

4.3 GEOLOGY AND SOILS

4.3.1 Introduction

This chapter describes existing geological and soil conditions, potential geologic and geotechnical hazards, and potential impacts for the project. This section also summarizes the erosion, sedimentation, and sediment budget analysis completed by consulting geomorphologist Martin Trso, P.G., which assesses the potential for surface erosion and sediment transport to affected downhill waterways off the project site. The Geology and Soil Summary Report is provided in Appendix B of this EIR.

4.3.2 Methodology

The methodology used to analyze impacts to geology and soils included:

- Geomorphic field surveys of the entire Rodgers property and the adjacent areas between Lake Hennessey and mainstem Napa River;
- A review of available geology/soils reports for the property; and
- The development and analysis of the sediment budget.

4.3.3 Regulatory Framework

The following laws and regulations pertain to geologic and seismic conditions.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zone Act), signed into law December 1972, requires the delineation of seismic zones along active faults in California. The purpose of the Alquist-Priolo Act is to regulate development on or near active fault traces in order to reduce the hazard of fault rupture and to prohibit the location of most structures for human occupancy across these traces. This act also requires cities and counties to regulate certain development projects within seismically active zones, which includes withholding permits until geologic investigations demonstrate that development sites are not threatened by future surface displacement. The project is not located in an Alquist-Priolo fault zone; however, surface fault rupture is not necessarily restricted to areas within an Alquist-Priolo fault zone. Dormant faults are mapped near the property (USGS 1963, 1995).

Napa County General Plan Safety Element

The Napa County General Plan contains a Safety Element which assesses known conditions and seismic hazards, and lays out three goals and corresponding policies. Relevant goals and policies include:

Goal A: Use existing local government authority to reduce hazards to life and property.

Policies

1. Include when necessary, a geologic/seismic evaluation as a part of required Environmental Impact Reports.
2. Require a geologic/seismic report in these cases:
 - a) When warranted by the results of a geologic/seismic evaluation.
 - b) For new residential developments, roads or highways proposed to be located on parcels which contain identifiable landsliding or slumps.
4. Identified active faults incorporated in the County's Seismic Safety Plan Element and the immediate adjacent areas should be restricted to open space uses such as agriculture, parks, trails, or wildlife habitat.

Napa County General Plan Conservation and Open Space Element

Relevant goals and policies in the Conservation and Open Space Element of the General Plan include:

Goal A: To conserve and improve wildlife and fishery habitat in cooperation with governmental agencies, private associations, and individuals in Napa County.

Policies

6. Conservation Policy

(a) All Fishery and Wildlife Habitat:

- 5) The County will protect the public interest in riverine systems and municipal water impoundments from sedimentation, siltation, and contamination, and ensure that urban, agricultural, and resource development projects utilize sound short-term and long-term erosion control and other appropriate watershed protection measures. The County, working in conjunction with the Natural Resources Conservation Service, will establish standards for terracing, contour planting, and maintenance of permanent crops on slopes exceeding five percent as provided by the County's Conservation Regulations.

(g) Fisheries Habitat:

1) Napa River and its Tributaries

- a) Implement sediment reduction measures in sand and gravel operations and other high sediment producing land uses because soil nitrates stimulate oxygen consuming algae in the river.

Napa County Zoning Ordinance

The Napa County Zoning Ordinance [Sections 18.108.070(A) and 18.108.050] requires that prior to commencement of a project involving grading, earthmoving, or land disturbance of any kind on slopes greater than 5 percent, an erosion control plan must be prepared by a qualified professional and approved by Napa County. Approval of the applicant's Erosion Control Plan #02-454-ECPA (Lincoln 2002) by the County is required for implementation of the project.

4.3.4 Existing Conditions

Affected Environment

The project is located in the North Coast area of California and is part of the California Coast Range. The Coast Ranges extend approximately 600 miles from southern California to the Oregon border and are comprised of a northwest trending series of mountain ranges and intervening valleys that reflect past and current regional tectonic forces.

Topography

The project site is part of the Pritchell Hill area in the Vaca Mountains, which frame the eastern side of the Napa Valley. Elevations range from approximately 168 feet above mean sea level to 1,033 feet on the southeastern edge of the project site. The project site gently slopes up from Silverado Trail until the tree line, at which point it becomes markedly steeper. The project covers a north-south trending ridge at its crest and along portions of its gentle to moderately steep flanks.

Five main drainages originate within the project site and drain their runoff and sediment supply (i.e., are connected) either into Lake Hennessey or Conn Creek/Napa River. These five drainages were identified by Martin Trso, P.G., as a guide for the geomorphic surveys and sediment budget calculations (see Figures 4.3-1 and 4.3-2, and Table 4.3-1). The Lake Hennessey Gulch Catchment is a drainage located in the northeastern portion

of the project site and is the largest of all five drainages (231.2 acres). It is fully connected to the north via a road culvert under Sage Canyon Road into Lake Hennessey. The Sage Canyon Road Gulch Catchment (20.4 acres) is a small drainage, and also fully drains to the northeast via a road culvert under Sage Canyon Road to upper Conn Creek, immediately below Conn Dam. However, the remainder of the project site drains to the southwest via road culverts and storm drains across Silverado Trail, and (except for the Rodgers Southwest Gulch Catchment) are largely disconnected from Conn Creek/Napa River as follows: 1) the Rodgers Southeast Gulch Catchment (107.8 acres), which is located in the southeastern portion of the project site, is naturally disconnected along the valley alluvial fan; 2) the Rodgers South Gulch Catchment (52.5 acres), which is located in the southern portion of the project site, is fully disconnected due to the presence of a wastewater treatment pond near Conn Creek; and 3) the Rodgers Southwest Gulch Catchment (24.4 acres), which is located in the southwestern portion of the project site, is fully connected via a storm drain upstream the Ponti Lane road crossing.

Geology

The project site is composed of three geomorphic terrains. The terrain in the southwestern half of the project site is underlain by volcanic, moderately erosive lava-flow rocks of the Sonoma Volcanics geologic formation. The footslopes stretching along Silverado Trail between the Mumm Napa Valley Visitor Center and Rodgers Southeast Gulch, in the area of the proposed Vineyard Blocks 10, 13 and 14, are underlain by soft, low-gradient Tertiary sedimentary rocks. The terrain in the northeastern part of the Rodgers property is underlain by highly erosive sheared serpentinite rocks. Compared to the volcanic terrain, the hillslopes in the serpentinite terrain exhibit high rates of surface erosion, particularly in the area of proposed Vineyard Block 52 (see Figure 4.3-1).

Erosion and Sedimentation

Erosion or sediment production is defined as all particles which “break free” or detach from the soil through surface erosion and mass wasting (persistent downslope movement of hillslope soils, bedrock and regolith). A transfer of the loose sediment from hillslopes to watercourses is referred to as ‘sediment delivery’. The process of sediment delivery reflects natural saturated overland flow from so called overland flow areas, as well as bank erosion due to soil creep (mass wasting). Not all delivered particles travel (i.e., are transported) long distances in the watercourses due to sedimentation (i.e., trapping of sediment). Those that do travel off-site comprise the

Insert Figure 4.3.-1 Soils, Fault Lines and Catchments (11 x 17)

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“sediment yield.” For the purposes of the erosion and sedimentation analysis, sediment production, delivery and yield at the properties (the entire area of the seven parcels) and the project site (the proposed vineyard blocks) have been assessed for all five drainages. An illustration of the five catchment areas, and their connectivity to neighboring water bodies, is shown in Figure 4.3-2.

According to the USLE calculations performed on each of the 27 proposed vineyard blocks, a total of 745.9 tons (T) of sediment is produced by surface erosion annually within the hillslope areas of proposed vineyard blocks under the existing conditions (Trso 2006). The amount of sediment delivered from these proposed blocks to on-site watercourses under existing conditions is approximately 103.5 T per year. Accounting for natural soil creep and hillside surface erosion within the five catchments draining the Rodgers property between Silverado Trail and Sage Canyon, an estimated 1,207.4 T of sediment are annually delivered from hillside to watercourses on-site and off-site over the total area of 436.4 acres (1.77 km²) under current conditions. This corresponds to an average sediment delivery rate of 3.07 T/acre-year. About 8.6% of the total sediment delivery originates from areas of the proposed vineyard blocks.

Two stock ponds exist on the property and a survey of sediment accumulation within both ponds was completed by Trso in April 2004. North Pond is located within the lower Rodgers South Gulch (RSG) Catchment near Silverado Trail, and South Pond is located near the Rodgers property ridgetop within upper Rodgers Southeast Gulch (RSEG) Catchment. Seasonal grazing over the past decades has resulted in rates of sedimentation in the ponds that are 5 to 10 fold higher than estimated natural sediment supply rates. Vineyard installation would result in lower sedimentation rates due to project.

Hillside surface erosion accounts for approximately 44% of the sediment supply in the North Pond and 42% of the sediment supply in the South Pond. The remaining sediment supply in the case of the North Pond is associated with soil creep (natural slow downslope movement of soil in response to gravity). In the case of the South Pond, the remaining sediment supply is associated with soil creep, and minor in-channel gullying and road-related surface erosion. An estimated 72.4 to 84.6 T/yr (comprising gravel, sand and silt grainsize fractions) are trapped by the two ponds, and an estimated 19 T/yr of clay are transmitted through the ponds downstream to Rodgers South and Southeast Gulch Catchments. Due to the ponds, the total sediment export (yield) from the five catchments is reduced to 1,207.4 T/yr.

Unpaved roads on the project site serve to locally reduce hillside surface erosion by interfering with natural runoff patterns and disconnecting hillside sheetflow pathways.

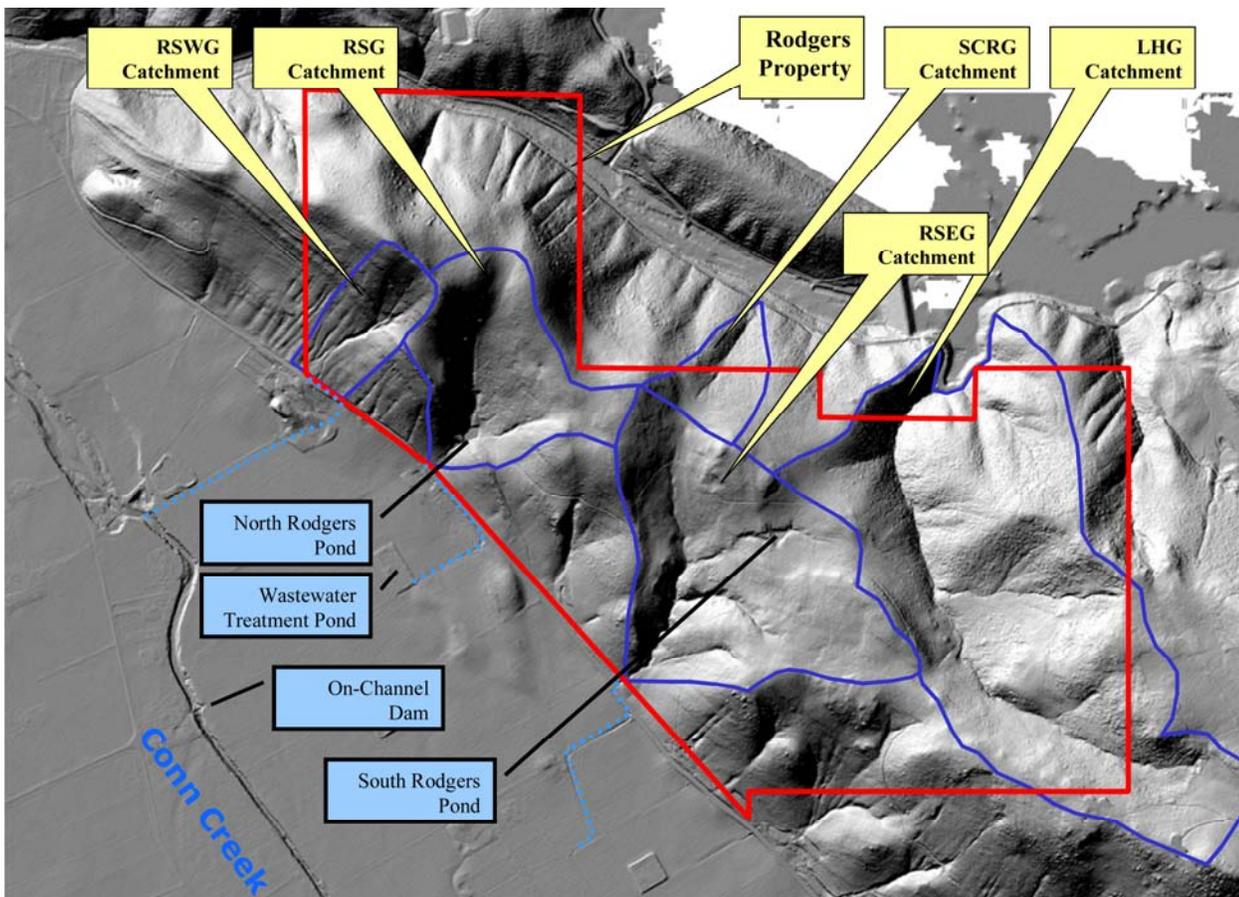


Figure 4.3.-2 Watershed Delineation and Connectivity to Neighboring Waterbodies

Note: Upper Range Vineyard Property location, boundary, sediment budget analysis watershed delineation, and connectivity to neighboring waterbodies. LiDAR-derived 1-meter DEM shaded relief of Rodgers property area (UC Berkeley 2004).

These unpaved roads can also divert concentrated runoff along road cuts, causing localized surface erosion and rilling in the road tread. Road surfaces located within the Volcanic terrain of the project site exhibit moderate surface erosion, while those roads located within the serpentinite terrain exhibit high rates of surface erosion. Due to its location, nearly the entire length of the road is disconnected from the delivery of sediment to on-site watercourses. Due to the generally high stream gradient conditions in on-site watercourses, sediment transport capacity at the Rodgers property (the amount of sediment that an on-site stream is able to carry) is high in both the Volcanic terrain as well as within the serpentinite terrain. Roadcuts along Sage Canyon Road recede annually and result in a corresponding high rate of sediment production and delivery to Conn Creek below the Conn Dam (Trso 2006). Overall, the sediment contribution due to unpaved roads comprises a negligible fraction of the total sediment budget.

Additional trapping of the sediment exported from the five watersheds occurs to the west of Silverado Trail, in the valley floor area of Napa River, due to the disconnectivity of the Rodgers South and Southeast Gulch Catchments. The runoff and sediment yield from these two watersheds does not reach Conn Creek. The South Gulch Catchment runoff and sediment yield are fully disconnected from delivery to Conn Creek due to the presence of a wastewater treatment pond near Conn Creek, and the runoff and sediment yield from the Southeast Catchments naturally fan out along the valley alluvial fan. An estimated 217.5 T of the sediment yield from the South and Southeast Gulch Catchments drainages are annually trapped to the west of Silverado Trail.

As a result, the total sediment export (yield) from the five catchments to Conn Creek and Lake Hennessey amounts to 905.3 T/yr (or 2.3 T/ac-yr) under current conditions. An estimated 804.3 T/yr are transported to Lake Hennessey, and 101.0 T/yr to Conn Creek/Napa River.

Soils

The Soil Survey of Napa County classified the soil in the project site as 152 Hambright, 154 Henneke and 179 Sobrante (see Figure 4.3-1). The Hambright rock outcrop complex, stretching along the southwestern slope of the northwest-southeast trending property ridge, is characteristic of steep terrain with 30 to 75 percent slopes. The Hambright series is a very stony loam and is formed of material weathered from basic volcanic rock. Soils appear to be very thin (<0.5 feet) or nearly absent on the ridgetops in the project site (Trso 2006).

The 154 Henneke soil is a gravelly loam that is mostly located on the northeastern portion of the project site, and is also characteristic of steep terrain with 30 to 75 percent slopes. The Henneke series consists of excessively drained soils that are formed of material weathered from serpentine. 179 Sobrante is a loamy soil, located in the northern portion and along the western edge of the project site. The Sobrante series is a well drained soil commonly found on 30 to 50 percent slopes on uplands and is formed of material weathered from sandstone. The soils found just outside of the project site, to the west of Silverado Trail, are soils characteristic of the valley floor, ranging from very gravelly loams to loams.

Landslide Potential

Relative potential for shallow landsliding was previously delineated for the entire Napa River Basin (Stillwater Sciences and W.E Dietrich 2002) using SHALSTAB, a model for mapping shallow landslide potential (Montgomery and Dietrich 1994, Dietrich and Montgomery 1998). Figure 4.3-3 illustrates the SHALSTAB prediction. SHALSTAB

theory is based on the observation that shallow landslides tend to occur in topographic hollows where shallow subsurface flow convergence leads to increased soil saturation,

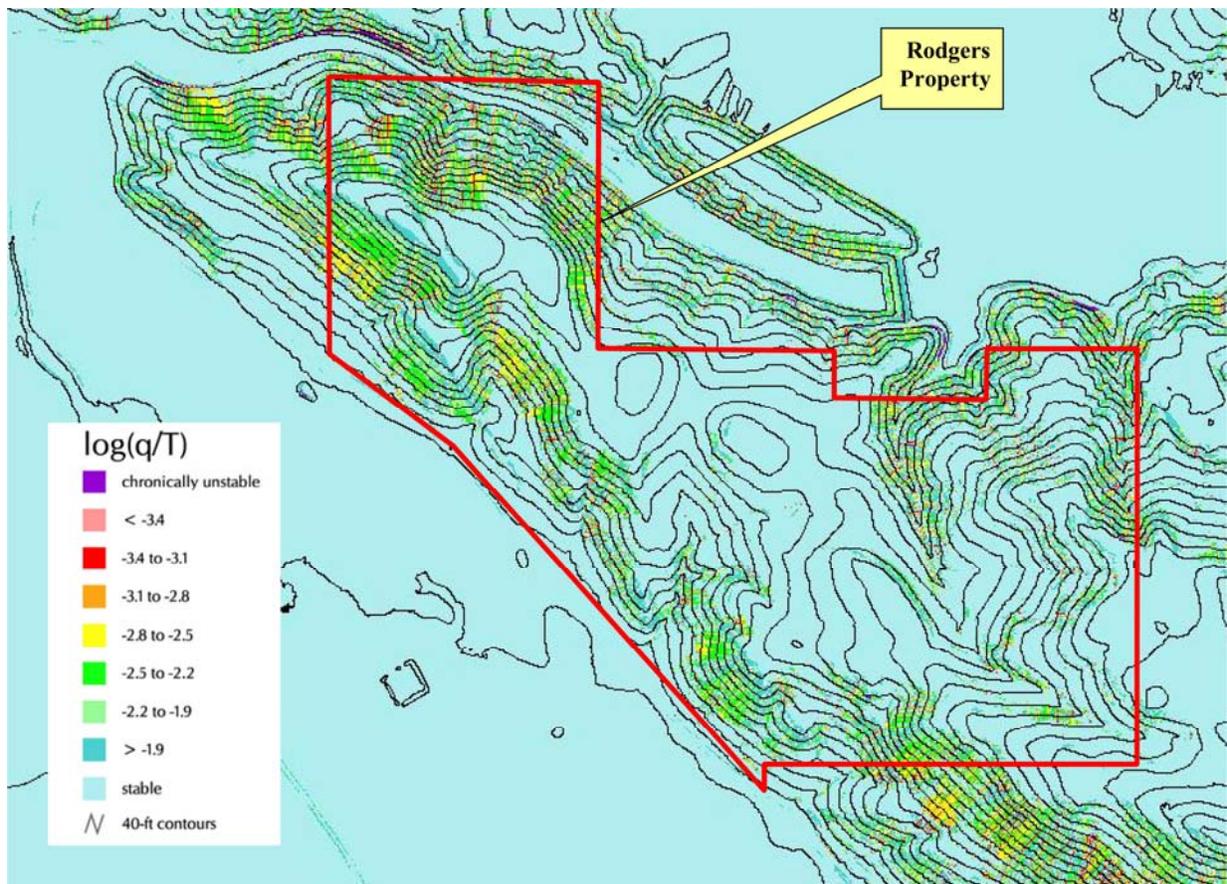


Figure 4.3-3 SHALSTAB model Prediction of Shallow Landslide Potential

Note: Color coding: Blue= Unconditionally stable to very low potential instability; Green = Low potential instability; Yellow and Orange = Moderate potential instability; Red = High potential instability; Pink = Very High potential instability; and Purple = Unconditionally unstable.

increased pore pressures, and reduced shear strength. The SHALSTAB prediction identified the volcanic terrain portion of the property as weakly to moderately prone to shallow landsliding (Trso 2006). It also identified the serpentinite terrain of the hillslopes as moderately prone to shallow landsliding. Most of the proposed ridgetop vineyard blocks are unconditionally stable according to SHALSTAB.

Paleontological

No documented paleontological resources are known to exist or have been found within or in the immediate vicinity of the project area. Further, the limited subsurface excavations associated with vineyard operations would have no impact on paleontological resources.

Seismicity

There are no known faults mapped within the project site according to the most recent Alquist-Priolo Earthquake Fault Zoning Map (Hart and Bryant 1997). However, two known faults identified in the Napa County Baseline Data Report are located in or near the project site (see Figure 4.3-1). The closest earthquake fault zone is located about 10 miles from the project site. Thus, seismic ground shaking potential exists at the project site.

4.3.5 Potential Impacts and Mitigation Measures

This section examines the potential for significant environmental impacts from the proposed project and determines if mitigation measures are needed to mitigate those impacts.

Significance Criteria

Significance criteria were developed from key issues identified in the CEQA Guidelines. Impacts resulting from the proposed project would be considered significant if they resulted in increased exposure of people or structures to major geologic hazards that result in substantial adverse effects. However, geologic impacts are typically considered less than significant if, through engineering, geotechnical investigation, and construction techniques, the risk of damage can be greatly reduced, even if not eliminated completely.

Project impacts would be significant if the project were to cause the following:

- Expose people or structures to major geologic hazards (e.g., slope failure, liquefaction, and ground shaking);
- Cause substantial soil erosion; or
- Adversely affect unique geologic or topographic features.

Impacts and Mitigation Measures

Construction/Installation Related Impacts

Impact 4.3-1: Erosion (Less than Significant)

Installation of the erosion control measures (#02-454-ECPA) and subsequent vineyard would have the potential to cause erosion on the project site through the use of farm equipment, including tractors, trenchers, and backhoes. Farm equipment would remove trees and large shrubs, rip and till the other existing vegetation into the soil, establish vineyard blocks/rows, and install a surface drainage system followed by the drip irrigation and trellis systems. Planting of the grape stock would occur the following

season. The vineyard layout was designed to minimize as much as possible the need for tree removal. During construction/installation, disturbed soils would be exposed to the erosive forces of wind and rain.

Erosion control measures as designed in the Erosion Control Plan (#02-454-ECPA) would prevent on-site and downstream drainages and watercourses from significant adverse impacts associated with erosion and sedimentation from project installation and the subsequent vineyard operation. As required by the County's Conservation Regulations (18.108), installation of the project vineyard blocks would occur during April 1 to October 15 of any year or the dry season, at which time rain events that could cause significant surface runoff and erosion would not be expected to occur. A temporary cover crop would be planted with a straw mulch overlay after smoothing the field, and is required to be in place by September 15th of the year of installation (for any area located in a sensitive domestic water supply drainage - in this case Lake Hennessey Gulch Drainage), which would further minimize erosion during the rainy season by about 54% on average as compared to current conditions (Trso 2006). In addition, areas within vineyard blocks with average slopes greater than 30 percent would not be affected by the vineyard installation. Following installation of the erosion control measures and subsequent planting of the vineyard, including the permanent cover crop, the sediment supply from the vineyard into the creeks and downstream from the project site would be less than under existing conditions (see Impact 4.3-3 discussion). The project would be in conformance with applicable policies in the Conservation and Open Space Element of the Napa County General Plan.

Mitigation Measure: None required.

Operation Impacts

Impact 4.3-2: Seismicity (Less than Significant)

Seismic and geologic hazards on the project site are limited to slope instability and ground shaking. Workers on the project site during installation and subsequent vineyard operations (including harvest) could be exposed to seismic shaking and potential slope failure during a major earthquake. The project is in conformance with applicable policies for agricultural land uses in the Safety Element of the Napa County General Plan. While ground shaking could occur, the risk to workers would be negligible.

According to SHALSTAB, the property is only weakly-to-moderately susceptible to shallow landslide, and the project site is generally unconditionally stable. Therefore, the probability for intensive ground shaking to cause landsliding during an earthquake would be low. The impact would be less than significant.

Mitigation Measure: None required.

Impact 4.3-3: Sediment Transport (Less than Significant)

Replacement of the existing grassland and oak woodland with the subsequent vineyard would introduce new vegetation and planting patterns, in combination with the erosion control measures. Future conditions reflecting natural geologic processes, the effects of past and on-going land uses, and effects of project implementation were modeled to quantify potential erosion and soil loss following installation of the ECPA and subsequent planting of the vineyard.

According to the USLE calculations performed (Irso 2006) on the 27 proposed vineyard blocks, 341.1 T of sediment would be produced annually (T/yr) under project conditions (a reduction of 404.8 T/yr). These results indicate a reduction in surface erosion ranging between 44% and 85% within the individual vineyard blocks, with an average hillslope surface erosion reduction of 54.3%. This decrease in surface erosion is primarily a result of the increased ground surface cover established as part of the project. Under project conditions, ground surface cover would increase from the existing 60% (or 50% in places of intense grazing) to 80% in the proposed vineyard blocks. In addition, the reduction in hillslope surface erosion would be achieved by building vineyard avenues around the proposed vineyard blocks, which would result in subsequent shortening of hillslope lengths within the blocks. Due to continued cattle grazing on the property, it is assumed that current levels of surface erosion in areas outside of the proposed vineyard blocks would remain unchanged.

The amount of sediment delivered to on-site watercourses would also decrease under project conditions. Under the existing conditions, approximately 103.5 T/yr of sediment produced within the area proposed for vineyard blocks is estimated to be delivered to on-site watercourses. It is estimated that approximately 38.4 T/yr of sediment would be delivered (a reduction of 65.2 T/yr) to on-site watercourses under project conditions.

When looking at specific drainages within the project site, there would be a reduction in the total drainage sediment supply ranging from 2 to 13.1 % (assuming grazing would continue along with vineyard development (see Table 4.3-1). The reduction in sediment supply (as compared to current conditions) reflects the sediment trapping capacities of the proposed erosion control measures, in combination with the cover-crop related decrease in sediment production. These results assume that erosion control measures are maintained frequently and function properly as part of subsequent routine vineyard maintenance.

Mitigation Measure: None required.

**Table 4.3-1
Sediment delivery budgets for existing and future project conditions.**

	TOTAL SEDIMENT SUPPLY (T/YR)	UNIT AREA SEDIMENT SUPPLY (T/KM ² -YR)	DECREASE IN TOTAL SEDIMENT SUPPLY FROM EXISTING CONDITIONS
RODGERS SOUTHWEST GULCH DRAINAGE			
Existing Conditions (GR)	82.9	1,110.0	-
Future with Project (GR, V)	72.0	726.8	13.1 %
RODGERS SOUTH GULCH DRAINAGE			
Existing Conditions (GR)	84.0	396.1	-
Future with Project (GR, V)	73.8	348.0	12.1 %
RODGERS SOUTHEAST GULCH DRAINAGE			
Existing Conditions (GR)	218.1	499.9	-
Future with Project (GR, V)	193.7	443.9	11.2 %
SAGE CANYON ROAD GULCH DRAINAGE			
Existing Conditions (GR)	18.1	294.9	-
Future with Project (GR, V)	15.9	250.2	12.2 %
LAKE HENNESSEY GULCH DRAINAGE			
Existing Conditions (GR)	804.3	1,034.6	-
Future with Project (GR, V)	788.3	1,013.8	2.0 %

Note: GR = Grazing; GL = Grasslands; V = Vineyards.

Source: Trso 2006