4.5 GEOLOGY AND SOILS

Geologic and soil conditions on campus are generally as described in the 1989 LRDP EIR. Relevant information from the Earth Resources section (pages 147-157) in Volume I of that document has been incorporated by reference. Additional information sources include a Preliminary Geologic/Geotechnical Evaluation for the Irvine Campus Housing Authority Planning Area 9 prepared by Neblett and Associates (2005), a Fault Investigation Study prepared by Petra International (1991), and a Geologic and Soil Reconnaissance Study prepared by Geolabs, Inc (1968). This section describes the existing geology, soils, and seismic conditions on campus and analyzes the potential physical environmental effects from implementation of the 2007 LRDP related to seismic hazards, underlying soil characteristics, slope stability, erosion, and excavation and export of soils. Potential effects of soil conditions on air and water quality as a result of construction-related activities are discussed in Section 4.2, Air Quality, and Section 4.7, Hydrology and Water Quality, respectively.

4.5.1 ENVIRONMENTAL SETTING

4.5.1.1 REGIONAL GEOLOGY

UCI is located in a structurally complex and tectonically active region of southern California. The geologic complexity of the region is due in part to its orientation between the physiographic provinces of the Transverse Ranges and Peninsular Ranges. The Transverse Ranges border the Peninsular Ranges to the north and form the northern boundary of the Los Angeles Basin. The Transverse Ranges are characterized by east-west trending faults with histories of seismic activity within the Los Angeles Basin. The Peninsular Ranges are traversed by dominant northwest trending faults consisting of the San Andreas fault, San Jacinto fault, Newport-Inglewood fault, and the Whittier-Elsinore fault. These faults are all major fault systems capable of producing magnitudes up to 7.5 on the Richter Scale.

4.5.1.2 SOILS AND GEOLOGIC FORMATIONS

In general, the campus is underlain by moderately dipping sediments of the Topanga Formation, which are in turn capped by younger terrace deposits including geologically young colluvium (less than 12,000 to 15,000 years old) and ancient marine terrace deposits estimated to be about 200,000 years old. Variable thicknesses of slopewash and colluvium fill many canyons and swales on campus. Colluvium and marine terrace deposits have locally been covered by artificial fill during past grading activities on the UCI campus. Soils and geologic formations that occur on the UCI campus are illustrated on Exhibit 32 in the 1989 LRDP EIR and are described below:

- **Alluvium –** These materials consist of dark brown, moist, soft to firm, clayey and sandy silt, and reddish brown clayey sand.

- **Artificial Fill –** These materials consist of black to brown-gray to yellow-brown, slightly moist to moist, firm to very stiff sandy silt or sand clay with occasional cobbles. Fill depths range to a maximum of 9 feet.

- **Slopewash** – Slopewash consists of brown to dark brown, dry to slightly moist, stiff, porous, sandy clay and medium dense clayey sand.

- **Colluvium** – These materials consist of moderate brown, slightly moist to moist, medium dense to dense, fine to medium grained, clayey sand.

- **Terrace Deposits** – These materials consist of moderate brown, slightly moist to moist, very dense, fine to coarse grained, silty sand or they consist of pale brown to pale gray, slightly moist to moist, stiff to very stiff, sandy silt.

- **Topanga Formation –** The underlying Topanga Formation was deposited about 20 million years ago. From these deposits, it was determined that movement has taken place within the last 300,000 years. Two members of the Topanga Formation are found on campus: the Los Trancos member and the Paularino member. The Los Trancos member can be found in the central and southern portions of the campus, and the Paularino member in the highlands at the southern boundary of the campus.

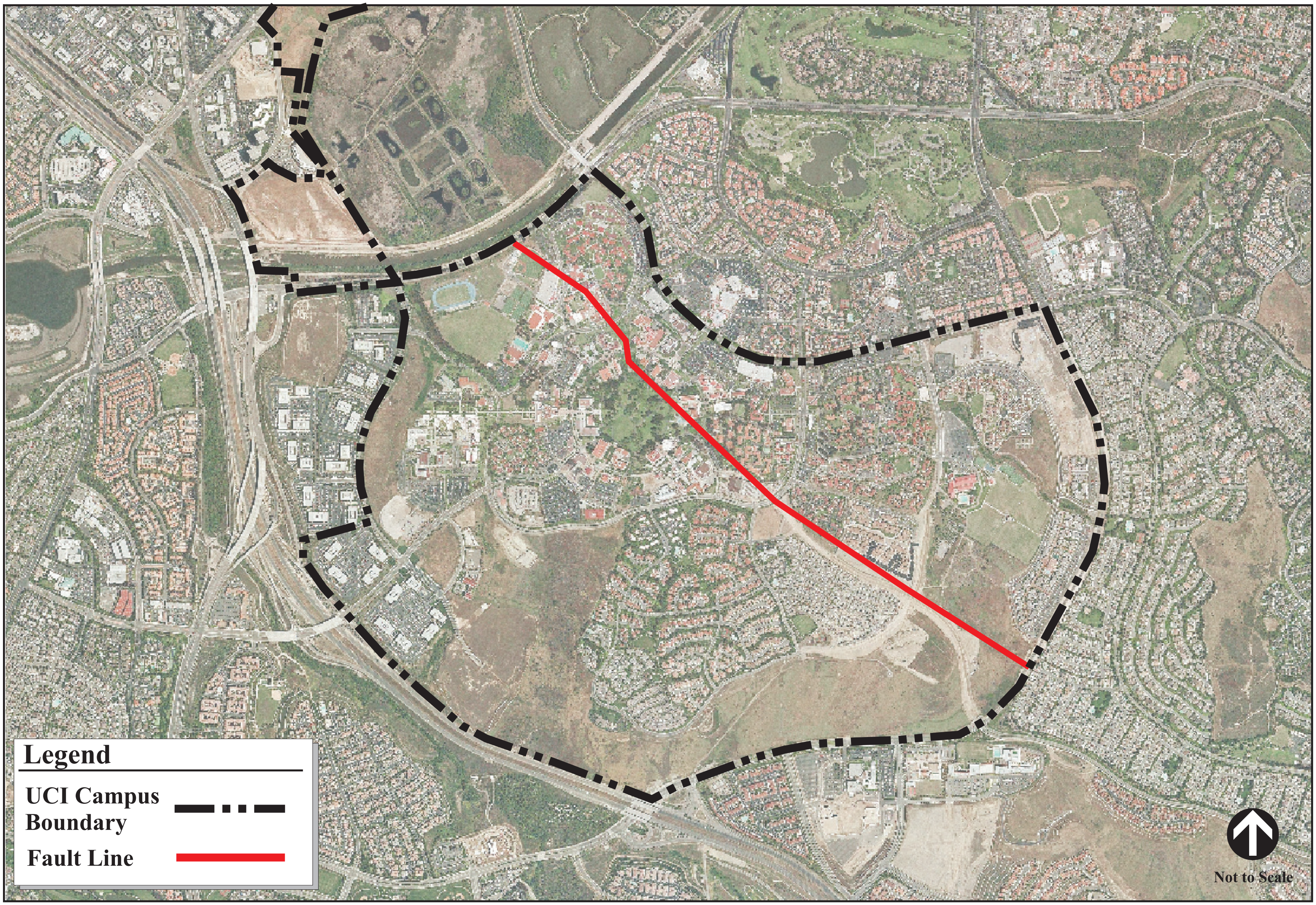
4.5.1.3 FAULTING AND SEISMICITY

Ground shaking as a result of earthquakes is a potential hazard throughout southern California. The intensity of ground shaking at any particular site and the relative potential for damage from this hazard depends on the earthquake magnitude, distance from the source (epicenter), and the site response characteristics (ground acceleration, predominant period, and duration of shaking).

UCI is located in a region of historic seismic activity. The Alquist-Priolo Earthquake Fault Zoning Act of 1972 defines active faults as those with evidence of displacement during the Holocene epoch (roughly the past 11,000 years). The San Andreas fault, located approximately 35 miles northeast of the campus, is capable of producing earthquakes of 8.0 on the Richter Scale; the San Jacinto fault, located 30 miles to the northeast, is capable of generating earthquakes up to 7.5 in magnitude; and the Newport-Inglewood fault that runs along the coast below Newport Bay and Balboa Island is located 4.5 miles southwest of the campus and is capable of producing earthquakes up to 7.5 in magnitude.

In addition to the active faults mentioned above, there are also several potentially active faults found near the campus and one located on the campus. Potentially active faults are those that show evidence of displacement or activity within the last 400,000 years (Quaternary period) but which cannot be traced forward to the last 11,000 years. San Gabriel, Whittier-Elsinore, and Pelican Hill faults are all potentially active faults within the general area of the UCI campus. The Whittier-Elsinore fault, located approximately 18 miles northeast of campus, is considered potentially active and is capable of producing magnitudes of up to 7.5. The UCI Campus Fault extends from beyond the southeast region of the campus northwest across the Central Campus, as shown in Figure 4.5-1. A study conducted by Petra Geotechnical, Inc in 1991 concluded that the fault is potentially active and significant, from an engineering design standpoint. Furthermore, Petra concluded that although no evidence was found to support recent activity of the fault, sufficient evidence was not found to definitively preclude Holocene activity.

UCI has adopted a Restricted Use Zone (RUZ), which is 50 feet on either side of the UCI Campus Fault. No full-time occupied structures can be placed within the RUZ unless a focused project-specific geotechnical analysis is conducted. The RUZ is enforced through the design review process, as discussed in Section 3.5.1 in the Project Description. Existing buildings and uses in the vicinity of the fault line include the Anteater Ballpark, parking structures and lots, academic buildings within the School of the Arts and Social Sciences Quad, and designated open space, including Aldrich Park. The Middle Earth Housing area, located in the Central Campus, and the Palo Verde Housing area, located in the East Campus, are located near the fault line, but outside of the RUZ.



SOURCE: Landiscor, 2005

FAULT LINE ON UCI CAMPUS **FIGURE 4.5-1**

Recent research has identified the San Joaquin Hills blind thrust fault in Orange County. A blind thrust fault is a fault hidden under the uppermost layers of the Earth's crust so there is no direct evidence of it on the ground; when the fault slips, however, it can produce large and significant uplifts, potentially damaging homes and roads. The San Joaquin Hills fault is a blind thrust fault accommodating the uplift and growth of the coastal regions of Orange County from Seal Beach to Dana Point. The exact location of this fault in unknown; however, it is probably connected to the offshore Newport-Inglewood fault that comes ashore in Newport Beach and continues north to Los Angeles. Evidence suggests that the San Joaquin Hills fault broke 200 to 300 years ago, indicating that it would be unlikely to happen again for another several hundred years. Based on GIS data from the City of Irvine, the highest intensity ground-shaking from this fault is anticipated to occur across southern Irvine, which is where the campus is located.

4.5.1.4 GEOLOGIC HAZARDS

Primary hazards associated with seismicity include surface rupturng and groundshaking. The major secondary effect of groundshaking is landsliding; other potential effects include settlement and liquefaction.

Surface Rupturing & Groundshaking

Unlike damage from ground-shaking, which can occur at great distances from the fault, damage due to surface rupturing is limited to the location of the fault-line break. Under the Alquist–Priolo Earthquake Fault Zoning Act, the State Geologist is required to delineate "Earthquake Fault Zones" along known active faults in California. The purpose of the act is to regulate development near active faults so as to mitigate the hazard of surface fault-rupture. In compliance with the Act, no structure for human occupancy is permitted to be placed across or within 50 feet of an active fault.

Landslides

Earthquake-induced landslides on steep slopes occur in either bedrock or soils and can result in undermining of buildings, severe foundation damage, and collapse. Although earthquake activity does induce some landsliding, most slides occur from the weight of water-saturated soil and rock exceeding the shear strength of the underlying material.

Settlement (Subsidence)

Subsidence is the downward settling of surface materials caused by natural or artificial removal of underlying support. Land subsidence would occur from one or more of several causes including withdrawal of fluids (oil, gas, or water) or the application of water to moisture-deficient unconsolidated deposits. Subsidence is a relatively slow process that may continue for several decades. No areas of subsidence have occurred within the campus.

Liquefaction

Liquefaction is another response to severe groundshaking that can occur in loose soils and near surface ground water. This transformation from solid state to quicksand, as a response to seismically induced groundshaking, can cause structures supported on the soils to tilt or settle as the supporting capabilities of the soils diminish. Water saturated clay-free sediments generally are expected to have a high susceptibility to liquefaction.

4.5.2 REGULATORY FRAMEWORK

4.5.2.1 FEDERAL

Uniform Building Code

The Uniform Building Code (UBC) is a model building code that provides the basis for the California Building Code (CBC). The UBC defines different regions of the United States and ranks them according to their seismic hazard potential (Seismic Zones 1 through 4). Zone 1 has the least seismic potential and Zone 4 has the highest. UCI is located in Seismic Zone 4.

4.5.2.2 STATE

California Building Code

California law provides a minimum standard for building design through the California Building Code (CBC). The University of California by administrative policy follows the CBC. Chapter 23 contains specific requirements for seismic safety. Chapter 29 regulates excavation, foundations, and retaining walls. Chapter 33 contains specific requirements pertaining to site demolition, excavation, and construction to protect people and property from hazards associated with excavation cave-ins and falling debris or construction materials. Chapter 70 regulates grading activities, including drainage and erosion control. Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in California Division of Occupational Safety and Health (Cal/OSHA) regulations (Title 8 of the California Code of Regulations [CCR]) and in Section A33 of the CBC.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was signed into law in 1972. The purpose of this Act is to prohibit the location of most structures for human occupancy across the traces of active faults and to thereby mitigate the hazard of fault rupture. Under the Act, the State Geologist is required to delineate "Earthquake Fault Zones" along known active faults in California. Cities and counties affected by the zones must regulate certain development projects within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites arte not threatened by surface displacement from future faulting.

Seismic Hazards Mapping Act

The California Geologic Survey, formerly the California Department of Conservation, Division of Mines and Geology (CDMG), provides guidance with regard to seismic hazards. Under CDMG's Seismic Hazards Mapping Act (1990), seismic hazard zones are to be identified and mapped to assist local governments in land use planning. The intent of this publication is to protect the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. In addition, CDMG's Special Publications 117, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," provides guidance for the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations.

UC's Seismic Safety Policy

The UC "Seismic Safety Policy," last updated on January 17, 1995, strives to acquire, build, maintain, and rehabilitate buildings and other facilities that provide an acceptable level of earthquake safety. The level of safety is also defined in the UC policy. The UC Seismic Safety Policy articulates five primary points:

- **Program for Abatement of Seismic Hazards.** Develop a program for the identification and temporary and permanent abatement of seismic hazards to existing buildings and other facilities.
- **Consulting Structural Engineer.** Engage structural engineers to examine existing buildings and other facilities. Structural engineers are to submit reports on the adequacy of University facilities to resist seismic forces, based on Chapter 23 of the CBC and the engineer's professional evaluations with respect to Appendix A of the UC Seismic Safety Policy.
- **Standards for Seismic Rehabilitation Projects.** Correctional programs for structures that do not provide adequate safety shall provide, at a minimum, an acceptable level of earthquake safety equivalent to the current seismic provisions of Chapter 23 of the CBC, or local seismic requirements, whichever is more stringent, with respect to life safety and prevention of personal injury. Preliminary plans for all seismic rehabilitation shall be reviewed by the consulting structural engineer, and recommendations of the structural engineer shall be incorporated into the project plans by the design engineer.
- **Repair of Buildings and Other Facilities Damaged by Earthquakes.** Sets standards for University buildings and facilities that are damaged by earthquakes, based on the reduction in lateral load capacity of the structure in question.
- **New Buildings and Other Facilities.** The design of new buildings shall, at a minimum, comply with the current provisions of Chapter 23 of the CBC, or local seismic requirements, whichever is more stringent. Provisions shall also be made for adequate anchoring of nonstructural building elements. No new University structures may be constructed on the trace of a known active fault. All plans shall be reviewed by a consulting structural engineer who must, prior to release of construction funds, certify that the structure complies with the UC Seismic Safety Policy.

The UC has also adopted an "Independent Seismic Review of Structures Policy," effective October 1, 1986, to ensure that seismic safety and other structural considerations are fully incorporated into capital project design, purchase, and lease decisions. The policy states that independent review shall be conducted of the structural seismic design of all capital projects, whether new construction or remodeling, that are intended for human occupancy by a qualified licensed structural engineer. The review shall be initiated during the preparation of schematic designs, so that it can be performed in conjunction with the independent design and cost review and value engineering processes, where applicable, and shall be continued at appropriate times during the design process. In all cases, working drawings and calculations shall be reviewed for conformance of the new work to the most current applicable seismic design code requirements prior to inviting bids for such work or authorizing structural change orders.

4.5.2.3 LOCAL

UCI Emergency Management Plans

Emergency management plans at UCI form the basis for emergency response procedures across campus. The goal of these plans is to allow for rapid and efficient mobilization of University resources necessary to handle emergencies. Although the response depends on the nature of the emergency and related circumstances, certain areas such as Facilities Management, University Police, and EH&S are normally involved in emergency situations and are critical to emergency management. The emergency response plans are activated when the University and/or its surrounding community have been subjected to a major emergency situation, and casualties or events have exceeded or impacted the resources normally available. Such emergencies include earthquakes, civil disturbance or demonstration, airplane crash, bomb threats, and hazardous material incidents. Further, UCI makes available emergency procedures available as a flip chart for easy reference to the University community.

4.5.3 PROJECT IMPACTS AND MITIGATION

4.5.3.1 ISSUE 1 – EXPOSURE TO SEISMIC-RELATED HAZARDS

Geology and Soils Issue 1 Summary

Would implementation of the 2007 LRDP expose people or structures to potential substantial adverse effects of a rupture of a known earthquake fault, strong seismic groundshaking, seismic related ground failure, liquefaction, or landslides?

Impact: While the UCI campus contains the potential for seismic related hazards such as fault ruptures, ground shaking, ground failure and liquefaction, and seismically induced landslides, compliance with the CBC and the UC Seismic Safety Policy and enforcement of the Restricted Use Zone (RUZ) reduces the exposure of people and structures to adverse effects involving seismic related hazards.	**Mitigation:** No mitigation is required.
Significance Before Mitigation: Less than significant.	**Significance After Mitigation:** Not applicable.

Standards of Significance

Based on Appendix G of the CEQA Guidelines, implementation of the 2007 LRDP may have a significant adverse impact 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;
- Strong seismic groundshaking;
- Seismic related ground failure, including liquefaction; or
- Landslides.

Significant adverse geologic impacts not directly related to seismic activity including topsoil loss, soil stability, land slides, lateral spreading, subsidence, liquefaction, collapse, and expansive soils are discussed in Issues 2 through 4.

Impact Analysis

Fault Rupture. According to the Alquist-Priolo Earthquake Fault Zoning Map, the UCI campus is not located in the immediate vicinity of any known active faults. However, ground surface rupture is possible along the UCI Campus Fault, which is classified as a potentially active fault, as a result of an earthquake or seismic event. However, this is not expected to result in significant impacts to people or structures because the campus routinely reviews all building plans for compliance with the CBC and the UC Seismic Safety Policy, as well as independent review of structural seismic design of both new construction and remodeling projects.

In addition, through design review, the University enforces the Restricted Use Zone (RUZ), a 50-foot setback for occupied buildings on either side of the UCI Campus Fault. Restricting development within the RUZ prevents increased hazards to people who live on campus. Existing buildings and uses in the vicinity of the fault line include the Anteater Ballpark, parking structures and lots, buildings within the School of the Arts and designated open space, including Aldrich Park. The Middle Earth Housing area, located in the Central Campus, and the Palo Verde Housing area, located in the East Campus, are also located near the fault line, but outside of an RUZ. Proposed uses in the 2007 LRDP within the RUZ include open space and parking. The 2007 LRDP does not propose residential uses in the RUZ. Therefore, impacts associated with fault ruptures are considered to be less than significant.

Ground Shaking. Ground shaking from seismic activity has the potential to dislodge objects from walls, ceilings, and shelves, and to damage and destroy buildings and other structures. People in the area would be exposed to these hazards. UCI minimizes such hazards by:

- Reviewing and approving all draft building plans for compliance with the CBC, which includes specific structural seismic safety provisions;
- Upgrading or replacing existing buildings not adequately prepared to withstand seismic hazards;
- Complying with the UC Seismic Safety Policy, which requires anchorage for seismic resistance of nonstructural building elements such as furnishings, fixtures, material storage facilities, and utilities that could create a hazard if dislodged during an earthquake; and
- Incorporating seismic related emergency procedures into departmental emergency response plans.

These programs and procedures reduce the hazards from seismic shaking by preparing faculty, staff, and students for emergencies. All of these programs and procedures would continue to be implemented as new facilities are developed on campus under the 2007 LRDP. Therefore, impacts associated with ground shaking are considered to be less than significant.

Ground Failure and Liquefaction. The majority of soils on the UCI campus are terraced deposits. Therefore, it is unlikely that these soils would be subject to liquefaction due to the denseness of the material and the depth to groundwater. Furthermore, geotechnical investigations that address the potential for liquefaction, lateral spreading, and other types of ground failure are routinely performed for applicable projects. Compliance with the CBC and implementation of recommendations in a site-specific geotechnical investigation would reduce hazards associated with liquefaction. Therefore, impacts associated with liquefaction are considered to be less than significant.

Landslides. The majority of the campus is characterized as gentle sloping to flat terrain with the exception of the South Campus, where approximately 40 acres of undeveloped land is located on steep terrain. This area is slated for future residential development and consists of clayey soils underlain by terrace deposits. According to a geotechnical evaluation conducted for the undeveloped area of the South Campus (Neblett and Associates, 2005), a review of literature and the 1997 and 1998 Seismic Hazard Zones Maps prepared by the California Geologic Survey indicate that slopes on the South Campus are not located in zones for potential earthquake-induced landslides. Further, designs that comply with the CBC and the UC Policy on Seismic Safety, which requires an independent review of the structural seismic design to ensure compliance with the CBC, would reduce any potential hazards associated with implementation of the 2007 LRDP. Therefore, impacts associated with landslides are considered to be less than significant.

Mitigation Measures

The 2007 LRDP would have a less than significant impact with regard to seismic related hazards such as fault rupture, strong seismic ground shaking, seismic related ground failure, liquefaction, and landslides; therefore, no mitigation measures are required.

4.5.3.2 Issue 2 – Soil Erosion or Topsoil Loss

Geology and Soils Issue 2 Summary

Would implementation of the 2007 LRDP result in substantial soil erosion or the loss of top soil?

Impact: Construction activities associated with the 2007 LRDP could result in increased erosion due to vegetation removal and earth-disturbing activities; however, compliance with dust abatement measures and NPDES requires would minimize erosion and topsoil loss.	**Mitigation:** No mitigation is required.
Significance Before Mitigation: Less than significant.	**Significance After Mitigation:** Not applicable.

Standards of Significance

Based on Appendix G of the CEQA Guidelines, implementation of the 2007 LRDP may have a significant adverse impact if it would result in substantial soil erosion or the loss of topsoil.

Impact Analysis

Erosion can occur as a result of, and can be accelerated by, site preparation activities associated with development. Vegetation removal in landscaped (pervious) areas could reduce soil cohesion, as well as the buffer provided by vegetation from wind, water, and surface disturbance, which could render the exposed soils more susceptible to erosive forces. Additionally, excavation or grading may also result in erosion, irrespective of whether hardscape previously existed at the construction site, because bare soils would be exposed and could be eroded by wind or water.

Earth-disturbing activities associated with construction would be temporary and erosion effects would depend largely on the areas disturbed, the quantity of disturbance, and the length of time soils are subject to conditions that would be affected by erosion processes. All construction activities would comply with Chapter 29 of the CBC, which regulates excavation activities and the construction of foundations and retaining walls, and Chapter 70 of the CBC, which regulates grading activities, including drainage and erosion control. As stated in Section 4.2, Air Quality, UCI would implement dust control measures consistent with South Coast Air Quality Management District regulations. Additionally, as stated in Section 4.7, Hydrology and Water Quality, UCI would comply with the National Pollutant Discharge Elimination System (NPDES) general permit for construction activities, including preparation of an erosion control plan and implementation of sedimentation control Best Management Practices, such as silt fences, watering for dust control, straw bale check dams, hydroseeding, and other measures. With the continued implementation of these measures, as required by law, substantial erosion or topsoil loss is unlikely to occur during construction activities associated with implementation of the 2007 LRDP, and the associated impacts would be less than significant.

Erosion can also occur in connection with increases in stormwater runoff typically associated with increased impermeable surfaces. As stated in Section 4.7, Hydrology and Water Quality, UCI would implement Mitigation Measure Hyd-1A which would reduce stormwater runoff velocities to pre-existing conditions. Other measures, such as Hyd-1B, 2A, and 2B, which protect slopes and channels, such as energy dissipaters, vegetation, and slope/channel stabilizers shall be applied where appropriate. Therefore, substantial erosion is unlikely to occur on an operational basis, and this impact would be less than significant.

Mitigation Measures

The 2007 LRDP would have a less than significant impact on the loss of topsoil and soil erosion with the implementation of mitigation measures Air-2B and Hyd-2A; no other mitigation measures are required.

4.5.3.3 Issue 3 – Soil and Slope Instability

Geology and Soils Issue 3 Summary

Would implementation of the 2007 LRDP be located on a geologic unit or soil that is unstable or that would become unstable and potentially result in a landslide, lateral spreading, subsidence, liquefaction, or collapse?

Impact: Unstable slopes and soils exist in undeveloped areas of the South Campus; however, recommendations provided in a geotechnical investigation would be implemented to remove such soils and slopes and reduce hazards to people or structures associated with unstable slopes and soils.

Mitigation: No mitigation is required.

Significance Before Mitigation: Less than significant.

Significance After Mitigation: Not applicable.

Standards of Significance

Based on Appendix G of the CEQA Guidelines, implementation of the 2007 LRDP may have a significant adverse impact if future development would be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and could potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. A significant impact would occur in cases where people or structures could be exposed to potential substantial adverse effects due to soil instability including the risk of loss, injury, or death.

Impact Analysis

Areas of the campus that are susceptible to landslides, collapse, liquefaction, and other seismic-related hazards are discussed in Issue 1. Compressible soils and slope instability are the other soil hazard issues discussed in this section.

Compressible Soils. Loose or compressible soils in undeveloped areas with deposits of alluvium or slope wash/colluvium are found primarily on the South Campus bordering Bonita Canyon Road. These materials may be subject to settlement under increased loads, or due to an increase in moisture content from site irrigation or changes in drainage conditions. Typical measures to treat compressible soils involve removal and replacement with properly compacted fill, compaction grouting, or deep dynamic compaction. A geotechnical investigation, prepared by Neblett and Associates in 2005, provided recommendations for development on compressible soils in the South Campus. Recommendations include removing alluvium and colluvium soils because these soils are considered unsuitable for the support of structures. The CBC requires that the recommendations provided in the geotechnical investigation be implemented. Therefore, impacts associated with compressible soils are considered to be less than significant.

Slope Instability. Potential hazards associated with slope instability may include surficial failures, earthflows, debris flows, mudslides, rockfalls, soil creep, or erosion. Slopes steeper than 25 degrees (approximately 2:1 [horizontal to vertical]) are more susceptible to instability. Areas with slopes this steep generally exist in the southern portions of the campus and in many of the drainages and canyons. Similar to landslides, steep slopes can typically be stabilized. A geotechnical investigation, prepared by Neblett and Associates in 2005 for the South Campus, provides several recommendations for development in steep topography and slope construction. The CBC requires that the recommendations provided in the geotechnical investigation be implemented. Therefore, impacts associated with slope instability are considered to be less than significant.

Mitigation Measures

The 2007 LRDP would have a less than significant impact related to soil stability; therefore, no mitigation measures are required.

4.5.3.4 Issue 4 – Expansive Soils

Geology and Soils Issue 4 Summary

Would implementation of the 2007 LRDP result in the construction of structures located on expansive soils?

Impact: While expansive soils are prevalent on campus, compliance with the CBC would reduce the potential for substantial risk to life or property due to construction of structures on expansive soils.

Mitigation: No mitigation is required.

Significance Before Mitigation: Less than significant.

Significance After Mitigation: Not applicable.

Standards of Significance

Based on Appendix G of the CEQA Guidelines, implementation of the 2007 LRDP may have a significant adverse impact if it would result in construction of structures located on expansive soil, as defined in Table 18-1-B of the UBC (1994 or most current edition), creating substantial risks to life or property.

Impact Analysis

Expansive soils are those that are high in expansive clays or silts and that swell and shrink with wetting and drying, respectively. This shrinking and swelling can be detrimental to foundations, concrete slabs, flatwork, and pavement. Expansive top soils are prevalent on campus and are generally a dark brown sandy clay, clayey sand, or lean clay. The top soil located through the UCI campus is highly expansive ranging from 8 to 12% swell. The underlying material consists of terrace deposits which is non-expansive to moderately expansive with a swell ranging from 0 to 8%.

The CBC includes provisions for construction on expansive soils. Proper fill selection, moisture control, and compaction during construction can prevent these soils from causing significant damage. Expansive soils can be treated by removal (typically the upper three feet below finish grade) and replacement with low expansive soils, lime-treatment, and/or moisture conditioning. Continued compliance with the CBC would ensure that this impact would be less than significant.

Mitigation Measures

The 2007 LRDP would have a less than significant impact related to expansive soils. Therefore, no mitigation measures are required.

4.5.4 CUMULATIVE IMPACTS AND MITIGATION

Geology and Soils Cumulative Issue Summary

Would implementation of the 2007 LRDP have a cumulatively considerable contribution to a cumulative geology and soils impact considering past, present, and probable future projects?

Cumulative Impact	Significance	LRDP Contribution
Seismic Related Hazards: Cumulative development in the region would expose a greater number of people and structures to seismic-related hazards.	Significant.	Not cumulatively considerable.
Soil Erosion and Topsoil Loss: Cumulative development at UCI and throughout the City of Irvine could result in excessive erosions; however, development projects are subject to numerous regulations to prevent soil erosion.	Less than significant	N/A
Soil and Slope Instability: Development occurring on unstable soils and slopes requires specific site preparation measures be applied to reduce hazards associated with unstable soils and slopes.	Less than significant	N/A
Expansive Soils: Development occurring on expansive soils require specific site preparation measures be applied to reduce hazards associated with expansive soils.	Less than significant	N/A

4.5.4.1 SEISMIC RELATED HAZARDS

The geographic context for the analysis of impacts resulting from seismic ground shaking is generally site-specific, rather than cumulative in nature, because each development site has unique geologic considerations that would be subject to uniform site development and construction standards. In this way, potential cumulative impacts resulting from geological, seismic, and soil conditions would be minimized on a site-by-site basis to the extent that modern construction methods and code requirements provide. Nevertheless, even though adequate study, design, and construction measures can be taken to reduce potential impacts, cumulative development in the region would contribute to the cumulative increase in the number of persons exposed to these hazards (e.g., the general seismic risk that exists throughout southern California). Therefore, there is an existing significant cumulative impact in terms of exposure of persons to seismic hazards. However, as described above and unlike some other areas within the region, the UCI campus is not located within an Earthquake Fault Zone as defined by the Alquist-Priolo Earthquake Fault Zoning Act. The Earthquake Fault Zone accounts for active faults. The UCI Campus Fault is classified as a potentially active fault. All development on campus would continue to comply with the CBC and UC Seismic Safety Policy, which requires the use of the most stringent seismic safety standards, consistent with all applicable regulations. The contribution of the 2007 LRDP to impacts associated with exposing people and property to ground shaking effects is, therefore, not considered to be cumulatively considerable.

4.5.4.2 Erosion and Topsoil Loss

The geographic context for the analysis of erosion and topsoil loss impacts is the San Diego Creek and Bonita Creek subwatersheds because impacts from erosion and loss of topsoil from site development and operation can be cumulative in effect within a watershed. This analysis accounts for all anticipated cumulative growth within the geographic area as represented by full implementation of the City of Irvine General Plan. Development at UCI and throughout the City of Irvine is subject to state and local runoff and erosion prevention requirements, including the applicable provisions of the general construction permit, BMPs, and Phases I and II of NPDES, as well as implementation of fugitive dust control measures required by the South Coast Air Quality Management District. These measures are implemented as conditions of approval for development projects and are subject to continuing enforcement. As a result, it is anticipated that cumulative impacts on the San Diego Creek and Bonita Creek subwatersheds due to runoff and erosion from cumulative development activity would be less than significant.

4.5.4.3 Soil and Slope Instability

The geographic context for the analysis of impacts of soil and slope instability on development is generally site specific. Nevertheless, when considering the impacts in a larger geographic context, all development on the UCI campus and in the surrounding jurisdictions is required to undergo analysis of the geologic and soil conditions applicable to the development site in question. The analysis provides recommendations to prepare the site for development to avoid the hazards associated with unstable soils. Typical measures to treat unstable soils involve removal and replacement with properly compacted fill, compaction grouting, or deep dynamic compaction. Because restrictions on development would be applied in the event that soil or slope conditions pose a risk to safety, it is anticipated that cumulative impacts from development on soil subject to soil instability, liquefaction, and subsidence would be less than significant.

4.5.4.4 Expansive Soils

The geographic context for the analysis of impacts of expansive soils is generally site specific. Nevertheless, when considering the impacts in a larger geographic context, all development on the UCI campus and in the surrounding jurisdictions is required to undergo analysis of the soil conditions applicable to the development site in question. The analysis provides recommendations to prepare the site for development to avoid the hazards associated with expansive soils. Typical measures to treat expansive involve removal, proper fill selection, and compaction. Because restrictions on development would be applied in the event that expansive soils are located on any development site, it is anticipated that cumulative impacts from development on expansive soils would be less than significant.

4.5.5 References

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