prior to the issuance of a grading permit, the project applicant shall, to the satisfaction of the Planning & Development Services Director, provide evidence that a qualified paleontologist has been retained to monitor mass grading and construction activities. The paleontological monitor may periodically inspect construction activities to adjust the level of monitoring in response to subsurface conditions. In the event that any potentially significant paleontological resources are discovered, the paleontological monitor shall stop work inside a zone designated by him/her where additional paleontological resources could be found. A plan for the evaluation of the resource shall be submitted to the Planning & Development Services Director for approval. In the event that a paleontological resource (fossilized invertebrate, vertebrate,

plan or micro-fossil) is found during construction, excavation within 50 feet of the find shall be temporarily halted or diverted until the discovery is evaluated. Upon discovery, the Planning & Development Services Director shall be notified immediately, and a qualified paleontologist shall be retained to document and assess the discovery in accordance with Society of Vertebrate Paleontology's 2010 Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources, and determine procedures to be followed before construction is allowed to resume at the location of the find. If determined to be significant, the paleontologist will prepare an excavation plan for mitigating the Project's impact on this resource, including preparation, identification, cataloging, and curation of any salvaged specimens.

4.5.5 CONCLUSION

The 2017 Preliminary Geotechnical Report did not identify any site-specific seismic hazard concerns associated with the project site. The incorporation of mitigation to implement all remedial grading measures in the 2017 ENGEO report to reflect current building code requirements would reduce impacts from seismic hazards to a less than significant level. In addition, based on the lack of known paleontological resources in the project area, and incorporation of mitigation to reduce impacts to unknown resources should they be discovered during construction, impacts to paleontological resources would be less than significant.

4.5.6 CUMULATIVE IMPACTS

Geology and soil-related impacts are generally site-specific and are determined by a particular site's soil characteristics, topography, and proposed land uses. Development projects are analyzed on an individual basis and must comply with established requirements of the applicable jurisdiction's development requirements and the California Building Standards Code as they pertain to protection against known geologic hazards and potential geologic and soil-related impacts.

Cumulative effects related to geology resulting from the implementation of future development of the site and surrounding areas could expose more persons and property to potential impacts due to seismic activity. Long-term impacts related to geology include the exposure of people to the potential for seismically induced ground shaking. Implementation of other cumulative projects would incrementally increase the number of people and structures subject to a seismic event. Seismic and geologic significance would be considered on a project-by-project basis through the preparation of a design-level geotechnical study and such exposures would be minimized through strict engineering guidelines as they pertain to protection against known geologic hazards and potential geologic and soil-related impacts.

Development projects would be required to be constructed in accordance with the latest edition of the CBC and to adhere to all current earthquake construction standards, including those relating to soil characteristics. The proposed project would not contribute to any cumulatively considerable geologic and/or soils impacts. Therefore, cumulative effects of increased seismic risk would be less than significant.

4.5.7 REFERENCES

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