3.6 Geology and Soils

This section of the Draft EIR evaluates potential impacts regarding geology and soils associated with implementation of the proposed Golden State Natural Resources Forest Resiliency Demonstration Project (proposed project). This section describes the existing geology and soils conditions at feedstock source locations (Sustainable Forest Management Projects); proposed pellet processing facility sites in Northern California (Lassen Facility) and the Central Sierra Nevada foothills (Tuolumne Facility); and the export terminal in Stockton, California (Port of Stockton), and then evaluates the potential for project-related geology and soils impacts, Comment letters contained scoping comments that pertained at least in part to geology and soils in response to the Notice of Preparation (NOP) (see Appendix A). These comments related to potential erosion and associated water quality impacts related to "increased mechanical removals from forests, logging activity, and road transport." In addition, a comment letter indicated that timber operations and road networks can "destabilize landslides and trigger mass wasting events."

The following environmental setting and impact evaluation is based in part on the following project-specific technical reports, included as appendices to this EIR:

1. Appendix E1 - Geotechnical Engineering Report, Golden State Natural Resources Lassen County, prepared by Wallace Kuhl & Associates, September 2022
2. Appendix E2 – Supplemental Geotechnical Investigation Services, Golden State Natural Resources Lassen County Percolation Test, prepared by Universal Engineering Sciences November 2023_
3. Appendix E3 - Geotechnical Engineering Report, Pellet Processing Facility (Tuolumne County), prepared by Wallace Kuhl & Associates, June 2021

3.6.1 Environmental Setting

3.6.1.1 Sustainable Forest Management Projects

Feedstock destined to the Lassen and Tuolumne facilities for manufacturing of wood pellets will be wood byproducts sourced from Sustainable Forest Management Projects such as hazardous fuel reduction projects, construction of shaded fuel breaks, and salvage harvests (see Chapter 2, Project Description, for a full description). The feedstock would originate from private, state, tribal, and federal timberlands located within the Working Area of the two wood pellet production facilities.

Lassen Facility Feedstock Area

A close association exists between physiographic areas and geology in many parts of California, and in general, large contiguous areas of the state have distinctive features not shared by the adjacent terrain. These are physiographic-geologic areas have been designated "geomorphic provinces" by the California Geological Survey (CGS). Geology and topography are closely linked by relationships between rock uplift rates, rock erodibility, and landscape form over geologic time. Rocks, which are the parent material for soil, also affect soil characteristics through variability in infiltration capacity and soil hydraulic conductivity, due to differing proportions of sand, silt, and clay.

The portion of the Working Area described in Section 2.4 covers parts of several geomorphic provinces of northern California, southern Oregon, and western Nevada, including the Modoc Plateau, Basin and Range, Cascade Range, Sierra Nevada, Great Valley, and Klamath Mountains provinces (Figure 3.6-1, Geomorphic Provinces). These large physiographic-geologic areas are based on geology, faults, topographic relief, and climate.

The central portion of this feedstock area is located on the Modoc Plateau, which is a volcanic table land (elevation 4,000 to 6,000 feet above mean sea level [amsl]), consisting of a thick accumulation of lava flows and tuff beds, along with many small volcanic cones. Occasional lakes, marshes, and sluggishly flowing streams meander across the plateau, which has low to moderate topographic relief. The Modoc Plateau, which is cut by many north-south faults, is bound by the Cascade Range on the west and the Basin and Range on the east and south (CGS 2002a).

The west central portion of this feedstock area is located in the Cascade Range, a chain of volcanic cones that extend through Washington and Oregon into California. This range is dominated by Mount Shasta, a glacier-mantled volcanic cone, rising 14,162 feet amsl. The southern termination of the Cascade Range is Lassen Peak, which last erupted in the early 1900s. The Cascade Range is transected by deep canyons of the Pit River, which flow through the range between these two major volcanic cones, after winding across interior Modoc Plateau on its way to the Sacramento River (CGS 2002a).

The western portion of this feedstock area is located within the Klamath Mountains, which consist of rugged topography, with prominent peaks and ridges reaching 6,000 to 8,000 feet amsl. In the western Klamath Mountains, an irregular drainage is incised into an uplifted plateau called the Klamath Peneplain. The Klamath River follows a circuitous course from the Cascade Range through the Klamath Mountains. This geomorphic province is considered to be a northern extension of the Sierra Nevada (CGS 2002a).

The eastern portion of this feedstock area is located within the Basin and Range geomorphic province, which is the western-most part of the Great Basin, an area characterized by high topographic relief and interior drainage, with no outlet to an ocean. Drainage occurs toward lakes and playas. The topography of this region was created by horst and graben structures (i.e., subparallel, fault-bounded ranges separated by down-dropped basins) (CGS 2002a).

The southern portion of this feedstock area is located in the Sierra Nevada, which is a tilted fault block nearly 400 miles long. The eastern face of this mountain range is a high, rugged scarp, which contrasts with the gentle western slope (about 2 degrees) that disappears under sediments of the Great Valley to the west. Deep river canyons are cut into the western slope. The upper portions of these river canyons, especially in massive granites of the higher Sierra, are modified by glacial sculpturing, forming scenic features such as Yosemite Valley. The high crest of the Sierra Nevada culminates in Mount Whitney, with an elevation of 14,495 feet amsl near the eastern scarp. The northern Sierra Nevada boundary is marked where bedrock disappears under the Cenozoic volcanic cover of the Cascade Range (CGS 2002a).

The southwestern portion of this feedstock area is located in the Great Valley, which is a nearly flat alluvial plain about 50 miles wide and 400 miles long, in the central part of California. The northern part is comprised of the Sacramento Valley, which is drained by the Sacramento River, and the southern part is comprised of the San Joaquin Valley, which is drained by the San Joaquin River. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic (about 160 million years ago). In the Sacramento Valley, the Sutter Buttes, the remnants of an isolated Pliocene volcano, rise above the valley floor (CGS 2002a).

Tuolumne Facility Feedstock Area

The portion of the Working Area described in Section 2.4 located near the Tuolumne Facility covers parts of the Sierra Nevada, Basin and Range, and Great Valley geomorphic provinces (Figure 3.6-1). The central and eastern portions of this feedstock area are located in the Sierra Nevada, as described above for the Lassen Facility Feedstock Area. The western portion of this feedstock area is located in the Great Valley geomorphic province, as described above, and the northeastern portion of the feedstock area is located in the Basin and Range, as described above.

3.6.1.2 Northern California (Lassen Facility) Site

Topography and Geologic Formations

The project site is located on relatively flat to gently sloping topography, with the northern portion a few feet higher and gently sloping to the south (Appendix E1 – Lassen Geotechnical Report). Based on regional geologic mapping (USGS 2021a; California Division of Mines 1958), the project site is underlain by Quaternary alluvium/lake deposits of the Pit River Valley. These deposits typically consist of relatively unconsolidated sand, silt, clay, and gravel.

Based on eight soil borings, drilled to depths ranging from 10 to 21.5 feet below ground surface, the upper 4 to 8 feet consists of very stiff to hard, variably cemented, lean clay and fat clay. Beneath the clays are a layer of medium to very dense, silty sand with fine gravel, to a depth of 19 to 20 feet, which are in turn underlain by stiff to very stiff, lean clay (Appendix E1).

Soils

Surficial topsoil at the project site consists primarily of Pit silty clay on 0% to 2% slopes. More specifically, this soil type consists of silty clay, clay, silty clay loam, and silt loam, to a depth of 5 feet. These soils are poorly drained, with medium runoff. These soils are frequently flooded. Topsoil in the southwest corner of the site consists of Cupvar silty clay on 0% to 2% slopes. The upper 21 inches of soil consists of silty clay, which is underlain by a 4-inch thick cemented soil layer. The cemented layer is underlain by fine sandy loam to a depth of 5 feet. These soils are moderately well drained, and the runoff potential is medium. The cemented layer has a very low capacity to transmit water (USDA 2021). Based on a percolation testing completed at two on-site locations, shallow on-site soils consist of loose, organic sandy clay in the upper 1.0 to 1.5 feet, underlain by very stiff to hard, fat clay to a depth of 3 feet (Appendix E2 – Lassen Percolation Testing).

Seismicity

Historical earthquakes in Lassen County have generally ranged from magnitude 4.0 to 5.9, resulting in strong ground shaking, property damage, and injuries. From 1934 to 1971, two earthquakes of magnitude 5.0 to 5.9 occurred near Honey Lake and three earthquakes of magnitude 5.0 to 5.9 occurred between Doyle and Herlong (Lassen County 2020). These earthquakes were all in excess of 75 miles southeast of the Lassen Facility. In addition, at least two damaging earthquakes, with magnitudes in excess of 5.0, occurred north of Susanville, approximately 50 miles southeast of the project site (CDMG 2000). An earthquake hazard map published by the U.S. Geological Survey (USGS) indicates the relative earthquake hazard at the project site is moderate. This rating is based on a greater than 2% chance that peak seismically induced ground accelerations will be exceeded in 50 years (USGS 2018).

Faulting

Based on maps by the CGS and USGS, no active faults, including Alquist-Priolo Earthquake Fault Zones, are in proximity to the site. The CGS classifies active faults as those which have demonstrated movement in the past

11,700 years (i.e., Holocene epoch). The nearest Holocene-active fault, the Pittville Fault, is approximately 7 miles west of the project site (Figure 3.6-2, Regional Faulting – Lassen Facility). The USGS classifies this fault as Latest Quaternary (less than 15,000 years), with a well-constrained location. The nearest pre-Holocene (or potentially active) fault and two unnamed faults in the Big Valley area are located approximately 0.75 miles south and 4.0 miles northeast of the site, respectively. The USGS classifies these faults as Undifferentiated Quaternary (past 1.6 million years), with well-constrained locations (CGS 2021a, 2021b; USGS 2021b).

Liquefaction

Liquefaction is a phenomenon that occurs when loosely consolidated soils lose their load bearing capabilities during ground shaking and flow in a fluid-like manner. The specific soil condition conducive to liquefaction is loose sands and silty sands below the water table and typically within the upper 50 feet of the ground surface. The CGS has prepared Seismic Hazard Maps for select USGS 7.5-Minute topographic quadrangle maps in California. These maps include areas of potential liquefaction and seismically induced landslides. A Seismic Hazards Map has not been prepared for the Bieber quadrangle, which includes the project site.

The project site is underlain by Quaternary alluvium/lake deposits of the Pit River Valley. Based on the USGS 7.5-Minute Bieber quadrangle, a relatively large marshy area is immediately northwest of the site, across State Highway 299. Numerous other small streams, sloughs, and marshy areas are east of the project site. The presence of these sloughs and marshes indicates that shallow groundwater is present in the vicinity of the project. Soil borings drilled on-site in July 2022 encountered groundwater at depths of 7 to 10 feet. Groundwater elevations in a well located approximately 0.5 mile northwest of the site (Well 38N07E32A002M) has fluctuated between depths of 1 to 12 feet, from 1959 to 2021 (Appendix E1). In addition, a groundwater well located approximately 2,000 feet west of the site (Well WCR2017-003484), had a static water depth of 25 feet in June 2017. The well is only 88 feet deep and has a yield of 50 gallons per minute (DWR 2021), indicating this well is screened at shallow depths (i.e., not a deep well). Based on the shallow groundwater and alluvial soils, the potential exists for liquefaction to occur at the site.

Landslides

Landslides generally occur on steep slopes that have been undercut by erosion or on slopes where the bedding planes of the bedrock are inclined down the slope. The topography of the project site is relatively flat to gently sloping. As a result, landslide hazards are not present on the site.

Subsidence

Land subsidence is the gradual sinking or settling of an area as a result of human activity, including pumping water, oil, or gas from underground reservoirs; collapse of underground mines; drainage of wetlands; and soil compaction. The site is not in an area of known subsidence due to groundwater pumping, peat loss, or oil extraction (USGS 2021c).

Expansive Soils

Expansive soils are those characterized as having a high shrink-swell potential, associated with a high percentage of clay content. The change in volume exerts stress on buildings and other loads placed on these soils. Expansive soils are common throughout California and can cause damage to foundations and slabs unless properly treated during construction. Grading, site preparations, and backfill operations associated with subsurface structures can often eliminate the potential for expansion. Based on the soil survey for the project area, surficial soils consist primarily of Pit silty clay (USDA 2021). Laboratory testing on near-surface soil samples indicated the soils have a medium to high expansion potential (Appendix E1).

Paleontological Resources

The Lassen Facility is located within the Modoc Plateau Geomorphic Province, as described above (CGS 2002a). According to surficial geological mapping by Gay and Aune (California Division of Mines 1958) at a 1:250,000 scale and the geological time scale of Cohen et al. (2022), the project area is underlain by Quaternary (late Pleistocene to Holocene) (< 129,000 years ago) lake deposits (map unit Ql). Quaternary lake deposits are typically fine-grained deposits consisting of unconsolidated sands and silts.

Dudek requested a paleontological records search from the Museum of Paleontology at the University of California, Berkeley (UCMP) on January 30, 2023 and the results were received on February 2, 2023. The UCMP reported no fossil localities from within the project site; however, they have one locality, 11 miles southwest of the project site, from similar sediments that likely underlie the project site on the surface and at depth. Fossil locality, UCMPV (Vertebrate) 3317 produced a complete *Bison latifrons* skull (Museum of Paleontology at the University of California, Berkeley 2023).

3.6.1.3 Central Sierra Nevada (Tuolumne Facility) Site

Tuolumne Facility

Topography and Geologic Formations

The Tuolumne Facility project site is located on gently to moderately sloping topography. The topography rises about 10 to 15 feet from the center of the facility to the northern property line and rises about 8 to 10 feet from the center of the facility to the eastern perimeter. In general, the eastern half to two-thirds of the site appears to have been cut to existing grade, while the remainder was raised with fill. Fill embankments ranging from about 1 to 10 feet high are present along the north, south, and west perimeters of the paved portion of the site. A cut slope ranging in height from about 1 to 10 feet is located along the eastern perimeter of the site. The perimeter of the site slopes down and away from the perimeter of the towards La Grange Road and two ponds located to the north. The detention pond appears to have been excavated into the existing grade, with the soil loosely packed on three sides of the basin (Appendix E3 – Tuolumne Geotechnical Report).

The project site is underlain by metavolcanic rock of the Copper Hill Volcanics (commonly referred to as greenstone) and serpentinized ultramafic rock. The upper 1 to 3 feet of greenstone in the project area tends to be highly weathered and fractured, quickly decreasing in weathering with depth and increasing in resistance and strength. Twelve 3- to 8-foot deep test pits excavated on the site encountered: 1) 2.0 to 5.5 feet of artificial fill underlain by 2) low plastic, sandy clay and highly plastic, sandy silt residuum that transitioned into 3) highly- to completely-weathered bedrock, with the consistency of hard sandy silt or dense silty sand, with angular gravel and cobble sized bedrock fragments, and 4) moderately weathered, friable to weak bedrock (Appendix E3).

Soils

Surficial topsoil at the project site consists primarily of Bonanza-Loafercreek complex, on 3% to 15% slopes. This soil type, which is residuum weathered from metavolcanics, consists primarily of loam and gravelly loam to a depth of 2 feet, underlain by bedrock. These soils are well-drained and form on low hills. The southern portion of the site is underlain by Copperopolis-Whiterock complex, on 2% to 8% rocky slopes. This soil type, which is residuum weathered from slate, consists primarily of loam and gravelly loam to a depth of 1 foot, underlain by bedrock. These soils are somewhat excessively drained and form on low hills (USDA 2021).

Seismicity

In Tuolumne County, the predicted seismically induced peak ground acceleration for the entire developed portion of the County does not exceed 20% of gravity, which indicates the County is in an area of very low potential for seismically induced ground shaking. Only four historical earthquake events, with recorded magnitudes of 3.5 or greater (Richter magnitude), occurred in or near Tuolumne County in the past century. These earthquakes did not cause substantial damage due to their occurrence in mountainous and remote areas generally devoid of development or human presence (Tuolumne County Community Resources Agency 2018). An earthquake hazard map published by the USGS indicates the relative earthquake hazard at the project site is moderate. This rating is based on a greater than 2% chance that peak seismically induced ground accelerations will be exceeded in 50 years (USGS 2018). Peak ground accelerations are anticipated to be less than 10% gravity (County of Tuolumne 2018).

Faulting

Geologic hazards in Tuolumne County are associated with potential seismic activity along the Foothills Fault Zone, which is a complex, braided system of individual fault segments that extend for approximately 200 miles, from Mariposa on the south to Lake Almanor on the north (Tuolumne County Community Resources Agency 2018). The northeastern portion of the project site is underlain by a pre-Quaternary (i.e., inactive) segment of the Green Springs Run Fault. A late Quaternary-age (i.e., potentially active) segment of this fault is immediately northwest of the site. Other nearby faults include the late Quaternary Negro Jack Point Fault, approximately 2 miles to the west of the site, the late Quaternary Bowie Flat Fault, approximately 2 miles to the north, and the late Quaternary Rawhide Flat West Fault, approximately 8 miles to the northeast. These faults are all part of the larger Foothills Fault System (Figure 3.6-3, Regional Faulting – Tuolumne Facility). The Negro Jack Point, Bowie Flat, and Rawhide Flat West faults are considered by the County of Tuolumne to be capable (or potentially active) faults, which are faults with tectonic displacement within the last 35,000 years that could produce an earthquake (County of Tuolumne 2018).

Based on maps by the CGS and USGS, no active faults, including Alquist-Priolo Fault Zones, are in proximity to the site. The CGS classifies active faults as those which have demonstrated movement in the past 11,700 years (i.e., Holocene epoch) (CGS 2021a, 2021b). However, based on the County of Tuolumne Multi-Jurisdictional Hazard Mitigation Plan, the New Melones Fault, approximately 8 miles northeast of the site, is considered active. The County classifies active faults as those that have demonstrated movement within the last 100,000 years (Tuolumne County Community Resources Agency 2018). The USGS classifies this fault as Late Quaternary (less than 130,000 years), with a well-constrained location (USGS 2021b).

Liquefaction

Based on the soil survey for the area (USDA 2021), bedrock is present at a depth of 1 to 2 feet below ground surface. Although seepage was observed in test pits excavated on-site, static groundwater was not present in the pits. In addition, no monitoring wells or groundwater wells were found near the site, based on California Department of Water Resources and State Water Resources Control Board GeoTracker databases. Based on the low seismicity of the area, lack of shallow groundwater, and shallow depth to bedrock, the potential for liquefaction and seismically induced settlement at the project site is low (Appendix E3).

Landslides

Landslides generally occur on steep slopes that have been undercut by erosion or on slopes where the bedding planes of the bedrock are inclined down the slope. Tuolumne County is located in a part of the state where landslide susceptibility is low, apart from some isolated areas of moderate-high susceptibility (Tuolumne County Community Resources Agency 2018). The topography of the project site is relatively flat to gently sloping, with very low-lying hills. As a result, landslide hazards are not present on the site.

Subsidence

Subsidence as a result of previous underground mining activity is potentially consequential in Tuolumne County (Tuolumne County Community Resources Agency 2018). However, such mining has not occurred beneath the project site. In addition, the site is not in an area of known subsidence due to groundwater pumping, peat loss, or oil extraction (USGS 2021c).

Expansive Soils

Based on the soil survey for the project area, surficial soils consist primarily of loam, which is soil with roughly equal proportions of sand, silt, and clay (USDA 2021). As a result, the potential for expansive clays exists at the site.

Paleontological Resources

The Tuolumne County portion of the project area is located within the Sierra Nevada Geomorphic Province, as described above (CGS 2002a). According to surficial geological mapping by Bartow et al. (1981) at a 1:62,500 scale and Rogers (CDMG 1972) at a 1:250,000 scale and the geological time scale of Cohen et al. (2022), the project area is underlain by Upper Jurassic (approximately 145 to 163 million years ago) marine sediments (map unit Ju) and Jurassic-Triassic (200 to 208 million years ago) metavolcanic rocks. The Jurassic marine sediments generally consist of slate, graywacke, minor siltstone and conglomerate, and minor pyroclastic rocks (CDMG 1972).

Dudek requested a paleontological records search from the UCMP on January 30, 2023 and the results were received on February 2, 2023. The UCMP reported no fossil localities from within the project site, or from the nearby area or similar sediments (Museum of Paleontology at the University of California, Berkeley 2023).

3.6.1.4 Port of Stockton

Topography and Geologic Formations

The Port of Stockton (Port) is located within the Great Valley geomorphic province, as previously described. The Port area consists of an island feature situated within the low-lying floodplains just east of the San Joaquin Delta. The surrounding topography is characteristic of a highly dissected alluvial plain with numerous river systems meandering to the west, including the San Joaquin and Calaveras rivers. The Port is surrounded by a perimeter levee that provides 100-year flood protection for the area (Port of Stockton 2003).

The majority of the Port area is underlain by Dos Palos Alluvium, which consists primarily of Holocene-age (past 11,700 years) flood deposits. A small portion of the Port area along the Stockton Deep Water Ship Channel is comprised of artificial fill. This fill was placed along the northeastern bank of the island during the initial construction of the Rough and Ready Naval Base in the 1930s. The extreme northern corner of the Port area is underlain by

Holocene age intertidal deposits, which primarily consist of soft mud and peat deposited by the San Joaquin River (Port of Stockton 2003; CDMG 1991).

Soils

Surficial topsoil in the Port area is characterized by deep, poorly-drained, and fine textured soils that contain a high percentage of organic materials and formed in flood plains. The primary soil type at the project site is Urban Land, which is artificial fill (as described above), Egbert-Urban land complex, which consists of approximately 35% Urban Land and 65% silty clay loam, to a depth of 60 inches. These soils occur on 0% to 2% slopes, are poorly drained, have very high runoff, and are rarely flooded. Groundwater occurs at a depth of approximately 48 to 72 inches (USDA 2023).

Seismicity and Faulting

The geology of San Joaquin County is comprised primarily of highly organic alluvium, which is susceptible to earthquake movement. No Holocene-active (past 11,700 years) and only one Quaternary age (past 1.6 million years) fault, the Vernalis Fault, is located within the County (Figure 3.6-4, Regional Faulting – Port of Stockton Facility) (CGS 2021a, 2021b; USGS 2021b). However, numerous active faults are present west of the County, within Contra Costa County. This scenario increases the likelihood of structural failures due to associated potential earthquake shaking and movement (San Joaquin County 2016). An earthquake hazard map published by the USGS indicates the relative earthquake hazard at the Port site is moderate. This rating is based on a greater than 2% chance that peak seismically induced ground accelerations will be exceeded in 50 years (USGS 2018).

No Alquist-Priolo Earthquake Fault Zones are located within the Port. The nearest faults to the Port exhibiting historic displacement (activity within the last 200 years) are the Concord-Green Valley, Hayward and Greenville fault zones, located approximately 35 miles west, 42 miles southwest, and 25 miles southwest of the Port, respectively (Figure 3.6-4). Portions of the Calaveras Fault Zone also have been rated as being active within the last 200 years and those portions are located approximately 35 miles southwest of the site (CGS 2021a, 2021b; USGS 2021b). Other Holocene-active faults within 50 miles of the Port are the Ortigalita (45 miles south) and West Napa (50 miles northwest) faults.

A seismically-active, concealed (blind) fold and thrust belt, referred to as the Coast Range Central Valley Geomorphic Boundary (CRCV), lies approximately 15 to 20 miles west of Stockton (CGS 2021a). Earthquakes associated with this fault system include the moment magnitude (Mw) 6.1 Kettleman Hills and Mw 6.5 Coalinga events (Wakabayashi and Smith 1994; USGS 2017). Published estimates of the CRCV slip rate derived from previous studies range from 1 to 10 millimeters (mm)/year, and estimated reoccurrence intervals of the Coalinga-type events range from 200 to 2,000 years. The concealed CRCV thrust is speculated to have produced the Vacaville-Winters earthquake (estimated Mw 6.75) (Wakabayashi and Smith 1994).

The maximum probable earthquake on the Greenville Fault is estimated to be Mw 6.0; however, the largest historic earthquake on the Greenville Fault was a Richter magnitude 5.8, comparable to a Mw 6.0 earthquake that occurred in 1980. That earthquake produced a peak ground acceleration of 0.15g in Brentwood, approximately 18 miles west of the Port (CGS 2021a; USGS 2021b; Port of Stockton 2003). The estimated likelihood of a magnitude 6.7 or greater earthquake in greater San Francisco Bay area before 2044 is 72%. For individual faults in proximity to the Port, forecasted probabilities include 0.17% for the CRCV and 4.03% for the Greenville Fault (USGS 2015).

For other similar industrial sites at the Port in proximity to the project site, the estimated Maximum Considered Earthquake peak ground acceleration adjusted for site class effects was determined to be 0.393g, based on both probabilistic and deterministic seismic ground motion. Nonetheless, regional seismic activity could cause accelerations severe enough to cause major damage to structures and foundations not designed to resist the forces generated by earthquakes. Underground utility lines are also susceptible where they lack sufficient flexibility to accommodate the seismic ground motion (Port of Stockton 2003).

Liquefaction

The CGS has produced liquefaction hazard maps for select USGS quadrangle maps throughout California; however, the Stockton area is not included in this map database (CGS 2023). Based on available data, the potential for liquefaction exists within the Port (Port of Stockton 2003). A geotechnical investigation completed in 2020 for a site within the Port indicated that the top 50 feet of soil have a moderate vulnerability to liquefaction, but that there is sufficient non-liquefiable soil on top of potentially liquefiable soil to prevent secondary liquefaction effects (e.g., sand boils or lurch cracking) following a major earthquake (Port of Stockton 2022).

Lateral spreading is lateral movement of soil along an unsupported slope, which occurs in association with liquefaction. Based on the relatively flat topography of the site, the potential for lateral spreading is low. However, lateral spreading could occur on the slopes of the levee surrounding the Port.

Landslides

Landslides generally occur on steep slopes that have been undercut by erosion or on slopes where the bedding planes of the bedrock are inclined down the slope. The topography of the Port site is relatively flat to gently sloping; therefore, landslide hazards are not present on the Port site.

Subsidence

The Port is not in an area of known subsidence due to groundwater pumping, peat loss, or oil extraction (USGS 2021b).

Expansive Soils

As previously discussed, the Port area is underlain by artificial fill and silty clay loam. Based on the presence of silty clay and heterogeneous unknown fill type, the potential for expansive clays exists at the site.

Paleontological Resources

The Port of Stockton portion of the project area is located within the Great Valley Geomorphic Province (Harden 2004). The Coast Ranges to the west are subparallel to the San Andreas Fault (CGS 2002a). According to surficial geological mapping by Rogers (CDMG 1972) at a 1:250,000 scale and the geological time scale of Cohen et al. (2022), the project area is underlain by recent (< 4,200 years ago) stream channel deposits (map unit Qsc) and recent basin deposits (map unit Qb) of the Great Valley.

Dudek requested a paleontological records search from the UCMP on January 30, 2023, and the results were received on February 2, 2023. The UCMP reported no fossil localities from within the project site; however, they have five localities nearby from similar sediments that likely underlie the project site on the surface and at depth. Fossil locality, UCMPV4822, 3.5 miles north of the project area, produced the dentary of a horse (*Equus*). UCMP

V2016003, V2016004, and V2016005 were all found during the realignment of US Highway 99, approximately 5.5 miles east of the project area, from a depth of 3 to 8 meters below the ground surface. These localities yielded unidentified mammal bones, a camel upper jaw, and a bison lower jaw (Museum of Paleontology at the University of California, Berkeley 2023).

3.6.2 Regulatory Setting

3.6.2.1 Federal

Earthquake Hazards Reduction Act

The United States Congress passed the Earthquake Hazards Reduction Act in 1977 to reduce the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards reduction program. To accomplish this goal, the act established the National Earthquake Hazards Reduction Program. This program was substantially amended in November 1990 by the National Earthquake Hazards Reduction Program Act, which refined the description of agency responsibilities, program goals, and objectives.

Occupational Safety and Health Administration Regulations

Excavation and trenching are among the most hazardous construction operations. Occupational Safety and Health Administration (OSHA) Regulations, OSHA Excavation and Trenching Standard, Title 29 of the Code of Federal Regulations, Part 1926, Subpart P, covers requirements for excavation and trenching operations. OSHA requires that all excavations in which employees could potentially be exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area.

Clean Water Act

The Clean Water Act (CWA) of 1948 (as amended in 1972 and 1987) establishes federal policy for the control of point and non-point pollution and assigns the states the primary responsibility for control of water pollution. The CWA regulates the dredging and filling of freshwater and coastal wetlands. Section 404 (33 USC 1344) prohibits the discharge of dredged or fill material into waters (including wetlands) of the United States without first obtaining a permit from the U.S. Army Corps of Engineers. Wetlands are regulated in accordance with federal Non-Tidal Wetlands Regulations (Sections 401 and 404). Compliance with the CWA by the U.S. Forest Service in California is achieved under state law. The California Water Code consists of a comprehensive body of law that incorporates all state laws related to water, including water rights, water developments, and water quality. The laws related to water quality (sections 13000 to 13485) apply to waters on the national forests and are directed at protecting the beneficial uses of water.

Section 402 of the Clean Water Act (National Pollutant Discharge Elimination System)

The NPDES permit program, as authorized by Section 402 of the CWA, was established to control water pollution by regulating point sources that discharge pollutants into waters of the United States (33 USC 1342). In the state of California, EPA has authorized the State Water Resources Control Board (SWRCB) permitting authority to implement the NPDES program. Regulations (Phase II Rule) that became final on December 8, 1999, expanded the existing NPDES Program to address stormwater discharges from construction sites that disturb land equal to or greater than 1.0 acres and less than 5.0 acres (small construction activity). The regulations also require that stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s) be regulated by an NPDES General Permit for Storm Water Discharges Associated with Construction Activity, Order No. 2022-0057-DWQ (i.e., the Construction General Permit [CGP]).

The CGP requires that construction sites be assigned a Risk Level of 1 (low), 2 (medium), or 3 (high), based both on the sediment transport risk at the site and the receiving waters risk during periods of soil exposure (e.g., grading and site stabilization). The sediment risk level reflects the relative amount of sediment that could potentially be discharged to receiving water bodies and is based on the nature of the construction activities and the location of the site relative to receiving water bodies. The receiving waters risk level reflects the risk to the receiving waters from the sediment discharge. Depending on the risk level, the construction projects could be subject to the following requirements:

- Effluent standards
- Good site management "housekeeping"
- Non-stormwater management
- Erosion and sediment controls
- Run-on and runoff controls
- Inspection, maintenance, and repair
- Monitoring and reporting requirements

The CGP requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP), which describes best management practices (BMPs) the discharger would use to protect stormwater runoff. The BMPs fall into several categories, including erosion control, sediment control, waste management, and good housekeeping, and are intended to protect surface water quality by preventing the off-site migration of eroded soil and construction-related pollutants from the construction area. Each category contains specific BMPs to achieve the goals of the overarching category. Specific BMPs may include the following:

- **Soil Stabilizing BMPs:** Use of straw mulch, erosion control blankets or geotextiles, and/or wood mulching
- **Sedimentation Control BMPs:** Use of storm drain inlet protection, sediment traps, gravel bag berms, and fiber rolls
- **Waste Management BMPs:** Stockpile management, solid waste management, and concrete waste management
- **Good Housekeeping BMPs:** Vehicle and equipment cleaning, implementing water conservation practices, and implementing rules for fueling construction vehicles and equipment

Routine inspection of all BMPs is required under the provisions of the CGP. In addition, the SWPPP is required to contain a visual monitoring program, a chemical monitoring program for non-visible pollutants, and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment. On September 8, 2022, the SWRCB issued a new NPDES General Permit for Storm Water Associated with Construction Activities (Order No. 2022-0057-DWQ, NPDES No. CAS000002), which became effective September 8, 2022.

In the project areas (i.e., Lassen Facility, Tuolumne Facility, Port of Stockton), the CGP is implemented and enforced by the Central Valley Regional Water Quality Control Board (RWQCB), which administers the stormwater permitting program. Dischargers are required to electronically submit a Notice of Intent (NOI) and permit registration documents in order to obtain coverage under this CGP. Dischargers are responsible for notifying the Central Valley RWQCB of violations or incidents of non-compliance, as well as for submitting annual reports identifying deficiencies of the BMPs and how the deficiencies were corrected. The risk assessment and SWPPP must be prepared by a State Qualified SWPPP Developer (QSD) and implementation of the SWPPP must be overseen by a State Qualified SWPPP Practitioner (QSP). A Legally Responsible Person, who is legally authorized to sign and certify permit registration documents, is responsible for obtaining coverage under the permit.

U.S. Forest Service

Water Quality Management Handbook

The 2011 Forest Service Region 5 Water Quality Management Handbook 2509.22, Chapter 10 (USFS 2011) includes requirements for BMP implementation monitoring of all projects with the potential to adversely affect water quality using a "checklist" approach. The USFS water quality protection program relies on implementation of prescribed BMPs. The checklists are the primary means for early detection of potential water-quality problems and should be completed early enough to allow corrective actions to be taken, if needed, prior to any significant rainfall or snowmelt throughout the duration of the project.

These BMPs are procedures and techniques that are incorporated in project actions and determined by the State of California to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. Forest Service BMPs, as presented in the 2011 Handbook, include detailed descriptions of individual BMPs (section 12), a requirement that site-specific BMPs be included in timber sale contracts (section 13), and direction that legacy sites (sites disturbed by previous land use that is causing or has potential to cause adverse effects to water quality) within timber project boundaries will be restored or improved. Additionally, the 2011 Handbook amendment establishes an expanded water quality management monitoring program (section 16).

National Best Management Practices for Water Quality Management on National Forest System Lands

Volume 1 – National Core BMP Technical Guide (FS-990a) directs compliance with required CWA permits and State regulations, and requires the use of BMPs to control nonpoint source pollution to meet applicable water quality standards and other CWA requirements.

Paleontological Resources Protection Act

The Paleontological Resources Protection Act (PRPA) of 2009 directs the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on federal land using "scientific principles and expertise." The PRPA incorporates most of the recommendations of the Secretary of the Interior's report titled Assessment of Fossil Management on Federal and Indian Lands (DOI 2022) to formulate a consistent paleontological resources management framework. In passing the PRPA, congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. The PRPA codifies existing policies of the U.S. Bureau of Land Management, National Park Service, U.S. Forest Service, Bureau of Reclamation, and the U.S. Fish and Wildlife Service, and provides the following:

- Criminal and civil penalties for illegal sale and transport and theft and vandalism of fossils from federal lands
- Minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants)
- Definitions for "paleontological resources" and "casual collecting"
- Requirements for curation of federal fossils in approved repositories

The PRPA requires the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on federal land. The PRPA furthers the protection of fossils on federal lands by criminalizing the unauthorized removal of fossils.

Federal Land Policy Management Act

The Federal Land Policy Management Act of 1976 (PL 94-579; 90 Statute 2743, USC 1701–1782) requires that public lands be managed such that the quality of their scientific values is protected. The act recognizes significant paleontological resources as scientific resources and requires federal agencies to manage public lands in a manner that protects scientific resource quality.

National Environmental Policy Act

The National Environmental Policy Act of 1969 (PL 91-190; 31 Statute 852, 42 USC 4321–4327) requires that important natural aspects of national heritage be considered in determining the environmental consequences of proposed projects.

3.6.2.2 State

Alquist-Priolo Earthquake Fault Zoning Act

California enacted the Alquist-Priolo Special Studies Zones Act in 1972, which was renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1994. Also known as the Alquist-Priolo Act, it requires the establishment of "earthquake fault zones" along known active faults in California. Regulations on development within these zones are enforced to reduce the potential for damage resulting from fault surface rupture.

California Building Code

The State's 2022 California Building Code (CBC), Title 24 of the California Code of Regulations, is a compilation of building standards, including seismic safety standards, for new buildings. CBC standards are based on building standards that have been adopted by State agencies without change from a national model code; building standards based on a national model code that have been changed to address particular California conditions; and building standards authorized by the California legislature but not covered by the national model code. The CBC applies to all occupancies in California, except where stricter standards have been adopted by local agencies. Specific CBC building and seismic safety regulations have been incorporated by reference into the current Lassen County, Tuolumne County, and City of Stockton building codes, with local amendments.

Chapters 16 and 16A of the 2022 CBC include structural design requirements governing seismically resistant construction, including (but not limited to) factors and coefficients used to establish seismic site class and seismic occupancy category for the soil/rock at the building location and the proposed building design. Chapters 18 and 18A include the requirements for foundation and soil investigations (Sections 1803 and 1803A); excavation, grading, and fill (Sections 1804 and 1804A); damp-proofing and water-proofing (Sections 1805 and 1805A); allowable load-bearing values of soils (Sections 1806 and 1806A); the design of foundation walls, retaining walls, embedded posts and poles (Sections 1807 and 1807A), and foundations (Sections 1808 and 1808A); and design of shallow foundations (Sections 1809 and 1809A) and deep foundations (Sections 1810 and 1810A). Chapter 33 of the 2022 CBC includes requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes (Section 3304).

Construction activities are subject to occupational safety standards for excavation and trenching, as specified in the California Safety and Health Administration regulations (Title 8 of the California Code of Regulations) and in Chapter 33 of the CBC. These regulations specify the measures to be used for excavation and trench work where workers could be exposed to unstable soil conditions. The project would be required to employ these safety measures during excavation and trenching.

The CBC is published on a triennial basis, and supplements and errata can be issued throughout the cycle. The 2023 edition of the CBC became effective on January 1, 2023, and incorporates by adoption the 2021 edition of the International Building Code of the International Code Council, with California amendments. The 2022 CBC incorporates the latest seismic design standards for structural loads and materials as well as provisions from the National Earthquake Hazards Reduction Program to mitigate losses from an earthquake and provide for the latest in earthquake safety.

California Occupational Safety and Health Administration Regulations

In California, California OSHA (Cal/OSHA) has responsibility for implementing federal rules relevant to worker safety, including slope protection during construction excavations. Cal/OSHA's requirements are more restrictive and protective than federal OSHA standards. Title 8 of the California Code of Regulations, Chapter 4, Division of Industrial Safety, covers requirements for excavation and trenching operations, as well as safety standards whenever employment exists in connection with the construction, alteration, painting, repairing, construction maintenance, renovation, removal, or wrecking of any fixed structure or its part.

Seismic Hazards Mapping Act

In order to address the effects of strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events, the State of California passed the Seismic Hazards Mapping Act of 1990 (Public Resources Code Section 2690-2699). Under the Seismic Hazards Mapping Act, the State Geologist is required to delineate "seismic hazard zones." Cities and counties must regulate certain development projects within these zones until the geologic and soil conditions of their project sites have been investigated and appropriate mitigation measures, if any, have been incorporated into development plans. The State Mining and Geology Board provides additional regulations and policies to assist municipalities in preparing the Safety Element of their General Plan and encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety. Under Public Resources Code Section 2697, cities and counties must require, prior to the approval of a project located in a seismic hazard zone, submission of a Preliminary Geotechnical Report defining and delineating any seismic hazard. Each city or county must submit one copy of each Preliminary Geotechnical Report, including mitigation measures, to the State Geologist within 30 days of its approval. Under Public Resources Code Section

2698, cities and counties may establish policies and criteria which are stricter than those established by the Mining and Geology Board.

State publications supporting the requirements of the Seismic Hazards Mapping Act include the CGS SP 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California,[1] and SP 118, Recommended Criteria for Delineating Seismic Hazard Zones in California (2004).[2] SP 117A provides guidelines to assist in the evaluation and mitigation of earthquake-related hazards for projects within designated zones requiring investigations and to promote uniform and effective Statewide implementation of the evaluation and mitigation elements of the Seismic Hazards Mapping Act.[3] SP 118 provides recommendations to assist the CGS in carrying out the requirements of the Seismic Hazards Mapping Act to produce the Probabilistic Seismic Hazard Maps for the State.

California Forest Practice Rules 2020

In accordance with Title 14, CCR Chapter 4, 4.5, and 10, the California Forest Practice Rules govern the management and harvesting of timber on non-federal lands in California. The rules are designed to protect the environment, wildlife, and public safety, while ensuring a sustainable supply of timber for the state's economy. The rules are updated annually by the Board of Forestry and Fire Protection, with input from various stakeholders and experts. The rules are enforced by the California Department of Forestry and Fire Protection (CAL FIRE) through a system of timber harvesting plans, inspections, and penalties.

California Environmental Quality Act of 1970

Paleontological resources are afforded consideration under CEQA. Appendix G of the State of California CEQA Guidelines (14 CCR 15000 et seq.) includes the following as one of the questions to be answered in the Environmental Checklist (Appendix G, Section VII, Part f): "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?"

California Health and Safety Code and Penal Code

California Public Resources Code Section 5097.5 specifies that any unauthorized removal of paleontological remains is a misdemeanor. Further, California Penal Code Section 622.5 sets the penalties for damage to or removal of paleontological resources. California state laws and regulations under California Public Resources Code Section 5097.5 apply to paleontological resources.

PRC 5097-5097.6 – Archaeological, Paleontological and Historical Sites

PRC Section 5097-5097.6 outlines the requirements for cultural resource analysis prior to the commencement of any construction project on State Lands. This section identifies that the unauthorized disturbance or removal of archaeological, historical, or paleontological resources located on public lands is a misdemeanor. It prohibits the knowing destruction of objects of antiquity without a permit (expressed permission) on public lands, and provides for criminal sanctions. This section was amended in 1987 to

1 Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California, prepared by California Geologic Survey, 2008, http://www.conservation.ca.gov/cgs/shzp/webdocs/Documents/sp117.pdf.

2 Special Publication 118, Recommended Criteria for Delineating Seismic Hazard Zones in California, dated May 1992, Revised April 2004, http://www.conservation.ca.gov/cgs/shzp/webdocs/Documents/sp118_revised.pdf.

3 Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California, prepared by California Geologic Survey, 2008, http://www.conservation.ca.gov/cgs/shzp/webdocs/Documents/sp117.pdf.

require consultation with the California Native American Heritage Commission (NAHC) whenever Native American graves are found. Violations for the taking or possessing remains or artifacts are felonies.

3.6.2.3 Local

Lassen County

Lassen County General Plan

Goal N-2. To protect and maximize the present and future productive, economic, and environmental values of the County's soil resources.

Policy NR-10. The County shall exercise an appropriate degree of regulation designed to minimize soil erosion, including the administration of standards for grading and site clearance related to development projects.

Policy NR-11. The County encourages state and Federal programs and projects designed to reduce soil erosion and to repair areas damaged by erosion.

Lassen County Code

Lassen County Building Code (Ord. 2022-03, Section 5)

Title 12 Buildings and Construction, Article I. Building Code, Chapter 12.08, California Building Code, Section 12.08.010 Adoption, indicates that Lassen County has incorporated the most recent version of the CBC, including the State of California Amendments, based on the most recent version of the International Code Council's International Building Code.

Lassen County Grading

Grading in Lassen County is regulated under the Lassen County Building Code, as described above.

Installation of Septic Tanks

Lassen County Code Title 8, Health and Safety, Chapter 8.16, Privies and Septic Tanks, Section 8.16.050 describes requirements for septic tanks that would ensure lot size, soil conditions, and water availability would adequately support such facilities. As part of the code requirements, any new disposal systems or modifications to an existing system require that a percolation test be performed in a manner satisfactory to the Lassen County Environmental Health Division and found by that Division to meet all applicable laws and regulations.

Tuolumne County

Tuolumne County General Plan

Policy 17.A.1. Increase Tuolumne County's capabilities to mitigate the effects of natural hazards.

Implementation Program 17.A.a. Implement the Tuolumne County Multi-Jurisdictional Hazard Mitigation Plan to protect life, safety, and property by reducing the potential for future damages and economic losses that result from geologic hazards.

Policy 17.A.2. Enhance existing policies that will reduce the potential damaging effects of hazards without hindering other County goals.

Implementation Program 17.A.b. Update the County's General Plan and Ordinance Code as new Federal and State laws regarding geologic hazards and requirements are enacted.

Policy 17.A.3. Protect Tuolumne County's most vulnerable populations, buildings and critical facilities through the implementation of cost-effective and technically feasible mitigation projects.

Implementation Program 17.A.c. Maximize the use of hazard mitigation grant programs to protect the most vulnerable populations and structures.

Policy 17.A.6. Ensure that all new construction is completed in a way most resistant to loss or damage from natural hazards.

Implementation Program 17.A.e. Through the development review process, ensure that projects located in or near areas that may pose public health and safety hazards are designed to minimize potential impacts on people and property.

Implementation Program 17.A.f. Locate vital/critical facilities where they are protected from natural hazards, such as fault zones, flooding and inundation areas.

Policy 17.D.1. Direct development away from areas with known seismic and geologic hazards as required by local, state, and federal codes.

Implementation Program 17.D.a. Designate areas within 100 feet of capable faults as non-urban, including, but not limited to, Open Space, Agriculture or Parks and Recreation on the General Plan land use diagrams and zone these areas for open space preservation, agriculture, recreation or other non-urban uses. For lands owned by a public agency, the designation of Public is also compatible.

Policy 17.D.2. Map areas determined to be potentially seismically active or otherwise subject to geologic hazards and apply restrictions to development within the affected areas.

Implementation Program 17.D.b. Apply zoning and other land use controls to regulate development in known hazardous areas capable of seismic activity.

Implementation Program 17.D.c. Require as part of the application review process when a potential hazard exists, a geologic, seismic, and/or geotechnical engineering report to be provided by the applicant.

Implementation Program 17.D.d. Establish a program for geologic, seismic, and geotechnical engineering reports required for proposed developments to be reviewed by a technically qualified consultant under contract to the County of Tuolumne.

Implementation Program 17.D.e. Identify the public costs which would be incurred if emergency or remedial actions became necessary in populated areas where seismic hazards exist.

Implementation Program 17.D.f. Review contingency plans for major disasters and emergencies and update as necessary to verify that the potential for damage and destruction due to earthquakes and geologically induced dam failure with accompanying flooding continues to be addressed.

Implementation Program 17.D.g. Use the General Plan's Geotechnical Interpretive Maps, which show the approximate boundaries of various hazard and resource zones (such as fault zones, erosive soil areas, limestone deposits, etc.) as a basis for future planning.

Implementation Program 17.D.h. Update the Geotechnical Interpretive Maps on a periodic basis to reflect new geologic and seismologic information.

Implementation Program 17.D.i. Increase public awareness of geoseismic hazards, their location, and their severity by making the Geotechnical Interpretive Maps readily available to the public.

Policy 17.D.3. Incorporate criteria into the design for dams and other important structures possibly affected by capable fault zones that provide an acceptable level of safety.

Implementation Program 17.D.j. Require developers of dams and critical use and high occupancy structures within 100 feet of capable fault zones to submit plans to the County of Tuolumne demonstrating that the proposed design and construction can accommodate the expected fault offset of the design earthquake and the structure can continue to function. The capable fault zones are defined along presently identified capable faults on the Geotechnical Interpretive Maps.

Implementation Program 17.D.k. Establish design review procedures that address safety issues for structures proposed for human occupancy which are to be located within 100 feet of a capable fault zone.

Implementation Program 17.D.l. Apply special requirements to critical use and high occupancy structures proposed within 100 feet of capable fault zones. These requirements should:

- Require special geologic and seismic studies to accurately locate all capable fault traces.
- Establish requirements for existing critical use and high occupancy structures within the capable fault zones and initiate a special building inspection program whose purpose is to locate existing critical-use and high occupancy structures within 100 feet of the capable fault zones and to evaluate the safety of such structures under expected seismic conditions.
- Require necessary training for building inspectors to evaluate the safety (under probable earthquake accelerations) of critical-use and high occupancy structures.

Implementation Program 17.D.m. Consider developing a hazardous structures mitigation program and enforcement regulations for critical use and high occupancy buildings located within 100 feet of a capable fault zone.

Policy 17.D.4. Ascertain that existing or proposed structures, particularly critical-use and high occupancy structures, can withstand the ground motion of the design earthquake without catastrophic failure or loss of critical services.

Implementation Program 17.D.n. Review plans for existing and proposed structures to see that they are designed and built in accordance with the California Building Code standards for Seismic Category C or D.

Implementation Program 17.D.o. Require that critical use and high occupancy structures be designed and built to retain their structural integrity when subjected to probable ground accelerations generated by the design earthquake.

Implementation Program 17.D.p. Prior to approval of proposed critical use and high occupancy facilities, require that the plans demonstrate that the proposed building can withstand, without collapse, the probable ground acceleration generated by the design earthquake. Require development plans to show that critical facilities, such as utilities and access roads, for critical use and high occupancy structures are adequately designed and constructed to withstand the design earthquake. Also require plans to show that, in the event of the failure of these structures, potential hazards created by the loss of utilities, roads, etc. have been identified and mitigated.

Implementation Program 17.D.q. Periodically inspect existing critical use and high occupancy buildings within the County to identify and require correction of potential hazards in the event of a major earthquake.

Implementation Program 17.D.r. Develop a hazardous structures mitigation program and enforcement regulations for critical use and high occupancy buildings. This shall include a database of the identified critical-use and high occupancy buildings existing in the County that do not meet modern standards for earthquake safety, and are, therefore, considered "hazardous." Descriptions of the buildings shall be included along with possible hazard mitigation measures.

Policy 17.D.5. Monitor development to see that construction in landslide or unstable slope areas is accomplished safely.

Implementation Program 17.D.s. Require detailed engineering studies in unstable slope or landslide areas, including, but not limited to those areas delineated on the Geotechnical Interpretive Maps, prior to approval of urban development. The studies should identify the extent of instability or potential for landslides, and recommend design alterations, considerations or other features which could reduce the potential hazards to an acceptable level. The feasible recommendations from the study(s) shall be required as part of the project approval process.

Policy 17.D.6. Reduce the potential for erosion and sedimentation from earthmoving and construction activities.

Implementation Program 17.D.t. Apply Chapter 12.20 of the Tuolumne County Ordinance Code, the Grading Ordinance, in order to protect soil stability and natural topography and to prevent soil erosion and creation of unstable slopes. Areas identified as having erosive soils, either by the Geotechnical Interpretive Maps or by other means, shall receive special consideration related to the erosive potential of grading and earthmoving activities.

Implementation Program 17.D.u. Apply Chapter 12.20 of the Tuolumne County Ordinance Code, the Grading Ordinance, to address the impacts of earth-disturbing development activities on any slope, whether or not it is shown as potentially unstable on the geotechnical maps.

Tuolumne County Code

Tuolumne County Grading Ordinance

Title 12 – Streets, Sidewalks, and Public Places, Chapter 12.20 – Grading, establishes minimum standards and provides regulations for the construction and maintenance of excavations, site reclamation, drainage control, stockpiling, as well as for protection of exposed soils surfaces, and cut and clearing of vegetation related to any or all of these practices in order to promote the safety, public health, convenience and general welfare of the community. This chapter is intended to fulfill the requirements for grading/stockpiling and erosion control as contained in Section 66411 of the Subdivision Map Act, establish the administrative procedure for issuance of permits, and provide for approval of plans and inspection of grading construction.

Tuolumne County Building Code

Title 15 - Buildings and Construction, Chapter 15.04 – Construction Codes, Section 15.04.010 – Adoption of Codes, indicates Tuolumne County has incorporated the most recent version of the CBC, including the State of California Amendments, based on the most recent version of the International Code Council's International Building Code.

Installation of Septic Tanks

General Plan Update, Chapter 13.08 of the Tuolumne County Ordinance Code describes requirements for septic tanks that would ensure soil conditions would adequately support such facilities. As part of the code requirements, any new disposal systems or modifications to an existing system require a permit from the County's Environmental Health Division, which would review the site and location of such systems and confirm that the installation of such a system at that location is feasible and would not result in significant impacts.

City of Stockton

City of Stockton 2040 General Plan

The City's 2040 General Plan contains a safety element that addresses environmental hazards, including but not limited to seismic hazards. Relevant safety element policies include the following:

Policy SAF-2.1. Ensure that community members are adequately prepared for natural disasters and emergencies through education and training.

Policy SAF-2.2. Prepare sufficiently for major events to enable quick and effective response.

Stockton Municipal Code

Section 15.48.050, Construction and Application

This code includes a requirement that seeks to mitigate hazards associated with erosion: "During construction, construction activities shall be designed and conducted to minimize runoff of sediment and all other pollutants onto public properties, other private properties and into the waters of the United States." Section 15.48.110, "Erosion Control Requirements," contains specific provisions for erosion control for those construction projects where a grading permit is not required. Section 15.48.070 includes requirements for a grading permit that apply to most construction projects. Such permits require implementation of erosion control measures, often referred to as Best Management Practices.

3.6.3 Thresholds of Significance

The significance criteria used to evaluate the project impacts to geology and soils are based on Appendix G of the CEQA Guidelines. According to Appendix G of the CEQA Guidelines, a significant impact related to geology and soils would occur if the 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.
  - Landslides.
- Result in substantial soil erosion or the loss of topsoil.
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property.
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

3.6.4 Impact Analysis

3.6.4.1 Methodology

The proposed project would consist of three primary phases: feedstock acquisition, wood pellet production, and transport to market. The impact analyses below evaluate each of these primary phases as related to geology and soils. The impact analysis evaluates potential project impacts during both construction and operation. The following analysis of impacts related to geology, seismicity and soils is based on publicly available information and site-specific geotechnical investigations, which address site-specific geotechnical issues, such as ground shaking, liquefaction, landslides, and any other geotechnical hazards found to be present. A final design level geotechnical report, based on final building plans, will also presumptively be required by local building officials prior to commencement of construction, as commonly practiced for all development, As such, a design level geotechnical report based on the finished construction and building plans will be prepared and reviewed by Lassen County, Tuolumne County, and the City of Stockton prior to issuance of building permits, in accordance with building code requirements.

In December 2015, the California Supreme Court found 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." In *California Building Industry Association v. Bay Area Air Quality Management District* (2015) 62 Cal.4th 369, 392, the Supreme Court explained that except under a limited number of circumstances specifically identified in CEQA, an agency is only required to analyze the potential impact of such hazards on future residents if the project would worsen those existing environmental hazards or conditions. CEQA analysis is, therefore, concerned with a project's impact on the environment, rather than the environment's impact on a project, including its users or residents. Thus, with respect to geologic and seismic hazards, the EIR is not required to consider the effects of bringing people or structures into an area where such hazards exist, because (with some exceptions) the project itself would not worsen or otherwise affect the geologic conditions that create those risks. Nonetheless, in order to provide a complete picture of the proposed project, these impacts are discussed below.

3.6.4.2 Project Impacts

Impact GEO-1a — The project would not 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.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock destined to the Lassen and Tuolumne facilities for manufacturing of wood pellets will be wood byproducts sourced from Sustainable Forest Management Projects such as hazardous fuel reduction projects, construction of shaded fuel breaks, and salvage harvests (see Chapter 2, Project Description, for a full description). The feedstock would originate from private, state, tribal, and federal timberlands located within the Working Area of the two wood pellet production facilities. Feedstock acquisition would not include construction or operation of structures or infrastructure. As a result, no fault-related structural impacts would occur with respect to project feedstock acquisition. In addition, feedstock acquisition would not directly or indirectly cause rupture of a known earthquake fault, resulting in risk of loss, injury, or death. **No impacts** would occur.

Wood Pellet Production

Lassen Facility

As discussed in Section 3.6.1, the Lassen Facility site is not within a State of California Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act. In addition, no known active earthquake faults underlie the site. Construction and operation of the wood pellet production facilities would not cause or exacerbate the potential for rupture to occur on any regional faults. As a result, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault. **No impacts** would occur.

Tuolumne Facility

As discussed in Section 3.6.1, the Tuolumne Facility site is not within a State of California Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act. In addition, no known active earthquake faults underlie the site. Construction and operation of the wood pellet production facilities would not cause or exacerbate the potential for rupture to occur on the nearby potentially active Foothills Fault Zone, or any other regional fault. As a result, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault. **No impacts** would occur.

Transport to Market

Port of Stockton

As discussed in Section 3.6.1, the Port is not within a State of California Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act. In addition, no known active earthquake faults underlie the site. Construction and operation of the Port facilities would not cause or exacerbate the potential for rupture to occur on any regional faults. As a result, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault. **No impacts** would occur.

Impact GEO-1b The project would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking.

Feedstock Acquisition

Sustainable Forest Management Projects

As described above for Impact GEO-1a, feedstock acquisition would not include construction or operation of structures or infrastructure. As a result, no seismic-related structural impacts would occur with respect to project feedstock acquisition. In addition, feedstock acquisition would not directly or indirectly cause seismic ground shaking, resulting in risk of loss, injury, or death. **No impacts** would occur.

Wood Pellet Production

Lassen Facility

As discussed in Section 3.6.1, the Lassen Facility site is not in a highly seismic area. Regardless, it is possible that the facility may be subject to strong seismic ground shaking during the life of the project. The project facilities would be designed and constructed in accordance with the recommendations set forth in the project-specific, preliminary geotechnical report (Appendix E1) and the then-applicable version of the CBC. The geotechnical investigation provides preliminary seismic design criteria based on the American Society of Civil Engineers Standard 7-16 for seismic design. The CBC specifies that the maximum considered earthquake ground motion response accelerations be used to evaluate seismic loads for design of buildings and other structures, thus minimizing the potential for damage as a result of seismically induced ground failure. The Lassen County Planning and Building Services Department ensures that all new construction complies with current codes and ordinances regarding earthquake safety. In addition, construction and operation of the proposed wood pellet facility would not cause or exacerbate the potential for earthquakes to occur. As a result, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking. **Less than significant** impacts would occur.

Tuolumne Facility

As discussed in Section 3.6.1, although the potentially active Foothill Fault System is in proximity to the Tuolumne site, Tuolumne County is not a highly seismic area. Regardless, it is possible that the facility may be subject to strong seismic ground shaking during the life of the project. As described for the Lassen Facility, the project facilities would be designed and constructed in accordance with the recommendations set forth in the project-specific, preliminary geotechnical report (Appendix E3) and the then-applicable version of the CBC, thus minimizing the potential for damage as a result of seismically induced ground failure. The Tuolumne County Building and Safety Division ensures that all new construction complies with current codes and ordinances regarding earthquake safety. In addition, construction and operation of the proposed facilities would not cause or exacerbate the potential for earthquakes to occur. As a result, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking. **Less than significant impacts** would occur.

Transport to Market

Port of Stockton

As discussed in Section 3.6.1, the Port is located in a moderately seismic area that may be subject to strong seismic ground shaking during the life of the project. As described for the Lassen Facility, the project facilities would be designed and constructed in compliance with the CBC, which requires construction in accordance with a project-specific geotechnical report, thus minimizing the potential for damage as a result of seismically induced ground failure. The City of Stockton Building Division ensures that all new construction complies with current codes and ordinances regarding earthquake safety. In addition, construction and operation of the proposed facilities would not cause or exacerbate the potential for earthquakes to occur. As a result, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking. **Less than significant impacts** would occur.

Impact GEO-1c The project would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismically related ground failure, including liquefaction.

Feedstock Acquisition

Sustainable Forest Management Projects

As described above for Impact GEO-1a, feedstock acquisition would not include construction or operation of structures or infrastructure. As a result, no seismic-related structural impacts would occur with respect to project feedstock acquisition. In addition, feedstock acquisition would not directly or indirectly cause seismic related ground failure, resulting in risk of loss, injury, or death. **No impacts** would occur.

Wood Pellet Production

Lassen Facility

Based on the presence of shallow groundwater and alluvial soils, the potential exists for liquefaction to occur at the site. Lateral spreading would not occur based on the lack of slopes at the site. However, total settlement up to 1.0 inch and seismically induced differential settlement up to 0.5 inch, over 50 linear feet, could potentially occur (Appendix E1). Seismically induced settlement is a result of non-uniform movement of soils (i.e., soil settlement at different rates),) which can result in foundation cracking and pipeline/utility damage. However, as described for Impact GEO-1b, project design and construction would occur in accordance with recommendations set forth in the project-specific geotechnical investigation (Appendix E1) and the provisions of the then-applicable version of the CBC, thus minimizing the potential for damage as a result of seismically induced liquefaction and differential settlement. The Lassen County Planning and Building Services Department ensures that all new construction complies with current codes and ordinances regarding earthquake safety. Furthermore, development of the proposed project would not directly or indirectly cause or exacerbate adverse effects involving seismic related ground failure, including liquefaction. As a result, wood pellet facility construction and operation would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving seismic related ground failure. **Less than significant** impacts would occur.

Tuolumne Facility

The potential for liquefaction, lateral spreading, and seismically induced differential settlement is low due to shallow bedrock conditions and generally low seismicity in the area (Appendix E3). Seismically induced landslides would not occur, as the topography of the site is relatively flat to gently sloping. However, strong seismically induced ground shaking and associated ground failure could occur at the site. Project design and construction would occur in accordance with provisions of the then-applicable version of the CBC and recommendations set forth in the project-specific geotechnical report (Appendix E3), thus minimizing the potential for damage. The Tuolumne County Building and Safety Division ensures that all new construction complies with current codes and ordinances regarding earthquake safety. Furthermore, development of the proposed project would not directly or indirectly cause or exacerbate adverse effects involving seismic related ground failure, including liquefaction. As a result, construction and operation of the wood pellet facility would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving seismic related ground failure. **Less than significant** impacts would occur.

Transport to Market

Port of Stockton

As discussed in Section 3.6.1, regional seismic activity could cause accelerations severe enough to cause major damage to structures and foundations in the Port not designed to resist the forces generated by earthquakes. Underground utility lines are also susceptible where they lack sufficient flexibility to accommodate the seismic ground motion. A geotechnical investigation completed in 2020 for a site within the Port indicated that the top 50 feet of soil have a moderate vulnerability to liquefaction, but that there is sufficient non-liquefiable soil on top of potentially liquefiable soil to prevent secondary liquefaction effects (e.g., sand boils or lurch cracking) following a major earthquake (Port of Stockton 2022). Based on the relatively flat topography of the site, the potential for lateral spreading is low. In addition, seismically induced landslides would not occur, as the topography of the site is relatively flat to gently sloping. Seismically induced differential settlement could potentially occur, resulting in foundation cracking and pipeline/utility damage. However, project design and construction would occur in accordance with provisions of the then-applicable version of the CBC and recommendations in the required project-specific geotechnical report, thus minimizing the potential for damage as a result of seismically induced differential settlement. The City of Stockton Building Division ensures that all new construction complies with current codes and ordinances regarding earthquake safety. As a result, construction and operation of the Port facilities would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving seismic related ground failure. **Less than significant** impacts would occur.

Impact GEO-1d — The project would potentially directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides.

Feedstock Acquisition

Sustainable Forest Management Projects

As discussed in Section 3.6.1, the portion of the Working Area near the Lassen Facility covers parts of several geomorphic provinces of northern California, including the Modoc Plateau, Basin and Range, Cascade Range, Sierra Nevada, and Klamath Mountains provinces. The portion of the Working Area near the Tuolumne Facility covers parts of the Sierra Nevada and Great Valley provinces (Figure 3.6-1). Each of these geomorphic provinces include steep hillsides and mountains. As set forth in Section 2.4, each Sustainable Forest Management Project could include construction of up to 1.0 mile of low-standard (i.e., unpaved) roads. In addition, existing unpaved roads would be improved and maintained as part of feedstock acquisition. Creation of new roads in hillside areas typically results in creation of oversteepened slopes immediately upslope of the road (i.e., construction of roadcuts). Similarly, maintenance of existing roads can result in removal of slough and rocks on the upslope side of the road, which would require minor excavations into the hillside. Depending on the rock type, bedding orientation, and steepness of slope, creation of new roadcuts and maintenance of existing roadcuts could undermine the stability of the slope and result in landslides, which is a **potentially significant** impact.

However, Project Design Features (PDFs) (see Section 2.4) would minimize the potential for slope instability during feedstock acquisition operations. PDF-GEO-1 requires suspension of mechanical treatments during wet winter weather, thus reducing the potential for creating slope instability in saturated soils. PDF-GEO-2 requires new road construction and maintenance in slope areas in excess of 50% (27 degrees) to be completed under the guidance of a California Engineering Geologist, who would evaluate the road route for potential slope instability and implement slope stability measures, as appropriate. PDF-GEO-3 requires implementation of a SWPPP or equivalent document, which would reduce the potential for soil erosion and associated slope instability. PDF-GEO-4 requires avoidance of slopes steeper than 75% (37 degrees), thus minimizing the potential for slope instability during wildfire fuel reduction operations. PDF-GEO-5 requires construction of drainage features in treatment areas, which will reduce erosion and associated slope instability. And PDF-GEO-6 requires that a Registered Professional Forester or licensed geologist evaluate treatment areas with slopes greater than 50% for unstable areas, thus minimizing the potential for slope instability during treatment operations. With implementation of **PDF-GEO-1** through **PDF-GEO-6** potentially significant landslide impacts would be reduced to less than significant levels.

Wood Pellet Production

Lassen Facility

As previously discussed in Section 3.6.1, the topography of the Lassen Facility site is relatively flat to gently sloping. Therefore, the project site would not be subject to damage due to landslides. However, potentially oversteepened temporary slopes during construction may be prone to failure. Saturated sidewalls of excavations and trenches could also result in caving and sloughing. Design and construction of the project would be in compliance with the CBC, which includes adherence to recommendations of the project-specific geotechnical report (Appendix E1). The geotechnical report includes recommendations for stabilization of temporary slopes. The recommendations indicate the contractor should be prepared to brace and/or shore excavation slopes as needed. Temporary slopes of excavations less than 20 feet deep should be constructed no steeper than a 1.5:1 (horizontal to vertical) inclination, if properly dewatered. Temporary slopes likely will stand at this inclination for the short-term duration of construction, provided significant pockets of loose and/or saturated granular soils are not encountered. Flatter slopes would be required if these conditions are encountered. With incorporation of recommendations of the project-specific geotechnical report, the project would not cause substantial adverse effects involving landslides and impacts would be **less than significant.**

Tuolumne Facility

As previously discussed in Section 3.6.1, the topography of the Tuolumne Facility site is gently sloping, with very low-lying hills. Therefore, there is no potential for existing landslides to adversely affect the site. However, there is a modest risk that displacement and/or movement could occur on proposed 5 to 10 foot slopes in the event of strong seismically induced ground shaking. As a result, the project geotechnical report (Appendix E3) recommends that all cut and fill slopes be constructed no steeper than 2:1 or 3:1 (horizontal to vertical), depending on tolerance for minor slope failure. With incorporation of recommendations of the geotechnical report, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving landslides. Project impacts would be **less than significant.**

Transport to Market

Port of Stockton

As previously discussed in Section 3.6.1, the topography of the Port is relatively flat to gently sloping. Therefore, landslides would not occur in association with construction and operation of the proposed wood pellet unloading facility. As a result, the project would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving landslides. **No impacts** would occur.

Impact GEO-2 The project would potentially result in substantial soil erosion or the loss of topsoil.

Feedstock Acquisition

Sustainable Forest Management Projects

Soil Erosion

Soil erosion is caused by the detachment and entrainment of soil particles through the action of water and wind and can be classified into four general types: rain splash, sheet, rill, and gully erosion. Sheet erosion is the removal of soil of a generally uniform depth across a slope and is caused by non-concentrated runoff. Rill erosion refers to the removal of soil in shallow (i.e., less than approximately 6 inches deep), usually parallel, channels from a slope and is caused by concentrated runoff. Gully erosion consists of removal of soil from deeper channels and is also caused by concentrated runoff. Although usually less conspicuous than rill and gully erosion, sheet erosion tends to result in greater soil loss over a wide area. Soils most susceptible to erosion are those high in coarse silt- and fine sand-sized particles (Balasubramanian 2017), particularly when organic matter content is low and soil structure is weak or nonexistent. Erosion can be substantially minimized by avoiding certain actions on highly erosive soils, choosing management activities appropriate for given slopes, and by managing the maintenance of soil cover (USFS 2009).

Forest thinning activities could potentially result in sediment releases due to exposure of previously stabilized soils to rainfall/runoff and wind. Such activities include the removal of vegetation and disturbance of soil by equipment. Environmental factors that affect erosion include topographic, soil, and rainfall characteristics. Erosion and sedimentation affect water quality and interferes with photosynthesis; oxygen exchange; and the respiration, growth, and reproduction of aquatic species. According to the USGS National Hydrography Dataset, the Northern California Feedstock Area intersects 157 watersheds and 42,476 linear miles of streams, rivers, canals, and ditches (USGS 2023). (See Section 3.3, Biological Resources for additional information.)

In addition to water quality impacts related to erosion, maintaining long-term soil productivity is imperative to protect and enhance long-term productivity of forests. Soil is a fundamental and largely non-renewable resource that is the basis for high-level sustained yields of all other resources. Therefore, loss of soil due to erosion is detrimental to long-term productivity of vegetation growth and all natural aspects of the forests. Changes in the productive qualities of soil resources can occur as a result of disturbances arising from management actions on the land. Compaction and surface erosion are examples of disturbances that modify the moisture holding capacity of soil, reducing moisture availability for seedling growth. The magnitude of change is associated with the type of disturbance, the size or extent of the affected area, and inherent soil properties (USFS 1980, 2009). Although most soil compaction occurs within ten vehicle trips (Gent et al. 1984), the greatest increases in bulk density occur within the first several trips (Froehlich et al. 1985). Increased soil moisture also usually results in increased levels of soil compaction (Alexander and Poff 1985).

In order to safeguard soil productivity, soil cover should be sufficient to prevent the rate of accelerated soil erosion from exceeding the rate of soil formation; soil porosity 4 to 8 inches beneath the soil surface should be at least 90% of the total porosity found under undisturbed or natural conditions; and organic matter should be present in sufficient amounts to prevent significant short or long-term nutrient cycle deficits and to help avoid adverse physical soil characteristics. To preserve hydrologic function, soil permeability and infiltration rates should not be adversely impacted. Overall soil health should be considered such that soil reaction class, buffering or exchange capacities, or biological populations are not altered to the degree that significantly affects soil productivity, soil hydrologic function, or the health of humans and animals (USFS 1980, 2009).

The likelihood of erosion is greater when the vegetative cover is removed or reduced, the soil is otherwise disturbed, or when both of these conditions exist. Soil erosion by water is more aggressive on steep slopes than on shallow slopes (e.g., 10% gradient or less), because at lower slope gradients surface runoff cannot reach peak velocities necessary to erode the soil. In general, areas with less vegetative cover are more prone to soil erosion than heavily vegetated areas, because surface cover and additional soil structure from plant roots can reduce soil erosion potential. Soil erosion can also be caused by wind in areas with a combination of high winds, removed or disturbed vegetation, fine sandy or silty textures, and low organic matter content. The erosion rate of a particular soil in the absence of human activities is referred to as the natural (background) or geologic erosion rate. Soil erosion in excess of the natural erosion rate is called accelerated soil erosion and is usually caused by poorly implemented human activities such as timber harvesting, road construction, grading, and other land-disturbing activities (Robichaud et al. 2010).

Studies by the CGS indicate that areas with more abundant landslides result in excessive erosion and sedimentation of downstream drainages. This is particularly true for watersheds underlain by the Franciscan Formation, a widespread geologic formation in California characterized by abundant deep-seated landslides and earthflows. Long duration precipitation results in localized shallow failures, gully erosion, and erosion of the in-channel toes of these large unstable features, which in turn results in excessive sedimentation of water bodies (CGS 2002b).

Roads and Erosion

Roads are ubiquitous in the forest environment. Forest roads are needed for economical removal of forest products, resource management activities, recreation activities, and public access. From a fuel management perspective, forest roads are needed to conduct thinning and timber harvest operations. The majority of forest roads are unpaved. These compacted road surfaces typically have very low infiltration rates and, as a result, generate large amounts of surface runoff. Road surfaces are subjected to rain-splash, and the combination of rain-splash with large amounts of surface runoff results in surface erosion rates that are several orders of magnitude higher than the adjacent undisturbed forest. Research has consistently shown that roads, including tractor skid trails and log landings, have the greatest effect on erosion of all practices associated with forest management. Although other forest management activities usually occur on a larger proportion of the landscape, the erosion rates on roads are the dominant source of sediment in most managed forests. Erosional impacts vary by the amount of roads and landings constructed, the season of construction, the type of soils, road surfacing and design, and especially the sensitivity of the soils on which roads are constructed. Constructing roads during the rainy season encourages surface runoff, erosion, and sedimentation. New roads are highly erodible during the first rains and/or snowmelt following construction (Robichaud et al. 2010; USFS 1980, 2012).

Roads having high cutbanks tend to produce more sediment than roads with low cutbanks. Freezing and thawing, heating and cooling, and raindrop action dislodge soil particles that travel into drainage ditches and are transported to streams. Road construction on slopes exceeding 70% often produce sidecast material that can bury downslope vegetation and create droughty conditions, resulting in reduced soil-site productivity. Improper location and inadequate number or size of drainage facilities can increase the incidence of road failures and road surface erosion (USFS 1980).

Runoff can detach and transport the fine material available on unpaved road surfaces. Without vehicle traffic, the sediment concentration in the road runoff decreases over time. However, vehicle traffic, especially heavy trucks, can crush road surface aggregate material and this generates more fine particles that are available for transport by runoff. In addition, the pressure of vehicular tires on saturated road aggregate can force fine particles from below the surface to move to the surface. In western Oregon, 20% of the material finer than 0.003 inches (0.075 mm) diameter was eroded over three months from a structurally weak road aggregate that was subjected to 26 inches (660 mm) of rainfall and 884 logging truck trips. The authors concluded that truck traffic generated 11 tons of fines per acre of road surface (Robichaud et al. 2010).

Road erosion rates generally increase with increased traffic, and heavy vehicles tend to cause more erosion than light vehicles. Higher use also is associated with more frequent maintenance operations, and grading increases the amount of available sediment and road erosion rates. Measurements were completed of sediment production from two forest roads in southwestern Washington—one mainline road with high traffic and one secondary road with little traffic. Routine maintenance was performed on the mainline road once or twice per week while maintenance was done on the secondary road every 7 to 8 weeks. Sediment production over the 23-week study period was 2.5 times greater for the mainline road than for the secondary road (Robichaud et al. 2010).

Many techniques used to estimate road sediment production assume factors that influence it (for example, rainfall, traffic, roadway material, etc.) are additive. For example, in the Washington Forest Practices (Washington State Department of Ecology 1993) analysis method, sediment production estimates are independently modified by factors for traffic and surface material. However, a study in western Oregon found little difference in sediment production between road plots that were subjected to traffic and those that were recently graded but had no traffic. They concluded that applying adjustment factors independently overestimated the effect of traffic on new roads or recently maintained roads (Robichaud et al. 2010).

Each Sustainable Forest Management Project could include construction of up to 1.0 mile of unpaved roads. In addition, existing unpaved roads would be improved and maintained as part of feedstock acquisition. As previously discussed, road construction and maintenance in hillside areas typically involves pushing sediments over the downslope side of the road (i.e., sidecast material), which can result in thick accumulation of sediments on the hillsides. These sediment accumulations would be subject to excessive erosion and siltation of down-slope water bodies during precipitation events. Mass wasting events could occur during periods of high intensity precipitation, resulting in substantial quantities of sediment in downstream water bodies. Increased sediment in downstream water bodies could contribute to increased sediment that would be in excess of U.S. Environmental Protection Agency Total Maximum Daily Load requirements for sediment and turbidity. (See Section 3.10, Hydrology and Water Quality for additional information.)

Feedstock acquisition on both flat and hillside unpaved roads would result in heavy truck traffic, which could result in surface erosion rates that are several orders of magnitude higher than the adjacent undisturbed forest. As described above, research has consistently shown that roads have the greatest effect on erosion of all practices associated with forest management. Although other forest management activities usually occur on a larger proportion of the landscape, the erosion rates on roads are the dominant source of sediment in most managed forests. As a result, erosion from unpaved roads during feedstock acquisition could result in potentially significant erosion and siltation and downstream water bodies.

However, PDFs (see Section 2.4) would minimize the potential for erosion during road construction, maintenance, and use. PDF-GEO-1 requires suspension of road use during wet winter weather, thus reducing the potential for soil erosion in saturated soils. PDF-GEO-2 requires implementation of erosion prevention and control measures in areas with slopes in excess of 50% (27 degrees). PDF-GEO-3 and PDF-GEO-4 require implementation of a SWPPP or equivalent document, which would reduce the potential for soil erosion. PDF-GEO-5 requires construction of drainage features in treatment areas, which will reduce erosion. And PDF-GEO-6 requires that a Registered Professional Forester or licensed geologist evaluate treatment areas with slopes greater than 50% for unstable soil areas (i.e., soil with moderate to high erosion potential). With implementation of **PDF-GEO-1** through **PDF-GEO-6** potentially significant road related erosion impacts would be reduced to **less than significant** levels.

Forest Thinning and Erosion

Numerous studies have evaluated the effects of timber harvest on runoff, water quality, erosion, and sediment yields. Most studies have focused on commercial harvests using relatively severe treatments such as clearcuts, patch cuts, or heavy selective cuts, while few studies have focused on forest thinning operations. Fuel management treatments conducted in accordance with the Project Design Features described in Section 2.4 are more similar to thinning operations, such as selective single tree selection or group cuts, rather than patch or clearcuts. This means that the observations and conclusions presented here are based partly on inference and extrapolation from studies of more intensive forest harvest operations, and to the extent possible, on the limited data from thinning studies that more closely correspond to the amount of disturbance that might be expected from fuel reduction treatments (Robichaud et al. 2010).

The removal of forest cover decreases interception and transpiration, and in wetter areas, this generally increases annual water yields. The increases in annual water yield following forest harvest are usually assumed to be proportional to the amount of forest cover removed, but at least 15% to 20% of the trees must be removed to produce a statistically detectable effect. In areas where the annual precipitation is less than 18 to 20 inches, removal of the forest canopy is unlikely to significantly increase annual water yields. In drier areas, the decrease in interception and transpiration is generally offset by the increase in soil evaporation, and there is no net change in runoff as long as there is no change in the underlying runoff processes (for example, a shift from subsurface stormflow to overland flow due to soil compaction). For example, removing 100% of the forest cover in a snow-dominated area with a mean annual precipitation of 21 inches resulted in an initial water yield increase of 1.1 inches per year, while a 24% reduction in forest cover in a snow-dominated area with a mean annual precipitation of 34 inches caused an initial water yield increase of 3 inches per year. In wetter environments, the combination of clearcutting and roads may increase annual water yields by 20 inches or more. Extrapolating from these and other results suggest that relatively heavy thinning operations can increase annual water yields in wetter environments. No measurable increase in runoff can be expected from thinning operations that remove less than 15% of the forest cover or in areas with less than 18 inches of annual precipitation. Since evapotranspiration rapidly recovers with vegetative regrowth in partially thinned areas, any increase in runoff due to thinning operations is likely to persist for no more than 5 to 10 years (Robichaud et al. 2010).

Timing of Forest Thinning

The timing of the increase in runoff due to forest harvest is important because of the potential impact on water supplies, sediment transport capacity, bank erosion, and aquatic ecosystems. If forest harvest only increases low or moderate flows, one would expect little or no change in channel erosion or sediment yields. An increase in larger flows provides a mechanism for increasing annual sediment yields (Robichaud et al. 2010).

The timing of the increased runoff due to harvesting will vary with the hydrologic/ physiographic characteristics and climate regime. Because the climate in northern California is dry in summer and rainy during the winter, the largest increase in runoff occurs in the fall to early winter. This is due to the increase in soil moisture in late summer after forest harvest and the resulting increase in runoff efficiency because less precipitation is needed for soil moisture recharge. Runoff rates also will increase throughout the winter due to the reduction in interception (Robichaud et al. 2010).

In snow-dominated environments, nearly all of the increase in runoff will occur in early spring. As in rain-dominated environments, forest harvest reduces summer evapotranspiration and increases the amount of soil moisture carryover. Less snowmelt is needed for soil moisture recharge, so more of the early season melt is converted into runoff. The reduction in forest canopy also increases the amount of solar radiation that reaches the surface of the snowpack and the transfer of advective heat, and these changes increase the rate of snowmelt and may slightly accelerate the timing of peak runoff (Robichaud et al. 2010).

Several recent studies have summarized erosion and sediment yields from managed and unmanaged forests. These include a summary of erosion and sediment production data from different site preparation and timber harvest activities in the United States and suspended sediment data from areas subjected to forest harvest and road construction. These reviews indicate a general lack of data for non-commercial thinning operations (i.e., non-clearcutting and harvesting operations) and a relatively rapid decline in surface erosion rates after timber harvest activities. For example, in central Idaho, 90% of the erosion from skyline and jammer logging occurred within the first two years after harvest (Robichaud et al. 2010).

Based on the preceding discussion regarding forest thinning, increased runoff, and increased erosion, project feedstock acquisition would result in potentially significant erosion related impacts. However, PDFs (see Section 2.4) would minimize the potential for erosion during feedstock acquisition. PDF-GEO-1 requires suspension of mechanical treatments during wet winter weather, thus reducing the potential for soil erosion in saturated soils. PDF-GEO-2 requires implementation of erosion prevention and control measures in areas with slopes in excess of 50% (27 degrees). PDF-GEO-3 and PDF-GEO-4 require implementation of a SWPPP or equivalent document, which would reduce the potential for soil erosion during feedstock acquisition. PDF-GEO-5 requires construction of drainage features in treatment areas, which will reduce erosion. And PDF-GEO-6 requires that a Registered Professional Forester or licensed geologist evaluate treatment areas with slopes greater than 50% for unstable soil areas (i.e., soil with moderate to high erosion potential). With implementation of **PDF-GEO-1** through **PDF-GEO-6** potentially significant erosion impacts during feedstock acquisition would be reduced to **less than significant** levels.

Tree Felling and Erosion

Felling is the action of cutting down a tree by machine or hand. Mechanized fellers cut a tree down with a saw blade and then de-limb the tree. Some machines are designed to collect the trees using a specialized attachment (feller-buncher). Mechanized felling is faster and less hazardous than hand-felling, but the trees need to be under a certain diameter and the area has to be machine accessible. Mechanized fellers can disturb and compact the soil, and the use of these machines is a potential source of erosion. However, because they do not drag the logs on the ground, they often generate less erosion than log skidders (Robichaud et al. 2010).

The effects of felling on erosion generally have not been studied independent of yarding. Hand felling can be accomplished by one person with a chainsaw, and the amount of soil disturbance from this activity generally is considered negligible. A comparison of clearcut and thinned plots to control plots showed that hand-felling without mechanized yarding caused minimal surface disturbance and no increase in erosion (Robichaud et al. 2010).

Non-commercial thinning to reduce fuel loads is being done on an increasingly large scale using masticating machines. These machines are usually large, rubber-tired or tracked skidders with a mulching or wood grinding attachment such as a Hydro-Ax or a Bull-Hog. Some machines are designed to masticate standing trees, while others fell the trees before masticating the material. Like mechanized fellers, the movement of masticating machines can disturb or compact the soil and thereby increase the potential for erosion. The shredded wood that remains after these operations may increase the amount of ground cover and reduce the erosion potential (Robichaud et al. 2010).

Based on the preceding discussion regarding tree felling and increased erosion, project feedstock acquisition would result in potentially significant erosion related impacts. However, PDFs (see Section 2.4) would minimize the potential for erosion during tree felling. PDF-GEO-1 requires suspension of mechanical treatments during wet winter weather, thus reducing the potential for soil erosion in saturated soils. PDF-GEO-2 requires implementation of erosion prevention and control measures in areas with slopes in excess of 50% (27 degrees). PDF-GEO-3 and PDF-GEO-4 require implementation of a SWPPP or equivalent document, which would reduce the potential for soil erosion during tree felling operations. PDF-GEO-5 requires construction of drainage features in treatment areas, which will reduce erosion. And PDF-GEO-6 requires that a Registered Professional Forester or licensed geologist evaluate treatment areas with slopes greater than 50% for unstable soil areas (i.e., soil with moderate to high erosion potential). With implementation of **PDF-GEO-1** through **PDF-GEO-6** potentially significant erosion impacts during tree felling operations would be reduced to **less than significant** levels.

Yarding and Erosion

The amount of disturbed area and bare soil due to thinning will depend largely on the amount and type of yarding activities. Tractor yarding generally produces the greatest amount of site disturbance, followed by jammer, high lead cable, skyline, and helicopter yarding. Ground-based tractor-yarding generally necessitates an extensive network of skid trails and roads, while full suspension cable yarding will cause much less ground disturbance and generally requires a less dense road network. The use of ground-based logging systems can result in increased soil disturbance by displacing soil cover through the mechanical action of machine travel. Alexander and Poff (1985) stated that commercial thinning operations which utilized tractors and rubber-tired skidders could result in 34% disturbance of a given activity area. The authors also showed that tractor logging of clearcuts can result in up to 43% areal extent of disturbance. But the authors also noted that when skid trail layout was considered, disturbance could be as low as 4% to 11% depending on skid trail spacing. Soil disturbance monitoring on the Klamath National Forest of conventional tractor logging with rubber-tired skidders showed that an average of 11.5% of a particular unit was in main skid trails and landings after harvest. Machine piling can also increase ground disturbance when the machine turns. Soil disturbance can occur when the equipment turns and the track scrapes the soil surface. In some situations, jammer logging (cut trees are cable yarded using a truck-mounted boom) can result in up to 29% more road area than tractor-logging, and the higher road density can greatly increase the total erosion rate from the project area. But increased ground disturbance, as long as it is not excessive, does not always equate with excessive surface erosion. Soils with high soil strength (loams and clay loams) show much less surface disturbance compared to low strength soils (sandy loams) (USFS 2009; Robichaud et al. 2010).

Although thinning a stand of trees to a desired density requires access to the entire stand, non-commercial thinning generally requires little or no yarding and can be one of the least disturbing forest management practices. Commercial thinning requires yarding methods appropriate for smaller trees, such as small skylines with light cables and short towers, small crawler tractors, rubber-tired skidders, horses, tractor-mounted winches, or specialty yarding machines. The use of skyline logging systems would be expected to cause smaller amounts of soil displacement than ground-based logging systems because the primary disturbance lies in the skyline yarding corridors where the butt end of logs drag over the soil surface. Unlike ground-based systems, there is no overland machine travel. Therefore, the affected area tends to be more limited. The spatial area occupied by yarding corridors in skyline operations can vary from 3% to 8%. Helicopter logging would be expected to cause even smaller amounts of soil disturbance than skyline operations, usually caused when cut trees hit the ground and cause a small depression to form in the surface soil. The level of estimated detrimental disturbance from past helicopter logging activities has been shown to average as much as 6% within a given unit. While unit-level disturbance from helicopter logging is often minimal, this harvest method can require the construction of landings that may cause an additional loss of soil productivity. Skyline and helicopter logging is typically used on slopes greater than 45% in order to reduce the potential amount of erosion on steeper slopes. In general, the amount of disturbance caused by yarding will depend on the site characteristics, timing of yarding, and the percent of the stand that is being thinned. In most cases, the amount of disturbance from commercial thinning will be similar to selective harvest techniques (USFS 2009; Robichaud et al. 2010).

Based on the preceding discussion regarding yarding and increased erosion, project feedstock acquisition would result in potentially significant erosion related impacts. However, PDFs (see Section 2.4) would minimize the potential for erosion during yarding. PDF-GEO-1 requires suspension of mechanical treatments during wet winter weather, thus reducing the potential for soil erosion in saturated soils. PDF-GEO-2 requires implementation of erosion prevention and control measures in areas with slopes in excess of 50% (27 degrees). PDF-GEO-3 and PDF-GEO-4 require implementation of a SWPPP or equivalent document, which would reduce the potential for soil erosion during yarding operations. PDF-GEO-5 requires construction of drainage features in treatment areas, which will reduce erosion. And PDF-GEO-6 requires that a Registered Professional Forester or licensed geologist evaluate treatment areas with slopes greater than 50% for unstable soil areas (i.e., soil with moderate to high erosion potential). With implementation of **PDF-GEO-1** through **PDF-GEO-6** potentially significant erosion impacts during yarding operations would be reduced to **less than significant** levels.

Wood Pellet Production

Lassen Facility

The proposed project would include construction of a new wood pellet processing facility, including a woodyard, green processing area, drying area, pellet mill, project storage, and loadout area. New roads for truck access and mill personnel access would be added, including a new road for truck access from Babcock Road at the southwest corner of the site. A new rail spur connecting to the adjacent BNSF Railway line would be added for finished product load out as well as additional rail siding tracks on-site for the storage of full and empty railcars. Other improvements would include new truck scales and a graded area for overflow raw material storage.

Construction-related activities could potentially result in sediment releases due to exposure of previously stabilized soils to rainfall/runoff and wind, which in turn could result in sedimentation of downstream receiving waters. Such activities include the removal of vegetation, demolition of on-site infrastructure, and grading of the site. In addition, grass and other low-lying vegetation would be degraded due to use (e.g., equipment staging area), resulting in exposure of underlying soils. Because greater than 1.0 acre of ground disturbance would occur, project construction would adhere to required erosion control measures stipulated in a SWPPP, pursuant to the conditions of a Construction General Permit.

The project proponent would file a Notice of Intent with the SWRCB to comply with the requirements of the Construction General Permit. This process would include the preparation of a SWPPP and incorporation of BMPs to control construction-related erosion and sedimentation in dry weather and stormwater runoff. Typical BMPs incorporated into a SWPPP to protect water quality will include the following:

- Diverting off-site runoff away from the construction site.
- Vegetating landscaped/vegetated swale areas as soon as feasible following grading activities.
- Placing perimeter straw wattles to prevent off-site transport of sediment.

- Using drop inlet protection (filters and sandbags or straw wattles), with sandbag check dams within paved areas.
- Regular watering of exposed soils to control dust during demolition and construction.
- Implementing specifications for demolition/construction waste handling and disposal.
- Using contained equipment wash-out and vehicle maintenance areas.
- Maintaining erosion and sedimentation control measures throughout the construction period.
- Stabilizing construction entrances to avoid trucks from imprinting soil and debris onto the project site and adjoining roadways.
- Training, including for subcontractors, on general site housekeeping.

Compliance with existing regulations would prevent violation of water quality standards as a result of erosion induced siltation of downstream water bodies. Therefore, compliance with existing regulations would ensure that wood pellet facility construction would not violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface quality from construction activities. As a result, the project would not result in substantial erosion or loss of topsoil and impacts would be **less than significant.**

Tuolumne Facility

The proposed project would include construction of a new wood pellet processing facility, including a woodyard, green processing area, drying area, pellet mill, project storage and loadout area. New roads for truck access and mill personnel access would be added, including a new truck access from La Grange Road at the southeast corner of the site. A new rail spur connecting to the adjacent Sierra Northern Railway line would be added for finished product loadout. Other improvements would include repurposing existing truck scales and a graded area for overflow raw material storage.

Erosion related impacts would be the same as that described above for the Lassen Facility. As a result, the project would not result in substantial erosion or loss of topsoil and impacts would be **less than significant.**

Transport to Market

Port of Stockton Facility

The proposed project would include a new wood pellet storage and loadout facility, including a rail unloading system, two storage domes, and a ship loadout system. A new rail spur connecting to an existing nearby rail line operated by CCTC would be added for pellet receipt.

Erosion related impacts would be the same as that described above for the Lassen Facility. As a result, the project would not result in substantial erosion or loss of topsoil and impacts would be **less than significant.**

Impact GEO-3 The project would potentially 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.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition would not include construction or operation of structures or infrastructure. As a result, no geotechnical-related impacts, such as liquefaction, lateral spreading, subsidence, or collapse would occur with respect to project feedstock acquisition. However, as described for Impact GEO-1d, grading for new roads and maintenance of existing roads could potentially destabilize hillsides, resulting in potentially significant landslides. PDFs (see Section 2.4) would minimize the potential for slope instability during feedstock acquisition operations. PDF-GEO-1 requires suspension of mechanical treatments during wet winter weather, thus reducing the potential for creating slope instability in saturated soils. PDF-GEO-2 requires new road construction and maintenance in slope areas in excess of 50% (27 degrees) to be completed under the guidance of a California Engineering Geologist, who would evaluate the road route for potential slope instability and implement slope stability measures, as appropriate. PDF-GEO-3 requires implementation of a SWPPP or equivalent document, which would reduce the potential for soil erosion and associated slope instability. PDF-GEO-4 requires avoidance of slopes steeper than 75% (37 degrees), thus minimizing the potential for slope instability during wildfire fuel reduction operations. PDF-GEO-5 requires construction of drainage features in treatment areas, which will reduce erosion and associated slope instability. And PDF-GEO-6 requires that a Registered Professional Forester or licensed geologist evaluate treatment areas with slopes greater than 50% for unstable areas, thus minimizing the potential for slope instability during feedstock acquisition. With implementation of **PDF-GEO-1** through **PDF-GEO-6** potentially significant landslide impacts would be reduced to **less than significant** levels.

Wood Pellet Production

Lassen Facility

As discussed for Impact GEO-1c, based on the presence of shallow groundwater and alluvial soils, the potential exists for liquefaction to occur at the site. Lateral spreading would not occur based on the lack of slopes at the site. As indicated in Impact GEO-1d, landslides would not occur at the site due to a lack of existing slopes However, potentially oversteepened temporary slopes may be prone to failure. Saturated sidewalls of excavations and trenches could also result in caving and sloughing. As indicated in Section 3.6.1, the site is not in an area of known subsidence due to groundwater pumping, peat loss, or oil extraction. Seismically induced differential settlement could potentially occur in shallow excavations into unconsolidated topsoil, existing fill, or alluvium, resulting in foundation cracking and pipeline/utility damage.

However, as discussed for Impact GEO-1b, design and construction of the project would be in compliance with the CBC, which includes adherence to recommendations of the project-specific geotechnical report (Appendix E1). This report provides seismic design criteria for the proposed project, thus minimizing the potential for damage as a result of seismically induced ground failure. The Lassen County Planning and Building Services Department ensures that all new construction complies with current codes and ordinances regarding earthquake safety. In addition, construction and operation of the proposed wood pellet facility would not cause or exacerbate the potential for earthquakes to occur. In addition, as described for Impact GEO-1d, the geotechnical report includes recommendations for stabilization of temporary slopes. As a result, construction would occur in compliance with standard geotechnical engineering, the CBC, and Cal/OSHA, such that onsite geologic units or soil would not become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. As a result, impacts would be **less than significant.**

Tuolumne Facility

As discussed for Impact GEO-1c, the potential for liquefaction, lateral spreading, and differential settlement is low due to shallow bedrock conditions and generally low seismicity in the area. As indicated in Impact GEO-1d, there is no potential for existing landslides to adversely affect the site. However, there is a modest risk that displacement and/or movement could occur on proposed 5 to 10 foot slopes in the event of strong seismically induced ground shaking. As a result, the project geotechnical report (Appendix E3) recommends that all cut and fill slopes be constructed no steeper than 2:1 or 3:1 (horizontal to vertical), depending on tolerance for minor slope failure. With incorporation of recommendations of the geotechnical report, construction and operation of the facility would not result in significant impacts related to on- or off-site landslides.

As indicated in Section 3.6.1, the site is not in an area of known subsidence due to underground mining, groundwater pumping, peat loss, or oil extraction. Based on the soil survey for the project area, and the site-specific geotechnical report (Appendix E3) competent bedrock is present at shallow depths. Therefore, any potential deep excavations for proposed structures would likely be completed into bedrock not susceptible to caving and collapse. Seismically induced differential settlement could potentially occur in shallow excavations into unconsolidated topsoil or existing fill, such as for standard slab-on-grade foundations, resulting in foundation cracking and pipeline/utility damage. However, for the reasons described above for the Lassen Facility, construction and operation of the facility would not result in significant impacts related to on- or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. Impacts would be **less than significant.**

Transport to Market

Port of Stockton

As discussed in Section 3.6.1, regional seismic activity could cause accelerations severe enough to cause major damage to structures and foundations in the Port not designed to resist the forces generated by earthquakes. Underground utility lines are also susceptible where they lack sufficient flexibility to accommodate the seismic ground motion. A geotechnical investigation completed in 2020 for a site within the Port indicated that the top 50 feet of soil have a moderate vulnerability to liquefaction, but that there is sufficient non-liquefiable soil on top of potentially liquefiable soil to prevent secondary liquefaction effects (e.g., sand boils or lurch cracking) following a major earthquake. Based on the relatively flat topography of the site, the potential for lateral spreading is low. In addition, seismically induced landslides would not occur, as the topography of the site is relatively flat to gently sloping. Seismically induced differential settlement could potentially occur, resulting in foundation cracking and pipeline/utility damage. However, for the reasons described above for the Lassen Facility, construction and operation of the facility would not result in significant impacts related to on- or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. Impacts would be **less than significant**.

Impact GEO-4 The project would not be located on expansive soil, creating substantial direct or indirect risks to life or property.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition would not include construction or operation of structures or infrastructure. As a result, no geotechnical-related impacts related to expansive soils would occur. **No impacts** would occur.

Wood Pellet Production

Lassen Facility

Based on the soil survey for the project area, surficial soils consist primarily of Pit silty clay. Laboratory tests performed on near surface soils indicated these clays have a medium to high expansion potential. As a result, near-surface soils could exert significant expansion pressures on building foundations, interior floor slabs, exterior flatwork, and pavements (Appendix E1). However, project development would comply with recommendations of the project specific geotechnical report, with the Lassen County Building Code, and with the CBC, which would mitigate potential risks to proposed structures associated with expansive soils. The geotechnical report recommends the upper 12 inches of soil beneath proposed foundations consist of nonexpansive, well-graded, granular soils, with a plasticity index of 15 or less, when tested in accordance with ASTM D4318, or an expansion index of 20 or less, when tested in accordance with ASTM D4829. The Lassen County Planning and Building Services Department ensures that all new construction complies with current codes and ordinances regarding earthquake safety. Lassen Facility construction and operation would not foreseeably create hazards or risks to life or property from expansive soils given the soil engineering that would be done prior to project construction, in accordance with the recommendations of the geotechnical report. As a result, construction and operation of the facility would not result in significant impacts related to expansive soils. Impacts would be **less than significant.**

Tuolumne Facility

Based on the soil survey for the project area, surficial soils consist primarily of loam, which is soil with roughly equal proportions of sand, silt, and clay. Laboratory tests performed on near-surface soils indicated these soils have a low plasticity index when tested in accordance with ASTM D4318. Therefore, the near-surface weathered bedrock should not exhibit significant expansion (shrink/swell) characteristics. In addition, although highly plastic, the silt encountered in test pits should also not exhibit significant expansion characteristics. Accordingly, measures to resist or control potential soil expansion pressures are not considered necessary (Appendix E3) and impacts would be **less than significant.**

Transport to Market

Port of Stockton

The Port area is underlain by artificial fill and silty clay loam. Based on the presence of silty clay and heterogeneous unknown fill type, the potential for expansive clays exists at the site. However, for the reasons described above for the Lassen and Tuolumne facilities, construction and operation of the Facility would not result in significant impacts related to expansive soils. Impacts would be **less than significant.**

Impact GEO-5 The project would potentially 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.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition would not include construction or operation of structures requiring wastewater disposal. As a result, no impacts related to wastewater disposal would occur. **No impacts** would occur.

Wood Pellet Production

Lassen Facility

Sanitary sewers are not available for wastewater disposal; therefore, a septic system would be required during project operations. Based on percolation testing at two on-site locations, the site may not be suitable for infiltration as the infiltration at the site will be very low to non-existent. In addition, the shallow depth of existing groundwater for the site is a concern with respect to the distance between the bottom of the system and groundwater. The geotechnical report recommends that the drainage system be designed by an experienced and qualified engineer familiar with the applicable regulatory agencies requirements and an appropriate factor of safety should be included in the overall design (Appendix E1).

As a result, use of a standard septic tank system may result in a potentially significant impact to groundwater quality.

An engineered septic tank system, which is designed to treat the effluent prior to discharge to the subsurface, would prevent potential adverse bacterial impacts to groundwater beneath the site. The requirement for such a system is described in mitigation measure **MM-GEO-1.** With the implementation of this Mitigation Measure, impacts would be reduced to **less than significant** levels.

Tuolumne Facility

Sanitary sewers are not available for wastewater disposal; therefore, a septic system would be required during project operations. A geotechnical investigation completed at the site (Appendix E3) included percolation tests at two locations on-site. In addition, a test pit was excavated near the percolation test locations to determine the depth of weathered bedrock. Resistant bedrock was encountered at a depth of about 3.5 feet below ground surface, overlain by low plastic clay (residual soil). Based on the percolation testing, which were completed at depths of 1 and 2 feet, respectively, the percolation rate was 150 and 300 minutes per inch, which is very slow.

Based on Section 13.08.220 of the Tuolumne County On-Site Sewage Treatment and Disposal Code (Chapter 13.08), "there shall be a minimum of five feet of permeable soil below the bottom of a leach trench or bed" with permeable soil defined as soil with a percolation rate not slower than 120 minutes per inch for standard leach trenches or beds. With the shallow bedrock conditions and slow percolation test results, a conventional absorption trench, bed or pit sewage treatment system will not meet Tuolumne County criteria. The geotechnical report recommended that a mound system or a system that incorporates pre-treatment prior to evaporation or ground disposal, be constructed.

As a result, use of a standard septic tank system may result in a potentially significant impact to groundwater quality.

An engineered septic tank system, which is designed to treat the effluent prior to discharge to the subsurface, would prevent potential adverse bacterial impacts to groundwater beneath the site. The requirement for such a system is described in mitigation measure **MM-GEO-1**. With the implementation of this Mitigation Measure, impacts would be reduced to **less than significant** levels.

Transport to Market

Port of Stockton

The Port of Stockton is a deep-water port located within City of Stockton jurisdiction. As a result, the project would be served by existing City sewers. As a result, **no impacts** would occur.

Impact GEO-6 The project would potentially directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition would not include construction or operation of structures or infrastructure requiring subsurface excavations. As a result, no impacts related to paleontological resources would occur. **No impacts** would occur.

Lassen Facility

No paleontological resources were identified within the Lassen County project site as a result of the institutional records search or desktop geological and paleontological review. In addition, the Lassen County project site is not anticipated to be underlain by unique geologic features. The project site is underlain by Quaternary, late Pleistocene to Holocene lake deposits and have low to high paleontological sensitivity (increasing with depth beneath the ground surface). If intact paleontological resources are located onsite, ground-disturbing activities associated with construction of the proposed project, such as grading during site preparation and trenching for utilities, have the potential to destroy a unique paleontological resource or site. As such, the project site is considered to be potentially sensitive for paleontological resources, and without mitigation, the potential damage to paleontological resources during construction associated with the project is considered a potentially significant impact. Given the proximity of past fossil discoveries in the surrounding area within similar sediments as those found at the project site, the project site is highly sensitive for supporting paleontological resources below the depth of fill and weathered, Pleistocene lake deposits. However, upon implementation of **MM-GEO-2**, impacts would be reduced to **less than significant** levels.

Tuolumne Facility

No paleontological resources were identified within the Tuolumne project site as a result of the institutional records search or desktop geological and paleontological review. In addition, the Tuolumne project site is not anticipated to be underlain by unique geologic features. The project site is underlain Triassic -Jurassic metavolcanic rocks, specifically greenschist, and has no paleontological sensitivity (Bartow et al. 1981; Morgan 1976; CDMG 1972). Given the lack of past fossil discoveries in the surrounding area within similar geological units as those found at the project site, the project site has no sensitivity for supporting paleontological resources, and potential impacts would be **less than significant.**

Port of Stockton

No paleontological resources were identified within the Port of Stockton project site as a result of the institutional records search or desktop geological and paleontological review. In addition, the Port of Stockton project site is not anticipated to be underlain by unique geologic features. The project site is underlain by recent stream channel and basin deposits of the Great Valley. These sediments are generally too young to preserve fossils on the surface and at shallow depths, and have low paleontological sensitivity, but are often underlain, at depth, by older Holocene and Pleistocene sediments that have high paleontological sensitivity. If intact paleontological resources are located onsite, ground-disturbing activities associated with construction of the proposed project, such as grading during site preparation and trenching for utilities, have the potential to destroy a unique paleontological resource or site. As such, the project site is considered to be potentially sensitive for paleontological resources, and without mitigation, the potential damage to paleontological resources during construction associated with the project is considered a potentially significant impact. Given the proximity of past fossil discoveries in the surrounding area within similar sediments as those found at the project site, the project site is highly sensitive for supporting paleontological resources below the depth of fill and weathered stream channel and basin deposits. However, upon implementation of **MM-GEO-2**, impacts would be reduced to **less than significant** levels.

3.6.4.3 Cumulative Impacts

The project would not contribute to cumulative impacts, including the risk of loss, injury, or death involving:

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.
D. Landslides.

Feedstock Acquisition

Sustainable Forest Management Projects

The geographic context of seismic hazards is a Working Area near the Lassen and Tuolumne wood pellet production facilities, where there is a general risk of experiencing a substantive earthquake on any of the regional Holocene-active faults in the area. With respect to rupture of an earthquake fault, strong seismic ground shaking, and seismic related failure, including liquefaction, no project impacts would occur, as feedstock acquisition would not include construction or operation of structures or infrastructure. As a result, no seismic-related structural impacts would occur with respect to project feedstock acquisition. In addition, feedstock acquisition would not directly or indirectly cause seismic impacts. As a result, the proposed project, in combination with cumulative projects within the Working Area of the pellet facilities, would not result in cumulatively considerable impacts.

With regard to landslides, project induced landsliding could potentially occur and impacts would be less than significant with mitigation. However, landslide risks tend to be site-specific rather than cumulative in nature, because the effects are so dependent on site-specific conditions and do not combine from site to site. For current, past, and reasonably foreseeable cumulative projects, any development occurring within the Working Area would be subject to site development construction standards and code requirements to ensure protection from substantive damage or injury. Cumulative projects would be subject to local, regional, and State regulations pertaining to slope stability, including CBC requirements when applicable. Therefore, the cumulative impact related to landslides would not be cumulatively considerable.

Wood Pellet Production

Lassen Facility

The geographic context of seismic hazards is a 50-mile radius of the project site, as there is a general risk of experiencing substantive ground shaking as a result of a large earthquake on any of the regional Holocene-active faults within a 50-mile radius. However, the majority of impacts from geologic hazards, such as liquefaction, landslides, and unstable soils, are site-specific and are therefore generally mitigated on a project-by-project basis. Each cumulative project, as identified in Section 3.0 of this EIR, would be required to adhere to required building engineering design, per the most recent version of the CBC, to ensure the safety of building occupants and avoid a cumulative geologic hazard. Additionally, as needed, projects would incorporate individual mitigation or geotechnical requirements for site-specific geologic hazards present on each individual cumulative project site. Therefore, a potential cumulative impact related to site-specific geologic hazards would not occur and the proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to seismicity and landslides.

Tuolumne Facility

Impacts would be the same as that described for the Lassen Facility. The proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to seismicity and landslides.

Transport to Market

Port of Stockton

Impacts would be the same as that described for the Lassen Facility. The proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to seismicity and landslides.

The project could contribute to cumulative substantial soil erosion or the loss of topsoil.

Feedstock Acquisition

Sustainable Forest Management Projects

Fuel management treatments generally are needed every 10 to 20 years and the associated cumulative effects occur during each access and treatment cycle. Although hillslope erosion rates recover quickly, the road system, which is typically used and maintained between treatment activities, is a chronic source of sediment. Sediment yields from high severity wildfires are much greater than the increase in sediment yields due to fuel management activities, but the recurrence interval of such wildfires can be hundreds of years. Over longer time scales, the cumulative impacts of fuel treatments, repeated at 10 to 20 year intervals, when combined with the impacts of continuous road maintenance and use, may be similar to the pulse impact from wildfires (Robichaud et al. 2010).

The cumulative effect of fuel management activities is related to their location and concentration within a given watershed as well as the degree and frequency of disturbance for each activity. The watershed-scale impacts of any fuel management activity must consider the associated activities of road use, road maintenance, increased traffic, and multiple entries with various types of equipment as well as the combined effects of all the fuel treatments being applied. However, these effects are complex and interrelated. Few studies have examined the role of different controlling factors, much less the effects and interactions of the different activities on runoff and erosion at the watershed scale. Identifying the cumulative effects of timber harvest activities is a continuing challenge, as it is almost impossible to quantify the relative contribution of each activity at each location. It follows that determining the cumulative effects of fuel treatments, which generally cause less disturbance than timber harvesting, is even more of a challenge (Robichaud et al. 2010).

Roads greatly increase runoff and erosion rates at the plot and road segment scale. The effect of these increases at the watershed scale depends on the connectivity of the road and stream networks, but several studies have indicated that roads have minimal effect on runoff at larger spatial scales. More studies have shown that unpaved forest roads are chronic sediment sources and that roads can significantly increase sediment yields on small to moderate-sized catchments. Road building, maintenance, and obliteration can generate significant short-term increases in runoff and sediment. The effects of forest roads on runoff and sediment yields can be greatly reduced by improved road placement, road designs that dissipate runoff and direct it away from streams, and the widespread use of erosion mitigation techniques (Robichaud et al. 2010).

With respect to the proposed project, the area of influence for cumulative erosion related impacts would be the Working Area. Erosion from unpaved roads, as a result of new road construction or road maintenance during feedstock acquisition, could result in potentially significant erosion and siltation of downstream water bodies. According to the USGS National Hydrography Dataset, the Northern California Feedstock Area intersects 157 watersheds and 42,476 linear miles of streams, rivers, canals, and ditches (USGS 2023). However, with implementation of PDF-GEO-3, potential significant impacts would be reduced to less than significant with mitigation. In addition, forest thinning operations could result in increased stormwater runoff and increased erosion, resulting in potentially significant impacts. However, with implementation of PDF-GEO-4, erosion related impacts during forest thinning would be reduced to less than significant with mitigation. Cumulative projects within the area of influence would similarly be subject to CEQA and/or NEPA review, which would result in creation and implementation of erosion control related mitigation measures, similar to the proposed project. In addition, cumulative construction projects greater than 1.0 acre would be subject to provisions of the Construction General Permit, which requires implementation of a project-specific SWPPP and associated BMPs to minimize the potential for erosion. As a result, Impact GEO-2 would be considered potentially significant for both direct and cumulative erosion related impacts, but would be reduced to less than significant with mitigation.

Wood Pellet Production

Lassen Facility

The cumulative area of influence with respect to erosion is the encompassing Pit River Watershed, of the larger Sacramento River and San Francisco Bay watersheds (Figure 3.9-1, Feedstock Area Hydrologic Regions), as erosion can result in siltation of downstream water bodies. During construction activities, the project site and cumulative projects would have the potential to result in local soil erosion during excavation, grading, trenching, and soil stockpiling. Erosion could result in sediment and other pollutants (attached to sediment) entering surface water bodies and adversely affecting water quality. However, the project and the cumulative projects would be subject to the same regulatory requirements discussed in Section 3.6.4.2, Project Impacts. Compliance with existing regulations would prevent violation of water quality standards as a result of erosion induced siltation of downstream water bodies. Similar to the proposed project, any cumulative projects greater than 1.0 acre would be subject to provisions of the Construction General Permit, which requires implementation of a project-specific SWPPP and associated BMPs to minimize the potential for erosion. As a result, the proposed project, in combination with past, present, and reasonably foreseeable projects would not result in cumulative considerable impacts with respect to erosion.

Tuolumne Facility

Erosion related impacts would be the same as that described for the Lassen Facility, although the cumulative area of influence with respect to erosion is the Upper Stanislaus River Watershed of the larger San Joaquin River and San Francisco Bay watersheds (Figure 3.9-1). The proposed project, in combination with past, present, and reasonably foreseeable projects would not result in cumulative considerable impacts with respect to erosion.

Transport to Market

Port of Stockton

Erosion related impacts would be the same as that described for the Lassen Facility. the proposed project, in combination with past, present, and reasonably foreseeable projects would not result in cumulative considerable impacts with respect to erosion.

The project would not contribute to cumulatively considerable impacts as a result of being 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.

Feedstock Acquisition

Sustainable Forest Management Projects

As described for cumulative Impact GEO-1, no seismic-related structural impacts would occur with respect to project feedstock acquisition. In addition, feedstock acquisition would not directly or indirectly cause seismic impacts. Similarly, no subsidence or collapse related impacts would occur with respect to project feedstock acquisition. In addition, feedstock acquisition would not directly or indirectly cause these types of impacts. As a result, the proposed project, in combination with cumulative projects within the Working Area, would not result in cumulatively considerable impacts.

With regard to landslides, project induced landsliding could potentially occur and impacts would be less than significant with mitigation. However, landslide risks tend to be site-specific rather than cumulative in nature, because the effects are so dependent on site-specific conditions and do not combine from site to site. For current, past, and reasonably foreseeable cumulative projects, any development occurring within the Working Area would be subject to site development construction standards and code requirements to ensure protection from substantive damage or injury. Cumulative projects would be subject to local, regional, and State regulations pertaining to slope stability, including CBC requirements when applicable. Therefore, the cumulative impact related to landslides would not be cumulatively considerable.

Wood Pellet Production

Lassen Facility

As described for cumulative Impact GEO-1, the majority of impacts from geologic hazards, such as liquefaction, landslides, and unstable soils, are site-specific and are therefore generally mitigated on a project-by-project basis.

Each cumulative project, as identified in Section 3.0 of this EIR, would be required to adhere to required building engineering design, per the most recent version of the CBC, to ensure the safety of building occupants and avoid a cumulative geologic hazard. Additionally, as needed, projects would incorporate individual mitigation or geotechnical requirements for site-specific geologic hazards present on each individual cumulative project site. Therefore, the proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to geotechnical hazards.

Tuolumne Facility

Impacts would be the same as that described for the Lassen Facility. The proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to geotechnical hazards.

Transport to Market

Port of Stockton

Impacts would be the same as that described for the Lassen Facility. The proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to geotechnical hazards.

The project would not contribute to cumulatively considerable impacts related to expansive soil, creating substantial direct or indirect risks to life or property.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition would not include construction or operation of structures or infrastructure. As a result, no geotechnical-related impacts related to expansive soils would occur. As a result, the proposed project, in combination with cumulative projects within the Working Area, would not result in cumulatively considerable impacts.

Wood Pellet Production

Lassen Facility

As described for cumulative Impact GEO-1, the majority of impacts from geologic hazards, such expansive soils, are site-specific and are therefore generally mitigated on a project-by-project basis. Each cumulative project, as identified within Section 3.0 of this EIR, would be required to adhere to required building engineering design, per the most recent version of the CBC, to ensure the safety of building occupants and avoid a cumulative geologic hazard. Additionally, as needed, projects would incorporate individual mitigation or geotechnical requirements for site-specific geologic hazards present on each individual cumulative project site. Therefore, the proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to geotechnical hazards.

Tuolumne Facility

Impacts would be the same as that described for the Lassen Facility. The proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to geotechnical hazards.

Transport to Market

Port of Stockton

Impacts would be the same as that described for the Lassen Facility. The proposed project, in combination with other cumulative projects, would not contribute to a significant cumulative impact associated with respect to geotechnical hazards.

The project would not contribute to cumulatively considerable impacts related to on-site soils being incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition would not include construction or operation of structures requiring wastewater disposal. As a result, no impacts related to wastewater disposal would occur. No impacts would occur.

Wood Pellet Production

Lassen Facility

As described in Section 3.6.4.2, Project Impacts, inadequate percolation resulting from the -on-site soils could result in potential groundwater quality impacts. Implementation of MM-GEO-5 would reduce this potential impact to less than significant. Additional septic systems are not proposed near the project site in the cumulative scenario. Therefore, a cumulative impact would not occur.

Tuolumne Facility

As described in Section 3.6.4.2, Project Impacts, inadequate percolation resulting from the -on-site soils could result in potential groundwater quality impacts. Implementation of MM-GEO-5 would reduce this potential impact to less than significant. Additional septic systems are not proposed near the project site in the cumulative scenario. Therefore, a cumulative impact would not occur.

Transport to Market

Port of Stockton

The Port of Stockton is a deep-water port located within City of Stockton jurisdiction. As a result, the project would be served by existing City sewers. As a result, no impacts would occur with respect to the proposed project.

The project would not contribute to cumulatively considerable impacts related to potential directly or indirectly destroying a unique paleontological resource or site or unique geologic feature.

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition would not include construction or operation of structures or infrastructure requiring subsurface excavations. As a result, no impacts related to paleontological resources would occur. No impacts would occur.

Wood Pellet Production

Lassen Facility

Potential cumulative impacts to paleontological resources would result from projects that combine to create an environment where fossils, exposed on the surface, are vulnerable to destruction by earthmoving equipment, looting by the public, and natural causes such as weathering and erosion. The majority of impacts to paleontological resources are site-specific and are therefore generally mitigated on a project-by-project basis. Cumulative projects would be required to assess impacts to paleontological resources. Additionally, as needed, projects would incorporate individual mitigation for site-specific geological units present on each individual project site. Furthermore, the project does not propose construction (including grading/excavation) or design features that could directly or indirectly contribute to an increase in a cumulative impact to paleontological resources, as the mitigation measure provided in this analysis ensures any significant paleontological resources uncovered during project excavations would be properly analyzed and salvaged by the on-site paleontological monitor. Therefore, the project, in combination with the past, present, and reasonably foreseeable future projects in the project vicinity, would result in less-than-significant cumulative impacts to paleontological resources, and no further mitigation measures are required. Moreover, impacts to paleontological resources would be avoided and/or mitigated with implementation of a paleontological mitigation program during excavations into paleontologically sensitive geological units. Therefore, the project's contribution to cumulative impacts would not be cumulatively considerable. As such, cumulative impacts on paleontological resources would be less than significant.

Tuolumne Facility

Potential cumulative impacts to paleontological resources would result from projects that combine to create an environment where fossils, exposed on the surface, are vulnerable to destruction by earthmoving equipment, looting by the public, and natural causes such as weathering and erosion. The majority of impacts to paleontological resources are site-specific and are therefore generally mitigated on a project-by-project basis. Cumulative projects would be required to assess impacts to paleontological resources. Additionally, as needed, projects would incorporate individual mitigation for site-specific geological units present on each individual project site. Furthermore, the project does not propose construction (including grading/excavation) or design features that could directly or indirectly contribute to an increase in a cumulative impact to paleontological resources, as the mitigation measure provided in this analysis ensures any significant paleontological resources uncovered during project excavations would be properly analyzed and salvaged by the on-site paleontological monitor. Therefore, the project, in combination with the past, present, and reasonably foreseeable future projects in the project vicinity, would result in less-than-significant cumulative impacts to paleontological resources, and no further mitigation measures are required. Moreover, impacts to paleontological resources would be avoided and/or mitigated with implementation of a paleontological mitigation program during excavations into paleontologically sensitive geological units. Therefore, the project's contribution to cumulative impacts would not be cumulatively considerable. As such, cumulative impacts on paleontological resources would be less than significant.

Transport to Market

Port of Stockton

Potential cumulative impacts to paleontological resources would result from projects that combine to create an environment where fossils, exposed on the surface, are vulnerable to destruction by earthmoving equipment, looting by the public, and natural causes such as weathering and erosion. The majority of impacts to paleontological resources are site-specific and are therefore generally mitigated on a project-by-project basis. Cumulative projects would be required to assess impacts to paleontological resources. Additionally, as needed, projects would incorporate individual mitigation for site-specific geological units present on each individual project site. Furthermore, the project does not propose construction (including grading/excavation) or design features that could directly or indirectly contribute to an increase in a cumulative impact to paleontological resources, as the mitigation measure provided in this analysis ensures any significant paleontological resources uncovered during project excavations would be properly analyzed and salvaged by the on-site paleontological monitor. Therefore, the project, in combination with the past, present, and reasonably foreseeable future projects in the project vicinity, would result in less-than-significant cumulative impacts to paleontological resources, and no further mitigation measures are required. Moreover, impacts to paleontological resources would be avoided and/or mitigated with implementation of a paleontological mitigation program during excavations into paleontologically sensitive geological units. Therefore, the project's contribution to cumulative impacts would not be cumulatively considerable. As such, cumulative impacts on paleontological resources would be less than significant.

3.6.4.4 Mitigation Measures

MM-GEO-1 Engineered Septic System. The on-site septic system shall be an engineered system to address on-site constraints including poor soil conditions (insufficient percolation) and high groundwater. The system may consist of an aerobic treatment unit or other system with equivalent pretreatment characteristics. The system, including any dispersal system, shall be located a minimum of 100 feet from any domestic water well. The system shall meet the requirements for protection of water quality of the local environmental health agency and the Regional Water Quality Control Board.

MM-GEO-2 Paleontological Resources. Prior to commencement of any grading activity on-site, GSNR shall retain a qualified paleontologist per the Society of Vertebrate Paleontology (SVP) (2010) guidelines. The paleontologist shall prepare a Paleontological Resources Impact Mitigation Program (PRIMP) for the project. The PRIMP shall be consistent with the SVP (2010) guidelines and should outline requirements for preconstruction meeting attendance and worker environmental awareness training, where monitoring is required within the proposed project site based on construction plans and/or geotechnical reports, procedures for adequate paleontological monitoring and discoveries treatment, and paleontological methods (including sediment sampling for microvertebrate fossils), reporting, and collections management. The PRIMP shall also include a statement that any fossil lab or curation costs (if necessary due to fossil recovery) are the responsibility of GSNR. The qualified paleontologist shall attend the preconstruction meeting and a qualified paleontological monitor shall be on-site during all rough grading and other significant ground-disturbing activities (including augering) in previously undisturbed, fine-grained Pleistocene alluvial deposits. In the event that paleontological resources (e.g., fossils) are unearthed during grading, the paleontological monitor will temporarily halt and/or divert grading activity to allow recovery of paleontological resources. The area of discovery will be roped off with a 50-foot radius buffer. Once documentation and collection of the find is completed, the monitor will remove the rope and allow grading to recommence in the area of the find.

Wood Pellet Production

Lassen Facility

Mitigation Measures **MM-GEO-1** and **MM-GEO-2** shall be implemented to reduce potentially significant impacts to less than significant levels.

Tuolumne Facility

Mitigation Measures **MM-GEO-1** and **MM-GEO-2** shall be implemented to reduce potentially significant impacts to less than significant levels.

Transport to Market

Port of Stockton

Mitigation Measure **MM-GEO-2** shall be implemented to reduce potentially significant impacts to less than significant levels.

3.6.4.5 Significance After Mitigation

Impact GEO-1d The project would potentially directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides.

PDF-GEO-1 through PDF-GEO-6 (see Section 2.4) provide slope stability and related measures that would reduce the potential for slope instability to occur as a result of construction of new roads and maintenance of existing roads, such that potentially significant landslide impacts would be reduced to **less than significant.**

Impact GEO-2 The project would potentially result in substantial soil erosion or the loss of topsoil.

PDF-GEO-1 through PDF-GEO-6 (see Section 2.4) provide erosion control and related measures that would reduce the potential for sedimentation of downstream water bodies during construction of new roads and maintenance of existing roads and during forest thinning operations, such that potentially significant erosion-related impacts would be reduced to **less than significant.**

Compliance with existing regulations, including the requirement for preparation of a SWPPP and incorporation of BMPs to control construction-related erosion and sedimentation, provides erosion control measures that would reduce the potential for sedimentation of downstream water bodies during construction of proposed wood pellet facilities (Lassen and Tuolumne) and pellet unloading facilities (Port of Stockton), such that potentially significant erosion-related impacts would be reduced to **less than significant.**

Impact GEO-3 — The project would potentially 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.

PDF-GEO-1 through PDF-GEO-6 (see Section 2.4) provide slope stability and related measures that would reduce the potential for slope instability to occur as a result of construction of new roads and maintenance of existing roads, such that potentially significant landslide impacts would be reduced to **less than significant.**

Impact GEO-5 — The project would potentially 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.

Implementation of **MM-GEO-1** at the Lassen and Tuolumne facility sites would reduce impacts related to groundwater to **less than significant.**

Impact GEO-6 — The project would potentially directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

Mitigation Measure **MM-GEO-2** provides a contingency plan for potentially encountering paleontological resources during grading and construction, such that potentially significant paleontology-related impacts would be reduced to **less than significant.**

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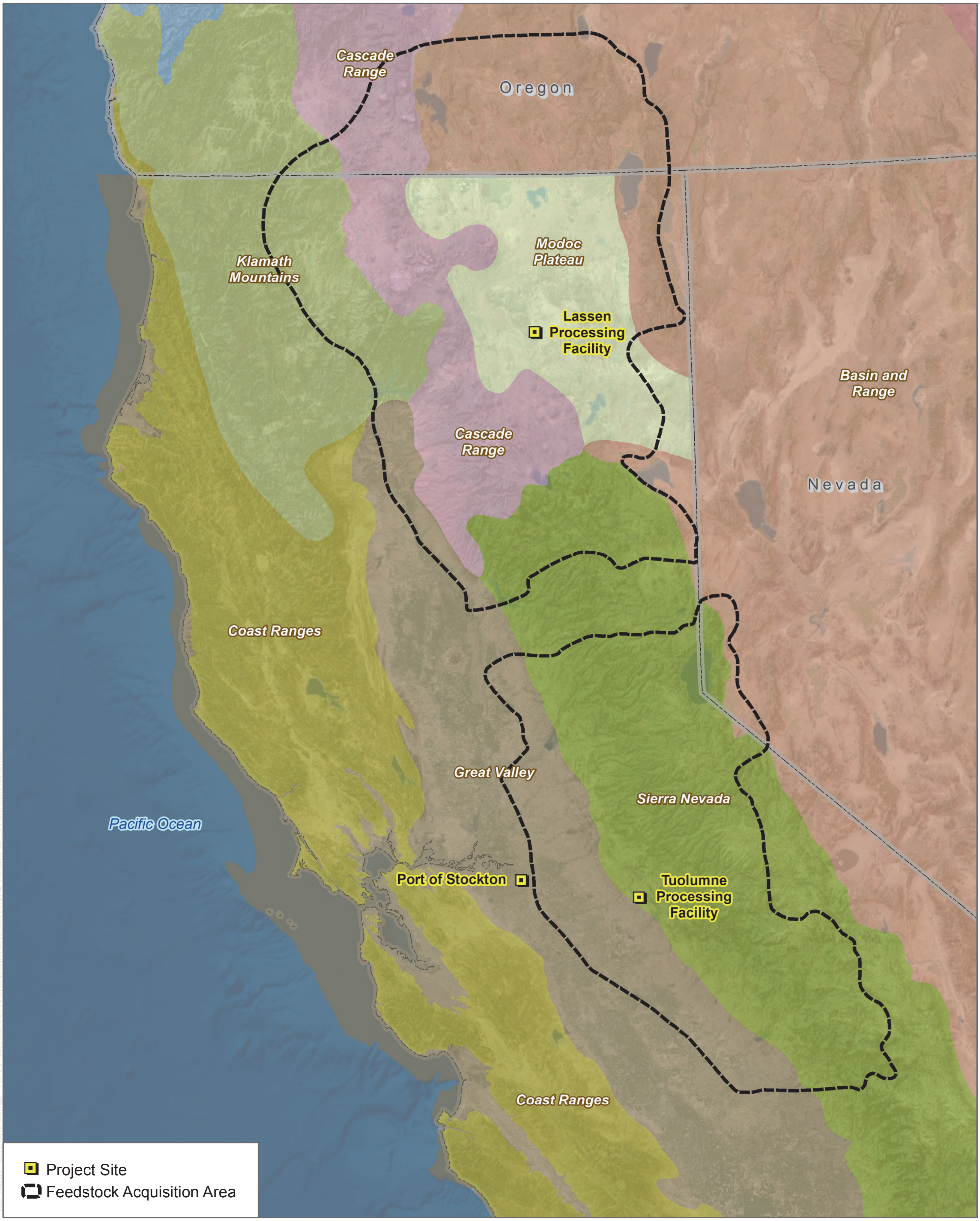

SOURCE: USGS, Bing Maps 2022

DUDEK

0 25 50 Miles

FIGURE 3.6-1

Geomorphic Provinces

Golden State Natural Resources Forest Resiliency Demonstration Project

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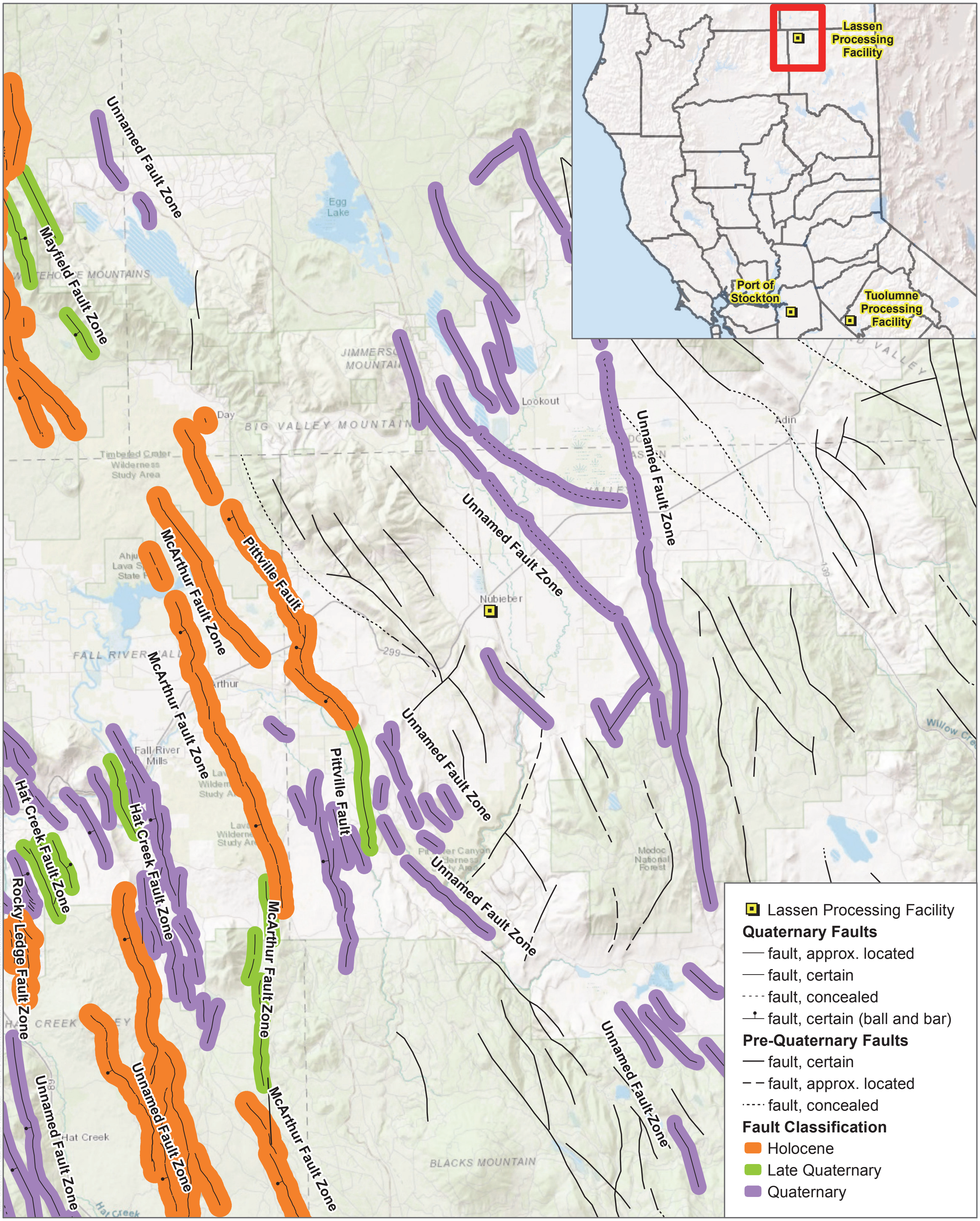

SOURCE: CGS 2022

DUDEK

0 2.5 5 Miles

FIGURE 3.6-2

Regional Faulting - Lassen Processing Facility

Golden State Natural Resources Forest Resiliency Demonstration Project

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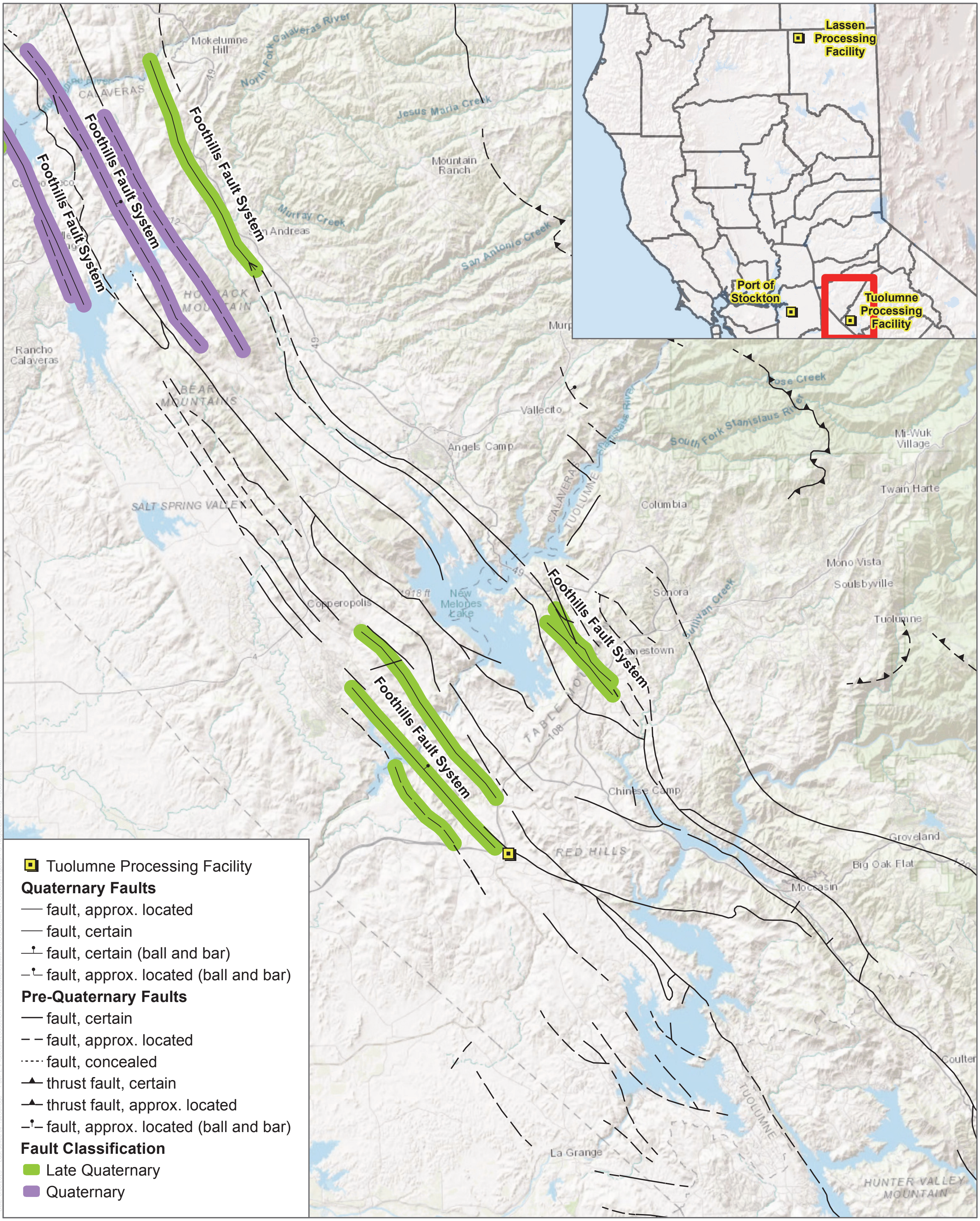

SOURCE: CGS 2022

FIGURE 3.6-3

Regional Faulting - Tuolumne Processing Facility

Golden State Natural Resources Forest Resiliency Demonstration Project

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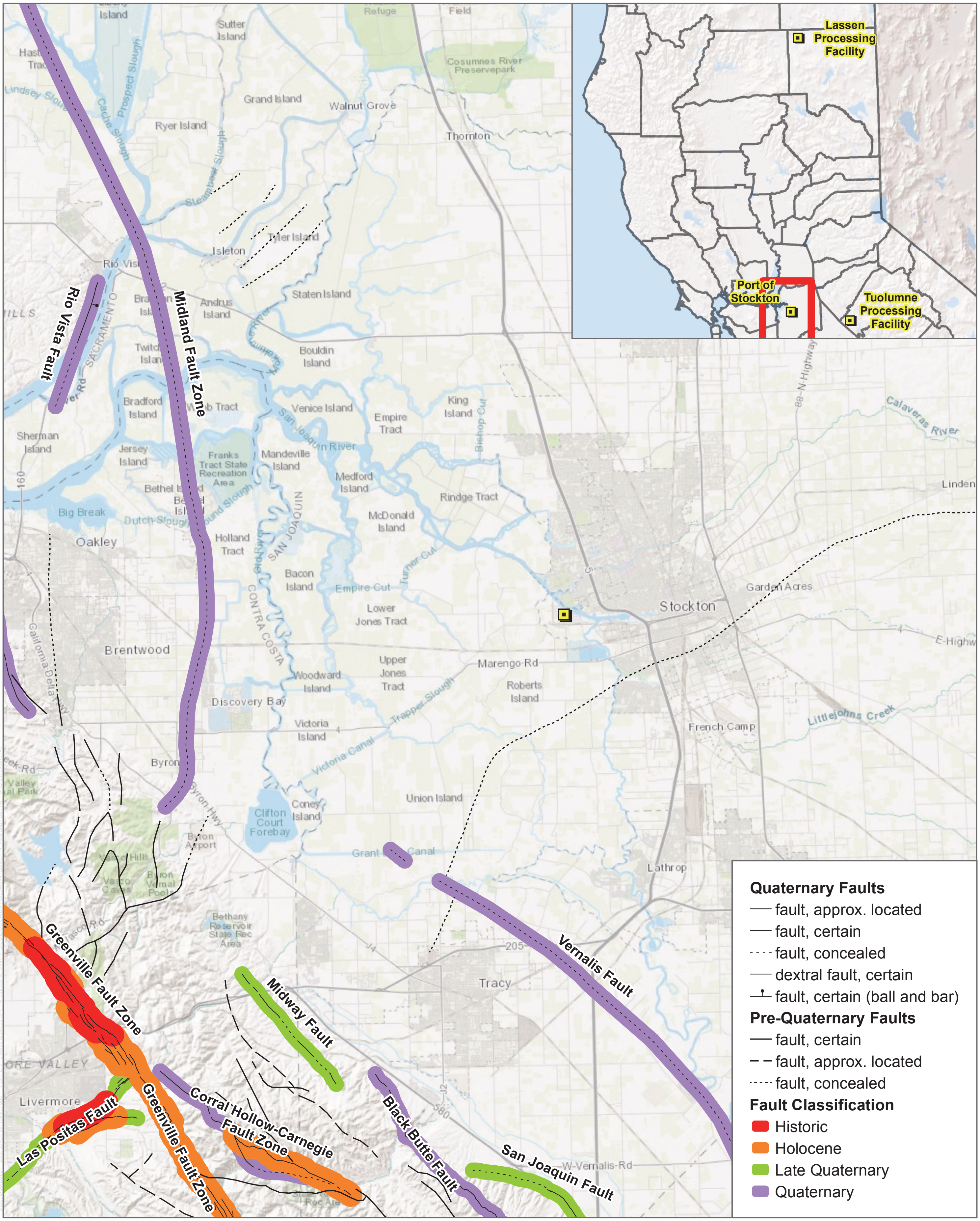

SOURCE: CGS 2022

FIGURE 3.6-4

Regional Faulting - Port of Stockton Facility

Golden State Natural Resources Forest Resiliency Demonstration Project

DUDEK

0 2.5 5 Miles

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