17 GEOLOGY, SOILS, AND MINERAL RESOURCES

17.1 INTRODUCTION

This chapter provides information relevant to geology, soils, and mineral resources impacts under NEPA and CEQA in connection with the Proposed Action and alternatives. This chapter includes: introduction, environmental and regulatory setting, impact analysis methods and assumptions, significance criteria, environmental effects of the action and alternatives, and mitigation measures to address effects that are identified as significant. Naturally occurring asbestos (NOA) which may be associated with serpentinite rock formations, is addressed in Chapter 19, *Hazardous Materials*.

17.1.1 Data Sources

The following key sources of data and information were used in the preparation of this chapter:

- ▲ Maps and reports published by the California Geological Survey (CGS),
- ▲ The Soil Survey of Yolo County, California (U.S. Department of Agriculture [USDA] 1972),
- ▲ Yolo County 2030 Countywide General Plan (Yolo County 2009a),
- ▲ Yolo County 2030 Countywide General Plan EIR (Yolo County 2009b), and
- ▲ Background Report for the Yolo County General Plan Update (Yolo County 2005).

17.1.2 Definitions

Geomorphic provinces are naturally defined geologic regions that display a distinct landscape or landform. Earth scientists recognize 11 provinces in California. Each region displays unique, defining features based on geology, faults, topographic relief, and climate (CGS 2002).

Active faults have a record of displacement (i.e., movement) sometime in the past 11,000 years. Potentially active faults have a record of displacement in the last 1.6 million years. *Inactive faults* do not have a record of displacement in the last 1.6 million years. When cracks appear in the ground surface during a seismic event, the phenomenon is referred to as *surface rupture*.

Seismic ground shaking is a general term referring to all aspects of motion of the earth's surface resulting from an earthquake. The measurement of the energy released at the point of origin, or epicenter, of an earthquake is referred to as the *magnitude*, which is generally expressed in the Richter Magnitude Scale or as moment magnitude. The scale used in the Richter Magnitude Scale is logarithmic, so that each successively higher Richter magnitude reflects an increase in the energy of an earthquake of about 31.5 times. Moment magnitude is the estimation of an earthquake magnitude using seismic moment, which is a measure of an earthquake size utilizing rock rigidity, amount of slip, and area of rupture. The greater the energy released from the fault rupture, the higher the magnitude of the earthquake. The *intensity* of ground shaking is described by two methods: ground acceleration as a fraction of the acceleration of gravity or the Modified Mercalli scale, which is a more descriptive method involving 12 levels of intensity denoted by Roman numerals. Modified Mercalli intensities range from I (shaking that is not felt) to XII (total damage).

A soil association is a landscape-level classification system based on the distinctive spatial distributions of combinations of soil series. Soils in each series have similar physical and chemical characteristics. *Liquefaction* is the temporary transformation of loose, saturated granular sediments from a solid state to a liquefied state. *Expansive soils* shrink and swell in response to the presence of water. *Erosion* is a natural

process whereby soil and highly weathered rock materials are worn away and transported, most commonly by wind or water.

Mineral resource zone (MRZ) classifications are established by the State Surface Mining and Reclamation Act (SMARA) of 1975 (described below in Section 17.2.2, *Regulatory Setting*) to evaluate an area's mineral resources. The MRZ classifications are based on available geologic information, including geologic mapping and other information on surface exposures, drilling records, and mine data; and socioeconomic factors such as market conditions and urban development patterns. The MRZ classifications are defined as follows.

- MRZ-1: Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.
- MRZ-2: Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood for their presence exists.
- ▲ MRZ-3: Areas containing mineral deposits, the significance of which cannot be evaluated from available data.
- ▲ MRZ-4: Areas where available information is inadequate for assignment into any other MRZ.

The term *onsite wastewater treatment systems* applies to sewage treatment and disposal systems that serve a particular site or facility. The most typical form of this type of system is a septic tank and leach fields.

17.2 AFFECTED ENVIRONMENT

17.2.1 Environmental Setting

GEOLOGY

The Plan Area spans two geomorphic provinces. Roughly 70 percent of the Plan Area is in the Great Valley geomorphic province that covers the central portion of the state. The western portion of the Plan Area includes the Coast Ranges geomorphic province, which is associated with mountains formed along the San Andreas Fault (CGS 2002).

The Great Valley geomorphic province, also called the Central Valley, is a nearly flat alluvial plain that extends from the Tehachapi Mountains in the south to the Klamath Mountains in the north, and from the Sierra Nevada in the east to the Coast Ranges in the west. The valley is approximately 450 miles long, with an average width of about 50 miles. Elevations of the alluvial plain are generally just a few hundred feet above mean sea level (MSL), with extremes ranging from a few feet below MSL to about 1,000 feet above MSL (Hackel 1966).

Geologically, the Great Valley geomorphic province is a large, elongated, northwest-trending asymmetric structural trough that has been filled with an extremely thick sequence of sediments ranging in age from Jurassic to Holocene. This asymmetric geosyncline has a stable eastern shelf supported by the subsurface continuation of the granitic Sierran slope and a short western flank expressed by the upturned edges of the basin sediments (Hackel 1966). Within the Great Valley geomorphic province, the Plan Area consists of gently sloping to level alluvial areas. Geologic units in this part of the Plan Area generally consist of Quaternary-age alluvium and basin deposits, and the Quaternary Modesto and Riverbank Formations. Rolling terraces of the Tehama Formation (non-marine sandstone, siltstone, and volcaniclastic rocks) project into the valley area northwest of Woodland and form the Dunnigan Hills (Wagner et. al. 1987).

The Coast Ranges geomorphic province includes many separate ranges; coalescing mountain masses; and several major structural valleys of sedimentary, igneous, and metamorphic origin. The northern Coast Range extends from the California/Oregon border south to the San Francisco Bay area, and the southern Coast Range extends from the San Francisco Bay area south to the northern edge of the Transverse Ranges geomorphic province. Both the northern and southern Coast Ranges generally extend to 50 to 75 miles inland from the coastline and parallel the Great Valley geomorphic province throughout their length, except for extreme northern California where the northern Coast Range is adjacent to the Klamath Mountains geomorphic province (Page 1966).

The Coast Ranges geomorphic province is characterized by the presence of two entirely different core complexes, one being a Jurassic-Cretaceous eugeosynclinal assemblage (the Franciscan rocks) and the other consisting of early Cretaceous granitic intrusives and older metamorphic rocks. The two unrelated, incompatible core complexes lie side by side, separated from each other by faults. A large sequence of Cretaceous and Cenozoic clastic deposits covers large parts of the province. The rocks in the province are characterized by many folds, thrust faults, reverse faults, and strike-slip faults that have developed as a consequence of Cenozoic deformation (Page 1966).

Within the Coast Ranges geomorphic province, the Plan Area consists of moderately sloping to very steep uplands and terraces and is characterized by parallel ridges and valleys that trend slightly west of north (Andrews 1972). The rocks in the Coast Ranges part of the Plan Area consist of a number of Quaternary and Cretaceous geologic formations, including upturned marine sandstones, shales, mudstones, and conglomerates, with some volcaniclastic rocks (Wagner and Bortugno 1982). A small area of ultramafic rocks, one of which may be serpentinite, occurs along Little Blue Ridge, west of Rumsey (USGS and CGS 2011). Elevations in the Coast Ranges reach more than 3,000 feet above MSL.

SEISMICITY

Seismic hazards include earthquake fault ground rupture and ground shaking (primary hazards), and liquefaction and earthquake-induced slope failure (secondary hazards). Localized ground shaking and liquefaction are the most significant seismic hazards in the Plan Area (Yolo County 2005).

Surface Rupture and Faulting

The only fault in the Plan Area that is potentially subject to surface rupture is the Hunting Creek Fault (sometimes referred to as the Hunting Creek-Berryessa Fault) (Yolo County 2005). There is evidence of activity on this fault during the Holocene epoch (approximately the last 11,000 years), and the fault is associated with a Special Studies Zone. (Special Studies Zones are delineated by the State of California, pursuant to the Alquist-Priolo Earthquake Fault Zoning Act, around potentially active faults. See Section 17.2.2, *Regulatory Setting*, below, for additional information.) The Hunting Creek Fault is a right-lateral fault and has an average slip rate of 6 mm per year. Its maximum expected Richter magnitude is 7.1 (CGS 2003, Appendix A). The fault is located in a sparsely inhabited part of the extreme northwestern corner of the Plan Area (Exhibit 17-1). Only a very short section of the fault occurs in the Plan Area; most of the trace extends through Lake and Napa counties.

In addition to the Hunting Creek Fault, the Dunnigan Hills Fault, which extends between the town of Dunnigan and northwest of the town of Yolo west of Interstate 5, is potentially active (Yolo County 2005: 3-5). There is evidence of displacement along the fault during the Holocene epoch (Jennings 1994); however, the Dunnigan Hills Fault is not within an Alquist-Priolo Earthquake Fault Zone (Hart and Bryant 1997), and surface fault rupture is considered unlikely.

There are also a number of pre-Quaternary faults (e.g., Capay, Sweitzer, and West Valley faults) in the western part of the Plan Area that show displacement more than 1.6 million years ago. These faults are considered inactive.



Exhibit 17-1

Faults in the Plan Area



Ground Shaking Hazard

Earthquake energy, and therefore the potential for ground shaking, is most intense at the fault epicenter; with the potential for, and intensity of, ground shaking typically decreasing with distance from the epicenter. Estimates of the peak ground acceleration are based on probabilistic models that account for multiple seismic sources. Under these models, consideration of the probability of expected seismic events is incorporated into the determination of the level of ground shaking at a particular location. Yolo County is mapped by CGS as a region that is generally distant from known, active faults. As a result, the county is expected to experience lower levels of shaking less frequently. Earthquake hazard in the western portion of the Plan Area is moderate and lower in the alluvium in the eastern portion of the Plan Area (CGS 2008).

In addition to the Hunting Creek and Dunnigan Hills faults discussed above, major regional faults outside the Plan Area in the Coast Ranges and in the Sierra Nevada foothills are capable of producing strong ground shaking in the Plan Area. The Coast Range-Sierran Block Boundary, at the edge of the western side of the lower Sacramento Valley, is currently recognized as a potential seismic source capable of generating moderate earthquakes that could affect the ground-shaking hazard within the Plan Area (Yolo County 2009b).

Liquefaction and Related Hazards

Liquefaction is a phenomenon in which the strength and stiffness of unconsolidated sediments are reduced by earthquake shaking or other rapid loading. Poorly consolidated, water-saturated fine sands and silts located within 50 feet of the surface typically are considered to be the most susceptible to liquefaction. Soils and sediments that are not water-saturated and that consist of coarser or finer materials are generally less susceptible to liquefaction (California Division of Mines and Geology 1997). The part of the Plan Area in the Coastal Ranges geomorphic province would generally be expected to have a low liquefaction hazard, except in the intermountain valleys underlain by alluvium and shallow groundwater. Liquefaction is expected to be a relatively greater hazard in the Great Valley portion of the Plan Area, particularly along the floodplains of streams where the sediments are generally sandier than other areas.

Two potential ground failure types associated with liquefaction are lateral spreading and differential settlement. Lateral spreading involves a layer of ground at the surface being carried on an underlying layer of liquefied material over a nearly level surface toward a river channel or other open face. Areas most prone to lateral spreading are those that consist of fill material that has been improperly engineered, that have steep, unstable banks, and that have high groundwater tables. The banks along the Deep Water Ship Channel and Turning Basin in West Sacramento may have such conditions. Damage caused by liquefaction and lateral spreading is generally most severe when liquefaction occurs within 15 to 20 feet of the ground surface (Yolo County 2005).

Differential settlement can occur as soil compacts and consolidates to varying degrees after ground shaking ceases. Differential settlement results when the layers that liquefy are not of uniform thickness, a common problem when the liquefaction occurs in artificial fills. Settlement can range from one percent to five percent, depending on the cohesiveness of the sediments (Tokimatsu and Seed 1984). Although differential settlement generally occurs slowly enough that its effects are not dangerous to inhabitants, it can cause significant building damage over time. Portions of the Plan Area that contain loose or uncontrolled (non-engineered) fill may be susceptible to differential settlement.

OTHER GEOLOGIC CONDITIONS

Land Subsidence

Land subsidence (lowering of the land-surface elevation) occurs in three ways: as a result of compaction and oxidation of peat soils; hydrocompaction (i.e., a soil is saturated, then when the moisture is removed the soil particles consolidate more tightly than before saturation); and groundwater overdraft, which is the main mechanism for subsidence in the Plan Area. The primary hazards associated with subsidence are increased pressure on levees and damage to underground utilities. Other effects of subsidence include changes in the gradients of stormwater and sanitary sewer drainage systems in which the flow is gravity-driven. Specific to

the Plan Area, land subsidence has damaged or reduced the integrity of highways, levees, irrigation canals, and wells (Yolo County 2009b).

In Yolo County, as much as 4 feet of land subsidence due to groundwater withdrawal has occurred since the 1950s, particularly in the area between the towns of Zamora, Knights Landing, and Woodland (Yolo County 2009b). More recently, subsidence has been observed in the Plan Area through periodic monitoring conducted in 1999, 2002, and 2005. A corridor that extends north from the City of Davis, through the City of Woodland, to the community of Zamora and through the northeast corner of the county showed evidence of the most subsidence in these studies. The greatest amount of subsidence was observed in the community of Zamora, which subsided roughly 6 inches during this six-year period. These areas generally have little access to surface water and rely on substantial groundwater pumping (D'Onofrio and Frame 2006).

Landslides

Landslides are commonly triggered by unusually high rainfall and the resulting soil saturation, by earthquakes, or a combination of these conditions. The general term "landslide" may include a wide range of slope failures, including but not limited to rock falls, deep failure of slopes, earthflows, and shallow debris flows. Some landslides occur as a result of human activities, such as timber harvest, undermining a slope, and improper drainage water management.

Steep slopes underlain by Cretaceous rocks along Cache Creek are susceptible to landslides, and numerous large and small landslides have been mapped in this area (Manson 1990). Areas in the northwestern portion of the Plan Area have high landslide susceptibility (CGS 2011). However, except for the communities of Guinda, Capay, Rumsey, and Brooks, landslides are generally not a significant hazard to life or property in the Plan Area, due in large part to the relatively flat topography in much of the County (Yolo County 2009b, Figure IV.L-6). Most of the areas subject to landslides are in agricultural use or are otherwise undeveloped.

SOILS IN THE PLAN AREA

Overlying the geologic units described above is a layer of soil. Soil types are important in describing engineering constraints such as erosion and runoff potential, corrosion risks, and various behaviors that affect structures, such as expansion and settlement (the nature of these constraints are described further below). There are 12 soil associations in the Plan Area that have formed through landscape-level physical and chemical processes (Exhibit 17-2). Table 17-1 summarizes the soil associations' characteristics. The soil associations in the Plan Area can be grouped into an uplands group, a lowland alluvial fan group, and a lowland Colusa/Yolo Basin group.



Exhibit 17-2

Soils Associations in the Plan Area



Soil Association Name	Water Erosion Hazard	Expansive Soil Potential (shrink-swell)	Corrosivity (uncoated steel)	Soil Limitations for Septic Tank Filter Field	
Yolo- Brentwood	None to slight	Yolo: Moderate Brentwood: High	Yolo: Low to Moderate Brentwood: High	Yolo: Moderate to Severe Brentwood: Severe	
Rincon-Marvin- Tehema	None to slight	Rincon: Mod/High Marvin: Mod/High Tehema: Moderate	Rincon: Mod/High Marvin: High Tehema: Low/Moderate	Severe	
Capay-Clear Lake	None to slight	High for most subtypes	High	Severe	
Sycamore- Tyndall	None to slight	Moderate to High	Sycamore: High Tyndall: Low/Moderate	Severe for most subtypes	
Sacramento	None to slight	Moderate to High	High	Severe	
Willows- Pescadero	None to slight	Moderate to High	High	Severe	
Capay-Sacramento	None to slight	High for most subtypes	High	Severe	
Corning-Hillgate	None to slight	Low to High	Low to High	Severe	
Sehorn-Balcom	Moderate to very high	Sehorn: High Balcom: Moderate	Sehorn: High Balcom: Moderate	Severe	
Dibble- Millsolm	Moderate to very high	Dibble: High Millsolm: Moderate	Dibble: High Millsolm: Moderate	Severe	
Positas	Moderate to very high	Low to High	Low to High	Severe	
Rock Land	Very high	-	-	-	
Source: USDA 1972					

Table 17-1	Soil Associations for Yolo County
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Uplands Soils Group

The uplands soils group consists of five soils associations: Rock Land, Dibble-Millsholm, Positas, Sehorn-Balcorn, and Corning-Hillgate. The Rock Land association is located on sandstone of Franciscan complex and Great Valley sequence materials along the highest ridges of Little Blue Ridge and Blue Ridge (Andrews 1972). Typically, 50 to 90 percent of the land surface of Rock Land is exposed sandstone, shale, or serpentinized bedrock; the remainder is covered by a thin layer of sandy loam (Andrews 1972). Immediately below the Rock Land association on Blue Ridge and along the flanks of the Capay Hills is the Dibble-Millsholm association, which formed from Great Valley sequence materials (Andrews 1972). Exposed bedrock covers less than 10 percent of the surface of the Dibble-Millsholm association, which consequently has more soil development. Although it lacks similar parent material, an outlier of this association has been mapped on the highest areas of the northern Dunnigan Hills.

The patchy Positas association formed on terraces over the Red Bluff Formation in the southern end of the Blue Ridge and along the western and northern slopes of the Capay Hills. Its soils are gravelly loams. The Sehorn-Balcom association formed over the Tehama Formation, along the eastern toes of the Blue Ridge and Capay Hills, and along most of the Dunnigan Hills. The soils of this association consist of silty clays and clays. Adjacent terraces of the Red Bluff and Tehama Formations support the Corning-Hillgate association, which also extends along the Plainfield Ridge. The soils of this association are gravelly loams or loams. One outlier of this association has been mapped across the entire Cache Creek Settling Basin. Among the upland soils used for livestock grazing, soils in the Sehorn-Balcom and Dibble-Millsolm associations generally produce the greatest amounts of forage (Andrews 1972).

Lowland Alluvial Fan Group

The lowland alluvial fan group consists of four soils associations: Yolo-Brentwood, Capay-Clear Lake, Rincon-Marvin-Tehama, and Willows-Pescadero. The Yolo-Brentwood association is most closely associated with alluvial floodplains and fans of Cache and Putah Creeks. In the Cache/Putah Basin, it forms the highest proportions of the basin rim at the mouths of the streams from the Blue Ridge and along the natural levee of

Putah Creek. Its soils are deep and well drained, and their textures range from silty loams to silty clay loams. Soils in the Yolo-Brentwood association are suited to a wide range of crops and are among the best arable soils in the Plan Area.

The soils of the Capay-Clear Lake association line the bottoms of portions of the Cache/Putah Basin and other lowland areas. These soils are generally poorly drained silty clays to clays. Their historic vegetation was primarily prairie/grassland, with some localized seasonal freshwater marsh. The Rincon-Marvin-Tehama association is found on the rim of the Cache/Putah Basin between the Yolo-Brentwood association and the Capay-Clear Lake association. On the eastern side of the Cache/Putah basin there is a patch of the Willows-Pescadero association that formed where groundwater was forced to the surface by the Dunnigan Hills/Plainfield anticline. The soils of this association are saline-alkaline silty clay loams to clays. These soil associations are also found east of the Dunnigan Hills/Plainfield Ridge anticline where salts that were transported eastward across the Putah/Cache alluvial fans accumulated at the basin rim interface between the alluvial fans and the Yolo and Colusa Basins.

Lowland Colusa/Yolo Basin and Sacramento River Natural Levee Group

The lowland Colusa/Yolo Basin and Sacramento River natural levee group consists of three soil associations: Sycamore-Tyndall, Sacramento, and Capay-Sacramento. The Sycamore-Tyndall association is found on the natural levees of the Sacramento River. Its soils are somewhat poorly drained very fine sandy loams to clay loams. Below the Sycamore-Tyndall association, in the rice lands of the Colusa Basin, is the Sacramento association. Its soils are poorly drained silty clay loams and clays. Finally, the Yolo Bypass and parts of the Colusa Basin contain the Capay-Sacramento association, with its moderately well-drained to poorly drained silty clay loams to clays. Note that the Capay-Sacramento soil association is not identified in in Exhibit 17-2.

Soil Characteristics

Erosion Potential

Natural rates of erosion vary depending on slope, soil type, and vegetative cover. Typically, soils with high amounts of silt are more easily eroded, while coarse-grained (sand and gravel) soils are less susceptible to erosion. Soil erosion can become problematic when human intervention causes rapid soil loss and the development of erosional features (such as incised channels, rills, and gullies) that undermine roads, buildings, or utilities. This is typically associated with vegetation clearing and earth moving, which reduces soil structure and cohesion. Many of the soils in the steeper, upland areas in the western part of the Plan Area have been subject to accelerated erosion, such that they have lost part, or all, of their original topsoil layer (Andrews 1972). This is, presumably, largely a result of past overuse of forage by grazing animals (Yolo County 2005).

Soils in the Yolo-Brentwood association are suited to a wide range of crops and are among the best arable soils in the Plan Area. The suitability of the soils for particular agricultural uses and their farmland classification (e.g., Prime Farmland) are described in more detail in Chapter 6, *Agricultural and Forestry Resources*.

Expansive Soil Potential/Shrink-Swell Potential

Expansive soils contain significant amounts of clay particles that have the ability to give up water (shrink) or take on water (swell). When these soils swell, the change in volume can exert significant pressure on loads that are placed on them, such as building and structure foundations or underground utilities, and can result in structural distress and/or damage. Often, grading, site preparations, and backfill operations associated with subsurface structures can eliminate the potential for expansion. The soils of the Plan Area generally have moderate to high shrink-swell potential and are classified as expansive soils (see Table 17-1).

Corrosivity

The corrosive potential of soil is a result of a combination of soil characteristics and environmental influences. Factors affecting corrosion potential include the amount of water in the soil, the conductivity of the soil solution, the pH of the soil solution, the oxygen concentration (aeration), and the activity of organisms capable of causing oxidation/reduction reactions. The estimation of corrosivity for untreated steel

pipe is a common metric for describing corrosive potential and is commonly based on resistance to flow of electrical current, total acidity, soil drainage, soil texture, and conductivity of the saturation extract of the soil. The potential for soil conditions to result in deterioration of concrete is also considered and is influenced by the amount of sulphates in the soil combined with soil texture and acidity. Soils in the Plan Area range from low to high corrosivity potential for uncoated steel.

Liquefaction Potential

The causes and effects of liquefaction, and the potential for liquefaction in the Plan Area are described above in the discussion of seismicity.

MINERAL RESOURCES

A variety of minerals were once mined in the Plan Area (Yolo County 2005). In the past, small amounts of gold and silver were mined from Cache and Putah Creeks. The Barrick Gold Mining Company's McLaughlin Mine, which is no longer operational, was located in the northeastern corner of the Plan Area. The primary minerals presently mined are aggregate and natural gas. According to the California Department of Conservation (2014) there are approximately 25 natural gas fields located within Yolo County. Most of the aggregate occurs along Cache Creek, beginning at the upstream end of Capay Valley (at County Road 85) and extending downstream to approximately Interstate 5.

Exhibit 17-3 highlights the significant mineral resources (MRZ-2) found throughout the Plan Area. The State of California has mapped the aggregate resources along lower Cache Creek as three Mineral Resource Zones: MRZ-1 comprises 1,458 acres, MRZ-2 comprises 18,452 acres, and MRZ-3 comprises 8,220 acres (Yolo County 2009b). The Off-Channel Mining Plan (OCMP) and relevant implementing ordinances (i.e., the Off-Channel Surface Mining Ordinance and the Surface Mining Reclamation Ordinance) currently authorize seven off-channel mining operations (Teichert-Schwarzgruber, Syar, CEMEX, Teichert-Woodland, Teichert-Esparto, Granite-Capay, and Granite-Esparto) along Cache Creek. This includes 968 acres of planned aggregate mining and 1,282 acres of additional future mining.

17.2.2 Regulatory Setting

This section describes the federal, state, and local regulations, laws, and policies that pertain to geology, seismicity, soils, and mineral resources within the Plan Area.

FEDERAL LAWS AND REGULATIONS

Clean Water Act

The Clean Water Act (CWA) is discussed in detail in Chapter 4, *Biological Resources*, and Chapter 9, *Hydrology and Water Quality*. However, because Section 402 of the CWA is directly relevant to potential land disturbance activities within the Plan Area, additional information is provided below.

Under the National Pollutant Discharge Elimination System Phase II Rule (an element of implementing Section 402 of the CWA), activity disturbing 1 acre or more must obtain coverage under the state's General Permit for Discharges of Storm Water Associated with Construction Activity (General Construction Permit). General Construction Permit applicants are required to prepare a Notice of Intent and a stormwater pollution prevention plan (SWPPP) and implement and maintain best management practices to avoid adverse effects on water quality as a result of construction activities, including earthwork. The Central Valley Regional Water Quality Control Board administers the stormwater permit program in the Plan Area.



STATE LAWS AND REGULATIONS

Alquist-Priolo Earthquake Fault Zoning Act

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act (the Alquist-Priolo Act) is to regulate development near active faults to mitigate the hazard of surface rupture. Under the Alquist-Priolo Act, faults are zoned, and construction along or across them is strictly regulated if they are "sufficiently active" and "well-defined." A fault is considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement within the last 11,000 years. A fault is considered well-defined if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface, using standard professional techniques, criteria, and judgment (Hart and Bryant 1997).

Seismic Hazards Mapping Act

Like the Alquist-Priolo Act, the Seismic Hazards Mapping Act of 1990 is intended to reduce damage resulting from earthquakes. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong ground shaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act: The state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards, and cities and counties are required to regulate development within mapped Seismic Hazard Zones. Permit review is the primary mechanism for local regulation of development. Specifically, cities and counties are prohibited from issuing development permits for sites in Seismic Hazard Zones until appropriate site-specific geologic or geotechnical investigations have been carried out, and measures to reduce potential damage have been incorporated into the development plans. To date, seismic hazard maps have been prepared for parts of the San Francisco Bay Area and in the Los Angeles area; no such maps are presently available for the Plan Area.

California Building Code

The State's minimum standards for structural design and construction are established in the California Building Standards Code (CBSC) (24 California Code of Regulations). The CBSC requires that "classification of the soil at each building site will be determined when required by the building official" and that "the classification will be based on observation and any necessary test of the materials disclosed by borings or excavations."

The 2013 California Building Code (CBC) is based on the 2009 International Building Code and contains necessary California amendments that are derived from the American Society of Civil Engineers' Minimum Design Standards 7-05. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure, or any appurtenances connected or attached to such buildings or structures, throughout California. The earthquake design requirements take into account the occupancy category of the structure, site class, soil classifications, and various seismic coefficients, all of which are used to determine a Seismic Design Category for a project. The CBC includes a seismic zone map to determine applicable seismic standards for proposed structures. Seismic zones range from 0 to 4, with Zone 0 being the least active and Zone 4 the most active.

Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act (SMARA) is the principal legislation addressing mineral resources in California. Its stated purpose is to provide a comprehensive surface mining and reclamation policy that will encourage the production and conservation of mineral resources while ensuring that:

- ▲ significant environmental effects of mining are prevented or minimized;
- mined lands are reclaimed and residual hazards to public health and safety are eliminated; and
- ▲ consideration is given to recreation, watershed, wildlife, aesthetic, and other related values.

SMARA governs the use and conservation of a wide variety of mineral resources, although some resources and activities are exempt from its provisions, including excavation and grading conducted for farming, construction, or recovery from flooding or other natural disaster.

SMARA provides for the evaluation of an area's mineral resources using a system of MRZ classifications that reflect the known or inferred presence and significance of a given mineral resource. The four MRZ classifications are described above in Section 17.1.2, *Definitions*. These classifications are based on available geologic information, including geologic mapping and other information on surface exposures, drilling records, and mine data; and socioeconomic factors such as market conditions and urban development patterns.

The State of California is responsible for mineral resources zoning under SMARA, but SMARA implementation and enforcement authority rests with the local jurisdiction and is carried out through the county or city land use planning process and codes. Yolo County's SMARA implementing regulations are contained in Chapter 3 of Title 10 in the County Code.

In addition to mineral resource conservation, SMARA regulates surface mining in California. Key elements of the regulations are summarized below.

Annual Mining Report

A mining report is required to be submitted by surface mining operations annually. The report must include such information as the amount of land disturbed during the previous year, acreage reclaimed during the previous year, and amendments made to the reclamation plan.

Reclamation Plan

Before a mining project is approved, a reclamation plan must be prepared and approved by the lead agency. The plan must include such information as:

- maximum anticipated depth of extraction,
- quantity and type of materials to be extracted,
- ▲ time span of the operation,
- mine waste disposal method,
- ▲ manner in which reclamation will be accomplished including erosion control measures,
- ▲ post-reclamation land use, and
- how the reclamation will affect future mining in the area.

Additionally, SMARA specifies that lead agencies require financial assurances of each mining operation to ensure reclamation is performed in accordance with the approved reclamation plan. The financial assurances may take the form of surety bonds, irrevocable letters of credit, trust funds, or similar mechanism.

Most of the mining operations along Cache Creek are subject to all of SMARA's requirements. However, two of the mines were operating before SMARA was enacted and are considered "grandfathered" operations. These facilities are, nevertheless, subject to certain regulatory requirements, such as providing financial assurances and implementing reclamation plans.

Oil, Gas, and Geothermal Wells Regulations

The California Department of Conservation's Division of Oil, Gas, and Geothermal Resources oversees the drilling, operation, maintenance, and plugging and abandonment of oil, natural gas, and geothermal wells. The regulatory program emphasizes the development of oil, natural gas, and geothermal resources in the State through sound engineering practices that protect the environment, prevent pollution, and ensure public safety. Applicable State law comes from the California Code of Regulations Title 14, Natural Resources of the California; Division 2, Chapter 4, Development, Regulation, and Conservation of Oil and Gas Resources. This chapter governs natural gas well drilling, operation, and abandonment procedures. It provides detailed standards and regulations that operators and local jurisdictions must comply with.

LOCAL LAWS AND REGULATIONS

Yolo County 2030 Countywide General Plan

The Health and Safety Element of the 2030 Countywide General Plan for Yolo County contains policies and actions aimed at reducing the risk of geologic or seismic hazards in the Plan Area. Policies and actions potentially relevant to the Plan are provided below.

- ▲ **Policy HS-1.1**. Regulate land development to avoid unreasonable exposure to geologic hazards.
- ▲ Policy HS-1.2. All development and construction proposals shall be reviewed by the County to ensure conformance to applicable building standards.
- ▲ Policy HS-1.3. Require environmental documents prepared in connection with CEQA to address seismic safety issues and to provide adequate mitigation for existing and potential hazards identified.
- ▲ Action HS-A1. Require a geotechnical analysis for construction in areas with potential geological hazards and/or for purposes of environmental analysis. Recommendations of the geotechnical analysis shall be implemented. (Policy HS-1.1, Policy HS-1.2, Policy HS-1.3)
- ▲ Action HS-A2. Rely upon the most current and comprehensive geological hazard mapping available in the evaluation of potential seismic hazards associated with proposed new development. (Policy HS-1.3)
- ▲ Action HS-A3. Continue to participate in the Yolo County Subsidence Network and implement its recommendations. (Policy HS-1.2, Policy HS-1.3)

The Conservation and Open Space Element of the 2030 Countywide General Plan contains policies and actions aimed at reducing the risk of geologic or seismic hazards in the Plan Area. Policies and actions potentially relevant to the Plan are provided below.

- Policy CO-3.1. Encourage the production and conservation of mineral resources, balanced by the consideration of important social values, including recreation, water, wildlife, agriculture, aesthetics, flood control, and other environmental factors.
- Policy CO-3.2. Ensure that mineral extraction and reclamation operations are compatible with land uses both on-site and within the surrounding area, and are performed in a manner that does not adversely affect the environment.
- Policy CO-3.3. Encourage the extraction of natural gas where compatible with both on-site and surrounding land uses, and when performed in a manner that does not adversely affect the environment.
- Policy CO-3.4. Within the Delta Primary Zone, ensure compatibility of permitted land use activities with applicable, natural gas policies of the Land Use and Resource Management Plan of the Delta Protection Commission.
- Policy CO-5.1. Coordinate with water purveyors and water users to manage supplies to avoid long-term overdraft, water quality degradation, land subsidence and other potential problems.
- Action CO-A37. Designate and zone lands containing identified mineral deposits to protect them from the encroachment of incompatible land uses so that aggregate resources remain available for the future. (Policy CO-3.1)
- ▲ Action CO-A39. Encourage the responsible development of aggregate deposits along Cache Creek as significant both to the economy of Yolo County and the region. (Policy CO-3.1)

- ▲ Action CO-A40. Encourage recycling of aggregate materials and products. (Policy CO-3.1)
- Action CO-A42. Implement the Cache Creek Area Plan to ensure the carefully managed use and conservation of sand and gravel resources, riparian habitat, ground and surface water, and recreational opportunities. (Policy CO-3.1)
- Action CO-A45. Prohibit commercial mining in or adjoining Putah Creek. (Policy CO-3.1, Policy CO-3.2)
- ▲ Action CO-A49. Consider the exploration, drilling, and extraction of natural gas as compatible with agriculture and open space uses. (Policy CO-3.3)
- ▲ Action CO-A50. Evaluate any impacts to identified natural gas fields as part of the development review process. (Policy CO-3.3)
- Action CO-A93. Require the implementation of Best Management Practices (BMPs) to minimize erosion, sedimentation, and water quality degradation resulting from new development and increases in impervious surfaces. (Policy CO-5.5, Policy CO-5.6)

Yolo County Onsite Wastewater Treatment Systems Local Agency Program

Yolo County has prepared a draft Onsite Wastewater Treatment Systems Manual that provides the policy, procedural, and technical requirements for the implementation of the provisions of the Yolo County Onsite Wastewater Treatment Systems Ordinance, codified in Chapter 19 of the Yolo County Code of Ordinances. The Yolo County Division of Environmental Health is responsible for the enforcement of the Yolo County Onsite Wastewater Treatment Systems Ordinance and the application of the manual, which is intended to provide guidance for homeowners, designers, installers, contractors and service providers.

City of Davis General Plan

The Davis General Plan includes the following policies related to geology, soils, and mineral resources potentially relevant to the Plan:

- ▲ Policy AG 3.1. Develop programs to help to conserve soil resources.
- ▲ Policy AG 4.1. Discourage the extraction of mineral resources in the planning area.
- Policy HAZ 2.1. Take necessary precautions to minimize risks associated with soils, geology and seismicity.

City of West Sacramento General Plan

The City of West Sacramento General Plan contains the following goal and policies that relate to geology, soils, or mineral resources that may be applicable to the analysis of the HCP/NCCP:

Goal S-3. To prevent loss of life, injury, and property damage due to geologic and seismic hazards.

- ▲ Policy S-3.1. New Structures. The City shall require that new structures are able to withstand the effects of seismic activity, including liquefaction, within the limits of technical and economic feasibility.
- Policy S-3.2. Geotechnical Report. The City shall require new development seeking a discretionary permit to prepare a geotechnical report or other appropriate analysis, and incorporate appropriate mitigation measure to ensure new structures are able to withstand the effects of seismic activity, including liquefaction.
- Policy S-3.8. Coordination with Utility Providers. The City shall require utility providers to design utility lines to withstand seismic forces, be accessible for repair, and contain safety features such as automatic shutoff valves, switches, and expansion joints.
- Policy S-3.10. Levee Inspections. The City shall work with responsible agencies to regularly inspect and repair area levees, as needed, to ensure structural integrity in the event of seismic activity.

City of Winters General Plan

The City of Winters General Plan includes the following policies related to erosion potentially applicable to the Plan:

- Policy VI.A.6. The City shall condition development approvals to minimize the discharge of sediment from grading into Putah Creek and Dry Creek. To this end, grading should be carried out during the dry months, when possible. Areas not being graded should be disturbed as little as possible. Construction and grading areas, as well as soil stockpiles, should be covered or temporarily revegetated when left for long periods. Revegetation of slopes should be carried out immediately upon completion of grading. Also, temporary drainage structures and sedimentation basins must be installed to prevent sediment from entering and thereby degrading the quality of downstream surface waters, particularly Putah Creek. The full cost of any necessary mitigation measures shall be borne by the projects creating the potential impacts.
- Policy VI.D.4. Any upstream development that creates potential erosion impacts on Dry Creek and Putah Creek shall be required to adopt all feasible measures to mitigate such impacts.
- Policy VI.D.7. The City shall work with Yolo County, Solano County, the Putah Creek Council, the California Department of Fish and Game, and the U.S. Army Corps of Engineers in establishing guidelines for erosion control measures along Putah Creek and Dry Creek. Such guidelines should implement the following principles:
 - ✓ Slope stabilization projects should emphasize revegetation.
 - Stabilization projects that involve the use of cribs, gab ions, rock and wire mattresses, or wire mesh over stone should be screened from public view with vegetation to assure a naturalistic appearance.
- Policy VILA. I. The City shall require new development to be constructed according to the requirements of the Uniform Building Code to ensure that new structures are able to withstand the effects of seismic activity, including liquefaction.
- Policy VII.A.2. Underground utilities, particularly water and natural gas mains, shall be designed to withstand seismic forces in accordance with state requirements.

City of Woodland General Plan

The Woodland General Plan includes the following policies related to geologic hazards that are potentially relevant to the Plan.

- Policy 8.A.1: Minimize Seismic Risk. Continue to maintain and enforce appropriate standards to ensure new development is designed to meet current safety standards associated with seismic activity. Require public and private development to be located, designed, and constructed to minimize the risk of loss of life and injury in the event of a major earthquake or other natural disaster.
- Policy 8.A.2: Geologic-Seismic Analysis. Require the preparation of a soils engineering and geologic-seismic analysis prior to permitting development in areas prone to geological or seismic hazards (i.e., groundshaking, liquefaction, expansive soils).
- Policy 8.A.3: Expansive Soils. Evaluate and avoid siting of structures across soil materials of substantially different expansive properties. Require appropriate design specification including special slabs where foundations are in areas of expansive soils.
- Policy 8.A.4: Indian Valley Dam. Work with the Yolo County Flood Control and Water Conservation District to ensure the continued maintenance of the Indian Valley Dam in order to protect against potential dam failure. Require new development in inundation areas to consider risks from dam failure.

Cache Creek Area Plan

The OCMP and Cache Creek Resources Management Plan (CCRMP) together comprise the Cache Creek Area Plan. The OCMP and CCRMP establish a number of goals to assist in management, balancing issues and concerns within the overriding vision of enhancing the variety of resource needs for the region. The Cache Creek Improvement Program was developed to implement the goals, objectives, actions, and performance standards of the CCRMP as it relates to the stabilization and maintenance of the Cache Creek channel. The Cache Creek Improvement Program provides the structure and authority for a Technical Advisory Committee, defines the procedures and methodologies for stream monitoring and maintenance activities, and identifies initial high priority projects for stream stabilization.

17.3 ENVIRONMENTAL CONSEQUENCES

17.3.1 Methodology and Significance Criteria

METHODS AND ASSUMPTIONS

The following evaluation identifies both the potential effects of geologic and soil hazards, and the potential for the HCP/NCCP to effect soil resources by means such as accelerated erosion. Evaluation of the potential impacts that may result from each alternative is based on a review of the covered activities as described in the Yolo HCP/NCCP; review of the Yolo County General Plan, and planning documents from the Cities of Davis, West Sacramento, Winters, and Woodland; and the assumption that activities under each alternative would comply with applicable local, state, and federal regulations and general plan policies. The assessment of potential effects on geology, soils, and mineral resources in the Plan Area is based on the anticipated changes in land cover and land uses over a 50-year study period, corresponding to the permit term under the Proposed Action Alternative. As described in Section 3.3, the issuance of ITPs by the Wildlife Agencies for take of 12 covered species associated with five categories of covered activities—together with subsequent adoption and implementation of the Plan by the Applicants consistent with the Permits—is the Proposed Action considered in this EIS/EIR. Issuance of permits by the Wildlife Agencies only provides compliance with the FESA and NCCPA.

All covered activities are subject to the approval authority of one or more of the Applicants with jurisdiction over such projects, and HCP/NCCP approval and permit issuance for take of covered species does not confer or imply approval from any entity other than the U.S. Fish and Wildlife Service (USFWS) or California Department of Fish and Wildlife (CDFW) to implement the covered activities. Rather, as part of the standard approval process, individual projects will be considered for further environmental analysis and generally will receive separate, project-level environmental analysis review under CEQA and, in some cases, NEPA for those projects involving federal Agencies.

Anticipated changes in land cover/land use for each alternative are described in Chapter 2, Proposed Action and Alternatives. See Chapter 3, *Approach to the Analysis*, for a description of the methodology used across all resource chapters for the analysis of cumulative effects.

As described in Chapter 2, *Proposed Action and Alternatives*, the Conservancy has proposed a number of changes to the HCP/NCCP since the release of the Draft on June 1, 2017. These changes are described and Characterized in Section 2.3.2, *Alternative B – Proposed Action Alternative (Permit Issuance/Plan Implementation)*, of Chapter 2.

These proposed changes fall into several categories;

▲ Copy edits such as correction of spelling errors,

- Minor text clarifications and corrections such as providing or correcting cross references to other parts of the document,
- ▲ Minor numeric corrections, such as small adjustments to acreages of particular land cover types,
- Providing updated information since publication of the Draft HCP/NCCP such as including information from the City of Woodland General Plan Update 2035, which was adopted after the Draft HCP/NCCP was published,
- Clarifications or enhancements to particular plan elements such as new or updated Avoidance and Minimization Measures (AMMs),
- Increased details on plan implementation such as providing additional information on the content of the Implementation Handbook, and
- ▲ Changes in assumptions regarding costs and funding to reflect updated information.

These proposed changes have been analyzed to determine whether they would result in any changes to the impact analysis or conclusions reached in the Draft EIS/EIR. This analysis is provided in Section 24.2, *Evaluation of Proposed Modifications to the Draft HCP/NCCP*. The analysis substantiates that the proposed changes to the HCP/NCCP do not alter the analysis or impact conclusions provided in the Draft EIS/EIR for geology, soils, and mineral resources. Therefore, no changes to the analysis provided below are merited.

SIGNIFICANCE CRITERIA

Effects would be significant if an alternative would result in the following:

- expose people or structures to 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;
 - strong seismic ground shaking;
 - ✓ seismic-related ground failure, including liquefaction; or
 - landslides;
- result in substantial soil erosion or the loss of topsoil;
- be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;
- ▲ be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property (Note: The updated CBC no longer cites the 1994 UBC Table 18-1-B for identifying expansive soils, although the criteria in Appendix G of the State CEQA Guidelines still refers to this table. The analysis of expansive soils relies on the updated CBC information.)
- have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater;

- result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state; or
- result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

ISSUES NOT EVALUATED FURTHER

The Planning Area is served by a large and expanding network of wastewater conveyance facilities that collect wastewater for treatment and disposal. The use of septic tanks and other onsite wastewater treatment and disposal systems in new development has declined substantially in the Plan Area. Where new development would use septic tanks or other onsite wastewater treatment and disposal systems, this activity would be heavily regulated by local jurisdictions, such as through the Yolo County Onsite Wastewater Treatment Systems Local Agency Program described above. Septic tanks and any other onsite systems cannot be installed without review and permitting, and review includes evaluation of soil conditions for suitability. Use of septic tanks or other onsite waste water treatment and disposal systems would not be authorized in areas with soils incapable of supporting these facilities. Therefore, this issue is not evaluated further in this impact analysis.

In some instances, placing additional persons within a seismic risk area has been considered as a cumulative seismic hazard impact. However, given the relatively low seismic risk in the Plan Area, and the fact that any development occurring within the Plan Area would be subject to various site development, engineering, and construction standards to minimize seismic risk, such as the CBS, this cumulative impact mechanism is not considered further in this EIS/EIR.

17.3.2 Effects of Proposed Action and Alternatives

ALTERNATIVE A-NO ACTION ALTERNATIVE (NO PERMIT/NO PLAN IMPLEMENTATION)

Environmental Consequences/Environmental Effects

As described previously in Chapter 2, *Proposed Action and Alternatives*, under the No Action Alternative (Alternative A), take associated with development would occur over the 50-year study period consistent with the local general plans and other applicable planning documents (e.g., community plans, specific plans, recreation plans). As also described in Chapter 2, for purposes of this analysis, development and related activities (e.g., operations and maintenance) under the No Action Alternative are considered using the same organizational categories identified in the Yolo HCP/NCCP; urban projects and activities; rural projects and activities, which includes rural public services, infrastructure, and utilities, agricultural economic development. and open space; and public and private operations and maintenance. Under the No Action Alternative, the Plan would not be approved and implemented and no Endangered Species Act authorizations would be issued by the USFWS or CDFW related to the Plan. Endangered species permitting and mitigation would continue on an individual project-by-project basis.

Urban projects and activities would be concentrated within the Cities of Davis, West Sacramento, Winters, and Woodland. Rural projects and activities would primarily occur within and around the existing communities in the unincorporated area of the county (primarily Elkhorn, Madison, Clarksburg, Dunnigan, Esparto, and Knights Landing). Activities associated with the rural public services, infrastructure, and utilities and agricultural economic development and open space categories would occur in various locations in the unincorporated county. Public and private operations and maintenance activities would occur both in the incorporated cities and the unincorporated county.

Since the distances to major regional faults is long compared to some parts of California, Yolo County is subject to relatively low risk from seismic shaking; nonetheless, active local faults like the Hunting Creek

Fault or the Coast Range-Sierran Block Boundary may result in significant shaking in the county. Any facilities under any of the development categories that would require some form of building permit would be designed and constructed to meet relevant requirements of the CBC, as required by the state, city, and county building codes, and as set forth in the local agencies' general plans. These building code requirements specify that detailed seismic investigations be completed for all public and private projects located within the boundaries of a designated Earthquake Fault Zone, and that such projects receive appropriate permit approvals. Site-specific geologic investigation and analysis by a licensed professional would be conducted in accordance with standard industry practices and State provided guidance, such as the CGS Special Publication 117 of 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California and would minimize risk associated with seismic hazards.

Projects constructed over the next 50 years in the Plan Area would result in additional people and structures being exposed to other existing geohazards, including liquefaction, slope instability, soil settlement or compaction, and adverse soil conditions. However, similar to seismic risk, existing federal, state, and local programs are designed to provide accurate and timely information detailing hazards, impose regulatory requirements regarding geotechnical and soils investigations, provide limitations on the locations of structures for human habitation, impose requirements for hazard notices to potential users, and establish structural standards for requirements for buildings and grading projects. Potential impacts from geohazards such as expansive soils (that cover roughly three-quarters of the County) can be addressed through implementation of standard remedial measures (e.g., soil removal, foundation design). Similarly, slope stability issues, such as those in the hills around the Capay Valley and along the western mountains of the County, can be addressed by site-specific geotechnical work and various established engineering measures. However, any planned development that utilizes groundwater from the area between the towns of Zamora, Knights Landing, and Woodland could accelerate the existing soil subsidence resulting from groundwater extraction.

Ground-disturbing earthwork associated with construction under any development category may increase soil erosion rates. Activities such as excavation, trenching, grading, and compaction, would cause groundbreaking and vegetation removal. As a result, soil would be exposed to rain and wind, potentially causing accelerated erosion. However, ground-disturbing earthwork would need to meet the relevant requirements of the state, city, and county building codes, as set forth in the local agencies' general plans and ordinances. Furthermore, compliance with applicable federal and local erosion-related regulations (i.e., the SWPPPs that are developed for individual projects and the requirements of the county and city stormwater quality management codes) would substantially reduce the potential for construction activities to result in adverse erosion effects.

Mineral resources would continue to be extracted at existing mining sites and natural gas fields consistent with SMARA and local land use regulations. Mining could be restarted at existing inactive sites, or permits could be issued for mineral extraction at new sites within the Plan Area. Mine reclamation would occur consistent with SMARA and local land use regulations. Development and other activities that could hinder access to mineral resources would also continue to occur under the No Action Alternative, as directed by the county and city general plans, various area plans, and other applicable planning documents. However, these plans generally guide development away from important mineral resources. Key aggregate extraction sites along Cache Creek are already identified for mining in various plans. Gas fields can be tapped from a limited number of extraction wells; therefore, development over one portion of a gas field does not necessarily limit the accessibility of the underlying natural gas from an extraction well at another location. Therefore, it is not anticipated that the activities associated with any of the development categories would substantially limit access to areas with significant mineral resources.

As the development and related activities are implemented as part of the No Action Alternative, impacts to threatened and endangered species and other biological resources would occur, requiring mitigation. Mitigation measures are likely to include on-site areas of preservation within a specific project site, and smaller, non-contiguous areas of preservation lands throughout Yolo County, or nearby sites outside the county with authorization from the permitting agencies. Generally, these required mitigation actions under the No Action Alternative would either retain lands in their existing condition (i.e., preserve habitat), or

convert lands to a more natural state (i.e., habitat restoration or creation). Retaining lands in their existing condition would not result in any effects related to geology and soils. Habitat restoration and creation would not result in facilities or structures being constructed that would be subject to geohazards. Although ground-disturbing activities could result in temporary increases in erosion risk, compliance with existing laws, regulations, and policies would substantially reduce the potential for ground disturbance associated with habitat restoration or creation activities to result in adverse erosion effects.

Establishment of protected mitigation lands, whether or not they include habitat restoration or creation, could result in reduced access to mineral resources. To be accepted by resource agencies, protected mitigation lands must include a deed restriction and other legal mechanisms that prohibit land uses that conflict with habitat and/or species conservation, which would likely include restrictions on mineral extraction. Although access to mineral resources could conceivably be restricted by biological resources mitigation, lands with significant mineral resources typically have higher monetary value and it becomes less cost effective to purchase and use these lands for biological resources mitigation. Given the extent of agricultural land and natural land cover in the Plan Area available for protected mitigation land establishment that does not contain significant mineral resources, it is unlikely that the biological resources mitigation would be located on sites that would preclude access to areas where significant mineral resources may be present.

Cumulative Effects

Impacts related to geology and soils are generally site-specific, rather than regional in nature. The geologic effects of multiple projects over large distances typically do not interact relative to issues such as seismic risk or the presence of expansive soils. However, for issues such as erosion, projects in close proximity may combine cumulatively to create a larger downstream erosion impact than would occur from a single project.

Geology, soils, and mineral resources in the Plan Area have been altered by agricultural operations, urban and rural development, and mining operations. However, no particular cumulative interactions or cumulative changes related to seismic risk, landslide, erosion, unstable soils, or expansive soils have been identified in the Plan Area. Due to the extensive regulations, standards, and policies related to these issues, as well as the limited ability for projects to interact on a cumulative basis related to geology and soils, it is unlikely that projects or actions under the No Action Alternative or implementation of other foreseeable future project actions would contribute to a cumulative impact associated with these issues.

The existing land subsidence in the area between the towns of Zamora, Knights Landing, and Woodland can be attributed to the cumulative extraction of groundwater from past and present projects in this area. Foreseeable future projects, such as wind and solar power generation and Caltrans highway improvements, would not result in the use of large amounts of groundwater and are unlikely to contribute further to this cumulative impact. However, any development under the No Action Alternative that results in an increase in groundwater extraction from this area could incrementally accelerate the land subsidence.

Although past and present projects may have limited access to mineral resources in isolated locations, such as a road crossing a site with mineable aggregate below the road bed, there are large areas remaining in the County where aggregate and natural gas are available (see Exhibit 17-3). As stated above, it is not anticipated that development and activities associated with the No Action Alternative would substantially limit access to mineral resources due to the various planning documents directing development away from important mineral resource areas and/or identifying important areas for continued mineral extraction. Continued extraction of aggregate is a specific component of the No Action Alternative. As also identified above, due to the flexibility available in siting extraction wells to tap a natural gas field, even if development were to occur over a portion of a natural gas field, the underlying gas could still be extracted from a well in another location. These same principals and conclusions would apply to the foreseeable future projects in Plan Area. In addition, for projects such as expansion or improvement of existing Caltrans facilities, the project footprint would be relatively small compared to the overall area where mineral resources are available. Also, the ability to extract mineral resources in the area would already be more difficult due to the presence of the existing highway facility. Overall, any cumulative reduction in area available for extraction of

mineral resources in the Plan Area resulting from the No Action Alternative and other foreseeable future projects would not be considerable relative to the continued availability of large areas for mineral extraction.

For the reasons described above, this same conclusion would also apply to the cumulative establishment of biological resource protected mitigation lands conducted as part of the No Action Alternative and that might also be established as part of the implementation of foreseeable future projects. In addition, as identified in the analysis of the No Action Alternative, lands with significant mineral resources typically have higher monetary value and it becomes less cost effective to purchase and use these lands for biological resources mitigation. It is unlikely that protected mitigation lands established as part of the No Action Alternative or the foreseeable future projects would be located on lands with important mineral resources.

ALTERNATIVE B-PROPOSED ACTION (PERMIT ISSUANCE/PLAN IMPLEMENTATION)

Environmental Consequences/Environmental Effects

The Proposed Action Alternative (Alternative B) incorporates the same development-related activities identified for the No Action Alternative (urban projects and activities, rural projects and activities, and public and private operations and maintenance), with the HCP/NCCP providing a mechanism for the Wildlife Agencies to provide incidental take authorization for these lawfully undertaken covered activities. Impacts related to geology, soils, and mineral resources as a result of these activities would be the same as those described under the No Action Alternative.

Where the Proposed Action Alternative differs from the No Action Alternative is in the implementation of the Yolo HCP/NCCP, including its conservation strategy and neighboring landowner protection program, as well as the required implementation of Avoidance and Minimization Measures (AMMs) during implementation of covered activities. The following impact discussions focus on the elements of the HCP/NCCP that differ from the No Action Alternative. Components of the conservation strategy include habitat assessment surveys and population surveys; habitat management; restoration, enhancement, and creation of habitats; conversion of agricultural lands to create habitat; construction of facilities necessary for management and maintenance; and monitoring; and control of invasive nonnative species.

The primary result of the neighboring landowner protection program, from a geology, soils, and mineral resources perspective, would be the general preservation of existing conditions on lands adjacent to reserve system lands. Also, as a voluntary program, a qualifying landowner may join or exit at will. If a landowner participating in the program had mineral resources on their property that they later decided to extract, they could exit the program with no effect on pursuing any necessary permits and authorizations for the mineral extraction. The voluntary neighboring landowner protection program is described in more detail in Chapter 2, *Proposed Action and Alternatives*. Since the program would not change conditions related to geology, soils, and mineral resources, it would not have an effect on these resources, and is not evaluated further in the impact discussions below. Similarly, the potential for addition of the lands in the expanded Plan Area to the reserve system would not have effects related to geology and soils because no development would occur. The potential for effects on mineral resources in the expanded Plan Area is discussed below.

All covered activities implemented under the Proposed Action Alternative (including both development and conservation actions) would be subject to AMMs required by the HCP/NCCP, some of which would reduce soil-related impacts. The AMMs that would reduce the likelihood of geology and soils related impacts include the following, which apply to General Construction and Operations and Maintenance projects:

AMM3, Confine and Delineate Work Area. Where natural communities and covered species habitat are present, workers will confine land clearing to the minimum area necessary to facilitate construction activities. Workers will restrict movement of heavy equipment to and from the project site to established roadways to minimize natural community and covered species habitat disturbance. The project proponent will clearly identify boundaries of work areas using temporary fencing or equivalent and will identify areas designated as environmentally sensitive. All construction vehicles, other equipment, and personnel will avoid these designated areas.

AMM8, Avoid and Minimize Effects of Construction Staging Areas and Temporary Work Areas. Project proponents should locate construction staging and other temporary work areas for covered activities in areas that will ultimately be a part of the permanent project development footprint. If construction staging and other temporary work areas must be located outside of permanent project footprints, they will be located either in areas that do not support habitat for covered species or are easily restored to prior or improved ecological functions. Within one year following removal of land cover, project proponents will restore temporary work and staging areas to a condition equal to or greater than the covered species habitat function of the affected habitat.

Effect GEO-1: Expose people or structures to substantial adverse effects due to rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, or landslides.

As mentioned previously, the northwestern portion of Yolo County has a high landslide susceptibility. Lateral spreading is a moderate to significant hazard in the eastern portion of the Plan Area. Historical and recent subsidence is present throughout northern and central Yolo County, and is likely to occur in the future. Liquefaction hazards are moderate and differential settlement or ground collapse is a common hazard for the Great Valley geomorphic province in the eastern portion of the Plan Area. Many unstable soil hazards are in predominately agricultural and open space areas where no urban development is planned.

The only seismic fault in the Plan Area considered subject to surface rupture is the Hunting Creek Fault, which extends into Planning Unit #1 (Little Blue Ridge). The Proposed Action Alternative does not include any covered activities in this planning unit, nor have any priority acquisition areas been identified.

Implementation of the conservation strategy under the Proposed Action Alternative does not include residential development or other habitable structures and, as such, it would not place housing within geotechnical hazard areas or expose people to seismic risk or other geohazards. While there may be structures associated with the reserve system such as gates and fences, they are not habitable structures and can be easily repaired if damage from a seismic event or other geohazard were to occur.

Conservation actions under the Proposed Action Alternative and those under the No Action Alternative would likely result in similar land uses on reserve system lands, with the same lack of potential to place people or structures at risk from seismic events and other geohazards.

Potential effects from establishing and managing a reserve system under the Proposed Action Alternative would not expose people or structures to substantial adverse effects due to rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, or landslides.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is less than significant.

CEQA Level of Significance: As compared to Existing Conditions, this impact is less than significant.

No mitigation is required.

Effect GEO-2: Result in substantial soil erosion or the loss of topsoil.

Implementation of the Proposed Action Alternative would involve natural resources conservation through the preservation of natural and seminatural landscapes and maintenance of ecological integrity of large habitat blocks. These activities would result in continuation of existing agricultural operations or the preservation of existing open space, and therefore would not cause or contribute to erosion.

The conservation strategy included in the Proposed Action Alternative also includes habitat enhancement, where existing habitat conditions and values to covered species would be improved in an area, and habitat restoration and creation where an existing natural or seminatural land cover type would be converted to a different natural land cover type (e.g., restoration of riparian habitat on land that once supported riparian habitat, but currently contains annual grassland vegetation). As discussed above for the No Action Alternative, where these activities include ground disturbance they could cause or accelerate erosion. However, compliance with applicable regulations and building codes would effectively reduce this potential

hazard. In addition, General Construction and Operations and Maintenance projects under the Proposed Action Alternative, including ground disturbing activities on reserve system lands, would be required to implement AMM3 and AMM8, which would reduce the potential for erosion by limiting temporary construction footprints within the Plan Area.

In general terms, the covered activities that are part of the implementation of the conservation strategy under the Proposed Action Alternative (e.g., establishment of reserves; habitat enhancement, restoration, and creation) are similar to conservation and mitigation actions that would occur on a project by project basis under the No Action Alternative, and are no more likely to result in substantial erosion. Grading activities that would occur in conjunction with the Proposed Action Alternative are regulated by the local jurisdictions in which they would occur. Each jurisdiction in the Plan Area has a unique permitting process. Generally, the Conservancy would submit an application that includes a description of the work. Additional reports, such as a soil engineering report, engineering geology report, or plans and specifications for grading may be required by the local building or engineering departments, depending on the proposal. The application, plans, and specifications (if any) would be checked by the appropriate building official or engineer, and may be reviewed by other departments of the County or City to check compliance with the laws and ordinances under their jurisdiction. Earthwork recommendations to ensure slope stability and erosion controls, based on site conditions, would be incorporated into the project construction documents. The Conservancy may also be required to secure a National Pollutant Discharge Elimination System permit, depending on the size of the project footprint. The SWPPP and best management practices required by the permit would limit the potential for reserve maintenance to generate substantial soil erosion or result in the loss of topsoil.

Conservation actions under the Proposed Action Alternative and those under the No Action Alternative would likely result in a similarly low potential to increase erosion.

Potential effects from establishing and managing a reserve system under the Proposed Action Alternative would not result in substantial soil erosion or the loss of topsoil.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is less than significant.

CEQA Level of Significance: As compared to Existing Conditions, this impact is less than significant.

No mitigation is required.

Effect GEO-3: Create a substantial risk to life or property by locating structures on expansive soil.

The soils of the Plan Area have moderate to high shrink-swell potential; soils with high shrink-swell potential generally occur in the far western edge of the Plan Area. Therefore, portions of the Yolo HCP/NCCP reserve system could be located on expansive soils. However, implementation of the conservation strategy under the Proposed Action Alternative does not include construction of structures susceptible to damage from expansive/shrink swell soils; therefore, no substantial risk to life or property from expansive soils would occur. This is consistent with the risk from expansive soils associated with implementation of the No Action Alternative.

Potential effects from establishing and managing a reserve system under the Proposed Action Alternative would not create a substantial risk to life or property by locating structures on expansive soil.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is less than significant.

CEQA Level of Significance: As compared to Existing Conditions, this impact is less than significant.

No mitigation is required.

Effect GEO-4: Result in the loss of availability of a known mineral resource.

As shown in Exhibit 17-3, mineral resources in the Plan Area identified pursuant to SMARA are concentrated in the area around Cache Creek. Natural gas fields are located throughout the low-lying portions of the Plan

Area, including the expanded Plan Area along Putah Creek. These areas correspond with high priority reserve system acquisition areas identified for the Proposed Action Alternative (see Exhibit 2-5 in Chapter 2, *Proposed Action and Alternatives*). Therefore, mineral rights, which could be exercised for the extraction of oil, gas, precious metals, trace elements, or other resources (i.e., aggregate), may occur on properties that the Conservancy considers for the reserve system. These rights may be severed from the surface rights of the real property. Evaluation of properties prior to acquisition would include determination, through the due diligence process, of whether a separate mineral estate exists. If a separate mineral estate exists, Conservancy staff members would assess the risk of mineral extraction occurring. Since exercise of a severed mineral right conflicts with the intent of the conservation easements placed on lands enrolled in the reserve system, the Conservancy is likely to purchase the mineral estate for properties with a high conservation value that have known mineral resources where the potential for those mineral rights to be exercised is moderate or high. This would reduce the availability of mineral resources in the Plan Area.

The Yolo HCP/NCCP covers aggregate mining within the Cache Creek Area Plan (CCAP) boundary, consistent with the OCMP (Yolo County 1996), which is expected to continue throughout the 50-year study period and beyond. The OCMP and relevant implementing ordinances currently authorize seven off-channel mining operations along Cache Creek. This includes approximately 968 acres of planned aggregate mining and 1.282 acres of additional future mining. The HCP/NCCP assumes 2.250 acres of new mining beyond those approved for the seven authorized operations (see Exhibit 2-4 in Chapter 2, Proposed Action and Alternatives). This area coincides with the MRZ-2 zones identified in the county, as depicted in Exhibit 17-4. Although both High Priority and Low Priority reserve system acquisition areas are identified in the MRZ-2 zone around Cache Creek, lands anticipated for mining are typically located outside the priority acquisition areas. Comparing the Cache Creek aggregate mining areas identified in Exhibit 2-4 to Exhibit 17-4, the mining areas generally overlap with white areas in Exhibit 17-4 were there is no priority for reserve system acquisition. The HCP/NCCP intentionally removes the potential for conflict between mining operations and reserve land acquisition. Reserves would not be established under the Yolo HCP/NCCP that conflict with the OCMP. In addition, through incorporation of aggregate mining in the CCAP as a Yolo HCP/NCCP covered activity, the Proposed Action Alternative may streamline the permitting and approval process for existing and future mining activities.

Since extraction of mineral resources is generally understood to conflict with conservation of surface resources, it is anticipated that the Conservancy would take measures, such as the purchase of severed mineral rights, to limit mineral resource extraction. Although access to mineral resources could conceivably be restricted if land enrolled in the reserve system possesses important mineral resources, lands with mineable resources typically have much higher monetary value and it becomes less cost effective, or cost prohibitive, to purchase these lands for the reserve system. Local jurisdictions also have policies in place to protect mineral resources. Conversely, implementation of the Proposed Action Alternative could also streamline access to aggregate resources from implementation of the conservation strategy under Proposed Action Alternative would not be appreciably different from the establishment of mitigation preserves under the No Action Alternative. Therefore, implementation of the Proposed Action Alternative would have a less-than-significant impact relative to the No Action Alternative.

Although, the Plan includes priority acquisition areas within the CCAP boundary, establishing and managing a reserve system under the Proposed Action Alternative would not substantially limit the availability of a known mineral resource compared to an existing conditions baseline.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is less than significant.

CEQA Level of Significance: As compared to Existing Conditions, this impact is less than significant.

No mitigation is required.



Exhibit 17-4

Cache Creek Area Mineral Resource Zones and HCP/NCCP Priority Acquisition Areas



Cumulative Effects

The existing cumulative condition in the Plan Area resulting from past and present projects is described above for the No Action Alternative and remains the same for the Proposed Action Alternative. The Proposed Action Alternative would not result in a significant cumulative impact related to, geology, soils, or mineral resources for the same reasons described for the No Action Alternative. In addition, the extent of any potential effects would be further reduced under the Proposed Action Alternative because the implementation of adopted AMMs would provide an additional mechanism for impact avoidance and oversight during reserve activities, and inclusion of aggregate mining in the CCAP as a covered activity could streamline access to mineral resources in this area.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is less than significant.

CEQA Level of Significance: As compared to Existing Conditions, this impact is less than significant.

ALTERNATIVE C – REDUCED TAKE ALTERNATIVE

Environmental Consequences/Environmental Effects

The Reduced Take Alternative (Alternative C) would include the same categories of development-related activities as the Proposed Action Alternative (Alternative B); however, under the Reduced Take Alternative there are eight areas designated for development under the Proposed Action Alternative in which activities that would result in take of covered species would not be permitted. (See Chapter 2, Section 2.3.3, *Alternative C-Reduced Take Alternative* for more information on this alternative.)

There is a potential that development displaced from these eight areas could occur in other parts of the Plan Area. Development that occurs in the Plan Area, but outside the restrictions of, and without the take coverage afforded to, the development-related activities under the Proposed Action Alternative would generally have similar potential to expose people or structures to potentially damaging geologic conditions or expansive soils, result in substantial erosion, or reduce the availability of a known mineral resource. As described above for the No Action Alternative, existing federal, state, and local programs are designed to provide accurate and timely information detailing hazards, impose regulatory requirements regarding geotechnical and soils investigations, provide limitations on the locations of structures for human habitation, impose requirements for hazard notices to potential users, and establish structural standards for requirements for buildings and grading projects. Development and other activities that could hinder access to mineral resources would occur as directed by county and city general plans, various area plans, and other applicable planning documents that generally guide development away from important mineral resources. Overall, Effects GEO-1, through GEO-4 would not be appreciably different from what is described for the Proposed Action Alternative.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is similar and is **less than significant**.

CEQA Level of Significance: As compared to the Proposed Action Alternative, this impact is similar and is **less than significant**.

Cumulative Effects

The existing cumulative condition in the Plan Area resulting from past and present projects is described above for the No Action Alternative and remains the same for the Reduced Take Alternative. The individual effects on geology, soils, and mineral resources in the Plan Area from the Reduced Take Alternative would be similar to those under the Proposed Action Alternative.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is similar and is **less than significant**.

CEQA Level of Significance: As compared to the Proposed Action Alternative, this impact is similar and is **less than significant**.

ALTERNATIVE D - REDUCED DEVELOPMENT ALTERNATIVE

Environmental Consequences/Environmental Effects

The Reduced Development Alternative (Alternative D) would include the same categories of developmentrelated activities as the Proposed Action Alternative (Alternative B). However, under the Reduced Development Alternative, development within a portion of the west side of the Dunnigan area and the Elkhorn Specific Plan Area would not be covered activities. Any development that results in take of listed species in these locations would be required to obtain authorization under the Federal and State Endangered Species Acts, as appropriate, on a project by project basis. (See Chapter 2, Section 2.3.4, *Alternative D-Reduced Development Alternative* for more information on this alternative.)

With implementation of the Reduced Development Alternative, development that occurs within a portion of the west side of the Dunnigan area and the Elkhorn Specific Plan Area would not be subject to AMM3 and AMM8, which limit temporary ground disturbance during construction activities. Development would, however, be subject to existing federal, state, and local programs designed to provide accurate and timely information detailing hazards, impose regulatory requirements regarding geotechnical and soils investigations, provide limitations on the locations of structures for human habitation, impose requirements for hazard notices to potential users, and establish structural standards for requirements for buildings and grading projects, as described above for the No Action Alternative. To the extent that preclusion from the HCP/NCCP drives development that would occur in the Dunnigan and Elkhorn Specific Plan Areas under the Proposed Action Alternative to occur elsewhere, the effects related to geology and soils would be as disclosed above for the Reduced Take Alternative. Displaced development that could hinder access to mineral resources would occur as directed by county and city general plans, various area plans, and other applicable planning documents that generally guide development away from important mineral resources. Overall, Effects GEO-1through GEO-4 would not be appreciably different from what is described for the Proposed Action Alternative.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is similar and is **less than significant**.

CEQA Level of Significance: As compared to the Proposed Action Alternative, this impact is similar and is **less than significant**.

Cumulative Effects

The existing cumulative condition in the Plan Area resulting from past and present projects is described above for the No Action Alternative and remains the same for the Reduced Development Alternative. The individual effects on geology, soils, and mineral resources in the Plan Area from the Reduced Development Alternative would be similar to those under the Proposed Action Alternative.

NEPA Level of Significance: As compared to the No Action Alternative, this impact is similar and is **less than significant**.

CEQA Level of Significance: As compared to the Proposed Action Alternative, this impact is similar and is **less than significant**.