4.6 GEOTECHNICAL RESOURCES

4.6.1 INTRODUCTION

This section describes the existing geological setting of the project site, identifies associated regulatory requirements, evaluates potential impacts, and identifies Mitigation Measures related to implementation of the SDSU New Student Housing Project (project or proposed project). The analysis contained in this report is based on the Geotechnical Resources Technical Report for the proposed project, prepared by Dudek in February 2017 (see **Appendix G**), as well as design information provided by SDSU.

4.6.2 METHODOLOGY

The project setting was developed by reviewing available information on geology, seismicity, and soils in the project vicinity. The information review was based on a geotechnical report of the project site completed by URS (2013) (see **Appendix G**) which incorporated the results of a previous geotechnical investigation by Woodward-Clyde Consultants (1988). Information was also derived from the California Geological Survey (CGS; formerly the California Division of Mines and Geology); the U.S. Department of Agriculture, Natural Resources Conservation Service; the U.S. Geological Survey (USGS); and the City of San Diego General Plan (City of San Diego 2015).

The impact analysis assumes the proposed ~~three phases of~~ development would be constructed in compliance with the most current provisions of the California Building Code (CBC), as well as the California State University Seismic Requirements. In addition, the project would undergo an independent technical peer review regarding seismic design, in accordance with California State University Seismic Requirements (CSU 2016).

4.6.3 EXISTING CONDITIONS

This section describes the existing conditions in the project area and identifies the resources that could be affected by the proposed project.

4.6.3.1 EXISTING ENVIRONMENTAL SETTING

Regional Seismicity

Southern California is considered one of the most seismically active regions in the United States, with numerous active faults and a history of destructive earthquakes. The San Diego region, and Southern California in general, lies within the broad margins of the San Andreas Fault System, which marks the boundary between the North American and Pacific plates. San Diego is located approximately 100 miles west of the San Andreas Fault, the predominate earthquake hazard in the state, but is also close to several other large active faults capable of producing severe ground shaking. Faults influencing local seismicity include the Elsinore, San Jacinto, Coronado Bank, San Diego Trough, San Clemente, and La Nacion. In addition, the downtown area of San Diego is underlain by the active Rose Canyon Fault Zone (City of San Diego 2015). In comparison to other Southern California areas, San Diego County has sparse seismicity. However, since 1984, earthquake activity in the County has doubled over that of the preceding 50 years. The project area could experience relatively strong ground shaking due to the presence of these nearby and distant faults (San Diego County Office of Emergency Services 2017, Appendix A).

Seismic Hazards

<u>Liquefaction</u>

Liquefaction is the phenomenon in which loose, saturated, granular soils lose strength due to excess pore water pressure buildup during an earthquake. Liquefaction is usually manifested by the formation of boils and mud-spouts at the ground surface, by seepage of water through ground cracks, or in some cases by the development of quick-sand-like conditions. Where the latter occurs, structures or equipment may sink substantially into the ground, i.e., dynamic settlement, or tilt excessively; lightweight structures may float upwards; and foundations may displace vertically or laterally, causing structural failures. The phenomenon of liquefaction generally adds to the damages that would otherwise be caused by strong ground motions alone. Lateral spreading typically occurs in association with liquefaction. Lateral spreading occurs when liquefaction of a subsurface layer causes the mass to flow down slope, moving blocks of ground at the surface. During a liquefaction event, the soils tend to spread laterally toward the free face of the slope.

State of California Liquefaction Hazard Zones have not been established for San Diego County. To date, the California Geological Survey has created liquefaction hazard maps for USGS quadrangle maps in the greater Los Angeles and San Francisco Bay areas (California Geological Society 2007). Based on site-specific geotechnical investigations (see Appendix G), the formational soils on the site (i.e., Lindavista Formation, Mission Valley Formation, Stadium Conglomerate, as discussed below) are dense and there is no apparent permanent groundwater table within expected grading limits. As a result, the formational soils do not have a potential for liquefaction. However, sandy surficial overburden soils do have a potential for liquefaction in a saturated state.

Peak Ground Acceleration

In 2008, the USGS produced updated seismic hazard maps for the continental United States, including peak ground accelerations and spectral accelerations for a range of return periods and exceedance probabilities (USGS 2008). Based on these maps, there is a 10% probability that on-site peak ground accelerations will exceed 0.16g to 0.21g (percent of gravity) over the next 50 years.

Local Faults

The CGS classifies faults as either active, potentially active, or inactive, according to the Alquist-Priolo Special Studies Zone Act of 1972. A fault that has exhibited surface displacement within the Holocene Epoch (the last 11,000 years) is defined as active by the California Geological Survey. A fault that has exhibited surface displacement during the Pleistocene Epoch (which began about 1.6 million years ago and ended about 11,000 years ago) is defined as potentially active. Pre-Pleistocene faults are considered inactive. The California Geological Survey has established Alquist-Priolo Special Study Zones around faults identified by the State Geologist as being active. The Alquist-Priolo Special Studies Zone Act limits development along the surface trace of active faults to reduce the potential for structural damage and/or injury due to fault rupture (CGS 2007, CGS 2010).

The closest Alquist-Priolo Special Study Zone to the project site is located along the Rose Canyon Fault Zone, approximately 6 miles west of the project site (**Figure 4.6-1, Regional Fault and Epicenter Map**) (CGS 2015). The Rose Canyon Fault Zone represents the most significant seismic hazard to the San Diego area. This fault zone is comprised of a complex set of fault segments that strike north-northwest through San Diego (Rockwell 2010, Kennedy and Welday 1980). Although San Diego is generally considered an area of low seismicity, the historical seismic record indicates many seismic events might be associated with the Rose Canyon Fault Zone. Among other potential earthquakes in the Rose Canyon Fault Zone, a series of earthquakes in 1985 with magnitudes up to 4.2 were attributed to a portion of the fault zone that traverses San Diego Bay. Recent studies of the geologic history of the Rose Canyon Fault Zone indicate that it is capable of producing a moderate to large magnitude earthquake (Appendix A in CDMG 1993). The largest credible earthquake predicted for the coastal and metropolitan areas of San Diego is a ~~magnitude~~ M7.2 (moment magnitude)[1] on the Rose Canyon Fault Zone (San Diego County OES 2017). Due to the proximity of the fault to the City of San Diego, a moderately large earthquake on this fault could potentially do significant damage to the City and surroundings, both in terms of shaking and ground rupture within the fault zone (Rockwell 2010).

The northern terminus of the north-trending La Nacion Fault Zone is located approximately 2,000 feet southwest of the site, at the closest point (**Figure 4.6-1, Regional Fault and Epicenter Map**). This fault is considered potentially active, as there is evidence of Pleistocene Epoch fault movement, but not Holocene Epoch movement. Although not proven definitively active, the La Nacion Fault is structurally tied to the Rose Canyon Fault Zone. One possible reason that geologists have not found definitive proof of its Holocene Epoch activity is that the movement of the fault is expected to be small on an event-by-event basis, so its expression in the active Holocene Epoch soil could easily be obscured. Similar to the Rose Canyon Fault, the La Nacion Fault is capable of producing a moderate to large magnitude earthquake. The largest credible earthquake predicted for the La Nacion Fault is a ~~magnitude~~ M6.2 to M6.6 (moment magnitude) (see Appendix A, San Diego County OES 2017, Rockwell 2010, CGS 2010, Kennedy and Tan 2008, CDMG 1975).

Topography

The project site lies on the southern flanks of Alvarado Canyon, a major westerly draining tributary to the San Diego River. The drainage is incised into a Pleistocene-age mesa surface that is typical of the western portions of San Diego County. The site encompasses two asphalt paved parking lots and adjoining open hillsides, located near the western limits of the SDSU campus. The western parking lot (Parking Lot 10A) is a gently sloping fill pad, constructed on the steep natural hillside north of Remington Road. A fill slope, inclined at 1.25 to 1.5 (horizontal to vertical) and up to 30 feet in height, extends from the edge of the fill pad onto the canyon sides below (**Figure 4.6-2, Project Site Topography**). Current site development and grading codes require fill slopes to be formed at 2 to 1 inclination (**Appendix G**), which is less steep than the existing fill slope.

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[1] Moment magnitude is more effective for large earthquakes than the Richter scale because moment magnitude uses more variables to calculate the energy released during the earthquake (Incorporated Research Institutions for Seismology (IRS) 2017).

The eastern parking lot (Parking Lot 9) is a gently sloping cut/fill pad, which is bound on the north by a downward fill slope inclined at approximately 1.5 to 1 for most of its length. The fill slope ranges from approximately 9 to 40 feet in height. The eastern, western, and southern edges of the lot are bound by cut and cut/fill slopes that are inclined at a maximum of 1.5 to 1 and are up to 15 feet in height. The hillsides below the fill slopes are generally in a natural condition, although a thin veneer of fill and/or scattered debris is locally present. Natural slope inclinations are locally up to 1.5 to 1 (see **Appendix G**).

Landslides/Slope Stability

The majority of the geologic formations on site are massively bedded (i.e., there is no distinct bedding) and the regional overall dip of the geologic formations in this area is less than five degrees to the south or southwest. Based on previous site reconnaissance and field explorations, no landslides were observed on site. Similarly, no landslides have been mapped on or adjacent to the site in reviewed geologic literature (see **Appendix G**).

The existing fill slopes at the north edge of both existing parking lots were formed at inclinations ranging from 1.25 to 1.5:1 (horizontal to vertical), which do not meet current site development and grading codes. It is also unlikely that proper grading practices, such as toe of slope keyways and intermediate benches, were used to form the slopes. Therefore, these slopes may be prone to surficial type failures (see **Appendix G**).

Stratigraphy

The project site is underlain by a series of Eocene-age (which began 56 million years ago and ended 33.9 million years ago) sedimentary deposits, including the Lindavista Formation, Mission Valley Formation, and the Stadium Conglomerate. These formational materials are capped by surficial soils, alluvium/colluvium, and multiple generation of fill soils that have provided level surfaces for the development of the site for parking and Chapultepec Hall.

<u>Soils, Colluvium, and Alluvium</u>

Based on a field investigation by URS (2013), surficial overburden soils at the project site include topsoils, residual clay, slopewash, and alluvium. Topsoils on the natural hillsides consist of up to one foot of clayey sand and sandy clay, with some local gravels. Residual clay soils, consisting of up to 2.5 feet of sandy lean to fat clays, are present below the topsoils or are exposed at the surface over most of the site. Remnants of the residual clay soil layer exist directly beneath the fill soils in some areas.

Colluvium, or natural slopewash soils, cover the portions of the site not underlain by topsoil and residual clay. The slopewash soils, which consist of porous sandy clay, have been observed up to 3.5 feet thick. Alluvial soils are confined to the drainage channels on the site, including the steep hillside drainages and the canyon drainage at the base of the canyon slopes. These alluvial deposits consist primarily of clayey, sandy gravels (Appendix A).

In addition, the U.S. Department of Agriculture, Natural Resources Conservation Service (USDA 2016) has mapped the surficial soils at the project site. The generally flat to gently sloping areas have been mapped as Olivenhain-Urban land complex, which consist of cobbly loam that is well-drained, forms on marine terraces of 2% to 9% slopes, and has primarily been reworked as artificial fill material. The steep canyon area soils consist of Olivenhain cobbly loam that is similarly well drained and occurs on 30% to 50% slopes.

Artificial Fill

Based on geotechnical investigations completed for the project site vicinity by URS (2013, provided as Appendix G to this report) and Woodward-Clyde Consultants (1988, included in **Appendix G**), the western parking lot (Parking Lot 10A) (**Figure 4.6-2, Project Site Topography**) is underlain entirely by fill soils, comprised primarily of clayey sand, gravel, cobbles, and rubble. The fill soil appears to extend to an estimated maximum depth of approximately 15 feet beneath the north-central edge of the lot. As to the eastern parking lot (Parking Lot 9), fill soils, consisting of lean to fat clays, gravels, silty sand, and clayey sand, underlie the northern half of the east parking lot and all of the extreme eastern end of the lot. The fill extends off site into the apartment property to the north and may be up to 30 feet thick, with the deepest areas being near the corner of the north property line. No records were available indicating that the fill was compacted or placed under engineering observation; therefore, the fill should be considered non-structural and not suitable for the support of building loads.

Lindavista Formation

Although not exposed at the surface or encountered in subsurface investigations, based on topographic indications and general geologic mapping in the area, natural formational soils above an elevation of approximately 430 feet at the site are assigned to the Lindavista Formation. Soils of this unit generally consist of dense, silty to clayey sand, with gravel. Large cemented zones are common within this formation (see **Appendix G**).

<u>Mission Valley Formation</u>

The Mission Valley Formation beneath the site consists of dense to very dense, layered sedimentary deposits, comprised of silty and clayey sandstone, with some gravel and cobble layers. Lenses of sandy clay and localized cemented layers are also present within this formation. These deposits are present beneath the variable thickness of artificial fill deposits (see **Appendix G**).

<u>Stadium Conglomerate</u>

The Stadium Conglomerate underlies the Mission Valley Formation at variable depths beneath the site and forms the lower hillsides in the site area, below an elevation of about 375 feet. This geologic unit characteristically consists of a dense cobble conglomerate with a silty to clayey sand matrix. The contact with the overlying Mission Valley Formation is gradational (see **Appendix G**).

Groundwater

Based on geotechnical investigations completed for the project site vicinity by URS (2013, provided in **Appendix G**) and Woodward-Clyde Consultants (1988, included in **Appendix G**), no groundwater, seeps, or springs were observed during site investigations at the project site. However, the occurrence of groundwater can fluctuate seasonally and with changes in land use.

4.6.4 RELEVANT PLANS, POLICIES, AND ORDINANCES

This section describes the applicable regulatory plans, policies, and ordinances related to geotechnical resources for the proposed project.

Federal

There are no federal regulations directly applicable to geotechnical conditions at the project site. Nonetheless, installation of underground infrastructure/utility lines must comply with national industry standards specific to the type of utility (e.g., National Clay Pipe Institute for sewers, American Water Works Association for water lines), and the discharge of contaminants must be controlled through the National Pollutant Discharge Elimination System (NPDES) permitting program for management of construction and municipal stormwater runoff. These standards contain specifications for installation, design, and maintenance to reflect site-specific geologic and soils conditions.

State

The primary state regulations protecting the public from geologic and seismic hazards are contained in the Seismic Hazards Mapping Act, the California Building Code, and the State Earthquake Protection Law. The California State University (CSU) Office of the Chancellor has established additional state requirements.

<u>Alquist-Priolo Earthquake Fault Zoning Act of 1972</u>

In response to the 1971 San Fernando Earthquake, which damaged numerous homes, commercial buildings, and other structures, California passed the Alquist-Priolo Earthquake Fault Zoning Act. The goal of the act is to avoid or reduce damage to structures like that caused by the San Fernando Earthquake by preventing the construction of buildings on active faults.

In accordance with the law, the CGS maps active faults and the surrounding earthquake fault zones for all affected areas. Any project that involves the construction of buildings or structures for human occupancy, such as residential housing, is subject to review under this law. The intent of the act is to ensure public safety by prohibiting the siting of most structures for human occupancy across traces of active faults that constitute a hazard to structures from surface faulting or fault creep. Structures for human occupancy must be constructed at least 50 feet from any active fault.

Locations of Earthquake Fault Zone boundaries are controlled by the position of fault traces shown on the Official Maps of Earthquake Fault Zones. Zone boundaries have been drawn approximately 500 feet away from major active faults and about 200 to 300 feet away from well-defined, minor faults, to accommodate imprecise locations of the faults and possible existence of active branches.

<u>Seismic Hazards Mapping Act</u>

The Seismic Hazards Mapping Act, passed by the California legislature in 1990, addresses earthquake hazards from non-surface fault rupture, including liquefaction and seismically induced landslides. The act established a mapping program for areas that have the potential for liquefaction, strong ground shaking, or other earthquake and geologic hazards. To date, the California Geological Survey has only created liquefaction hazard maps for USGS quadrangle maps in the greater Los Angeles and San Francisco Bay areas (California Geological Survey 2007).

<u>California Building Code</u>

The state regulations protecting structures from geo-seismic hazards are contained in the California Code of Regulations, Title 24, Part 2 (the California Building Code), which is updated on a triennial basis. These regulations apply to public and private buildings in the state. Until January 1, 2008, the California Building Code was based on the then-current Uniform Building Code and contained additions, amendments, and repeals specific to building conditions and structural requirements of the State of California. The 2016 California Building Code, effective January 1, 2017, is based on the current (2015) International Building Code and enhances the sections dealing with existing structures. Seismic-resistant construction design is required to meet more stringent technical standards than those set by previous versions of the California Building Code.

Chapter 16 and 16A of the 2016 California Building Code include structural design requirements governing seismically resistant construction, including (but not limited to) factors and coefficients used to establish seismic site class and seismic occupancy category for the soil/rock at the building location and the proposed building design. Chapters 18 and 18A include (but are not limited to) the requirements for foundation and soil investigations (Sections 1803 and 1803A); excavation, grading, and fill (Sections 1804 and 1804A); damp-proofing and water-proofing (Sections 1805 and 1805A); allowable load bearing values of soils (Sections 1806 and 1806A); the design of foundation walls, retaining walls, embedded posts and poles (Sections 1807 and 1807A), and foundations (Sections 1808 and 1808A); and design of shallow foundations (Sections 1809 and 1809A) and deep foundations (Sections 1810 and 1810A). Chapter 33 of the 2016 California Building Code includes (but is not limited to) requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes (Section 3304).

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

As indicated above, the California Building Code is updated and revised every 3 years. The 2019 version of the California Building Code will be effective January 1, 2020. It is anticipated that future development on the campus would use the most current California Building Code at the time of specific project building activity.

State Earthquake Protection Law

The State Earthquake Protection Law (California Health and Safety Code section 19100 et seq.) requires that structures be designed and constructed to resist stresses produced by lateral forces caused by wind and earthquakes, as provided in the California Building Code. Chapter 16 of the California Building Code sets forth specific minimum seismic safety and structural design requirements, requires a site-specific geotechnical study to address seismic issues, and identifies seismic factors that must be considered in structural design. Because the project site is not located within an Alquist-Priolo Earthquake Fault Zone, as noted below, no special provisions would be required for project development related to fault rupture.

CSU Seismic Requirements

The CSU Seismic Requirements (CSU 2016), prepared by the CSU Office of the Chancellor, include specific requirements for the construction of new buildings and the rehabilitation of existing buildings to ensure that all CSU buildings provide an acceptable level of earthquake safety, per the CBC. These seismic requirements set forth procedures to follow in order to manage current construction programs and limit future seismic risk to acceptable levels. All new construction is required to meet the life, safety, and damage objectives of the California Building Code, while the standard for rehabilitating existing structures is that reasonable life safety protection is provided, consistent with the requirement for new structures. All approved plans for construction shall have a stamp that verifies the design is in compliance with appropriate CSU Seismic Requirements. The stamp shall indicate that new projects have been reviewed consistent with Chapter 16 of the California Building Code; that renovation projects have been reviewed consistent with Chapter 34 of the California Building Code; and that new projects are either compliant, below all application thresholds, or are waived for specific reasons.

California Porter-Cologne Water Quality Control Act

Since 1973, the California State Water Resources Control Board and its nine Regional Water Quality Control Boards (RWQCBs) have been delegated the responsibility for administering permitted discharge into the waters of California. The Porter-Cologne Water Quality Act (California Water Code section 13000 et seq.; California Code of Regulations, Title 23, Chapter 3, Chapter 15) provides a comprehensive water-quality management system for the protection of California waters. Under the Act, "any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the waters of the state" must file a report of the discharge with the appropriate RWQCB. Pursuant to the Act, the RWQCB may then prescribe "waste discharge requirements" that add conditions related to control of the discharge. Porter-Cologne defines "waste" broadly, and the term has been applied to a diverse array of materials, including non-point source pollution. When regulating discharges that are included in the Federal Clean Water Act, the state essentially treats Waste Discharge Requirements and NPDES as a single permitting vehicle. In April 1991, the State Water Resources Control Board and other state environmental agencies were incorporated into the California Environmental Protection Agency.

The Porter-Cologne Water Quality Control Act is the primary state regulation addressing water quality and waste discharges on land. Permitted discharges must be in compliance with the regional Basin Plan that was developed by the San Diego RWQCB (2016), which includes San Diego County and the SDSU campus. Each RWQCB implements the Basin Plan to ensure that projects consider regional beneficial uses, water quality objectives, and water quality problems.

The RWQCB regulates urban runoff discharges under the NPDES permit regulations. NPDES permitting requirements cover runoff discharged from point, e.g., industrial outfall discharges, and nonpoint, e.g., stormwater runoff, sources. The RWQCB implements the NPDES program by issuing construction and industrial discharge permits.

Under the NPDES permit regulations, Best Management Practices (BMPs) are required as part of a Stormwater Pollution Prevention Plan (SWPPP). The Environmental Protection Agency defines BMPs as "schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of Waters of the United States." BMPs include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage" (40 CFR 122.2).

Local

As a state entity, SDSU is not subject to local government planning, such as the City of San Diego General Plan. Accordingly, because neither the general plan nor any other local land use plans or ordinances are applicable to SDSU, the summary of the City land use documents presented in this section and analyzed later in this chapter is provided for informational purposes only.

<u>City of San Diego General Plan</u>

Section Q, Seismic Safety, of the Public Facilities, Services and Safety Element of the General Plan provides objectives, policies, and programs regarding seismic safety, including the following:

Policy PF-Q.1. Protect public health and safety through the application of effective seismic, geologic, and structural considerations.

a. Ensure that current and future community planning and other specific land use planning studies continue to include consideration of seismic and other geologic hazards. This information should be disclosed, when applicable, in the California Environmental Quality Act document accompanying a discretionary action.

b. Maintain updated citywide maps showing faults, geologic hazards, and land use capabilities, and related studies used to determine suitable land uses.

c. Require the submission of geologic and seismic reports, as well as soils engineering reports, in relation to applications for land development permits whenever seismic or geologic problems are suspected.

d. Utilize the findings of a beach and bluff erosion survey to determine the appropriate rate and amount of coastline modification permissible in the City.

e. Coordinate with other jurisdictions to establish and maintain a geologic "data bank" for the San Diego area.

f. Regularly review local lifeline utility systems to ascertain their vulnerability to disruption caused by seismic or geologic hazards and implement measures to reduce any vulnerability.

g. Adhere to state laws pertaining to seismic and geologic hazards.

Policy PF-Q.2. Maintain or improve integrity of structures to protect residents and preserve communities.

a. Abate structures that present seismic or structural hazards with consideration of the desirability of preserving historical and unique structures and their architectural appendages, special geologic and soils hazards, and the socio-economic consequences of the attendant relocation and housing programs.

b. Continue to consult with qualified geologists and seismologists to review geologic and seismic studies submitted to the City as project requirements.

c. Support legislation that would empower local governing bodies to require structural inspections for all existing pre-Riley Act (1933) buildings, and any necessary remedial work to be completed within a reasonable time.

4.6.5 THRESHOLDS OF SIGNIFICANCE

The significance criteria used to evaluate the project impacts to geology and soils are based on Appendix G of the CEQA Guidelines. According to Appendix G of the CEQA Guidelines, a significant impact related to geology and soils would occur if the project would:

1. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
   a. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area based on other substantial evidence of as known fault. Refer to Division of Mines and Geology Special Publication 42.
   b. Strong seismic ground shaking.
   c. Seismic-related ground failure, including liquefaction.
   d. Landslides.
2. Result in substantial soil erosion or the loss of topsoil.
3. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
4. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.
5. Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

4.6.6 IMPACTS ANALYSIS

Following issuance of the Notice of Preparation (NOP) for the proposed projects, CSU/SDSU received comment letters from public and private entities related to geotechnical resources. These comment letters were concerning safety issues related to the project's close proximity to existing faults, and resulting potential hazards that could occur to land or property both on and off-site due to an earthquake. The analysis presented below addresses each of these topics.

Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: (i) 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 based on other substantial evidence of as known fault. (Refer to Division of Mines and Geology Special Publication 42); (ii) strong seismic ground shaking; (iii) seismic-related ground failure, including liquefaction; or (iv) landslides?

~~*Phases I, II, and III*~~

The closest Alquist-Priolo Special Study Zone to the project site is located along the Rose Canyon Fault Zone, approximately 6 miles west of the project site (**Figure 4.6-1, Regional Fault and Epicenter Map**). No other known active faults are located on or near the project site. Alquist-Priolo Special Study Zone boundaries are controlled by the position of fault traces shown on the Official Maps of Earthquake Fault Zones. Zone boundaries have been drawn approximately 500 feet away from major active faults and about 200 to 300 feet away from well-defined, minor faults, to accommodate imprecise locations of the faults and possible existence of active branches. Surface fault rupture is not anticipated beyond the boundaries of these fault zones. As a result, surface fault rupture is not anticipated at the site and the project would not expose people or structures to potential adverse effects involving rupture of an earthquake fault.

The Rose Canyon Fault Zone represents the most significant seismic hazard to the San Diego area. Although San Diego is generally considered an area of low seismicity, the historical seismic record indicates many seismic events might be associated with the Rose Canyon Fault Zone. Recent studies of the geologic history of the Rose Canyon Fault Zone indicate it is capable of producing a moderate to large magnitude earthquake. Due to the proximity of the fault to the City of San Diego, a moderately large earthquake on this fault could potentially do significant damage to the City and surroundings.

The northern terminus of the La Nacion Fault Zone is located approximately 2,000 feet southwest of the site, at the closest point (see **Figure 4.6-1**). Although considered potentially active rather than active, the La Nacion Fault is structurally tied to the Rose Canyon Fault Zone and therefore is capable of producing a moderate to large magnitude earthquake. Such an earthquake could cause severe ground shaking, slope failure, lateral spreading, and differential settlement, which in turn could severely damage foundations, utilities, and associated infrastructure.

The potential for liquefaction in the Lindavista Formation, Mission Valley Formation, and Stadium Conglomerate on-site soils is low. However, there is a potential for liquefaction in the surficial overburden soils. In the absence of proper remedial measures to abate the liquefaction potential, strong seismically induced ground movement could result in distress to proposed foundations, utilities, and associated infrastructure.

The project would be designed in accordance with the CSU Seismic Requirements (CSU 2016), which include specific requirements for the construction of new buildings, to ensure that all CSU buildings provide an acceptable level of earthquake safety for students, employees, and the public, per the California Building Code. These seismic requirements set forth procedures to follow in order to manage current construction programs and limit future seismic risk to acceptable levels. CSU has established campus-specific seismic ground motions parameters that supersede California Building Code values and implement a conservative evaluation on California Building Code Structural Risk Category assignments.

The CSU Seismic Requirements require that all major capital building projects, such as the proposed project, be peer reviewed. This process starts at project inception and continues until construction completion. Peer review concurrence letters are typically issued at completion of the Schematic and Construction Documents Phases and during the course of construction on deferred submittals that have a seismic component. Resolution of outstanding Seismic Review Board peer review comments is required before start of construction, and resolution of Seismic Review Board construction phase submittals is required prior to occupancy. In addition, the project would be submitted to the CSU Architecture and Engineering, Building Code Plan Check Review process. All approved plans for construction would include a stamp that verifies the design would be completed in compliance with appropriate CSU Seismic Requirements. The stamp would also indicate that the project has been reviewed consistent with Chapter 16 of the California Building Code and the State Earthquake Protection Law.

Compliance with the CSU Seismic Requirements includes completion of a project-specific geotechnical investigation, which provides site-specific design-, grading-, and construction-related recommendations. Woodward-Clyde Consultants (1988, included in **Appendix G**) completed a geotechnical investigation in association with the existing Chapultepec Hall and adjacent one-story multi-purpose building. The geotechnical report provided feasibility of construction and tentative design recommendations regarding geotechnical engineering. The subsequent geotechnical investigation by URS (2013, **Appendix G**) was completed primarily to further delineate the artificial fill deposits and evaluate the overall feasibility of developing the site from a geotechnical standpoint. The URS report concluded that the site is geotechnically suitable for proposed project development; however, the report is preliminary and not comprehensive with respect to grading and construction of the project. In the absence of a more comprehensive geotechnical investigation, similar to the 1988 Woodward-Clyde Consultants report that included geotechnical engineering recommendations specific to the preliminary design of the development, the project could expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death. As a result, impacts are considered potentially significant and mitigation is provided (see Mitigation Measure (MM) **MM-GEO-1** in **Section 4.6.7, Mitigation Measures**).

Would the project result in substantial soil erosion or the loss of topsoil?

~~*Phases I, II, and III*~~

Proposed grading and construction would result in removal of vegetation and exposure of soils to erosion, which in turn could result in sedimentation of on-site drainages and downstream Alvarado Creek and the San Diego River. The effects of erosion would be intensified by the steepness of the existing slopes. Increased rate of runoff would increase the amount of sediment transported downslope and would create rilling and gullying, which in turn would increase the runoff velocity. Short-term erosion could occur during grading and construction and long-term erosion could occur in areas not paved during construction. On-site drainages and downstream water bodies would be particularly susceptible to erosion-induced siltation during the rainy season, i.e., October 15 to April 15. Upon completion of grading and construction, landscaping would be established to minimize long-term erosion of exposed soil areas. In the absence of erosion control features during grading and construction, as well as establishment of new vegetation, project related erosional impacts would be considered potentially significant.

However, because the project site is greater than 1 acre, grading and construction would be completed in accordance with a SWPPP, as mandated by a required NPDES permit for construction. In accordance with the SWPPP, the applicant would implement BMPs and monitor and maintain stormwater pollution control facilities identified in the SWPPP, in a manner consistent with the provisions of the Clean Water Act (NPDES Program).

Stormwater management protection measures and wet weather measures would be designed by a California registered, Qualified SWPPP Developer. In addition, a California registered Qualified SWPPP Practitioner would oversee and monitor construction and operational BMPs and stormwater management, in accordance with the State General Construction Permit and the San Diego RWQCB. SWPPPs typically require the following preventative measures:

1. Implement temporary BMP mitigation measures:
    - Use silt fences, sandbags, and straw wattles;

- Use temporary sediment basins and check dams;
- Cover temporary stockpiled soil with Visqueen plastic during rain events; and
- Use temporary BMPs outlined in the California Stormwater Quality Association Best Management Practice Handbook.

2. Implement permanent erosion and sediment control measures:
   - Minimize grading, clearing, and grubbing to preserve existing vegetation;
   - Use mulches and hydroseed, free of invasive plants, to protect exposed soils;
   - Use geotextiles and mats to stabilize soils;
   - Use drainage swales and dissipation devices; and
   - Use erosion control measures outlined in the California Stormwater Quality Association Best Management Practice Handbook.
3. Implement tracking control BMPs to reduce tracking sediment off site.
   - Use stabilized construction entrance and exit with steel shakers;
   - Use tire wash areas; and
   - Use tracking control BMPs outlined in the California Stormwater Quality Association Best Management Practice Handbook.

Compliance with the federal- and state-mandated erosional control measures described above would reduce erosion such that any potential impacts would be **less than significant**.

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

~~*Phases I, II, and III*~~

No landslides have been observed or mapped on or in the vicinity of the project site. Bedding is massive (i.e., there is no distinct bedding) and relatively flat; therefore, the potential for deep-seated landslides is low. However, the existing fill slope~~s~~ at the north edge of ~~both existing~~the parking lot~~s~~ (**Figure 4.6-2, Project Site Topography**) ~~were~~ was formed at an inclination~~s~~ ~~ranging from 1.25 to~~of 1.5:1 (horizontal to vertical), which does not meet City of San Diego site development and grading codes that ~~, which~~ are used for reference purposes. It is also unlikely that proper grading practices, such as toe of slope keyways and intermediate benches, were used to form the slopes. Therefore, these this slopes may be prone to surficial type failures.

Based on a review of pre-grading topography and borings drilled on the site, the western parking lot (Parking Lot 10A) is underlain entirely by fill soils, comprised primarily of clayey sand, gravel, cobbles, and rubble, with variable engineering characteristics. The fill soil appears to extend to an estimated maximum depth of approximately 15 feet beneath the north-central edge of the lot. As to the eastern parking lot (Parking Lot 9), fill soils, consisting of lean to fat clays, gravels, silty sand, and clayey sand, underlie the northern half of Parking Lot 9 and all of the extreme eastern end of the lot. The fill extends off site into the apartment property to the north and may be up to 30 feet thick, with the deepest areas being near the corner of the north property line. The fill is clay-rich and has poor drainage characteristics, low shear strengths and R-values, and a high expansion potential. No records were available indicating that the fill under either parking lot was compacted or placed under engineering observation; therefore, the fill should be considered non-structural and not suitable for the support of proposed building loads. The project site is geotechnically suitable for the proposed development; however, substantial remedial grading and/or deep foundations would be needed to develop the site to provide long-term performance of the new buildings and associated exterior surface improvements. Because the project is located on a geologic unit that is potentially unstable, or would potentially become unstable as a result of the project, impacts are considered potentially significant and mitigation is provided (see **MM-GEO-1** and **MM-GEO-**2 in **Section 4.6.7, Mitigation Measures**).

Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

Phases I, II, and IIIExpansive soils primarily consist of clayey soils that have a potential for significant volume changes (i.e., shrinking and swelling) with moisture fluctuations, which in turn can cause building slabs to crack and buckle. Other expansive soil-related problems include poor drainage and poor establishment of vegetation. On-site fill soils consist of lean to fat clays, gravels, silty sand, and clayey sand, which have poor drainage characteristics, low shear strengths and R-values, and a high expansion potential. Construction of structure foundations, residential courtyard and park patios, pedestrian walkways, storm drains, and other related infrastructure would be subject to substantial risk of property damage because of construction on expansive soils. Therefore, impacts are considered potentially significant and mitigation is provided (see **MM-GEO-1** and **MM-GEO-**2 in **Section 4.6.75, Mitigation Measures**).

Would the project 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?

~~*Phases I, II, and III*~~

Septic tanks or alternative waste water disposal systems would not be constructed in association with the proposed project; therefore, **no impacts** would occur.

Would the project have impacts that are individually limited, but cumulatively considerable (i.e., the incremental effects of the project are considerable when viewed in connection with the effects of past projects, the effects of other projects, and the effects of probable future projects).

~~*Phases I, II, and III*~~

The effects of ~~Phases I, II, and III of~~ the proposed project, when considered with other projects in the region, would not result in a cumulative impact associated with geotechnical resources. Following mitigation, geotechnical impacts associated with the proposed project would be mitigated to less-than-significant levels. Cumulative impacts related to seismically induced ground shaking and associated ground failure, as well as slope failures and other impacts, for present and probable future projects near the proposed project, would be similar to what is described for project-specific impacts. The impacts would be addressed on a project-by-project basis through compliance with existing building codes and any site-specific Mitigation Measures for individual projects, including site-specific geotechnical investigations and associated reports. All Mitigation Measures are based on conventional techniques and standards within the industry. All geotechnical hazards can be mitigated to acceptable levels by licensed professionals who would provide guidelines and specifications to mitigate and remediate the specific hazard. Therefore, cumulative impacts relating to geotechnical hazards would be **less than significant.**

4.6.7 MITIGATION MEASURES

The following Mitigation Measures would reduce potential geology- and soils-related impacts by ensuring that the project is constructed such that geologic hazards would not adversely impact the environment, proposed structures, or persons living and working within the structures or in the project site vicinity. Implementation of the following Mitigation Measures would reduce impacts to a less-than-significant level.

MM-GEO-1 Prior to issuance of grading or construction permits for ~~any phase of~~ the project, a Registered Civil Engineer and Certified Engineering Geologist shall complete a final geotechnical investigation specific to the preliminary design of the proposed development. The final geotechnical investigation shall include, but not be limited to, an estimation of both vertical and horizontal anticipated peak ground accelerations, as well as an updated slope stability analysis. The results shall be included in a final geotechnical report that shall be submitted to the California State University Office of the Chancellor for review and approval. The report shall provide conclusions and design recommendations including, but not limited to, slope stability, grading and earthwork, types and depths of foundations, allowable soil bearing pressures, settlement, expansive soils, design pressures for retaining walls, and corrosivity and sulfate content of soil samples.

All geotechnical recommendations provided in the final report shall be followed during grading and construction at the project site. The final geotechnical report shall conform to all applicable laws, regulations, and requirements, including, but not limited to, all of the applicable California State University Seismic Requirements (CSU 2016).

MM-GEO-2 Based on the preliminary geotechnical investigation completed by URS (2013), the following measures shall be implemented:

a. Surficial overburden soils, including soils, alluvium, and colluvium, shall be overexcavated and recompacted to reduce the potential for liquefaction.

b. The existing fill material shall be removed and replaced with fill more suitable for project construction, including better drainage characteristics, higher shear strengths and R-values, and a lower expansion and compressibility potential.

c. Foundations that support new campus housing should extend into materials with low expansion and compressibility characteristics.

d. Surficial soils and alluvium left in place beneath existing fill, primarily in existing drainages, shall be removed to prevent elastic settlement associated with structure loading.

e. New fill slopes shall be constructed in conformance with current site development and grading codes, including slope inclinations and construction of slope keyways and intermediate benches.

4.6.8 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of the above Mitigation Measures would reduce potential impacts from ~~Phases I, II, and III of~~ the proposed project to less-than-significant levels. Implementation of MM-GEO-1, completion of a comprehensive, final geotechnical report that includes specific grading and construction recommendations based on the preliminary project design, would reduce potential geohazard impacts to less-than-significant levels. Similarly, implementation of MM-GEO-2, completion of geotechnical Mitigation Measures based on conclusions of the 2013 URS geotechnical report, would reduce potential geohazard impacts to **less-than-significant** levels.

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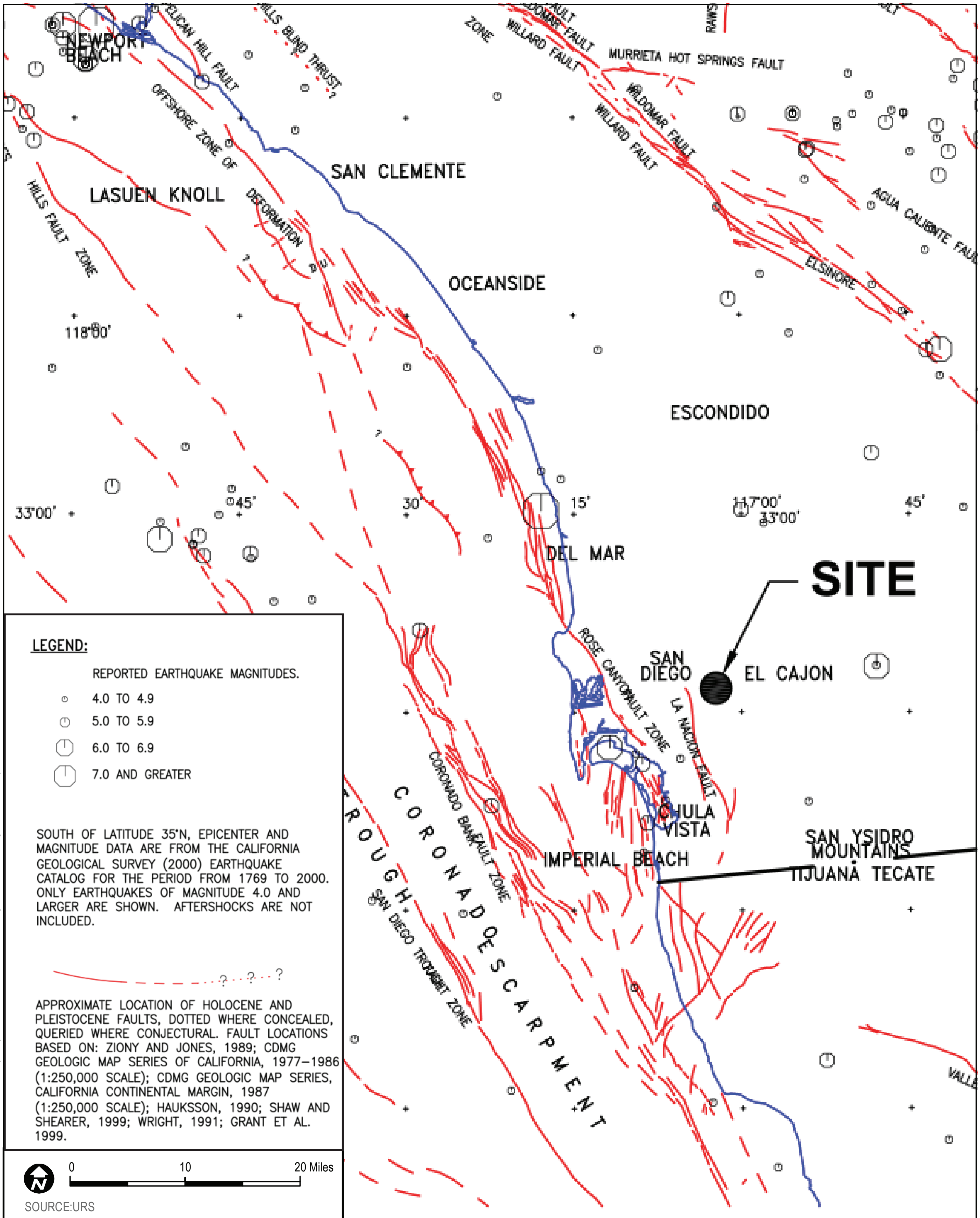

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Figure 4.6-1
Regional Fault and Epicenter Map

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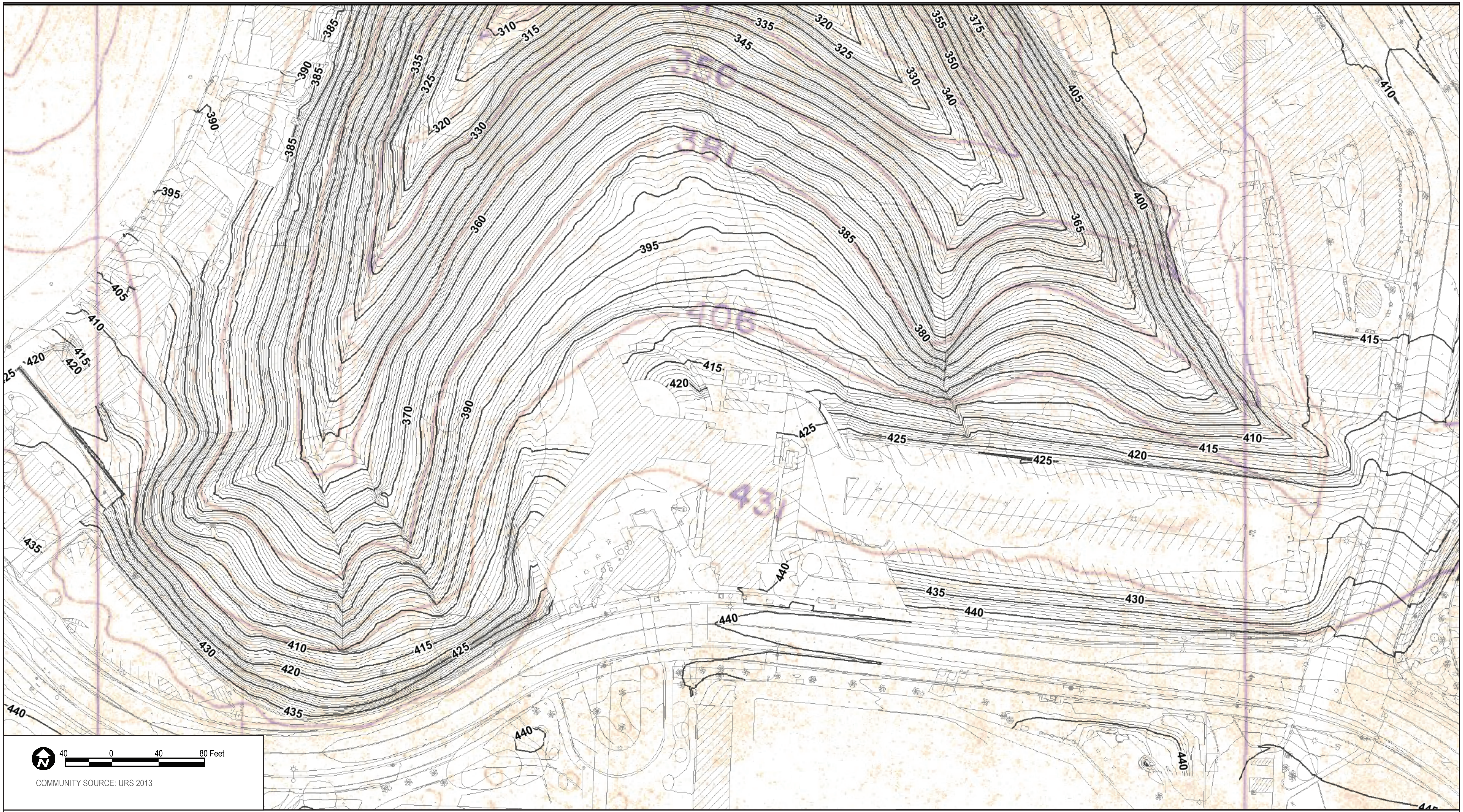

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Figure 4.6-2
Project Site Topography

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