4.5.1 INTRODUCTION

This section presents a description of the existing geology, soils, and seismic conditions in the project area and analyzes the potential effects of implementation of the proposed California State University, East Bay (CSUEB) Hayward Campus Master Plan related to these conditions.

No public or agency comments related to geology and soils were received in response to the Notice of Preparation (NOP) issued for this EIR.

4.5.2 ENVIRONMENTAL SETTING

4.5.2.1 Geologic Overview

Regional Geology

The Hayward campus is located in the Coast Ranges geomorphic province in the northwest-trending Hayward hills. The Coast Ranges geomorphic province is characterized by a northwest-trending structural grain of parallel ridges and valleys that is the result of active uplift and tectonics associated with the San Andreas fault system. The Coast Ranges are dominantly composed of rocks of the Franciscan Complex and the Great Valley Sequence, in places overlain by Pleistocene to Holocene (less than 1.6 million years old) alluvial, colluvial, lacustrine, and landslide deposits. The Franciscan Complex consists of metamorphic rocks, graywacke, basalt, argillite, chert, and other rocks (Dibblee 2005) that were accreted to the western margin of the North American Plate during the Cretaceous period (about 200 to 65 million years ago). Locally, rocks of the Coast Range Ophiolite (uplifted oceanic crust) are in fault contact with Franciscan Complex and Great Valley Sequence rocks (less than 65 million years old) along the Hayward and Chabot faults (Graymer et al. 1995a; Graymer 2000; Dibblee 2005). The Hayward fault lies at the western base of the Hayward hills, while the Chabot fault extends southeast across the western part of the hills, east of and subparallel to the Hayward fault. Cenozoic rocks are largely absent in the East Bay hills between the Chabot and Hayward faults, with the exception of isolated outcrops of Pleistocene gravels overlying bedrock and late Pleistocene (less than 120,000 years old) and Holocene (less than 11,000 years old) surficial deposits within several small alluvial valleys (Witter et al. 2006).

Regional strain associated with tectonic activity between the Pacific and North American plates along the San Andreas fault system is concentrated along major faults of the San Andreas fault system in a broad zone of right-lateral transpression[1] and strike-slip faulting. The major active strike-slip faults near the site

1 Right-lateral transpression occurs in areas of the earth's crust that experience right-lateral strike-slip shear and a component of shortening, resulting in oblique shear. The term right-lateral strike-slip refers to movement on a

include the San Andreas, Hayward, and Calaveras faults. These faults and others in the San Francisco Bay Area are shown in **Figure 4.5-1, Major Active Faults in the Bay Area**. The site is located approximately 0.18 mile (0.3 kilometers [km]) east of the Hayward fault, 7.4 miles (12 km) west of the Calaveras fault, and approximately 18.6 miles (30 km) east of the San Andreas Fault. Seismicity and seismic hazards associated with these faults are discussed below.

Site Geology

A geologic map of the Hayward campus and surrounding area is provided in **Figure 4.5-2**, **Geologic Map of Campus Area**. The major geologic units that underlie the campus include Franciscan Complex glaucophane schist, Coast Range Ophiolite gabbro, Leona Rhyolite, and Great Valley Group clay shale, claystone, and conglomerate (Graymer 2000; Dibblee 2005). The gabbro, which underlies much of the campus, extends from the Hayward fault on the west to the Chabot fault on the east (Ponce et al. 2003). Quaternary sediments overlying bedrock near the campus consist of Pleistocene and Holocene alluvium, colluvium, and landslide deposits (Nilsen 1975; Graymer et al. 1995a; Witter et al. 2006).

The campus is located 0.18 mile (0.3 km) east of the main trace of the active Hayward fault. The Dibblee, West Chabot, and East Chabot faults are located in the campus area and are not considered to be Holocene active faults (CDMG 1982; Jennings 1994; WGCEP 2008). In the site area, tectonically emplaced gabbro of the Coast Range Ophiolite and the Leona Rhyolite are in fault contact with marine sedimentary rocks of the Knoxville Formation along the West Chabot fault (**Figure 4.5-2**; Dibblee 2005; CEL 2006). Strands of the Dibblee fault separate Knoxville Formation shale and claystone from gabbro in the area of the student-housing complex (CEL 2006). Faults located on and near the campus are discussed below.

4.5.2.2 Soils

The soils beneath the Hayward campus include Xerorthents–Los Osos complex, 30 to 50 percent slopes; Altamont clay, 30 to 50 percent slopes; Diablo clay, 9 to 15 percent slopes; Millsholm silt loam, 30 to 75 percent slopes; and urban land, 0 to 50 percent slopes (NRCS 2007). The soils are well drained. The Millsholm silt loam and Los Osos complex exhibit rapid runoff and may be subject to severe erosion (Earth Metrics 1987). Additionally, soil creep and slumping are common in the steep-sloped canyon areas. Much of the surficial soil in the campus area has been removed or modified by development. Soils in parts of the site (e.g., the area of the Student Services building) are highly expansive with corresponding shrink/swell potential; thus remediation for expansive soil conditions may be required for some areas of the site (CEL 2006).

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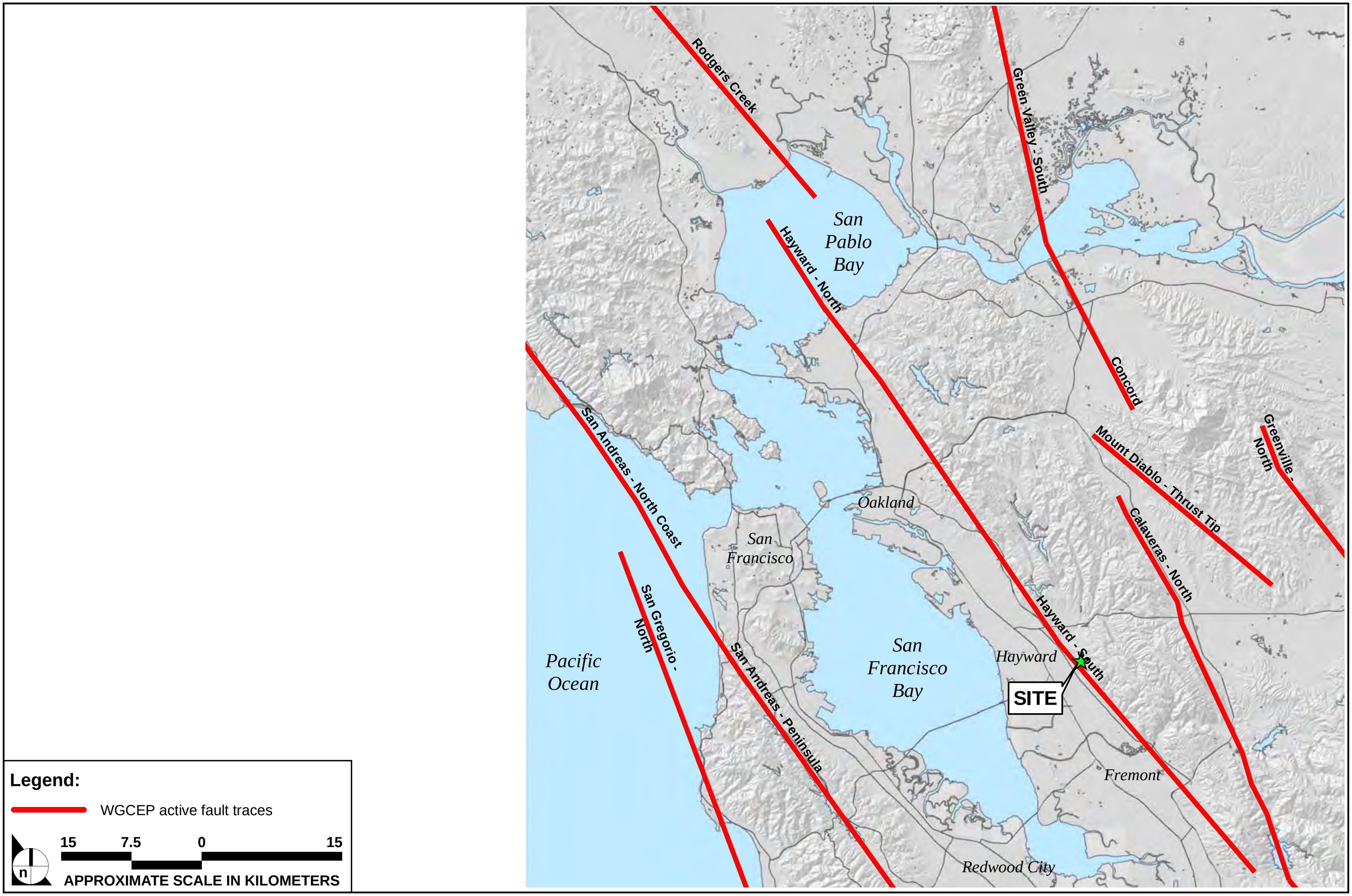
fault, which if you were to stand on it and look along its length, the right block would move toward you and the left block would move away from you.



SOURCE: Geomatrix - May 2008

FIGURE **4.5-1**

Major Active Faults in the Bay Area

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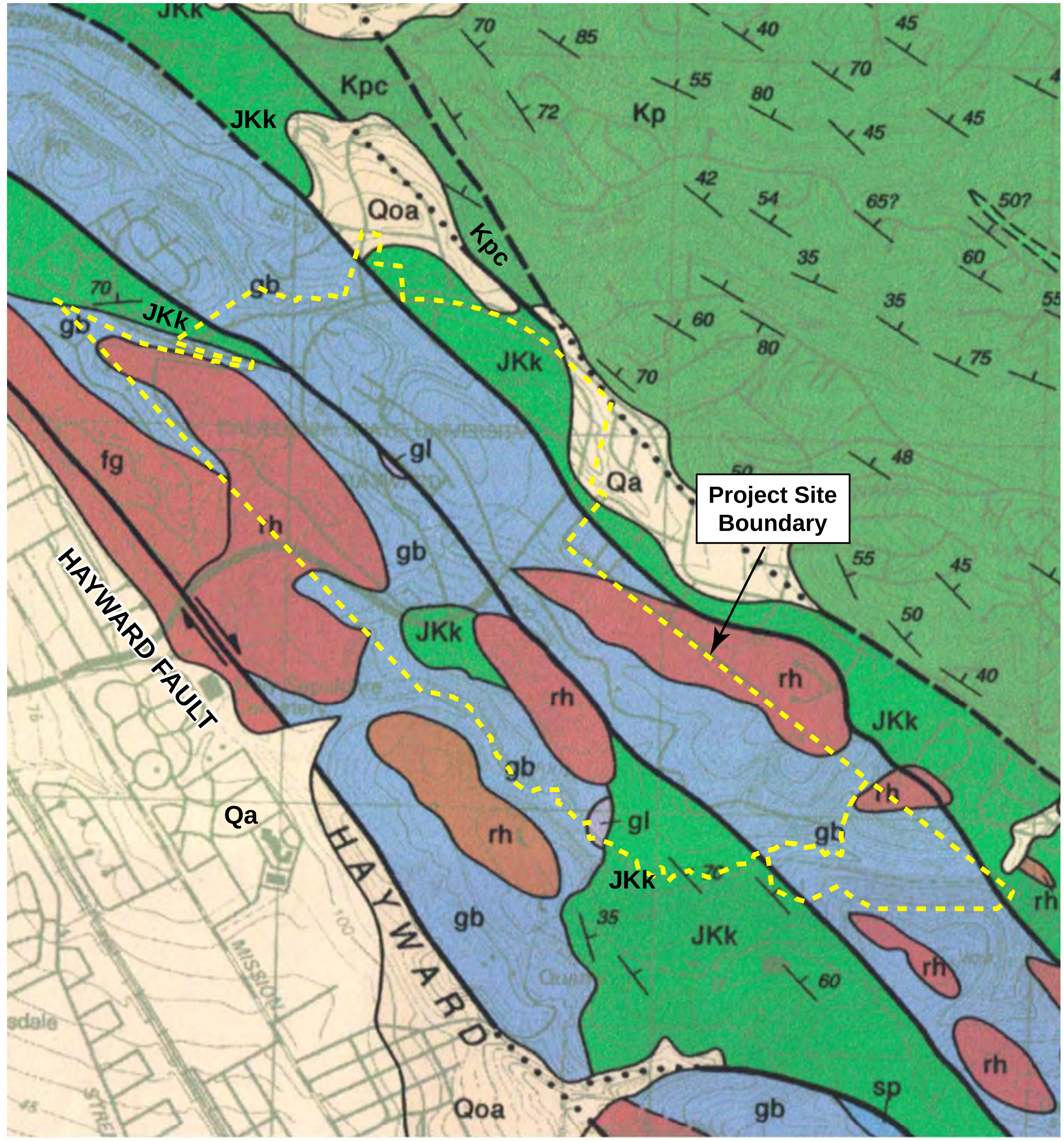

Legend:

Geologic Units (Dibblee, 2005)

Quaternary

Qa	Surficial sediments
Qoa	Older surficial sediments

Jurassic-Cretaceous

Kp	Clay shale or claystone
Kpc	Conglomerate
JKk	Clay shale
rh	Leona Rhyolite
gb	Gabbro-diabase
fg	Greenstone
gl	Glaucophane blueschist

Fault (dashed where indefinite or inferred, dotted where concealed; arrows show relative sense of movement)

Geologic contact

Strike and dip of bedding

Approximate site boundary

1000 500 0 1000

APPROXIMATE SCALE IN FEET

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SOURCE: Geomatrix - May 2008

FIGURE **4.5-2**

Geologic Map of Campus Area

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The following are descriptions of the soils beneath the campus based on the National Resources Conservation Service (NRCS 2008). The Altamont clay, 30 to 50 percent slopes, is derived from sandstone and shale and/or residuum weathered from conglomerate, and occurs on the slopes of hills. It is well drained and approximately 40 to 60 inches thick. The Diablo clay, 9 to 15 percent slopes, is residuum from weathered sandstone, shale, and rhyolite, and occurs on the slopes of hills. It is commonly formed on the Leona Rhyolite. It is well drained and approximately 40 to 60 inches thick. The Millsholm silt loam, 30 to 75 percent slopes, is residuum from weathered sedimentary rock and occurs on the slopes of hills. It is well drained and approximately 10 to 20 inches thick. Xerorthents–Los Osos Complex, 30 to 50 percent slopes, is residuum from weathered sedimentary rock and gabbro, and occurs on the slopes of hills. It is well drained and approximately 20 to 40 inches thick.

4.5.2.3 Seismicity

Faulting and Seismic Shaking

The site is located in a seismically active region where tectonic activity is related to slip on various faults of the San Andreas fault system, which forms the North American/Pacific Plate boundary in central California (**Figure 4.5-1**). Lateral motion along the plate boundary occurs across a distributed zone of right-lateral faulting, expressed as a nearly 50-mile-wide zone of northwest-trending, near-vertical strike-slip faults, including the San Andreas, Hayward, and Calaveras faults. Major active faults in the San Francisco Bay area are shown on **Figure 4.5-1** and listed in **Table 4.5-1, Major Faults near the Hayward Campus**.

Table 4.5-1
Major Faults near the Hayward Campus

Fault	Distance from Site (miles)	Direction from Site	Moment Magnitude[1]	Slip Rate[1] (mm/yr)
Hayward–Rodgers Creek	0.18	West	6.5 to 7.25	9 ± 2
Calaveras	7.4	East	5.8 to 6.9	6 ± 2 and 15 ± 4
Mt. Diablo	12.4	East	6.3 to 6.7	3 ± 2
Concord–Green Valley	17.3	Northeast	6.0 to 6.7	4 ± 2 and 5 ± 3
San Andreas	18.6	West	6.9 to 7.9	17 ± 4 and 24 ± 3
Greenville	18.6	East	6.5 to 6.9	2 ± 1
San Gregorio	26	West	6.9 to 7.5	3 ± 2 and 7 ± 3

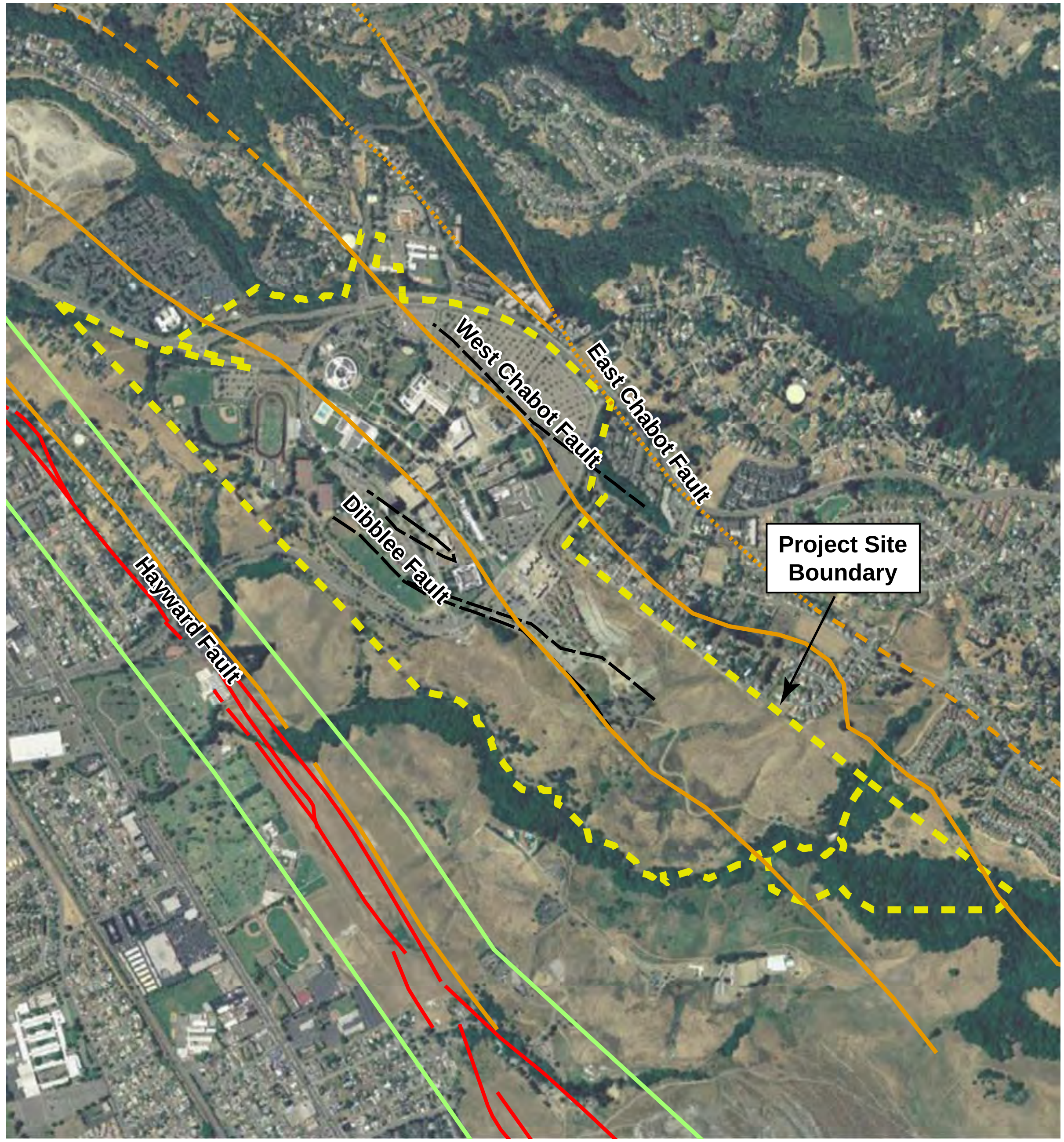
[1] *Moment magnitude and slip rate data from Working Group on California Earthquake Probabilities (WGCEP, 2003, 2008).*

The San Andreas, Hayward, and Calaveras faults have the highest slip rates and are the most seismically active of any faults in the Bay Area. Other faults that are capable of producing large-magnitude earthquakes are the San Gregorio, Mt. Diablo, Rodgers Creek, and Greenville fault zones. The closest active fault to the Hayward campus is the Hayward fault, which is located about 0.18 mile (0.3 km) west of the western margin of the campus. Within the City of Hayward, the Hayward fault delineates the boundary between flatlands along the San Francisco Bay margin and the East Bay hills. The Hayward fault is the southern part of an extensive fault system that includes the Hayward, Rodgers Creek–Healdsburg, and Maacama faults. The Hayward–Rodgers Creek fault system is approximately 90 miles (145 km) long and is deemed capable of generating a maximum earthquake of about Moment Magnitude (M) 7.25 (WGCEP 2003, 2008). The last major earthquake on the Hayward fault occurred in 1868 and was M 6.8, rupturing along the southern segment of the fault from Fremont to Oakland. Geologic and geodetic data indicate that the fault has a long-term slip rate of about 9 millimeters per year (mm/yr) (WGCEP 2008). The Hayward fault is characterized by fault creep at the ground surface, which deforms curbs, buildings, and other structures that cross the fault. The rate of creep deformation along the fault in the City of Hayward is about 5 mm/yr (roughly 2 inches every 10 years) (Lienkaemper and Galehouse 1997). The Hayward fault poses a high seismic hazard because of its high slip rate, its demonstrated ability to generate a large earthquake, and importantly, its location through the highly urbanized eastern San Francisco Bay Area.

The campus is not located in an Alquist-Priolo Earthquake Fault Zone (CDMG 1982). It is located 0.01 mile (160 m) east of the eastern boundary of the Alquist-Priolo Earthquake Fault Zone established for the Hayward fault. Other potentially active faults near the Hayward campus include the Chabot fault and several unnamed secondary faults adjacent to the Chabot and Hayward faults.

Three faults have been mapped on the Hayward campus: the Dibblee fault, the West Chabot fault, and the East Chabot fault. These faults are shown on **Figure 4.5-3, Faults within the Hayward Campus**. The Chabot fault is truncated on the north by the Hayward fault and on the south by the Mission fault. Prominent linear valleys and topographic saddles mark the location of the fault in the East Bay hills. Correlation of lithologically distinct Pliocene and early Pleistocene gravels across the Chabot fault suggests about 14.2 miles (23 km) of cumulative right-lateral offset (Graymer et al. 1995b). The Chabot fault is overlain by apparently unfaulted terrace gravels containing middle to late Pleistocene vertebrate fossils, and therefore is considered to be not active.

Geotechnical evaluations at the site of the Pioneer Heights Student Housing Complex considered the potential for fault rupture at the site to be low; the West Chabot fault, however, could experience sympathetic movement on the order of less than 6 inches during a major earthquake on the Hayward fault (CEL 2006). Trenching investigations of the Dibblee fault on the Hayward campus revealed an unfaulted Holocene soil (of unknown age) overlying the fault, which suggests the fault is not currently active (CEL 2006).



Legend:

Fault (CEL, 2006)

Fault (dashed where indefinite or inferred) (Dibblee, 2005)

Approximate site boundary

Hayward Fault Trace (CDMG, 1982)

Boundaries of Alquist Priolo Fault Zone (CDMG, 1982)

Aerial base map is from ESRI 2008.

n

1000 500 0 1000

APPROXIMATE SCALE IN FEET

SOURCE: Geomatrix - May 2008

FIGURE **4.5-3**

Faults within the Hayward Campus

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As with any site in the San Francisco Bay Area, strong ground shaking is likely to occur at the site during a future earthquake. The recently updated US Geological Survey assessment of seismic hazard (WGCEP 2008) indicates there is a 63 percent probability that a magnitude 6.7 or larger earthquake will occur in the Bay Area within the next 30 years, and there is about a 15 percent probability that this earthquake will occur along the Hayward fault adjacent to the site. The most recent update of the US Geological Survey (USGS) national hazard maps (Petersen et al. 2008) shows the probabilistic peak ground accelerations (PGA) and spectral accelerations (SA) for the vicinity of the campus. PGA is expressed as a fraction of the acceleration due to gravity (g). Accordingly, there is a 10 percent probability of exceeding a PGA of 0.66 g in 50 years, and a 2 percent probability of exceeding a PGA of 1.15 g in 50 years.

Liquefaction

Liquefaction is defined as the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore pressure and decreased effective stress. Liquefaction typically is caused by strong ground shaking during an earthquake. Observed types of ground failure resulting from liquefaction during earthquakes in the San Francisco Bay region include sand boils, lateral spreads, ground settlement, ground cracking, and ground warping. Observations of surface deformation and damage produced by liquefaction indicate that the effects tend to occur in areas underlain by saturated, unconsolidated sand, silt, and uncompacted artificial fill. Liquefaction susceptibility is a function of both the susceptibility of surficial deposits to liquefaction and the probability that earthquake ground motions will exceed a specified threshold level.

Liquefaction susceptibility in the study area has been assessed in the California Geological Survey (CGS) Seismic Hazard Zone maps (CGS 2003) and by Witter et al. (2006). The liquefaction susceptibility map of Witter et al. (2006) was developed from recent 1:24,000-scale mapping of Quaternary deposits, historical observations of liquefaction-related ground failure, hydrologic information, and liquefaction analyses of geotechnical boring data. Based on maps of liquefaction susceptibility from CGS (2003) and Witter et al. (2006), the site is in a very low to low liquefaction susceptibility area. Areas of low susceptibility are shown in **Figure 4.5-4**, **Seismic Hazard Zone Map**, and located in the northern part of the campus and in drainages southwest of and in the southern part of the campus. Portions of the campus underlain by bedrock are not susceptible to liquefaction.

Settlement and Lateral Spreading

Settlement of the ground surface can occur during an earthquake as a result of rapid compaction and settling of subsurface loose, noncompacted sediments. The potential for earthquake-induced ground settlement in the main area of the campus is very low because most of the campus is underlain by bedrock. Lateral spreading is the result of large, permanent lateral movements typically associated with sloping ground that is susceptible to liquefaction. Portions of the campus underlain by bedrock are not susceptible to lateral spreading in the areas of bedrock, and elsewhere the potential is low.

Landslides

Landslides may occur as a result of nearby earthquakes or during non-earthquake (static) conditions during the rainy season. Heavy rains, particularly in areas with minimal vegetation or recently affected by fires, can also cause debris flows and mudslides.

Based on the 2003 CGS seismic hazards mapping, much of the southeastern half of the campus is located in landslide hazard zones (**Figure 4.5-4**). Mapping of existing landslides by Nilsen (1975) shows that landslides have occurred in the drainage areas in the southeastern part of the campus. Most of the steep slopes surrounding the campus are also mapped as landslide hazard zones (CGS 2003).

4.5.2.4 Regulatory Setting

Federal

Clean Water Act. The Federal Water Pollution Control Act of 1972, often referred to as the Clean Water Act empowers the US Environmental Protection Agency (US EPA) with regulation of wastewater and stormwater discharges into surface waters by using National Pollutant Discharge Elimination System (NPDES) permits and pretreatment standards. At the state level, these permits are issued by the Regional Water Quality Control Boards, but the US EPA may retain jurisdiction at its discretion. The Clean Water Act's primary application for geology and soils is with respect to the control of soil erosion during construction.

State

California Building Code. The 2007 California Building Code (CBC) (California Building Standards Commission 2007) contains the minimum standards for grading, building siting, development, seismic design, and construction in California. It includes the standards associated with seismic engineering detailed in the 2006 International Building Code (International Code Council 2006) and the American Society of Civil Engineers (ASCE) Standard 7-05 (ASCE 2005). Local standards other than the CBC may be adopted if those standards are stricter.

Legend:

Liquefaction hazard zone:
Areas where historic occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required. (CGS, 2003)

Earthquake-Induced Landslides:
Areas where Holocene occurrence of landslide movement, or local slope of terrain, and geological, geotechnical and ground moisture conditions indicate a potential for permanent ground displacementssuch that mitigation as defined in Public Resources Code Section 2693(c) would be required. (CGS, 2003)

Fault (CDMG, 1982)

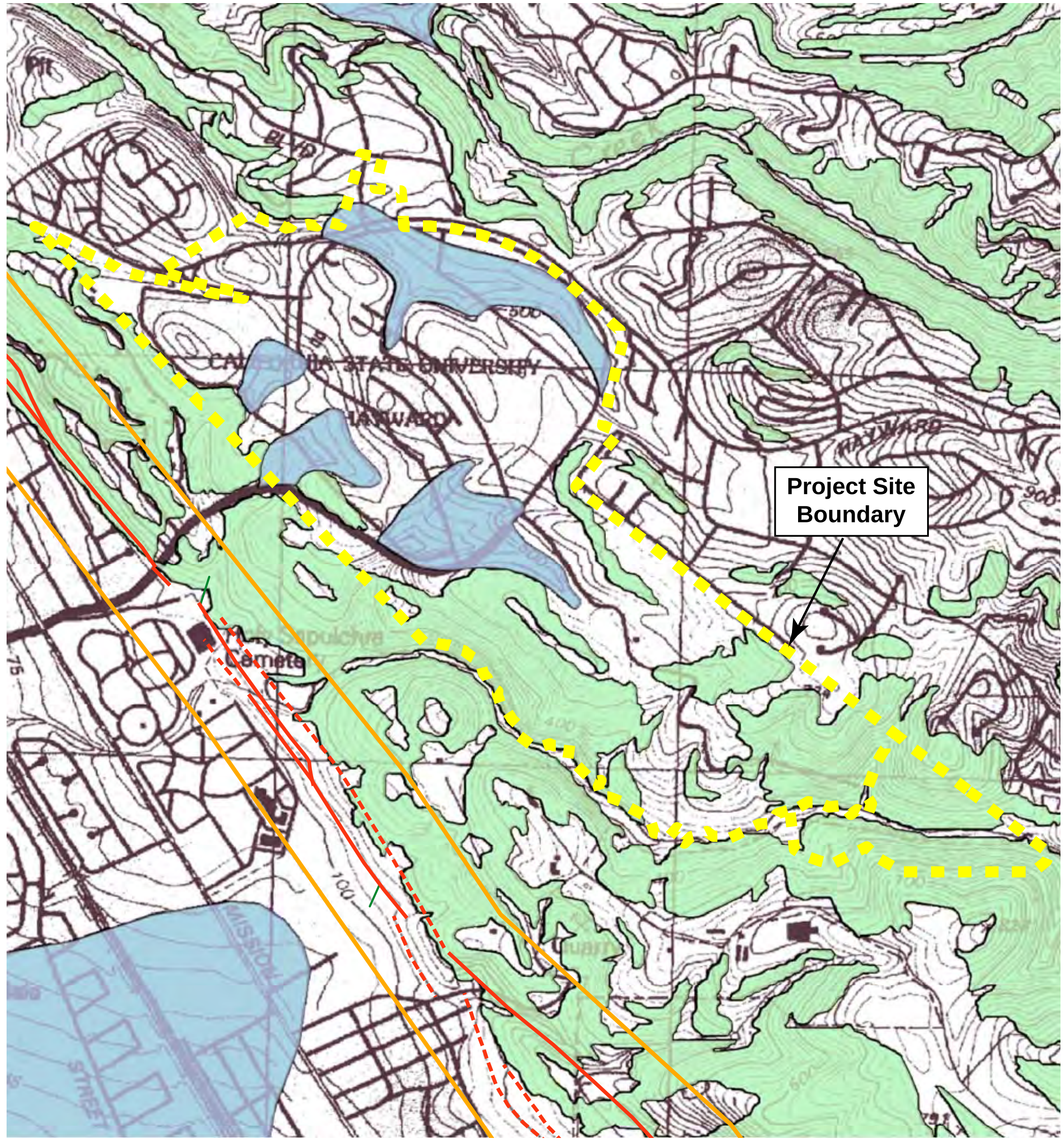
Alquist Priolo Earthquake Fault Zone (CDMG, 1982)

Approximate site boundary

Base map from USGS 7.5' Hayward, California topographic quadrangle.

1000 500 0 1000

APPROXIMATE SCALE IN FEET



SOURCE: Geomatrix - May 2008

FIGURE **4.5-4**

Seismic Hazard Zone Map

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Alquist-Priolo Earthquake Fault Zoning Act. The Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code Section 25523(a); 20 CCR 1752(b) and (c); 1972 [amended 1994]) was passed in 1972 to regulate development on or near active fault traces to reduce the hazards associated with surface faulting. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. Within Alquist-Priolo Earthquake Fault Zones, site-specific geologic investigations must be performed prior to permitting, and must demonstrate that a proposed building will not be constructed across active faults. If an active fault is found, any structures for human occupancy must be set back from the fault, generally 25 to 50 feet.

Seismic Hazards Mapping Act. The Seismic Hazards Mapping Act addresses seismically induced hazards, including liquefaction and landsliding (slope instability). Seismic hazard zones showing areas where there is potential for ground shaking, liquefaction, landsliding, and other types of ground failure have been developed to better regulate development in hazard-prone areas. For sites located within a seismic hazard zone, geotechnical investigations must be conducted to assess if a hazard exists, and the investigations must provide options for mitigation if any hazards are identified. Geotechnical investigations within seismic hazard zones should be conducted following guidelines specified by CGS Special Publication 117, "Guidelines for Evaluating and Mitigating Seismic Hazards." The California Public Resources Code Chapter 7.8, 1990 Seismic Hazards Mapping Act, allows the lead agency to withhold permits until geologic investigations are conducted and mitigation measures are incorporated into plans. The Seismic Hazards Mapping Act is relevant to conditions at the campus.

4.5.3 IMPACTS AND MITIGATION MEASURES

4.5.3.1 Standards of Significance

In accordance with Appendix G of the *State CEQA Guidelines* and the CSU CEQA Handbook, the impact of the proposed project related to geology and soils would be considered significant if it would:

- 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; and
  - strong seismic ground shaking, seismic-related ground failure, including liquefaction, landslides;
- result in substantial soil erosion or the loss of topsoil;

- be located on a geologic unit or soil that is unstable or would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse;

- be located on expansive soil, as defined in Section 1802.3.2 of the 2007 CBC, creating substantial risks to life or property; or

- have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

The above standards are further addressed in the evaluation of impacts with one exception. The standard related to soils incapable of supporting septic tanks is not further evaluated in this section because the Campus does not current utilize septic facilities and there are no plans to develop such facilities in the future on the campus.

4.5.3.2 Methodology

The following resources were reviewed to assess the potential for impacts associated with site geologic conditions.

- Prior geotechnical investigations conducted for campus construction projects

- Prior environmental review documents for campus and adjacent construction projects

- Regional and state data related to geologic, seismic, and soils conditions (e.g., seismic hazard mapping prepared by the US Geological Survey and CGS)

- Relevant federal and state regulations

The analysis compares identified impacts to the standards of significance stated above and determines the impact's level of significance under CEQA. If the impact is determined to be significant, the analysis identifies feasible mitigation measures to eliminate the impact or reduce it to a less than significant level. If the impact cannot be reduced to a less than significant level after implementation of all feasible mitigation measures, then the impact is identified as significant and unavoidable. The project's potential contribution to cumulative impacts is also identified.

4.5.3.3 Project Impacts and Mitigation Measures

MP Impact GEO-1: **Development under the proposed Master Plan would not expose people and structures on campus to substantial adverse effects associated with fault rupture, but could result in substantial adverse effects related to seismic ground shaking or seismic-related ground failure, including liquefaction, lateral spreading, landslides, and/or settlement.**

Level of Significance: Potentially significant

Faults identified on the campus include the East and West Chabot faults and the Dibblee fault. There is no evidence that these faults have been active during the Holocene. Geotechnical evaluations at the site of the Pioneer Heights Student Housing Complex considered the potential for fault rupture at the site to be low. However, the campus is located only 0.18 mile (0.3 km) from the active Hayward fault and it has been estimated that the West Chabot fault could experience sympathetic movement on the order of less than 6 inches during a major earthquake on the Hayward fault (CEL 2006).

Severe seismic ground shaking and related ground failure is a possibility in the area of the Hayward campus. As discussed above, portions of the campus have potential for ground failure related to liquefaction and landsliding. To address these types of concerns, the Hayward campus routinely performs geotechnical investigations to evaluate the potential for liquefaction and other types of ground failure at each building site. These reports include recommendations applicable to foundation design, earthwork, and site preparation to minimize or avoid the potential for building damage and injury. The Campus would implement **MP Mitigation Measure GEO-1** to ensure that such investigations continue to be performed as the campus develops under the proposed Master Plan, and that the recommendations of such investigations are incorporated into project designs. Moreover, the design of all future projects would comply with the California Building Code, which includes specific provisions for structural seismic safety. Future projects would also be subject to review by the CSU Seismic Review Board.

As indicated above, portions of the campus have been identified as seismic hazard zones by the CGS (2003). The mapping by CGS shows four areas where a liquefaction hazard may exist in the northwestern portion of the campus site, and several areas where a landslide hazard may exist along the western and southern portion of the site. As a result of these designations, future construction in these areas would be required to comply with the California Geological Survey's *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (Special Publication 117), which specifically addresses the evaluation and mitigation of liquefaction and landslide hazards in designated Seismic Hazard Zones (CGS 1997). **MP Mitigation**

Measure GEO-1 requires that geotechnical investigations for proposed buildings and/or foundations in the valley portion of the campus will be conducted in accordance with these guidelines.

Overall, with the implementation of **MP Mitigation Measure GEO-1**, development under the proposed Master Plan would not expose people and structures on campus to substantial adverse effects associated with seismic ground shaking or seismic-related ground failure, including liquefaction, lateral spreading, landslides, and/or settlement.

MP MM GEO-1: Where existing geotechnical information is not adequate, detailed geotechnical investigations shall be performed for areas that will support buildings or foundations. Such investigations for building or foundation projects on the CSUEB Hayward campus will comply with the California Geological Survey's *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (Special Publication 117), which specifically address the mitigation of liquefaction and landslide hazards in designated Seismic Hazard Zones (CGS 2003). All recommendations of the geotechnical investigations will be incorporated into project designs. Recommendations for buildings located near mapped faults, prepared by the California State University seismic review committee, shall be reviewed prior to project design.

Significance after Mitigation: Less than significant

MP Impact GEO-2: **Development under the proposed Master Plan would not result in substantial erosion of soils during construction.**

Level of Significance: Less than significant

Construction of facilities anticipated under the proposed Master Plan would result in short-term soil-disturbing activities that could lead to increased erosion, including cut and fill, grading, trenching, boring, and removal of trees and other vegetation. To comply with NPDES requirements for construction site storm water discharges, projects involving construction sites that are 1 acre or more are required to prepare and implement a storm water pollution prevention plan (SWPPP). In compliance with the law, appropriate erosion-control measures would be incorporated into each SWPPP and implemented during site preparation, grading, and construction. These measures would include but are not limited to the following: design and construction of cut and fill slopes in a manner that will minimize erosion, protection of exposed slope areas, control of surface flows over exposed soils, use of wetting or sealing agents or sedimentation ponds, limiting soil excavation in high winds, construction of beams and runoff diversion ditches, and use of sediment traps such as hay bales. Following construction of individual projects, erosion potential would be very low because future project sites would be covered by buildings, pavement, and/or landscaping. Therefore, the impact related to erosion and sedimentation will be less than significant.

Erosion issues related to the effects of alterations to predevelopment storm water runoff patterns are discussed in **Section 4.7, Hydrology and Water Quality**.

Mitigation Measure: No mitigation is required.

MP Impact GEO-3: **Expansive soils are present on the project site and could result in unstable conditions where buildings are proposed.**

Level of Significance: Potentially significant

Portions of the campus are located on expansive soils. Expansive soils increase in volume when they absorb water and shrink when they dry out. Expansion is measured by shrink-swell potential, which is the relative volume change in a soil with a gain in moisture. Expansive soils could exert enough pressure to cause damage to foundations of aboveground structures, concrete slabs, and paved roads and streets.

As described for **MP Impact GEO-1**, to comply with **MP Mitigation Measure GEO-1,** site-specific geotechnical studies will be conducted prior to design and construction to assess whether geologic hazards, including expansive soils, are present. If expansive soils are present, recommendations to mitigate the adverse affects of expansive soils would be presented in the geotechnical reports, and would be incorporated into the final design and implemented during construction of buildings, utilities, walkways, and roadways, in compliance with the California Building Code. The impact related to expansive soils is considered less than significant because proper engineering and construction techniques will eliminate this hazard and because any residual effects that might be the result of expansive soils would not have a significant adverse effect on humans or the environment.

MP MM GEO-3: The Campus shall implement **MP Mitigation Measure GEO-1.**

Significance after Mitigation: Less than significant

4.5.3.4 Cumulative Impacts and Mitigation Measures

The broader geographic area for the analysis of cumulative impacts involving risks associated with earthquakes and geologic hazards is the City of Hayward. New development throughout Hayward will comply with the current seismic provisions of the CBC and local building codes. These state and local requirements are designed to ensure that structures developed in regions prone to significant ground shaking can withstand the likely stress that would result. Compliance with the CBC by the development community, including the Hayward campus, would ensure that cumulative effects involving seismic ground shaking and related ground failure will be less than significant. It is reasonable to assume that Hayward would enforce the seismic provisions of the CBC on new development, and significant adverse cumulative impacts would be avoided.

4.5.4 REFERENCES

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