APPENDIX G

Geotechnical Resources Technical Report

DRAFT

Geotechnical Resources Technical Report for the SDSU New Student Housing Project

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SUMMARY OF FINDINGS

Based on geotechnical investigations completed for the project site vicinity by URS (2013, provided as Appendix A to this report) and Woodward-Clyde Consultants (1988, included in Appendix A), the site is geotechnically suitable for the proposed development. However, relatively substantial remedial grading may be required to develop the site, to provide suitable long-term performance of new buildings and associated improvements. No active faults are located on or in the vicinity of the project site; therefore, surface fault rupture is not anticipated at the site.

No landslides have been observed or mapped on or in the vicinity of the project site, and the potential for deep-seated landslides is low. However, the potential for surficial slope failures is present due to oversteepened fill slopes. The fill material 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 nonstructural and not suitable for the support of proposed building loads.

There is a potential for liquefaction in the surficial overburden soils; however, this hazard can be abated through overexcavation and recompaction of these materials. The potential for liquefaction in the underlying formational soils is low. Short-term erosion can be expected during grading and construction; however, such erosion can be mitigated through standard erosion control measures, Best Management Practices (BMPs), and proper drainage control. Similarly, long-term erosion can be abated through construction of proper drainage and implementation of standard erosion control measures pending revegetation of the site.

The Woodward-Clyde Consultants (see Appendix A) geotechnical investigation was completed for the existing Chapultepec Hall and adjacent one-story multi-purposed building. The report associated with the investigation provided feasibility of construction and tentative design recommendations regarding geotechnical engineering. The subsequent geotechnical investigation by URS (2013) 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 construction of the project. A more comprehensive geotechnical investigation should be completed similar to the 1988 Woodward-Clyde Consultants report, which includes design recommendations regarding geotechnical engineering specific to the preliminary design of the development.

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1 INTRODUCTION

1.1 Regional and Local Setting

The San Diego State University (SDSU) campus is located along Interstate 8 (I-8), approximately 10 miles from downtown San Diego (see Figure 1, Regional Map, and Figure 2, Vicinity Map). The proposed project would be located on a 7.84-acre site at the northwest corner of the main campus (see Figure 3, Project Area Map), which is part of the College Area Community of the City of San Diego (City).

The proposed project would be developed west of the SDSU academic buildings and north of the campus athletic fields. The project site is defined by Remington Road to the south, 55th Street to the east, and private properties to the north and west. The land on which the proposed project would be developed is owned by SDSU and is located within the existing campus boundary.

1.2 Project Description

The proposed project is the expansion of on-campus student housing facilities to be located adjacent to the existing Chapultepec Hall. Specifically, the proposed project would consist of the development of facilities to accommodate up to 2,566 student housing beds in a series of residential towers to be located on the existing Parking Lot 9 (formerly "U" Parking Lot) and centered around the existing Chapultepec Hall. See Figure 2, Vicinity Map. The proposed project would be developed in three successive phases, and the analyses conducted by SDSU will address, where applicable, the environmental impacts that could arise in each phase. In particular, Phase I would include construction of dormitory facilities to house up to 850 student housing beds on the existing Parking Lot 9, east of the existing Chapultepec Hall; Phase II would include construction of facilities to house up to an additional 850 beds in the area located to the west of the existing Chapultepec Hall; and Phase III would include construction of facilities to house up to an additional 866 beds in buildings that would cantilever over the canyon behind Chapultepec Hall. The proposed project would consist of up to eight new buildings. One building would serve as a dining hall (2 stories), while the remainder of the buildings would consist of up to 4- to 14-story buildings of single-, double-, and triple-occupancy student housing units. The complex would include outdoor gathering spaces and green space. The proposed project would entail permanent removal of the existing Parking Lot 9; these parking spaces would not be replaced.

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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) (Appendix A), 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).

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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.

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 predominant 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 (Figure 4, Regional Fault and Epicenter Map) (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 OES 2017; Appendix A).

Seismic Hazards

Liquefaction

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 quicksand-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 damage that would otherwise be caused by strong ground motion 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 CGS has only created liquefaction hazard maps for USGS quadrangle maps in the greater Los Angeles and San Francisco Bay areas (CGS 2007). Based on site-specific geotechnical investigations (Appendix A), 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 conterminous 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 CGS. 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 CGS 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, 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;** CDMG 1993). The largest credible earthquake predicted for the coastal and metropolitan areas of San Diego is a magnitude 7.2 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, 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 6.2 to 6.6 (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 5, Project Site Topography). Current site development and grading codes require fill slopes to be formed at 2 to 1 inclination (Appendix A), which is less steep than the existing fill slope.

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 (Appendix A).

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 5 degrees to the south or southwest. No landslides are located on site. Similarly, no landslides have been mapped on or adjacent to the site in reviewed geologic literature (Appendix A).

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 (Appendix A).

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.

Soils, Colluvium, and Alluvium

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 1 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 A to this report) and Woodward-Clyde Consultants (1988, included in Appendix A), the western parking lot (Parking Lot 10A) (Figure 5, 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 nonstructural 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 (Appendix A).

Mission Valley Formation

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 (**Appendix A**).

Stadium Conglomerate

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 (**Appendix A**).

Groundwater

Based on geotechnical investigations completed for the project site vicinity by URS (2013, provided as Appendix A to this report) and Woodward-Clyde Consultants (1988, included in Appendix A), 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.

3.2 Regulatory Setting

This section describes the applicable regulatory plans, policies, and ordinances for the proposed project.

3.2.1 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.

3.2.2 State

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

Alquist–Priolo Earthquake Fault Zoning Act of 1972

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.

Seismic Hazards Mapping Act

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 CGS has only created liquefaction hazard maps for USGS quadrangle maps in the greater Los Angeles and San Francisco Bay areas (CGS 2007).

California Building Code

The state regulations protecting structures from geo-seismic hazards are contained in the California Code of Regulations, Title 24, Part 2 (the CBC), which is updated on a triennial basis. These regulations apply to public and private buildings in the state. Until January 1, 2008, the CBC 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 CBC, 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 CBC.

Chapter 16 and 16A of the 2016 CBC 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 CBC 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 CBC. 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 CBC is updated and revised every 3 years. The 2019 version of the CBC will be effective January 1, 2020. It is anticipated that future development on the campus would use the most current CBC 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 CBC. Chapter 16 of the CBC 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 CBC, 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 CBC; that renovation projects have been reviewed consistent with Chapter 34 of the CBC; 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).

3.2.3 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.

City of San Diego General Plan

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.

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4 THRESHOLDS OF SIGNIFICANCE

The following significance criteria included in Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 CCR 15000 et seq.) assist in determining the significance of a geology and soils impact. Impacts would result 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 or based on other substantial evidence of a 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.
6. 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).

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5 IMPACT ANALYSIS

5.1 Project Impacts

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 or based on other substantial evidence of a 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, 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 (**Figure 4, Regional Fault and Epicenter Map**). 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 CBC. 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-motion parameters that supersede CBC values and implement a conservative evaluation on CBC 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 CBC 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 A**) completed a geotechnical investigation in association with the existing Chapultepec Hall and adjacent one-story multipurpose building. The geotechnical report provided feasibility of construction and tentative design recommendations regarding geotechnical engineering. The subsequent geotechnical investigation by URS (2013, **Appendix A**) 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 6, 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 slopes at the north edge of both existing parking lots (**Figure 5, Project Site Topography**) were formed at inclinations ranging from 1.25 to 1.5:1 (horizontal to vertical), which do not meet City of San Diego site development and grading codes, 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 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 nonstructural 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 6, 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 III

Expansive 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 6, Mitigation Measures**).

Would the project 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?

Phases I, II, and III

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

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**.

6 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 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.

7 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of the above Mitigation Measures would reduce potential impacts from Phases I, II, and III of the 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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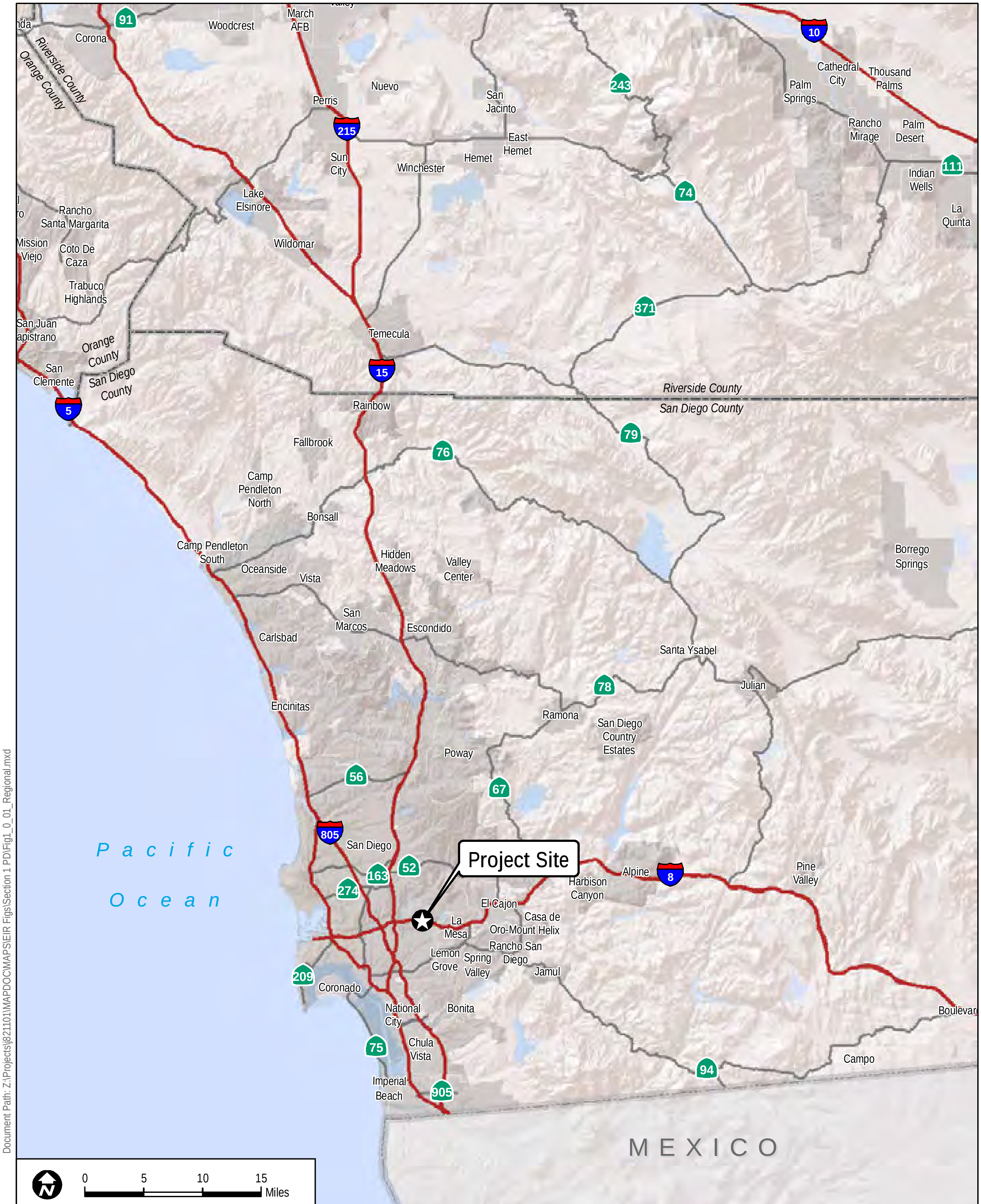

SDSU New Student Housing Project
Geotechnical Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 1
Regional Map

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SDSU New Student Housing Project
Geotechnical Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 2
Vicinity Map

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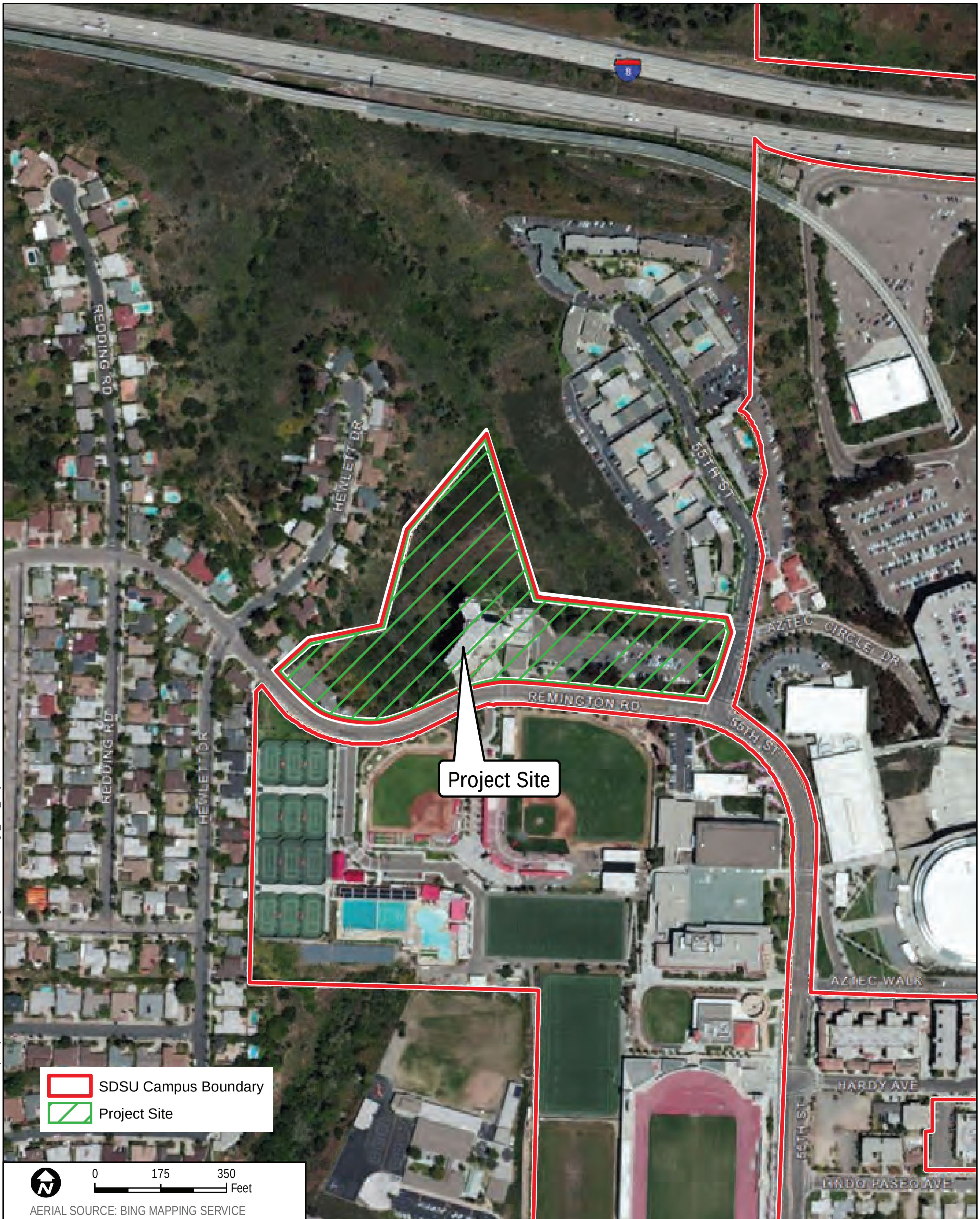

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SDSU New Student Housing Project
Geotechnical Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 3
Project Area Map

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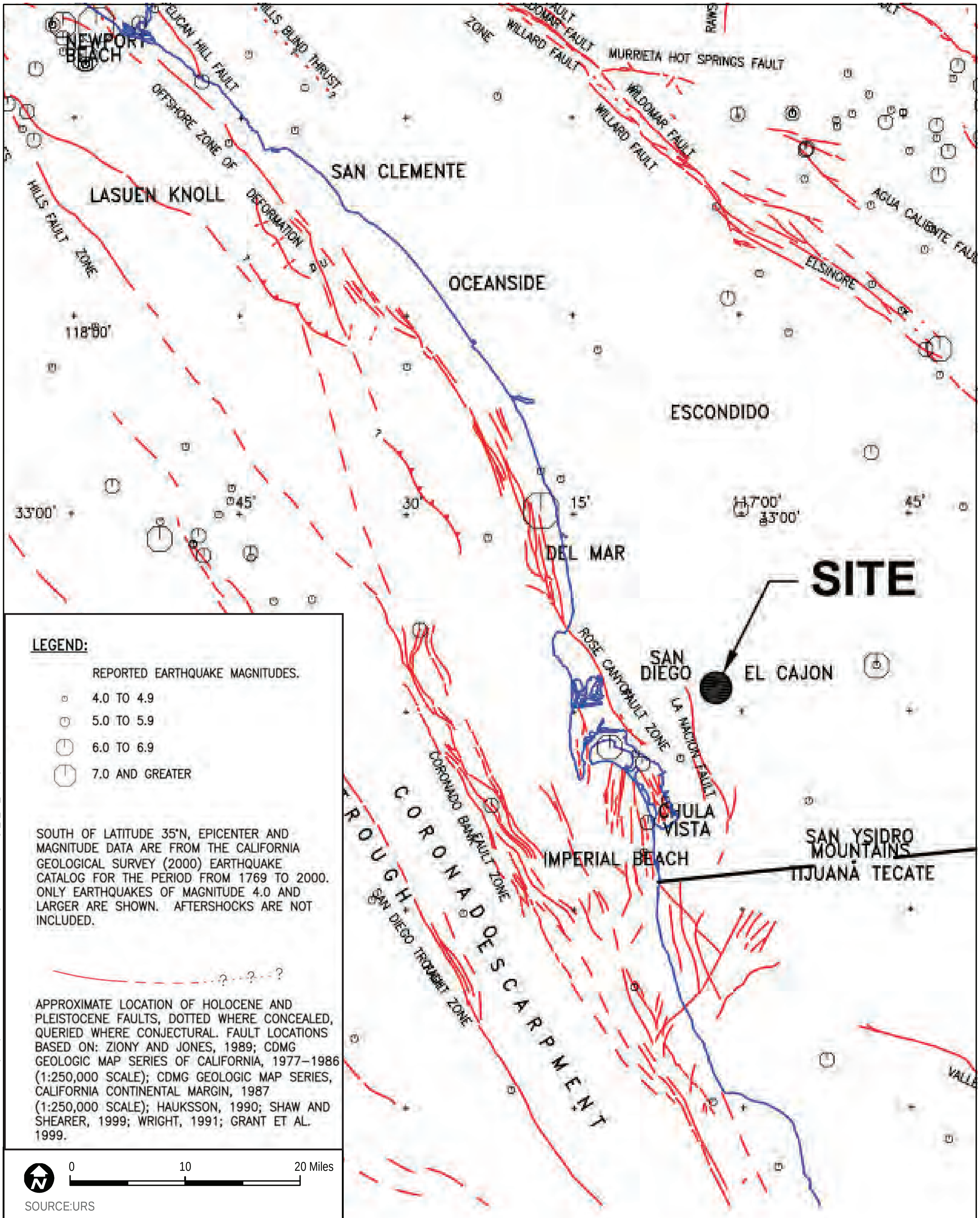

SDSU New Student Housing Project
Geotechnical Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 4
Regional Fault and Epicenter Map

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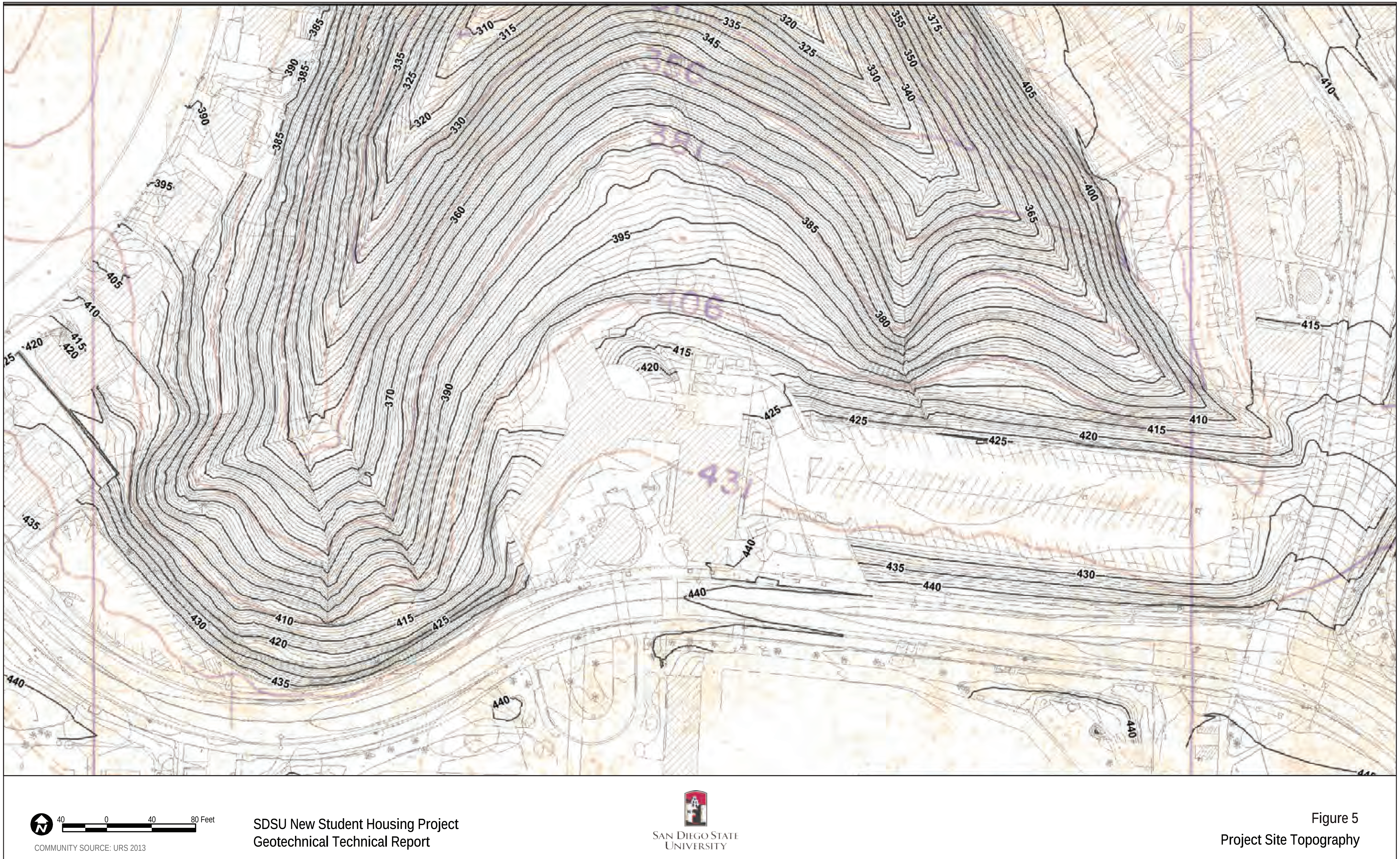

SDSU New Student Housing Project
Geotechnical Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 5
Project Site Topography

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APPENDIX A

URS Geotechnical Report

REPORT

FACTUAL GEOTECHNICAL REPORT WEST CAMPUS HOUSING SAN DIEGO STATE UNIVERSITY REMINGTON ROAD AND 55^{th} STREET SAN DIEGO, CALIFORNIA 92182

Prepared for

San Diego State University
Facilities Planning Design and Construction
5500 Campanile Drive
San Diego, CA 92182-1624

URS Project No. 27661317.10000

December 17, 2013

URS

4225 Executive Drive, Suite 1600
Las Jolla, CA 92037
858.812.9292 Fax: 858.812.9293

URS

December 17, 2013

Ms. Kristi Marian
Capital Project Planner
San Diego State University
Facilities Planning Design and Construction
5500 Campanile Drive
San Diego, CA 92182

Subject: Factual Geotechnical Report
West Campus Housing
San Diego State University
Remington Road and 55th Street
San Diego, California 92182
Project No. 27661317.10000

Dear Ms. Marian:

URS Corporation Americas (URS) is pleased to present this Factual Geotechnical Report for the above referenced project. This report summarizes the existing information available for the site and presents the results of our subsurface exploration and laboratory testing. The report also provides discussions of the geologic and tectonic settings and the subsurface conditions. The report concludes with a discussion of geotechnically related site development considerations.

URS prepared this report in accordance with our proposal dated April 26, 2013. We look forward to continuing to work with you on this project. Should you have any questions, please contact us.

Sincerely,

URS CORPORATION

REGISTERED PROFESSIONAL ENGINEER
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CERTIFIED ENGINEERING GEOLOGIST
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EXECUTIVE SUMMARY

This report presents factual geotechnical information to support the design and construction of the proposed West Campus Housing at San Diego State University (SDSU). SDSU proposes to use two existing parking lots located east and west of Chapultepec Hall and the undeveloped area north of Chapultepec Hall as the sites for new dormitories that are planned to range from six to ten stories.

This report provides a summary of existing information and the results from recent subsurface exploration and laboratory testing along with discussions regarding subsurface conditions and geotechnically related site development considerations. The scope of services was to conduct additional subsurface exploration to further evaluate the undocumented fill that could influence the planning, design and/or construction of the proposed development. URS' subsurface exploration consisted of exploratory borings located in the eastern and western parking lots to depths of 12 and 26 feet respectively.

URS predecessor firm Woodward-Clyde Consultants (WCC) conducted a geotechnical investigation for Chapultepec Hall. WCC reported the site was underlain by fill, surficial deposits, alluvium and formational materials belonging to the Mission Valley Formation and the Stadium Conglomerate. They estimated the fill could be up to 30 and 15 feet thick in the eastern and western parking lots respectively. WCC indicated there were no observation and compaction testing records and therefore the fill was not suitable for the support of building loads. The Site Plan from their report depicts the estimated limits of this fill on plan.

In our opinion, the site is geotechnically suitable for the proposed development. However, relatively substantial remedial grading and/or deep foundations may be needed to develop the site to provide suitable long term performance of the new buildings and their associated exterior surface improvements.

The majority of the existing fill is undocumented and therefore it is likely to possess variable engineering characteristics if left in place. Whether left in place or removed and properly recompacted, the existing fill is a fine-grained soil consisting of sandy clay to clayey sand that will possess poor drainage characteristics, low shear strengths and R-values, and a high expansive potential if excavated and recompacted. This material is not suitable for the support of foundations or as the subgrade for exterior surface improvements.

There may be local surficial deposits and alluvium below the undocumented fill, especially where this fill has been placed over existing drainages. These materials are unlikely to be suitable for support of fill and structures. In addition, these soils may be prone to further elastic settlement with the imposition of additional loading and collapse settlement when wetted from irrigation or other sources of water.

The existing fill slopes at the north edge of both 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 require additional maintenance and/or be prone to surface type failures.

The underlying formational materials should generally possess high shear strengths and low expansion and compressibility characteristics. Foundations that support new campus housing should extend into these materials.

SECTION 1 INTRODUCTION

This report presents factual geotechnical information to support the design and construction of the proposed West Campus Housing. The project site is located northwest of the intersection of Remington Road and 55th Street in the western portion of San Diego State University (SDSU) campus, as shown on Figure 1.

URS prepared this report for the SDSU Facilities Planning Design and Construction and their architectural and engineering consultant team to assist with preparation of construction documents. We understand SDSU intends to use Design-Build (DB) to procure the new housing. DB teams should not view this report as a contractual statement of geotechnical conditions (baseline report).

This report summarizes the existing information available for the site and presents the results from our subsurface exploration and laboratory testing program. The report also provides a discussion of the geologic setting and an assessment of geologic and seismic hazards. The report concludes with a discussion of geotechnically related site development considerations.

1.1 PROJECT DESCRIPTION

SDSU proposes to use two existing parking lots as the site for new campus dormitories. The parking lots are located east and west of the existing Chapultepec Hall. The dormitory structures are planned to range from six to ten stories. Additional dormitories may be located southwest of Chapultepec Hall within a gently inclined slope. The project may also include a pool and dining hall. We have based our understanding of the project on an undated masterplan concept sketch prepared by Carrier Johnson + Culture Architects.

1.2 PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to further evaluate the physical characteristics and thickness of the existing undocumented fill within the existing parking areas east and west of Chapultepec Hall. Undocumented fill is soil that has been placed without records of observation and compaction testing by a Geotechnical Engineer and their field designate. Therefore, because the physical characteristics are unknown, the undocumented fill could be poorly compacted and/or contain thick deposits of remnant vegetation or other deleterious material. Loose surficial soils may exist beneath the fill.

The scope of our services was to conduct additional subsurface exploration to further evaluate the undocumented fill since it could influence site preparation, earthwork and foundations, and possibly the desired configuration for the proposed development. The scope of services also included geotechnical laboratory testing and report preparation.

SECTION 2 GEOTECHNICAL INVESTIGATION

2.1 PREVIOUS GEOTECHNICAL STUDIES

URS, as predecessor firm Woodward-Clyde Consultants (WCC), conducted a geotechnical investigation of the site to support the design of the Chapultepec Hall, and prepared a report titled “Preliminary Geotechnical Investigation for the Proposed SDSU West Residence Hall, San Diego, California” and dated August 1, 1988. Appendix C provides a copy of this report.

The subsurface exploration for the WCC investigation included eight test borings advanced with a hollow stem auger to depths ranging from 8 to 22 feet and 11 test pits excavated with a backhoe to depths ranging from 3 to 12 feet. These explorations were located throughout the site currently proposed for further development. The approximate locations of these explorations are shown on Figure 2.

The WCC report provided the following salient information (direct extracts from the report) regarding the subsurface conditions that existed at that time.

- *The site is underlain by fill soils, natural overburden soils (including topsoil, residual clay, slopewash and alluvium) and formational soils consisting of the Pleistocene Lindavista Formation and the Eocene Mission Valley Formation and Stadium Conglomerate.*
- *Based on review of pre-grading topography, the western parking lot is underlain entirely by fill soils. The fill appears to extend to an estimated maximum depth of approximately 15 feet beneath the north central edge of the lot. Based on Boring 7, the fill consists largely of clayey sand and gravel and rubble.*
- *Fill soils underlie the northern half of the east lot and all of the extreme eastern end. The fill extends offsite into the apartment property to the north. Our test excavations indicate that the fill in the east lot generally consists of lean to fat clays, often containing gravels, and some silty and clayey sands. Our estimate of original site grades indicates that the fill may be up to 30 feet thick, with the deepest areas being near the east corner of the north property line.*
- *We have no records that indicate any of the fills on the subject site were placed under engineering observation or compacted. The fills should be considered non-structural and not suitable for the support of building loads.*

WCC also prepared the following additional reports to support the design and construction of the Chapultepec Hall:

- Review of Recent Foundation Plans West Residence Hall – SDSU San Diego, California, January 24, 1989 (copy included in Appendix C).
- Seismic Study of the San Diego State University West Residence Hall, San Diego, California, January 25, 1989.

A search of URS archives did not locate any further information, including an as-built geotechnical report for the development of the site for the Chapultepec Hall. The as-built geotechnical report would have provided documentation of any site preparation including fill placement and compaction and the observation of the bottom of foundation excavations.

2.2 SUBSURFACE EXPLORATION

The subsurface exploration consisted of exploratory borings located in the western and eastern parking lots at the approximate locations shown on Figure 2. The locations were estimated by taped measurements from existing surface reference points. The elevations of the existing ground surface were estimated using topographic contours shown on an aerial survey prepared by Vertical Mapping Resources dated March 13, 2013.

One boring was advanced in the western parking lot (B01) on October 9, 2013 to a depth of 26.5 feet using a truck mounted drill rig with a 6.5 inch diameter hollow stem auger. Relatively intact soil samples were obtained using a Standard Penetration Test (SPT) sampler and California Sample (2.5 inch inner diameter) with thin stainless steel liners. Samples were typically collected at 5-foot depth intervals. The sampler was generally driven 18-inches into the material at the bottom of the boring by a 140-pound hammer falling 30-inches and the blows required to advance the sampler were recorded in 6-inch increments. One disturbed bulk soil sample was obtained in the upper 10 feet.

Three borings were advanced in the eastern parking (B02, B02a and B02b) on October 10, 2013 and November 5, 2013 to depths of 12.5, 11and 12 feet, respectively. The borings were performed with a track mounted drill rig using a 24 inch diameter solid stem auger. The first boring was terminated due to a mechanical breakdown prior to confirming the depth to formational material. Disturbed bulk soil samples were obtained at 5-foot depth intervals.

The relatively intact samples were obtained from the sampler and the disturbed samples were obtained from the auger cuttings. The samples were sealed to preserve the natural moisture content and returned to the laboratory for further examination and testing.

At the completion of the drilling, the open holes were backfilled with nominally compacted auger cuttings and the surface was reinstated with an asphalt patch. Excess spoil was removed from the site.

Appendix A provides a Key of Boring Logs and the Logs of Borings. The descriptions on the logs are based on field observations, sample inspection and laboratory test results. The results of the laboratory tests are shown at the corresponding sample location on the boring logs and in Appendix A.

2.3 LABORATORY TESTING

Selected soil samples were tested in a laboratory for evaluation of pertinent geotechnical engineering characteristics and parameters. The emphasis of the testing was to supplement the existing laboratory test results provided in the WCC report (1988). Representative soil samples were selected for moisture content, plasticity index, fines (silt and clay) content, expansion index, compaction (relationship between optimum moisture content and maximum dry unit weight), and R-Value (engineering characteristics of subgrade soils for pavement and other hardscaping). Testing was performed in general accordance with American Society of Testing and Materials (ASTM) International Standards. Table 1 summarizes the laboratory test data. Appendix B presents the test data sheets and plots.

SECTION 3 SITE CONDITIONS

Knowledge of the site conditions was developed from a review of published geologic information, previous reports, site reconnaissance, and the results of this investigation.

3.1 GEOLOGIC SETTING

The 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 is underlain by a series of Eocene age sedimentary deposits, including the Mission Valley Formation and the Stadium Conglomerate. These formational materials are capped by multiple generations of fill soils that have provided level surfaces for the development of the site for parking and Chapultepec Hall.

The Subsurface Conditions section of this report describes these units in greater detail. The Site Plan in the previous WCC report (WCC, 1988) shows the approximate limits of the main geologic units encountered at the site prior to development of the Chapultepec Hall site. Appendix C provides a copy of this Site Plan.

3.2 TECTONIC SETTING

The San Diego region and southern California, in general, lies within the broad margins of the San Andreas Fault System that marks the boundary between the North America and Pacific plates. This active tectonic area is cut by numerous faults as shown on Figure 3. The nearest active fault zones to the site are the Rose Canyon–Newport Inglewood fault zone located to the west of the site and the Elsinore fault zone to the east at distances of 6 miles and 35 miles, respectively. Figure 3 present the historical seismicity for the region.

3.3 SURFACE CONDITIONS

With the exception of the area around Chapultepec Hall, the surface conditions of the site do not vary substantially from those described in the appended previous WCC report (WCC, 1988). We note the existing fill slopes at the north edge of both parking lots were formed at inclinations ranging from 1.25 to 1.5H:1V (horizontal to vertical). Current site development and grading codes require fill slopes to be formed at 2H:1V inclinations.

3.4 SUBSURFACE CONDITIONS

The site is underlain by at least two episodes of fill placement and formational material belonging to the Eocene age Mission Valley Formation and the Stadium Conglomerate at depth. The borings completed for this study encountered fill over the Mission Valley Formation.

The earlier episode of fill placement is undocumented and it occurred over most of the site prior to development of Chapultepec Hall. The previous WCC report (WCC, 1988) estimated this fill could be up to 15 feet thick in the western parking lot and up to 30 feet thick in the northeast portion of the eastern parking lot. Figure 4 depicts the 1951 topographic contours (City of San Diego Map Series, 1952) and the approximate boundary of the property. The second episode of fill placement occurred as part of the development of Chapultepec Hall. While there are no as-built records for compaction of this fill, given the time of development (1989), it is likely the fill was properly placed and compacted. The extent of this fill is not known, but it probably occurs locally around Chapultepec Hall.

There may be local surficial deposits (topsoil, residual clay, colluvium, and alluvium) below the undocumented fill; these deposits were not encountered in the borings completed for this study.

The following paragraphs described the materials encountered in the borings.

3.4.1 Fill

The fill soils encountered during the current subsurface exploration were observed to consist of clayey sand (Unified Soil Classification System Group Symbol SC) to sandy clay (CH) with gravel and cobbles. The thickness of the fill encountered in the current borings ranged from 7.5 to 12.5 feet. As noted in the previous geotechnical investigation, fill soils underlying the western lot appear to extend to depths of approximately 15 feet along the north-central portion of the lot. Fill soils were noted to include rubble intermixed with cobbles and gravel.

In the eastern lot, the fills may extend to depths of approximately 30 feet in the eastern corner of the site along the northern boundary. As suggested by the 1951 topography, this area included the upper reaches of Alvarado canyon that was subsequently buried. The borings performed in the east lot encountered fills ranging to depths of 2 to greater than 15 feet.

3.4.2 Mission Valley Formation

The Mission Valley Formation consisted of layered sedimentary deposit consisting of silty and clayey sandstone with some gravel and cobbles layers. The materials excavated from the borings were observed to consist of silty to clayey sand (SC) to sand clay (CH) with cobbles. Based on auger resistance, the relative density of the material is dense to very dense. The Mission Valley Formation underlies a variable thickness of fill and was encountered in Borings B01 and B02a and B02b.

3.4.3 Stadium Conglomerate

The Stadium Conglomerate underlies the Mission Valley Formation at variable depths below the site. The previous investigation estimated the contact between the Stadium Conglomerate and the Mission Valley Formation occurs at an elevation of approximately 375 Mean Sea Level (MSL) in the general site area.

3.4.4 Groundwater Conditions

At the time of our subsurface exploration, groundwater or seepage was not observed within the explorations. The occurrence of groundwater can fluctuate seasonally and with changes in land use.

SECTION 4 DISCUSSIONS AND CONCLUSIONS

The discussions and conclusions presented in this report are based on the information provided to us, the data from the previous geotechnical studies, the findings from the current subsurface exploration and geotechnical laboratory testing, and our engineering evaluations and professional judgment. In our opinion, the site is geotechnically suitable for the proposed development. However, relatively substantial remedial grading may be needed to develop the site to provide suitable long term performance of the new buildings and their associated improvements.

The majority of the existing fill is undocumented and therefore it is likely to possess variable engineering characteristics if left in place. Whether left in place or removed and properly recompacted, the existing fill is a fine-grained soil consisting of sandy clay to clayey sand that will possess poor drainage characteristics, low shear strengths and R-values, and a high expansive potential when excavated and recompacted. This material is not considered suitable for the support of foundations for the new campus housing or as subgrade for exterior surface improvements.

There may be local surficial deposits (topsoil, residual clay, colluvium, and alluvium) below the undocumented fill, especially where this fill has been placed over existing drainages. These materials are unlikely to be suitable for support of fill and structures. In addition, these soils may be prone to further elastic settlement with the imposition of additional loading and collapse settlement when wetted from irrigation or other sources of water.

The existing fill slopes at the north edge of both parking lots were formed at inclinations ranging from 1.25H:1V to 1.5H:1V (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.

The underlying formational materials should generally possess high shear strengths and low expansion and compressibility characteristics. Foundations that support new campus housing should extend into these materials.

SECTION 5 UNCERTAINTIES AND LIMITATIONS

URS has observed only a very small portion of the pertinent subsurface conditions. The conclusions made herein are based on the assumption that soil and geologic conditions do not deviate appreciably from those found during our investigation. We recommend that a qualified Geotechnical Engineer or Engineering Geologist observe the earthwork, foundation excavations, and other geotechnical construction to evaluate if the subsurface conditions are as anticipated, or to provide revised recommendations, if necessary. If variations or undesirable geotechnical conditions are encountered during construction, a Geotechnical Engineer should be consulted for further recommendations.

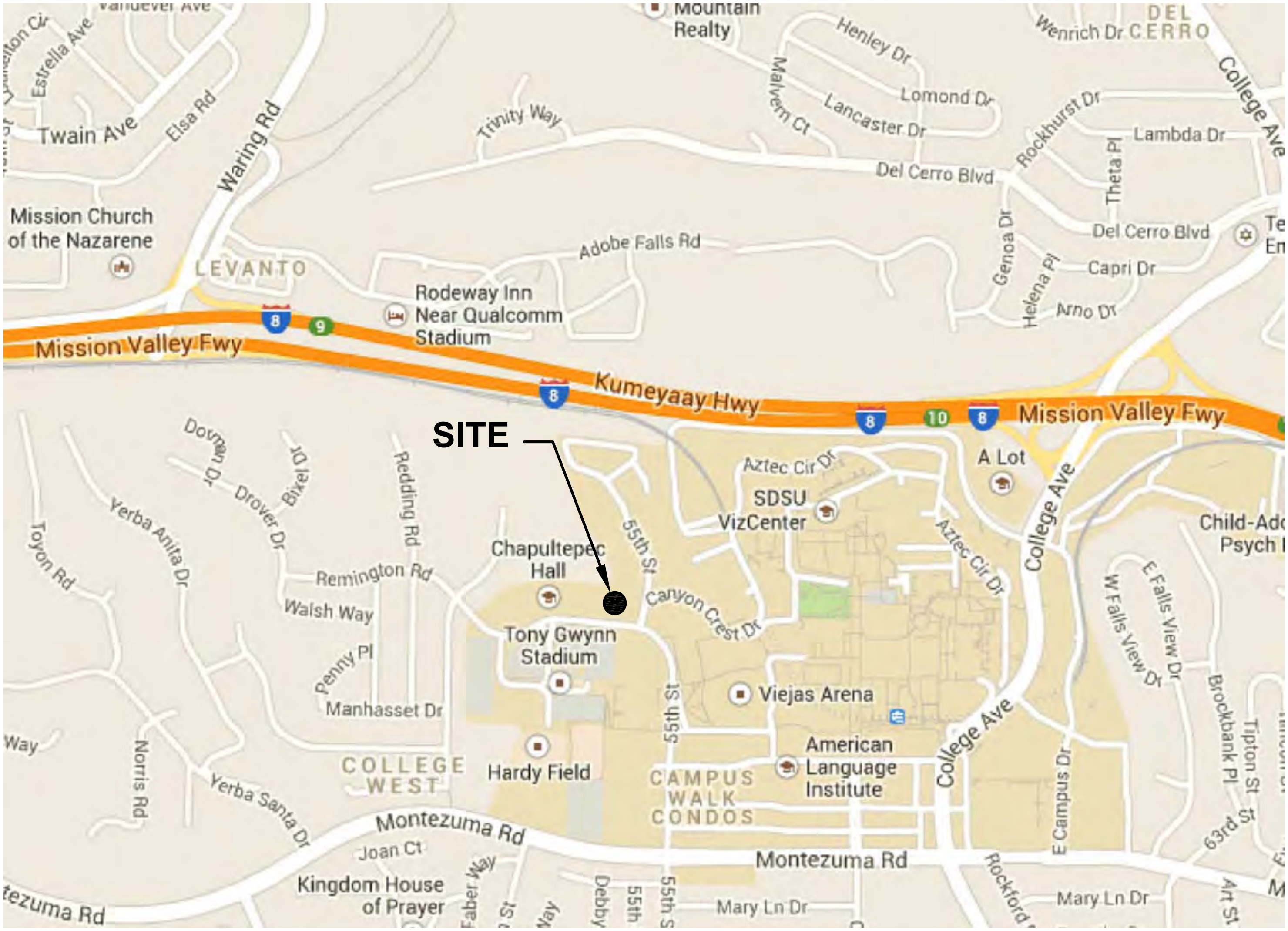
Geotechnical engineering and the geologic sciences are characterized by uncertainty. Professional judgments presented herein are based partly on our understanding of the proposed construction, and partly on our general experience. Our engineering work and judgments rendered meet current professional standards; we do not guarantee the performance of the project in any respect.

SECTION 6 REFERENCES

URS, 1988. Preliminary Geotechnical Investigation for the Proposed SDSU West Residence Hall, San Diego, California, August 1, 1988.

Table 1
Summary of Geotechnical Laboratory Testing

Boring Number	Sample/ Specimen Number	Depth (ft)	USCS Group Symbol	Water Content (%)	Liquid Limit ASTM D4318	Plasticity Index ASTM D4318	Gravel (%) ASTM D422	Sand (%) ASTM D422	Fines (%) ASTM D422	Max. Dry Unit Weight (pcf) ASTM D1557	Opt. Water Content (%) ASTM D1557	R Value California Test Method 301	Expansion Index, EI @ 50% S ASTM D4829	pH California Test Method 532	Sulfate Content (ppm) USEPA Method 8051	Chloride Content (ppm) USEPA Method 8225	Resistance Value California Test Method 643
B-01	Bulk	6-10	CL		47	33	5.0	41.0	54.0	126.0	9.5	-5.0	72 (Medium)	8.40	459	1170	410
B-01	3	10.0	CL	17.8					52.9								
B-01	4	15.0	SM		---	NP	0.0	86.0	14.0				0				
B-01	5	20.0	SC	7.7					20.9								
B-01	6	25.0	SM	6.4					18.6								
B-02	Bulk	0-5	SC		54	41	29.0	32.0	39.0	130	9.5	-5	97 (High)	8.30	NT	NT	490
B-02	1	2.0	SC	14.4					46.8								
B-02	2	5.0	GC	5.9	64	46			18.1								

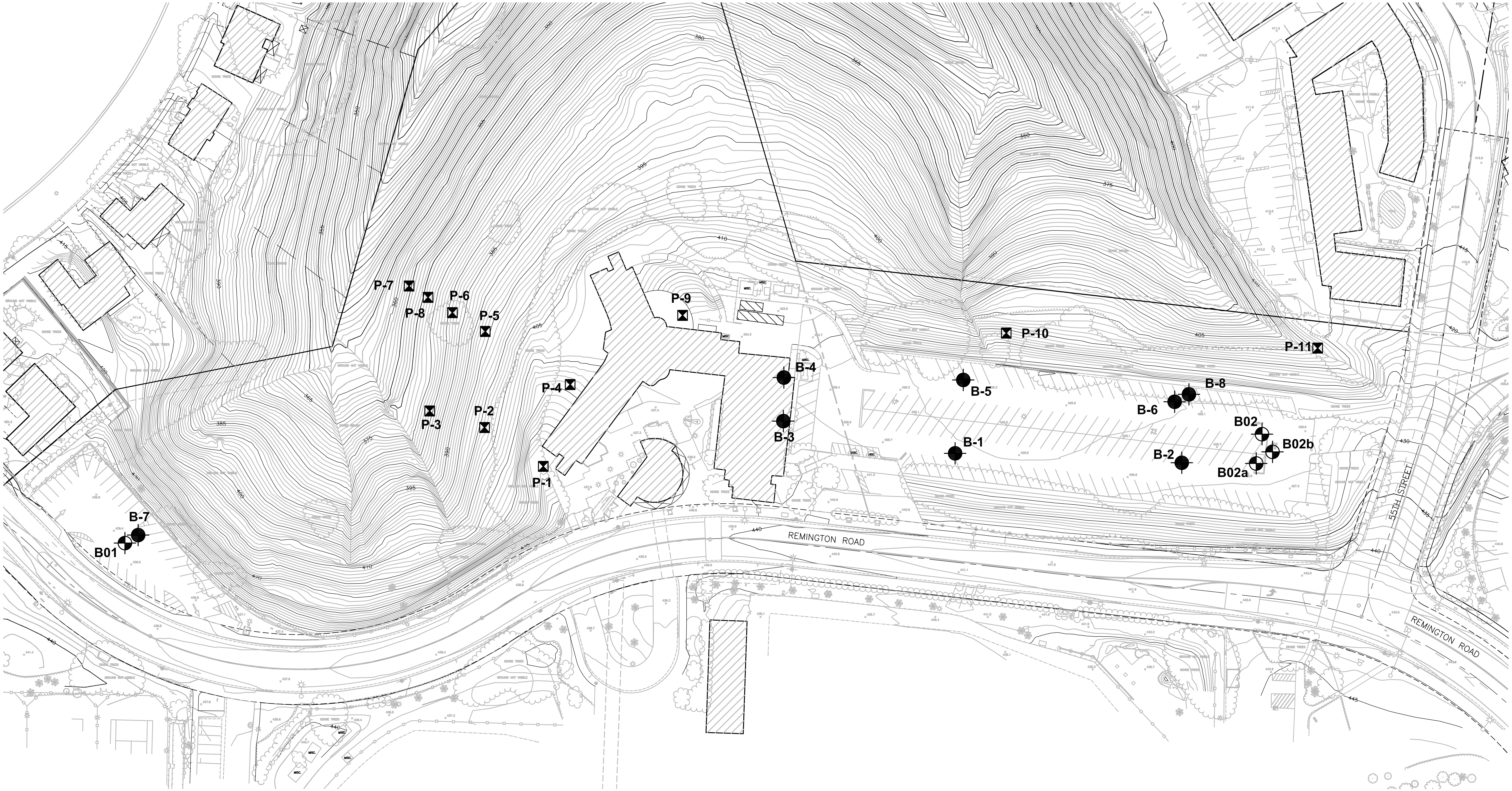


REFERENCE: GoogleMaps, 2013

URS	**VICINITY MAP** **WEST CAMPUS HOUSING** **SAN DIEGO STATE UNIVERSITY**

NOT TO SCALE	CHECKED BY: CRS	DATE: 12–17–13	FIG. NO: 1
	PM: CRS	PROJ. NO: 27661317.10000	

X:\27661317\SDSU West Campus VicMap.dwg Jan 16, 2014 – 10:29am



SOURCE: Aerial Survey, Vertical Mapping Resources, March 13, 2013

LEGEND

- APPROXIMATE LOCATION OF TEST BORING (URS, 2013)
- APPROXIMATE LOCATION OF TEST BORING (WCC, 1988)
- APPROXIMATE LOCATION OF TEST PIT (WCC, 1988)

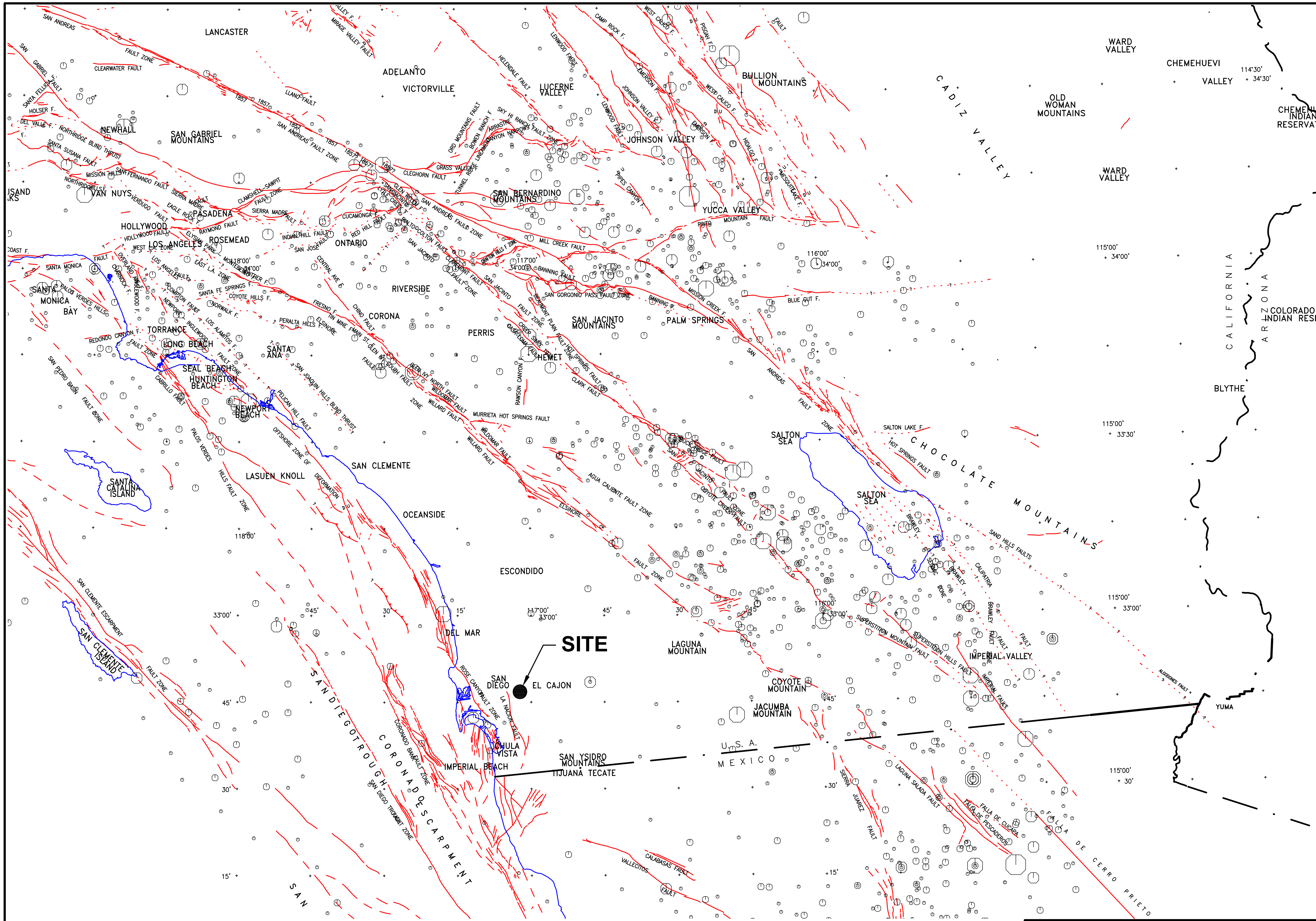
SITE PLAN
WEST CAMPUS HOUSING
SAN DIEGO STATE UNIVERSITY

URS

40 0 40 80 feet
SCALE: 1"= 80'

CHECKED BY: CRS	DATE: 12-17-13	FIG. NO:
PM: CRS	PROJ. NO: 27661317.10000	2

X:\27661317\SDSU West Campus Site.dwg Jan 16, 2014 - 10:30am



LEGEND:

REPORTED EARTHQUAKE MAGNITUDES.

- 4.0 TO 4.9
- 5.0 TO 5.9
- 6.0 TO 6.9
- 7.0 AND GREATER

SOUTH OF LATITUDE 35°N, EPICENTER AND MAGNITUDE DATA ARE FROM THE CALIFORNIA GEOLOGICAL SURVEY (2000) EARTHQUAKE CATALOG FOR THE PERIOD FROM 1769 TO 2000. ONLY EARTHQUAKES OF MAGNITUDE 4.0 AND LARGER ARE SHOWN. AFTERSHOCKS ARE NOT INCLUDED.

? ? ?

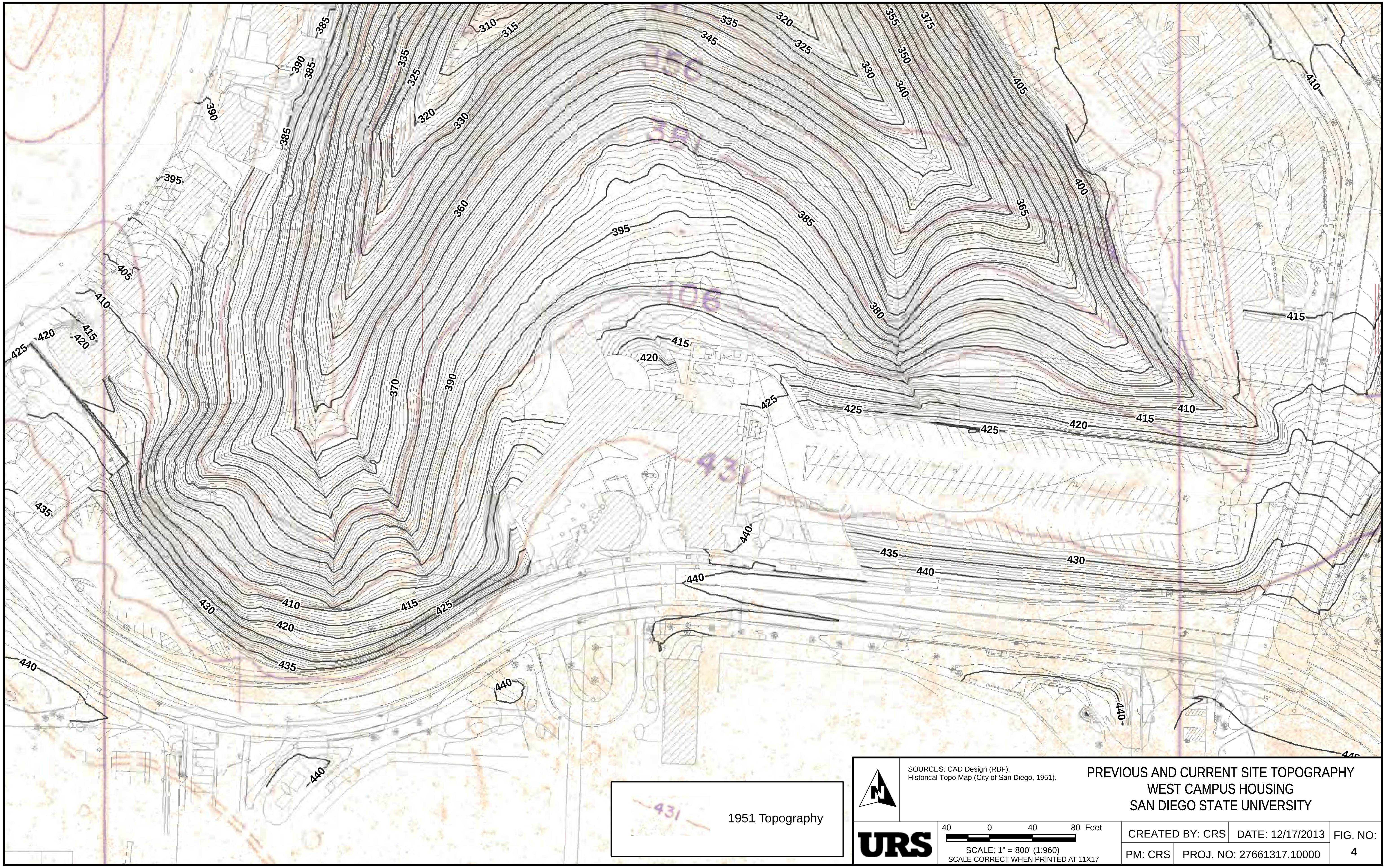
APPROXIMATE LOCATION OF HOLOCENE AND PLEISTOCENE FAULTS, DOTTED WHERE CONCEALED, QUERIED WHERE CONJECTURAL. FAULT LOCATIONS BASED ON: ZIONY AND JONES, 1989; CDMG GEOLOGIC MAP SERIES OF CALIFORNIA, 1977–1986 (1:250,000 SCALE); CDMG GEOLOGIC MAP SERIES, CALIFORNIA CONTINENTAL MARGIN, 1987 (1:250,000 SCALE); HAUKSSON, 1990; SHAW AND SHEARER, 1999; WRIGHT, 1991; GRANT ET AL. 1999.

REGIONAL FAULT AND EPICENTER MAP
WEST CAMPUS HOUSING
SAN DIEGO STATE UNIVERSITY

URS

10 0 10 20 Miles
SCALE: 1"= 20 miles

CHECKED BY: CRS	DATE: 12–17–13	FIG. NO: 3
PM: CRS	PROJ. NO: 27661317.10000	



SOURCES: CAD Design (RBF), Historical Topo Map (City of San Diego, 1951).

PREVIOUS AND CURRENT SITE TOPOGRAPHY
WEST CAMPUS HOUSING
SAN DIEGO STATE UNIVERSITY

URS

40 0 40 80 Feet
SCALE: 1" = 800' (1:960)
SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: CRS	DATE: 12/17/2013	FIG. NO:
PM: CRS	PROJ. NO: 27661317.10000	4

.

Project: West Campus Housing Project Location: San Diego State University Project Number: 27661317.10000	**Key to Logs** Sheet 1 of 1

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number. Unnumbered sample indicates no sample recovery.

5 **Blows per foot:** Number of blows required to advance driven sampler 12 inches beyond first 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

6 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

7 **Material Description:** Description of material encountered; may include relative density/consistency, moisture, color, particle size; texture, weathering, and strength of formation material.

8 **Water Content:** Water content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.

9 **Dry Unit Weight:** Dry unit weight of soil sample measured in laboratory, in pounds per cubic foot.

10 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel.

WA	Three-point Wash Analysis, %<#200 sieve
SA	Sieve Analysis, %<#200 sieve
LL	Liquid limit (from Atterberg limits test), %
PI	Plasticity Index (LL-PL), %; NP=nonplastic
EI	Expansion Index, % volume
R-value	Resistance-Value test
COMP	Laboratory Compaction test
CORR	Corrosion Suite

TYPICAL MATERIAL GRAPHIC SYMBOLS

Sandy CLAY (CL) to clayey SAND (SC)

Silty, clayey SAND (SC-SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Grab sample

Bulk sample

California sampler (2.5"ID)

Standard Penetration sampler

OTHER GRAPHIC SYMBOLS

First water encountered at time of drilling and sampling (ATD)

Water level measured at specified time after completion of drilling and sampling

Minor change in material properties within a stratum

Inferred or gradational contact between strata

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: West Campus Housing
Project Location: San Diego State University
Project Number: 27661317.10000

Log of Boring B01

Date(s) Drilled	**10/09/13**	Logged By	**D. Rector**	Checked By	**M. Hatch**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6.5-inch finger bit**	Total Depth of Borehole	**26.5 feet**
Drill Rig Type	**Marl M5**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**436.5 feet**
Water Level Depth	**None Encountered**	Sampling Method(s)	**Bulk/Cal(2.5")/SPT**	Hammer Data	**140 lbs/30-inch drop**
Borehole Completion	**Soil Cuttings**	Location	**West Parking Lot (See SIte Plan Figure 2)**		

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
	0					FILL 4" asphalt over 3" base over moist, brown, clayey sand to sandy clay with gravels			
435									
	5		1-1	9			10	126	SA(54), LL(47), PI(53), EI(72), R-value, COMP, CORR Difficult drilling
430						Increase in cobbles			
			1-2						
	10		1-3	29		MISSION VALLEY FORMATION Medium dense, moist, light reddish brown, silty to clayey fine to coarse grained SAND (SM-SC) with few cobbles and gravels 4" thick layer of brown, sandy clay	18		
425									
						Becomes very dense			
	15		1-4	50/4"					SA(14)
420									
						Becomes dense, light yellowish brown			
	20		1-5	31			8		SA(21)
415						Increase in cobbles			
	25		1-6	57			6		SA(19)
410						Bottom of boring at 26.5 feet			
	30								

URS

Project: West Campus Housing **Project Location: San Diego State University** **Project Number: 27661317.10000**	**Log of Boring B02** Sheet 1 of 1

Date(s) Drilled	**10/10/13**	Logged By	**D. Rector**	Checked By	**M. Hatch**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**24-inch flight auger/24-inch core barrel**	Total Depth of Borehole	**12.5 feet**
Drill Rig Type	**Tescar DR-35 (rubber-track mounted)**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**427 feet**
Water Level Depth	**None Encountered**	Sampling Method(s)	**Grab/Bulk**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**East Parking Lot (See SIte Plan Figure 2)**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
	0					FILL 3" asphalt over 6" base over moist, brown, clayey sand to sandy clay with rounded cobbles			SA(39), LL(54), PI(421), EI(47), R-value, COMP
425			2-1						SA(47)
	5		2-2						SA(18), LL(64), PI(46)
420									
						Moist, yellowish brown, clayey sand with many rounded cobbles (large) mixed with brown, sandy clay			Switched to 24" core barrel
	10								
			2-3						
415									
						Bottom of boring at 12.5 feet			
	15								
410									
	20								
405									
	25								
400									
	30								

Project: West Campus Housing **Project Location: San Diego State University** **Project Number: 27661317.10000**	**Log of Boring B02a** Sheet 1 of 1

Date(s) Drilled	**11/05/13**	Logged By	**A. Avakian**	Checked By	**M. Hatch**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**24-inch flight auger**	Total Depth of Borehole	**11.0 feet**
Drill Rig Type	**Tescar DR-35 (rubber-track mounted)**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**427 feet**
Water Level Depth	**None Encountered**	Sampling Method(s)	**Grab**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**East Parking Lot (See SIte Plan Figure 2)**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, yellowish brown to dark yellowish brown, sandy fine to medium clay, some fine to coarse gravel, some cobbles some dark grayish brown soil			
425		☒	2a-1						
	5					Becomes grayish brown to dark grayish brown			
		☒	2a-2						
						Becomes strong brown			
420		☒	2a-3			MISSION VALLEY FORMATION Moist, light yellowish brown, silty, clayey fine to medium SAND (SM-SC), trace fine to coarse gravel, localized weak cementation At 8.5', increase in fine to coarse gravel, some cobbles up to 9", becomes darker in color			Drilling becoming more difficult, soil is tighter
	10					Moist, light yellowish brown to yellowish brown, fine to coarse sandy CLAY (CL) to clayey, fine to coarse SAND (SC), some fine to coarse gravels, some cobbles At 10.5', grinding on large cobble or small boulder			
						Bottom of boring at 11 feet			
415									
	15								
410									
	20								
405									
	25								
400									
	30								

Report: GEO_10_SNA; File: 27661317.GPJ; 1/16/2014 B02a

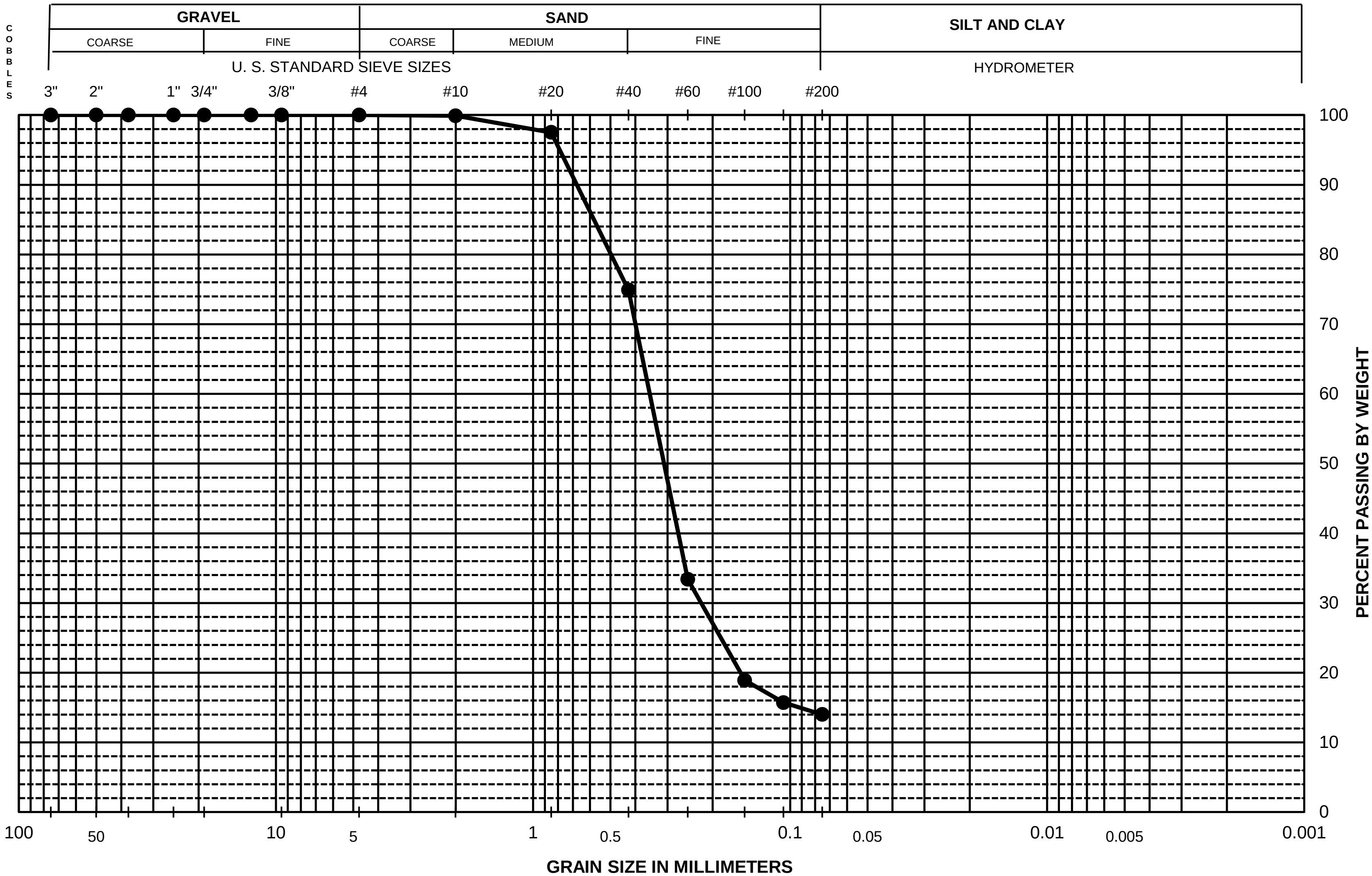
URS

Project: West Campus Housing **Project Location: San Diego State University** **Project Number: 27661317.10000**	**Log of Boring B02b** Sheet 1 of 1

Date(s) Drilled	**11/05/13**	Logged By	**A. Avakian**	Checked By	**M. Hatch**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**24-inch flight auger**	Total Depth of Borehole	**12.0 feet**
Drill Rig Type	**Tescar DR-35 (rubber-track mounted)**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**427 feet**
Water Level Depth	**None Encountered**	Sampling Method(s)	**Grab**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**East Parking Lot (See SIte Plan Figure 2)**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, yellowish brown to dark yellowish brown mottled with dark grayish brown, fine to medium sandy clay with some fine to coarse gravel, some cobbles			
425									
	5								
420		☒	2b-1			Becomes strong brown with trace fine to coarse gravels			
		☒	2b-2			MISSION VALLEY FORMATION Moist, light yellowish brown, fine to coarse sandy CLAY (CL) to clayey fine to coarse SAND (SC), some fine to coarse gravels, some cobbles (20-25% gravels and cobbles) At 9.75', large cobble/small boulders (16"x7"x5") At 10.25', cobble/boulders (12"x9")			Soil becomes denser Auger grinding on large cobbles
	10	☒	2b-3						
415						Bottom of boring at 12 feet			
	15								
410									
	20								
405									
	25								
400									
	30								

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	97.5
#40	0.425	74.9
#60	0.250	33.4
#100	0.150	18.9
#140	0.106	15.7
#200	0.075	14.0
Hydrometer Analysis		

% Cobbles	---
% Gravel	0.0
% Sand	86.0
% Fines	14.0
D_{85}	0.579
D_{60}	0.351
D_{50}	0.309
D_{30}	0.222
D_{15}	0.092
D_{10}	#N/A
C_u	----
C_c	-----

Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
B-01	4	15.0	●	6.0	---	NP	---	**Yellowish red silty Sand (SM)**

PROJECT NAME: **SDSU West Campus Housing**

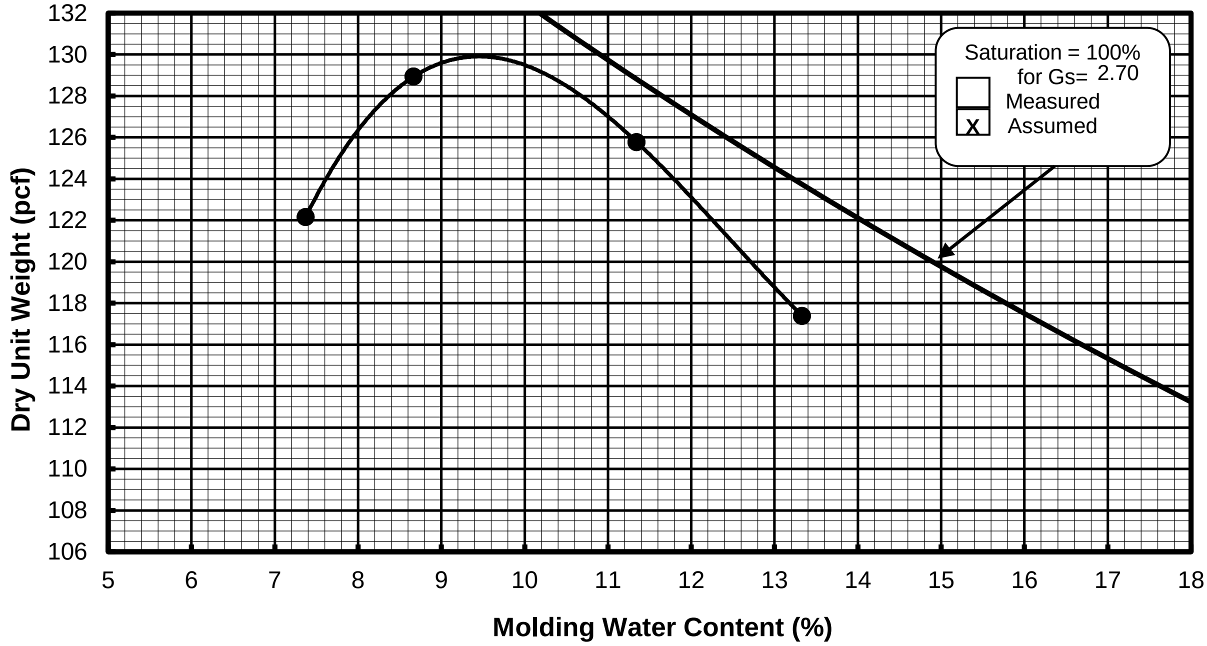
PROJECT NUMBER: **27661317**

PARTICLE-SIZE DISTRIBUTION CURVES

COMPACTION CURVE

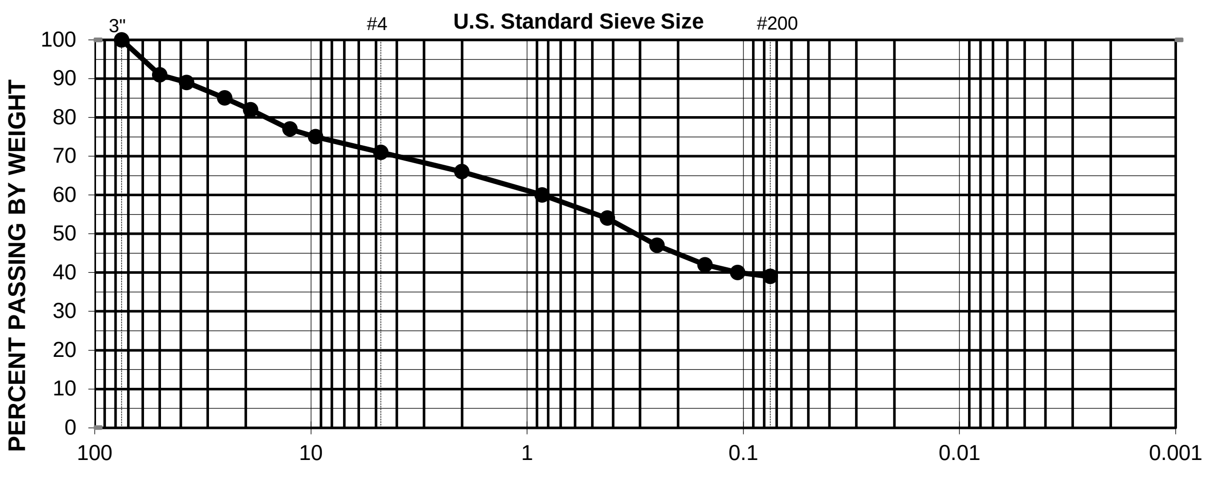
Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL COARSE	GRAVEL FINE	SAND COARSE	SAND MEDIUM	SAND FINE	SILT OR CLAY



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Boring Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-02		0 ~ 5	9.5	130.0	Brown clayey Sand with gravel (SC)

PROJECT NAME: SDSU West Campus Housing
PROJECT NUMBER: 27661317

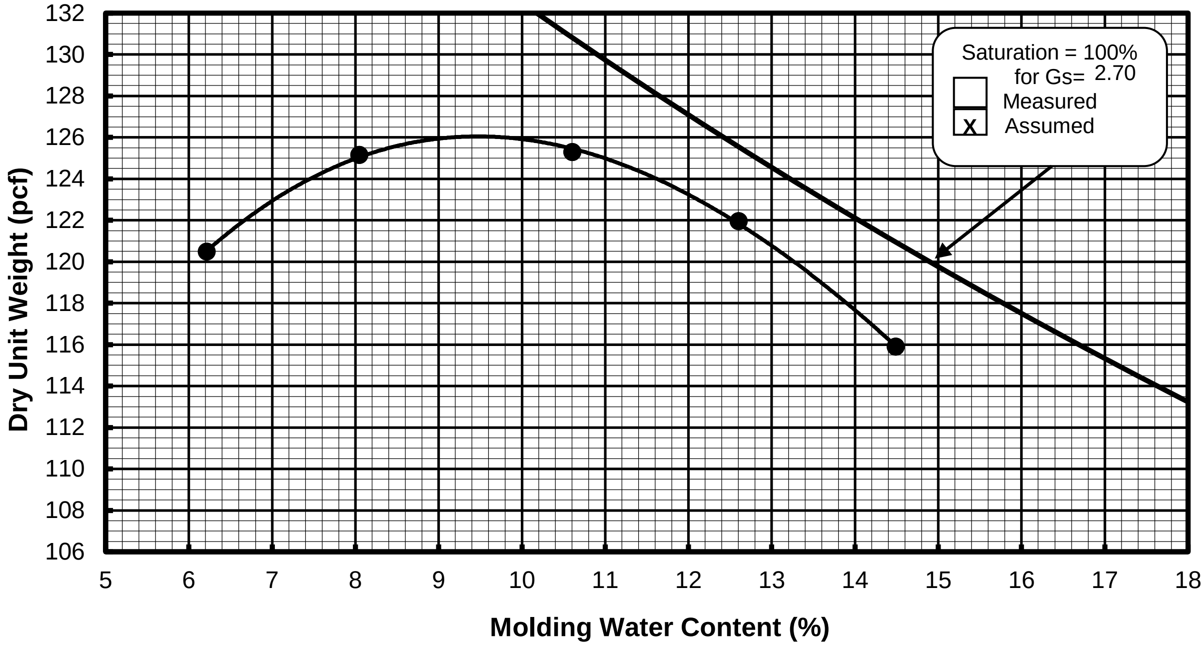
COMPACTION AND INDEX PROPERTY DATA

SUBMITTED BY: Thomas J. O'Mara

COMPACTION CURVE

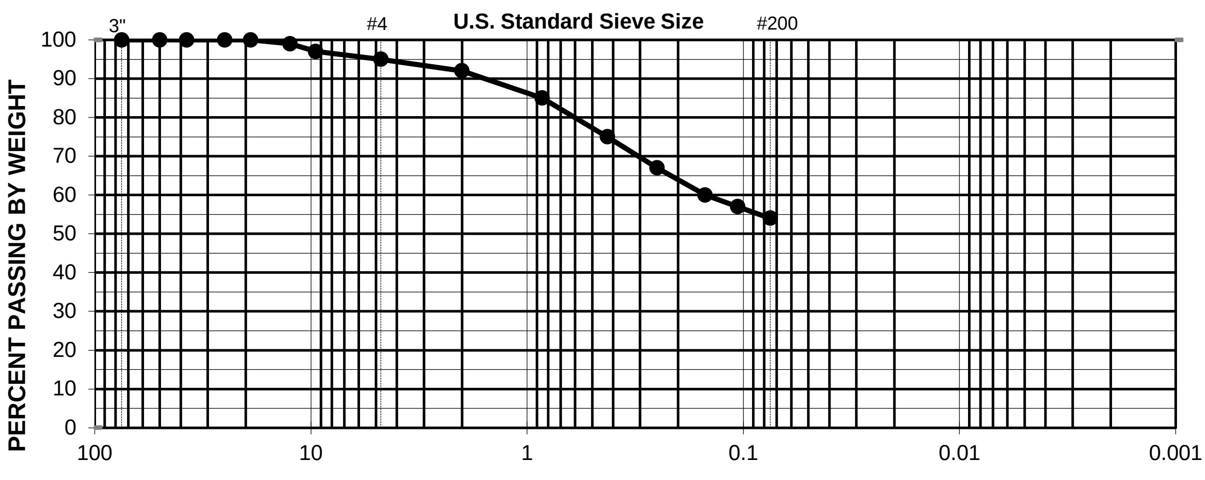
Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL COARSE	GRAVEL FINE	SAND COARSE	SAND MEDIUM	SAND FINE	SILT OR CLAY



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Boring Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-01	2	6.5	9.5	126.0	Dark brown sandy Clay (CL)

PROJECT NAME: SDSU West Campus Housing
PROJECT NUMBER: 27661317

COMPACTION AND INDEX PROPERTY DATA

SUBMITTED BY: Thomas J. O'Hare

Project No. 8851179W-SI01

PRELIMINARY GEOTECHNICAL
INVESTIGATION
FOR THE PROPOSED
SDSU WEST RESIDENCE HALL
SAN DIEGO, CALIFORNIA

Prepared for:

California State University
P.O. Box 92229
Long Beach, California 90802

a/rpw4

August 1 1988
Project No. 8851179W-SI01

California State University
P.O. Box 92229
Long Beach, California 90802

Attention: Ms. Sheila Chaffin, Assistant Vice Chancellor

PRELIMINARY GEOTECHNICAL INVESTIGATION
FOR THE PROPOSED SDSU
WEST RESIDENCE HALL
SAN DIEGO, CALIFORNIA

Dear Ms. Chaffin:

Woodward-Clyde Consultants is pleased to provide the accompanying report, which presents the results of our geotechnical investigation for the project. This study was performed in accordance with our proposal dated April 22, 1988 and your Agreement No. 8515.

This report presents our conclusions and recommendations pertaining to the project, as well as the results of our field explorations and laboratory tests.

If you have any questions of if we can be of further service, please give us a call.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

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PRELIMINARY GEOTECHNICAL INVESTIGATION FOR THE PROPOSED SAN DIEGO STATE UNIVERSITY WEST RESIDENCE HALL

PURPOSE AND SCOPE OF INVESTIGATION

This report presents the results of our preliminary geotechnical investigation at the site of the proposed West Residence Hall. The site is located west of the SDSU campus, north and adjacent to Remington Road, between 55th Street and Hewlett Drive in San Diego, California.

This report has been prepared for the California State University and their consultants for use in project design. This report presents our conclusions and/or tentative design recommendations regarding:

- The geologic setting of the site;
- Potential geologic hazards;
- General subsurface soil conditions;
- General location of existing fill soils;
- Presence and effect of expansive soils;
- Stability of cut and fill slopes;
- Grading and earthwork;
- Types and depths of foundations;
- Allowable soil bearing pressures;
- Settlements;
- Design pressures for retaining walls; and
- Corrosivity and sulfate content of soil samples.

DESCRIPTION OF THE PROJECT

For our study, we have discussed the project with Mr. Ralph Bradshaw of Bradshaw Bundy. We have also been provided with a preliminary plan showing the location of the proposed buildings entitled "Site Plan-West Residence Hall - SDSU," dated June 23, 1988, furnished us by Bradshaw Bundy. We understand that the proposed project will include a 12-story tower structure over a basement at elevation 425 feet. A one-story multi-purpose building will be constructed south of the tower. Patios, service yards, courtyards, and bike locker areas will be provided. An existing parking lot to the east of the hall will remain.

We understand that column loads for the 12-story tower will range from 225 to 550 kips. Wall loads are expected to be as high as 72 kips per lineal foot. The one-story multi-purpose building will have relatively light footing loads. Retaining walls of various heights and backslope conditions are proposed.

The location and layout of the project are shown on the Site Plan (Figure 1).

FIELD AND LABORATORY INVESTIGATIONS

Our field investigation included making a visual reconnaissance of the existing surface conditions, making eight test borings and eleven test pits between May 26, and June 2, 1988, and obtaining soil samples. The test borings were advanced to depths ranging from 8 to 22 feet, while the test pits were excavated to depths of 3 to 12 feet. The locations of the borings and pits are shown on Figure 1.

A Key to Logs is presented in Appendix A as Figure A-1. Final logs of the test boring and pits are presented as Figures A-2 through A-20. The descriptions on the logs are based on field logs, sample inspection, and laboratory test results. Results of laboratory tests are shown at the corresponding sample locations on the logs and in Appendix B. The field investigation and laboratory testing programs are discussed in Appendices A and B.

SITE, SOIL, AND GEOLOGIC CONDITIONS

Geologic Setting

The site lies on the southern flanks of Alvarado Canyon, a major westerly draining tributary to the San Diego River. The site area is characteristically underlain by eroded remnants of Tertiary sedimentary formations capped by Quaternary terrace deposits.

Surface Conditions

The project site encompasses two asphalt paved parking lots and adjoining open hillsides located near the western limits of the SDSU campus. The western lot is a gently sloping, fill pad constructed on the steep natural hillside north of Remington Road. A fill slope, inclined at approximately 1-1/4 to 1 and up to 30 feet in height, extends from the fill pad onto the canyon sides below. We understand that no development will take place on this parking lot at this time.

The eastern parking lot is a gently sloping cut/fill pad. The lot is bounded on the north by a downward fill slope inclined at approximately 1-1/2 to 1 for most of its length. The fill slope generally ranges from 9 to 40 feet in height. The eastern, western, and southern edges of the lot are bounded by cut and cut/fill slopes inclined at a maximum of 1-1/2 to 1. These slopes that are up to 15 feet in height. The slopes around the lot are landscaped with groundcover and some trees. A paved, driveway at the west end of the lot provides access up to Remington Road. The existence of underground utilities in the project area, with the exception of conduit for the eastern lot lighting, is not known. The hillsides below the fill slopes are essentially in a natural condition although in some areas along Remington Road a thin Veneer of fill and/or scattered debris is present. Natural slope inclinations are locally up to 1-1/2 to 1. The natural vegetation consists of dense trees and brush along drainage channels and moderate to dense chaparral and grasses on the hillsides.

Subsurface Conditions

The site is underlain by fill soils, natural overburden soils (including topsoil, residual clay, slopewash and alluvium) and formational soils consisting of the Pleistocene Lindavista Formation and the Eocene Mission Valley Formation and Stadium Conglomerate. These soils are described below. The approximate areal extent of each unit, with the exception of the natural overburden soils, are shown on Figure 1. The geologic map symbol for each mapped unit is given after the formal name.

Fill (Qf)

Based on review of pregrading topography, the western parking lot is underlain entirely by fill soils. The fill appears to extend to an estimated maximum depth of approximately 15 feet beneath the north central edge of the lot. Based on Boring 7, the fill consists largely of clayey sand and gravel and rubble.

The fill soils continue from the western parking lot along the upper hillside on the northern edge of Remington Road into the eastern parking lot. Fill soils underlie the northern half of the east lot and all of the extreme eastern end. The fill extends offsite into the apartment property to the north. Our test excavations indicate that the fill in the east lot generally consists of lean to fat clays, often containing gravels, and some silty and clayey sands. Our estimate of original site grades indicates that the fill may be up to 30 feet thick, with the deepest areas being near the east corner of the north property line.

We have no records that indicate any of the fills on the subject site were placed under engineering observation or compacted. The fills should be considered non-structural and not suitable for the support of building loads.

Surficial Overburden Soils (Not Mapped)

Natural surficial overburden soils at the site include topsoils, residual clay, slopewash, and alluvium. Topsoils on the natural hillsides, as observed in our test explorations, consist of up to 1 foot of clayey sand and sandy clay with some local gravels. Residual clay soils, consisting of up to 2-1/2 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 soil layer exist directly beneath the fill soils in some areas.

Natural slopewash soils cover the portions of the site not underlain by topsoil and residual clay. The slopewash soils achieved a maximum thickness of 3-1/2 feet in our test excavations and were composed of porous, sandy clay.

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. Although not specifically investigated, we estimate that the alluvial soils consist of clayey, sandy gravels.

Lindavista Formation (Qln)

Based on topographic indications and previous 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 which contains numerous gravels. Large cemented zones are common to the Lindavista Formation. It is anticipated that foundation elements for the multi-purpose building will be founded in this unit.

Mission Valley Formation (Tmv)

The hillsides above an elevation of about 375 feet in the project area are underlain by sediments of the Mission Valley Formation. Soils of this unit are generally composed of dense, silty to clayey fine sand. Lenses of sandy clay or gravels and localized cemented layers were also encountered within the Mission Valley Formation in our test borings. All of the foundation elements for the tower structure will be founded in the Mission Valley Formation.

Stadium Conglomerate (Tst)

The stratigraphic unit forming the lower hillsides in the site area below an elevation of about 375 feet is the Stadium Conglomerate. This unit characteristically consists of a dense, cobble conglomerate having a silty to clayey sand matrix. Based on our test excavations, the contact with the overlying Mission Valley Formation appears to be gradational.

Geologic Structure

The large majority of the formational soils encountered in our test excavations appear to be massively bedded. In Test Pit 7, however, a thin iron oxide stained layer suggested a possible dip of approximately 3 degrees to the north. Our experience indicates that regionally, the general overall dip of the Eocene sediments in this area is less than 5 degrees to the south or southwest.

Groundwater

No groundwater seeps or springs were observed in our test excavations or during our site reconnaissance. Some surface soils were wetted due to storm drain-directed runoff in a hillside drainage below Remington Road between the two parking lots.

Local and Regional Faults

Our field studies did not indicate the presence of faults within the site area. Our review of geologic literature indicates that the uppermost reaches of the La Nacion Fault Zone is mapped approximately 2,000 feet southwest of the site. Other significant faulting in the area includes the Rose Canyon Fault zone located approximately 6.7 miles west of the site.

Although the La Nacion Fault zone and the Rose Canyon Fault zone have been seismically quiescent through most of recorded history, a series of earthquakes in 1985 with events up to Richter Magnitude 4.2 were attributed to the Rose Canyon Fault zone in San Diego Bay. Recent studies of the geologic history and character of the La Nacion Fault zone and, in particular, the Rose Canyon Fault zone, indicate that they are capable of producing a moderate to large magnitude earthquake.

Other known active fault systems where recurring seismic events of Richter Magnitude 4.0 or greater have been recorded are within the Elsinore Fault zone and the Coronado Banks Fault zone, located approximately 36 miles northeast and approximately 18 miles southwest (offshore) of the sites, respectively. Both of these systems are also considered capable of producing a moderate to large magnitude earthquake.

Landslides

Our site reconnaissance and field explorations did not identify the presence of landslides on the site. No landslides are mapped on or adjacent to the site in reviewed geologic literature.

DISCUSSIONS, CONCLUSIONS, AND RECOMMENDATIONS

The discussions, conclusions, and recommendations presented in this report are based on the information provided to us, results of our field and laboratory studies, analysis, and professional judgement.

Potential Geologic Hazards

Our field studies did not indicate the presence of faulting within the project area. Our review of geologic literature and maps also indicates that no nearby major faults are mapped as projecting toward the site. Thus, fault surface rupture does not appear to present a potential geologic hazard.

Southern California is a seismically active region and the San Diego area is subject to periodic seismic shaking from earthquakes on local or more distant faults. It is not unreasonable to anticipate that the general project area, as well as the entire San Diego coastal area, could experience relatively strong ground shaking due to nearby or distant earthquakes.

Landslides

No landslides were identified on or adjacent to the site during our site investigation. Landslides are generally not common to the formational units underlying the site.

Liquefaction

The formational soils on the site are dense, and there is no apparent permanent groundwater table within expected grading limits. In our opinion, the formational soils do not have a potential for liquefaction. Sandy surficial overburden soils have a potential for liquefaction in a saturated state. In our opinion, this potential can be essentially eliminated by over-excavation and recompaction as recommended in the Earthwork section of this report.

Groundwater

We did not encounter a permanent groundwater table within the proposed depths of grading. Perched water conditions may be present within the Tertiary sediments where porous sands overlie sedimentary units containing a higher percentage of fine grained soils. Perched water zones may also exist within the alluvial and surficial soils. If such perched water zones are encountered in cut slopes, we recommend installing slope drains in accordance with recommendations in the attached Guide Specifications for Subsurface Drains (Appendix C).

Excavation and Soil Characteristics

Results of our field exploration indicate that all material within the proposed grading depths can be excavated with light to heavy ripping effort with heavy-duty grading equipment. The efficiency of excavation is dependent upon conditions of equipment and capability of its operator. Cemented zones, which are typical of the Lindavista and Mission Valley Formations, should be expected. The cemented zones may produce oversize material during grading which will require exporting from the site. The Mission Valley Formation above approximate elevation 415 feet appears to have lower shear strength than the formation below that level.

In our opinion, all soil materials generated on-site during the grading operations are suitable for use as fill soils. However, the clayey fill and surficial soils and the clayey portions of the Mission Valley Formation are expected to be moderately to high expansive, and thus not suitable for use at finish grade. The remainder of the on-site soils should range from nonexpansive to slightly to moderately expansive.

Slopes

We do not anticipate that major cut or fill slopes will be constructed at the site. However, we recommend that any new permanent slopes be made at inclinations of 2 to 1 (horizontal to vertical) or flatter. We are of the opinion that cut or fill slopes composed of formational soils or properly compacted fill will be grossly stable up to heights on the order of 25 feet. We recommend that any natural overburden soils or existing fill be excavated from cut slopes and recompacted in accordance with earthwork specifications.

Fill slopes, especially those constructed at inclinations steeper than 2:1, are particularly susceptible to shallow slope sloughing in periods of rainfall, heavy irrigation, and/or upslope surface runoff. Periodic slope maintenance may be required, including rebuilding the outer 1-1/2 to 4 feet of the slope. Sloughing of fill slopes can be reduced by overbuilding at least 3 feet and cutting back to the desired slope. To a lesser extent, sloughing can be reduced by backrolling slopes at frequent intervals. As a minimum, we recommend that all fill slopes be trackwalked so that a dozer track covers all surfaces at least twice. We recommend that all cut and fill slopes be planted, drained, and maintained.

Grading

We recommend that all earthworking at the site be done under the observation of Woodward-Clyde Consultants (WCC) and in accordance with the attached "Guide Specifications for Earthwork" Appendix D. We recommend that all grading plans be reviewed by WCC prior to finalizing. A pre-construction conference is recommended prior to site clearing, grubbing, and building.

We recommend that any existing fill or loose overburden soils in areas of new buildings, decks, patios, parking areas, etc., be excavated and recompacted in accordance with specifications. The maximum depth of these soils in the area of new construction is estimated to be on the order of 10 feet. However, the actual depth should to be evaluated in the field at the time of grading.

We recommend that all expansive soils located in proposed concrete slab-on-grade areas be excavated to a depth of 3 feet and replaced with select soil; for parking areas, the depth of excavation should be 1 foot. Select soil is defined in the earthwork specifications in Appendix D. Concrete slab-on-grade areas are defined as the footprint of the slab plus a horizontal distance of 5 feet. The soils of the Lindavista and Mission Valley Formations are expected to provide select soils for use below concrete slabs.

We recommend that all fill be placed at moisture contents equal to or greater than the optimum moisture content.

We recommend that positive measures be taken to properly finish grade each pad area so that drainage waters from the pads and adjacent properties are directed off the pads and away from foundations, floor slabs, and slope tops. Even when these measures have been taken, experience has shown that a shallow ground water or surface water condition can and may develop in areas where no such water condition existed prior to site development; this is particularly true where a substantial increase in surface water infiltration results from landscaping irrigation.

To further reduce the possibility of moisture related problems, we recommend that all landscaping and irrigation be kept as far away from the building perimeter as possible. Irrigation water, especially close to the building, should be kept to the minimum required level. We recommend that the ground surface in all areas be graded to slope away from the building foundations and floor slabs and that all runoff water be directed to proper drainage areas and not be allowed to pond. A minimum ground slope of 2 percent is recommended.

Foundations

We recommend that the foundation system for the tower structure be founded located through the less dense upper portion of the Mission Valley Formation into the dense, silty to clayey sands below an elevation of 415 feet MSL. Spread footings supporting the tower structure may be designed for an allowable soil bearing pressure of 9,000 psf. The footings should be at least 4 feet wide.

Because of the recommended depth of spread footings, it may be cost effective to utilize reinforced, cast-in-place concrete piers founded below elevation 415 feet. Piers that have a minimum diameter of 3 feet and at bottom elevation of at least 405 feet may be designed for an allowable soil end bearing of 15,000 psf (total dead plus live load). An allowable skin friction of 750 psf may also be used for the portion of the pier below elevation 420 feet. Straight sided or hilled piers may be used; the bell should be no more than three times the shaft diameter. The skin friction should only be used on the straight shaft above the bell area for downward bearing. For uplift, a straight shaft defined by the diameter of the bell may be used in calculations for allowable uplift capacity.

All piers should be cleaned of loose soil and observed by the geotechnical engineer prior to placing steel or concrete.

When access is available, we recommend that three additional borings be performed in the tower area, to verify soil conditions. This can be done during or following site clearing and grading.

Continuous wall or conventional spread footings for the multi-service building that are founded in properly compacted fill or the dense, Lindavista Formation may be designed for an allowable soil bearing pressure of 3,000 psf (total dead plus live load). All footings should be at least 24 inches wide. Perimeter and interior footings should be founded at least 2 feet below rough pad grade prepared in accordance with the recommendations presented above.

All bearing pressures presented may be increased by one-third for loads that include seismic or wind forces. The footings and piers should be reinforced in accordance with the structural engineer's recommendations.

Settlements

We expect that settlement of conventional foundation, such as those for the one story multi-service structure, will generally be less than 1/2 inch with differential settlements being about half the total settlement.

Settlements of reinforced concrete piers founded in the Mission Valley Formation are estimated to be negligible for the level of loading recommended above.

Floor Slabs

We recommend that floor slabs underlain by the Mission Valley Formation or properly compacted select fill be at least 4 inches thick and reinforced in accordance with the structural engineer's recommendations. Floor slabs underlain by undocumented or uncompacted fill should be designed as structural slabs independent of the underlying soil. All floor slabs should be underlain by 4 inches of clean coarse sand and a vapor barrier.

Lateral Pressures

We recommend that an allowable equivalent passive fluid weight of 450 pcf be used to resist lateral pressure against grade beams or footings. This assumes that the ground is level for at least 10 feet in front of the surface generating passive pressures. No credit should be given to the upper 12 inches of grade not protected by paving or floor slabs. An allowable friction factor of 0.4 may also be used to resist lateral loads but should be reduced to 0.3 when used in conjunction with passive resistances.

Results of our analysis of a 36-inch diameter, laterally loaded pier are presented in Appendix E. Appendices E1, E2 and E3 present lateral pier deflections (Y) versus depth (X) for free-headed piers subjected to allowable lateral loads of 40, 60, and 80 kips, respectively. Lateral load capacities of different diameter drilled piers can be evaluated if necessary.

Retaining Walls

We recommend using an equivalent fluid weight of 35 pcf for the design of retaining walls having level backfill surfaces and height up to 15 feet that retain formational soils. Basement type walls or those restrained from movement at the top should be designed for an additional uniform horizontal pressure of 10H psf, where H is the height of the wall in feet. For 2:1 backslopes, we recommend an equivalent fluid weight of 50 pcf. WCC should be contacted for design recommendations if other surcharge loads or greater wall heights are proposed.

UNCERTAINTY AND LIMITATIONS

We have observed only a very small portion of the pertinent soil and groundwater conditions. The recommendations made herein are based on the assumption that soil conditions do not deviate appreciably from those found during our field investigation. We recommend that Woodward-Clyde Consultants review the foundation and grading plans to verify that the intent of the recommendations presented herein has been properly interpreted and incorporated into the contract documents. We further recommend that Woodward-Clyde Consultants observe the site grading, subgrade preparation under concrete slabs and paved areas, and foundation excavations to verify that site conditions are as anticipated or to provide revised recommendations if necessary. If the plans for site development are changed, or if variations or undesirable geotechnical conditions are encountered during construction, we should be consulted for further recommendations.

This report is intended for design purposes only and may not be sufficient to prepare an accurate bid.

California, including San Diego, is an area of high seismic risk. It is generally considered economically unfeasible to build a totally earthquake-resistant project; it is, therefore, possible that a large or nearby earthquake could cause damage at the site.

Geotechnical engineering and the geologic sciences are characterized by uncertainty. Professional judgements presented herein are based partly on our understanding of the proposed construction, and partly on our general experience. Our engineering work and judgements rendered meet current professional standards; we do not guarantee the performance of the project in any respect.

Inspection services allow the testing of only a small percentage of the fill placed at the site. Contractual arrangements with the grading contractor should contain the provision that he is responsible for excavating, placing, and compacting fill in accordance with project specifications. Inspection by the geotechnical engineer during grading should not relieve the grading contractor of his primary responsibility to perform all work in accordance with the specifications.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we can not be responsible for the safety of personnel other than our own on the site; the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

APPENDIX A

FIELD INVESTIGATION

Eight exploratory test borings and eleven test pits were advanced at the approximate locations shown on the site plan and geology map (Figure 1). The drilling was performed during the period of May 26 and June 2, 1988, under the direction of a geologist from our firm, using a 8-inch diameter, hollow stem, continuous flight auger. The backhoe pits were dug with a tractor-mounted Kubata KH-170L backhoe with an 18 inch bucket.

Samples of the subsurface materials were obtained from the test borings using a modified California drive sampler (2-inch inside diameter and 2-1/2-inch outside diameter). The sampler was generally driven 18 inches into the material at the bottom of the hole by a 140-pound hammer falling 30 inches. Thin metal liner tubes containing the sample were removed from the sampler, sealed to preserve the natural moisture content of the sample, and returned to the laboratory for examination and testing.

The location of each test excavation and the elevation of the ground surface at each location were estimated by reference to the available plans furnished us and by referring to the City of San Diego topographic series sheets.

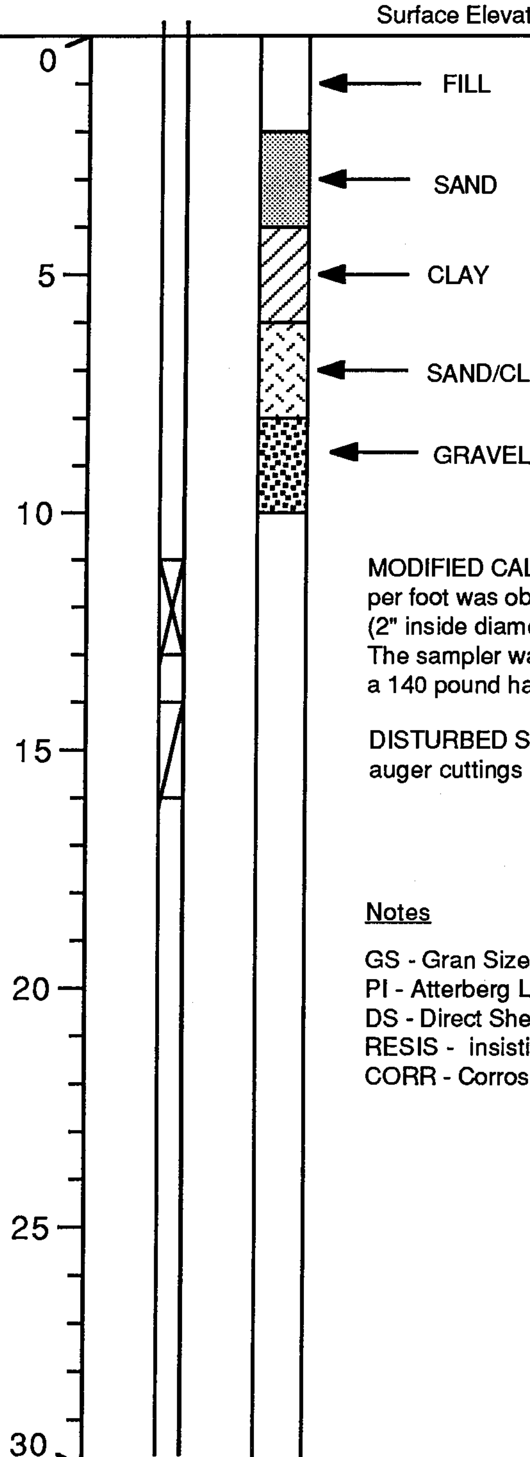
A Key to Logs is presented as Figure A-1. Final logs of the borings and test pits are presented as Figures A-2 through A-20.

Project:SDSU WEST RESIDENCE HALL	KEY TO LOGS

Date Drilled:	Water Depth: Dry	Measured:
Type of Boring:	Type of Drill Rig:	Hammer:

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*

Surface Elevation:



MODIFIED CALIFORNIA SAMPLER Sample with recorded blows per foot was obtained with a Modified California drive sampler (2" inside diameter 2.5" outside diameter) lined with sample tubes. The sampler was driven into the soil at the bottom of the hole with a 140 pound hammer falling 30 inches.

DISTURBED SAMPLE LOCATION Obtained by collecting the auger cuttings in a plastic or cloth bag.

Notes

GS - Gran Size Distribution
PI - Atterberg Limits Test
DS - Direct Shear Test
RESIS - insistivity Test
CORR - Corrosivity Test

Project:SDSU WEST RESIDENCE HALL	Log of Boring No: B-1

Date Drilled: 5-26-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 8" HSA | Type of Drill Rig: Mobile B-61 | Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Surface Elevation: Approximately 425'

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
0			3.5" asphaltic concrete on 3" of aggregate base over dense, moist, light gray clayey fine sand (SC-CL) with silt MISSION VALLEY FORMATION			
	1-1	33		16	108	GS, PI
5			Cobbley zone			
	1-2	90	Decrease in clay content			
10						
			Very dense, moist, light grey, clayey silty fine sand (SC/SM) MISSION VALLEY FORMATION			
	1-3	95		13	105	
15			Cobbley zone, becomes light brown			
	1-4	50/ 4.5	Becomes light grey			
20						
	1-5	50/5		14		
			Bottom of Hole at 22.5 Feet Sampler refusal on cobbles			
25						
30						

Project No: 8851179W-SI01 | **Woodward-Clyde Consultants** | Figure: A-2

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: B-2

Date Drilled: 5-26-88	Water Depth: Dry	Measured: At Time of Drilling
Type of Boring: 8" HSA	Type of Drill Rig: Mobile B-61	Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Surface Elevation: Approximately 425'

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
0			4" of asphaltic concrete on 4" aggregate base over moist, dark grey to dark brown (mottled) gravelley clay with cobbles and some sand FILL			
	2-1	47	Dense, moist, light grey, clayey silty fine sand (SC/SM) MISSION VALLEY FORMATION	15	107	
5			cobbly zone			
10	2-2	77				
			Very dense, moist, light grey fine sandy clay (CH) MISSION VALLEY FORMATION			
	2-3	50/4	cobbly zone	15	92	GS, PI
15			Bottom of Hole at 14.5 Feet. Auger Refusal on Cobbles			
20						
25						
30						

Project No: 8851179W-SI01	Woodward-Clyde Consultants	Figure: A-3

Project:SDSU WEST RESIDENCE HALL	Log of Boring No: B-3

Date Drilled: 5-26-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 8" HSA | Type of Drill Rig: Mobile B-61 | Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Surface Elevation: Approximately 425'

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
0			5" of asphaltic concrete on 3.5" aggregate base over very dense, moist, light grey, clayey silty fine sand (SC-SM) MISSION VALLEY FORMATION			
	3-1	56		15	108	
5						
			Very dense, moist, grey clayey silty fine sand (SM/SM) cemented MISSION VALLEY FORMATION			
10			Very dense, moist, light grey, silty fine sand, (SM) MISSION VALLEY FORMATION			
			cobbly zone			GS
	3-2	50/6				
15						
	3-3	50/4		12	103	
20						
		50/.5				
			Bottom of Hole at 22 Feet Sampler refusal			
25						
30						

Project No: 8851179W-SI01 | **Woodward-Clyde Consultants** | Figure: A-4

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: B-4

Date Drilled: 5-26-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 8" HSA | Type of Drill Rig: Mobile B-61 | Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Surface Elevation: Approximately 425'

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
0	4-1		4" of asphaltic concrete on 4" aggregate base over moist, dark gray to dark brown (mottled), gravelly clay, with cobbles and some sand (CL) FILL			
5			Very dense, moist, light brown, clayey fine sand (SC) MISSION VALLEY FORMATION			
	4-2	88	Becomes more silty with less clay (SM), light grey	29	90	GS, PI DS
10	4-3	50/ 1.5				
			Bottom of Hole at 10.5 Feet			
15						
20						
25						
30						

Project No: 8851179W-SI01 | **Woodward-Clyde Consultants** | Figure: A-5

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: B-5

Date Drilled: 5-26-88 — Water Depth: Dry — Measured: At Time of Drilling

Type of Boring: 8" HSA — Type of Drill Rig: Mobile B-61 — Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Surface Elevation: Approximately 425'

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
0			4" of aspahltic concrete on 5" aggregate base over moist, dark grey to dark brown (mottled) gravelly clay with cobbles and some sand FILL			
	5-1	15				
5			becomes hard			
	5-2	50/4				
			increase in cobble and gravel content			
10			Very dense, moist, light grey, clayey fine sand (SC) MISSION VALLEY FORMATION			
	5-3	68				
15			cobbly zone			
	5-4	50/6		13	104	
			Bottom of Hole at 18 Feet			
20						
25						
30						

Project No: 8851179W-SI01 — **Woodward-Clyde Consultants** — Figure: A-6

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: B-6

Date Drilled: 5-27-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 8" HSA | Type of Drill Rig: Mobile B-61 | Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 425'			
0			4" of asphaltic concrete on 4" aggregate base over moist, dark grey to dark brown (mottled), gravelly clay with cobbles and some sand FILL			
	6-1					
5						
10			increase in gravel and cobbles			
	6-2	50/4		17	91	
			increase in gravel and cobbles			
15			Bottom of Hole at 15 Feet Auger Refusal			
20						
25						
30						

Project No: 8851179W-SI01 | **Woodward-Clyde Consultants** | Figure: A-7

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: B-7

Date Drilled: 5-27-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 8" HSA | Type of Drill Rig: Mobile B-61 | Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 434'			
0			2" of asphaltic concrete over dry, light brown, clayey sand with gravel, cobbles FILL			
	7-1					
5			increase in cobble and gravel or rubble content			
	7-2					GS, PI RESIS. CORR.
			Bottom of Hole at 8 Feet Auger Refusal			
10						
15						
20						
25						
30						

Project No: 8851179W-SI01 | Woodward-Clyde Consultants | Figure: A-8

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: B-8

Date Drilled: 5-27-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 8" HSA | Type of Drill Rig: Mobile B-61 | Hammer: 140 lbs

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 425'			
0			4" of asphaltic concrete on 4" aggregate base over moist, dark grey to dark brown (mottled), gravelly clay with cobbles and sand. FILL			
5						
10						
			increase in cobble and gravel content			
15			Bottom of Hole at 14 Feet			
20						
25						
30						

Project: SDSU WEST RESIDENCE HALL	**Log of Boring No: P-1**

Date Drilled: 6-2-88	Water Depth: Dry	Measured: At Time of Drilling
Type of Boring: 18" Backhoe	Type of Drill Rig: Kubota KH-170L	Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 425'			
0			Loose, dry, pale brown clayey medium sand (SC) with some gravels TOPSOIL			
	P1-1		Hard, moist, brown sandy lean clay (CL) RESIDUAL CLAY grades to			
	P1-2		Very dense, moist, light gray silty very fine sand (SM) MISSION VALLEY FORMATION			
5						
			Bottom of Pit at 6 Feet			
10						
15						
20						
25						
30						

Project No: 8851179W-SI01 | **Woodward-Clyde Consultants** | Figure: A-10

Project: SDSU WEST RESIDENCE HALL			Log of Boring No: P-2
Date Drilled: 6-2-88	Water Depth: Dry		Measured: At Time of Drilling
Type of Boring: 18" Backhoe	Type of Drill Rig: Kubota KH-170L		Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 405'			
0			Hard, moist, dark grey brown fine sandy lean clay (CL) SLOPEWASH COLLUVIUM			
	P2-1					
			---------- grades to ----------			
5	P2-2		Very dense, moist, pale grey silty very fine sand (SM) with some limey zones from 4 to 6 feet MISSION VALLEY FORMATION			
10			Bottom of Pit at 9 Feet			
15						
20						
25						
30						

Project No: 8851179W-SI01	Woodward-Clyde Consultants	Figure: A-11

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: P-3

Date Drilled: 6-2-88
Water Depth: Dry
Measured: At Time of Drilling
Type of Boring: 18" Backhoe
Type of Drill Rig: Kubota KH-170L
Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 380'			
0	P3-1		Hard, moist, dark grey brown fine sandy lean clay (CL) SLOPEWASH COLLUVIUM			
			Very dense, moist, pale grey poorly graded medium sand (SP) with trace silt MISSION VALLEY FORMATION			
5	P3-2					
			Bottom of Pit at 9 Feet			
10						
15						
20						
25						
30						

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: P-4

Date Drilled: 6-2-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 18" Backhoe | Type of Drill Rig: Kubota KH-170L | Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 425'			
0	P4-1		Moist, grey brown with reddish brown mottles, fine sandy lean clay with some gravels FILL			
	P4-2		Moist, light brown, silty, medium to coarse sand with some gravel and trace clay FILL			
5	P4-3		Very dense, moist, pale grey silty fine sand (SM) MISSION VALLEY FORMATION			
			Bottom of Pit at 5.5 Feet			
10						
15						
20						
25						
30						

Project No: 8851179W-SI01 | **Woodward-Clyde Consultants** | Figure: A-13

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: P-5

Date Drilled: 6-2-88
Water Depth: Dry
Measured: At Time of Drilling
Type of Boring: 18" Backhoe
Type of Drill Rig: Kubota KH-170L
Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 395'			
0			Hard, moist, dark brown, fine sandy lean clay with trace of gravel FILL			
	P5-1					
			-------------grades to -------------			
			Very dense, moist, pale grey with yellow brown mottles, silty fine sand (SM) MISSION VALLEY FORMATION			
5	P5-2					
			Bottom of Pit at 8.5 Feet			
10						
15						
20						
25						
30						

Project No: 8851179W-SI01 | **Woodward-Clyde Consultants** | Figure: A-14

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: P-6

Date Drilled: 6-2-88	Water Depth: Dry	Measured: At Time of Drilling
Type of Boring: 18" Backhoe	Type of Drill Rig: Kubota KH-170L	Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 380'			
0			Hard, moist, dark brown, fine sandy lean clay (CL) RESIDUAL CLAY			
			grades to			
	P6-1		Very dense, moist, pale grey with light red brown mottles, silty medium to fine sand (SM) MISSION VALLEY FORMATION			
5						
	P6-2		Very dense, moist, light reddish brown, silty medium to fine sand (SM) STADIUM CONGLOMERATE			
10			Bottom of Pit at 10 Feet			
15						
20						
25						
30						

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: P-7

Date Drilled: 6-2-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 18" Backhoe | Type of Drill Rig: Kubota KH-170L | Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 362'			
0	P7-1		Hard, dry, gray brown, fine sandy lean clay (CL) with some gravels TOPSOIL			
	P7-2		Hard, moist, gray brown to dark reddish brown, sandy lean clay to clayey sand (CL/SC) RESIDUAL CLAY			
			Very dense, moist, yellowish brown, sandy gravel with some clay (GC) STADIUM CONGLOMERATE			
5			Bottom of Pit at 3 Feet			
10						
15						
20						
25						
30						

Project: SDSU WEST RESIDENCE HALL		**Log of Boring No: P-8**
Date Drilled: 6-2-88	Water Depth: Dry	Measured: At Time of Drilling
Type of Boring: 18" Backhoe	Type of Drill Rig: Kubota KH-170L	Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 370'			
0			Hard, moist, dark brown, fine sandy lean clay (CL) RESIDUAL CLAY			
			Very dense, moist, pale gray with light red brown mottles, silty medium to fine sand (SM) MISSION VALLEY FORMATION OR STADIUM CONGLOMERATE			
5			Very dense, moist, yellowish brown gravel (GM) STADIUM CONGLOMERATE			
			Bottom of Pit at 4 Feet			
10						
15						
20						
25						
30						

Project: SDSU WEST RESIDENCE HALL	**Log of Boring No: P-9**

Date Drilled: 6-2-88 | Water Depth: Dry | Measured: At Time of Drilling

Type of Boring: 18" Backhoe | Type of Drill Rig: Kubota KH-170L | Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 421'			
0	P9-1		Dry to moist, gray brown, fine sandy lean clay with gravels FILL			
5	P9-2		Hard, moist, brown fine sandy fat clay (CH) RESIDUAL CLAY grades to			
	P9-3		Very dense, moist, pale gray, silty fine sand (SM) with some limey zones MISSION VALLEY FORMATION			
			Bottom of Pit at 6 Feet			
10						
15						
20						
25						
30						

Project: SDSU WEST RESIDENCE HALL	Log of Boring No: P-10

Date Drilled: 6-2-88	Water Depth: Dry	Measured: At Time of Drilling
Type of Boring: 18" Backhoe	Type of Drill Rig: Kubota KH-170L	Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 413'			
0	P10-1		Moist, gray brown, lean to fat clay FILL			
5	P10-2		Moist, dark gray brown, lean clay with some fine sand FILL			
	P10-3		Firm, moist, brown, fat clay (CH) RESIDUAL CLAY grades to			
	P10-4		Dense, moist, pale gray brown to gray brown, silty very fine sand (SM) MISSION VALLEY FORMATION			
10			Bottom of Pit at 9.5 Feet			
15						
20						
25						
30						

Project No: 8851179W-SI01	Woodward-Clyde Consultants	Figure: A-19

Project: SDSU WEST RESIDENCE HALL	**Log of Boring No: P-11**

Date Drilled: 6-2-88	Water Depth: Dry	Measured: At Time of Drilling
Type of Boring: 18" Backhoe	Type of Drill Rig: Kubota KH-170L	Hammer:

* see Key to Logs, Fig. A-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation: Approximately 413'			
0			Moist, gray brown, fat clay with some sand and gravels FILL			
	P11-1					
5			Moist, brown clayey medium sand FILL			
	P11-2					
10	P11-3		Mottled, moist, gray, silty to clayey fine sand (SC-SM) inter-bedded with brown fat clay FILL			
			Bottom of Pit at 12 Feet			
15						
20						
25						
30						

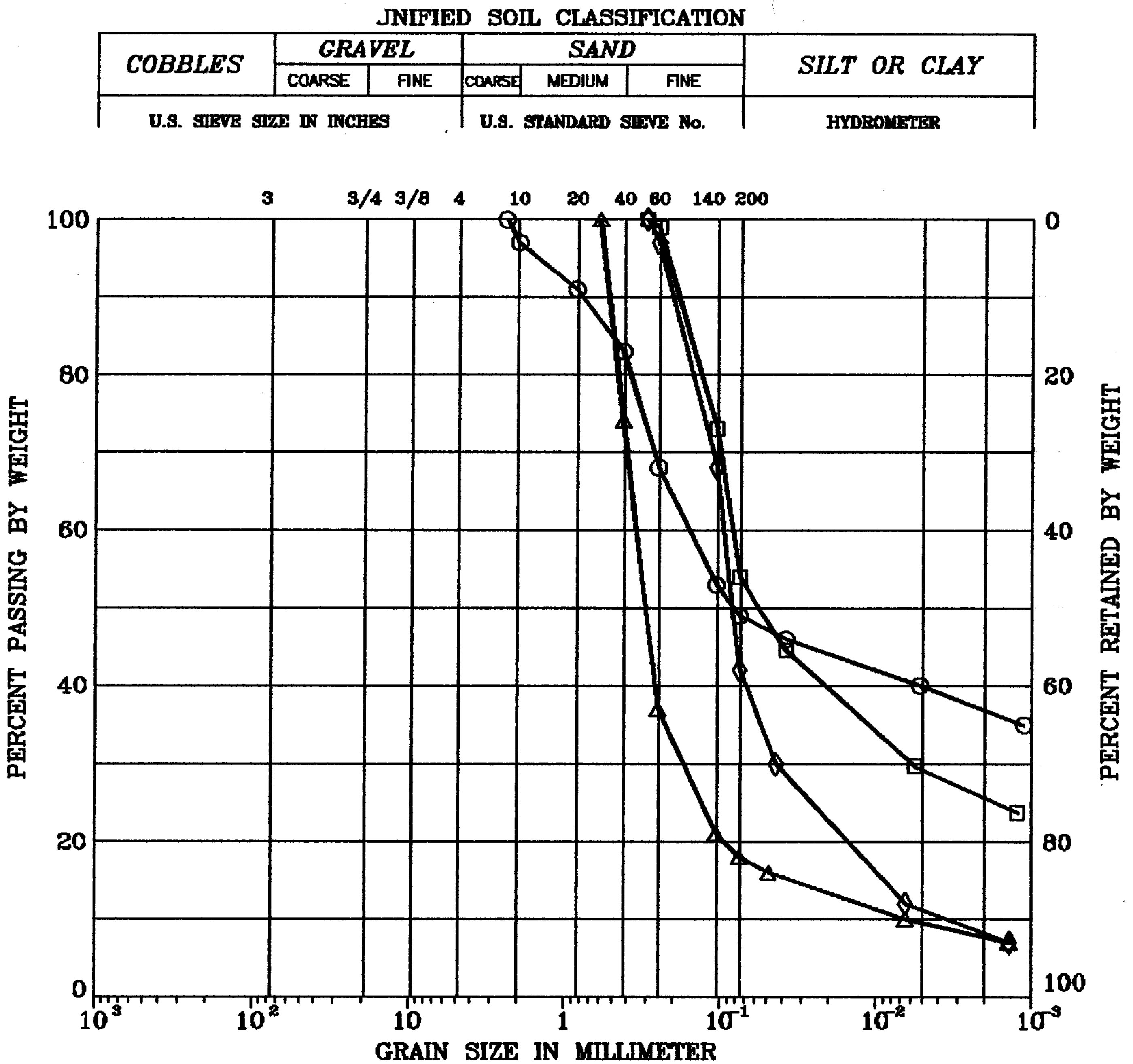
APPENDIX B

LABORATORY TESTS

The materials observed in the excavations were visually classified and evaluated with respect to strength, swelling, and compressibility characteristics; dry density; and moisture content. The classifications were substantiated by performing grain size analyses and evaluating plasticity characteristics of samples of the soils.

The strength of the soils was evaluated by performing direct shear tests on selected samples, and by considering the density and moisture content of the samples and the penetration resistance of the sampler.

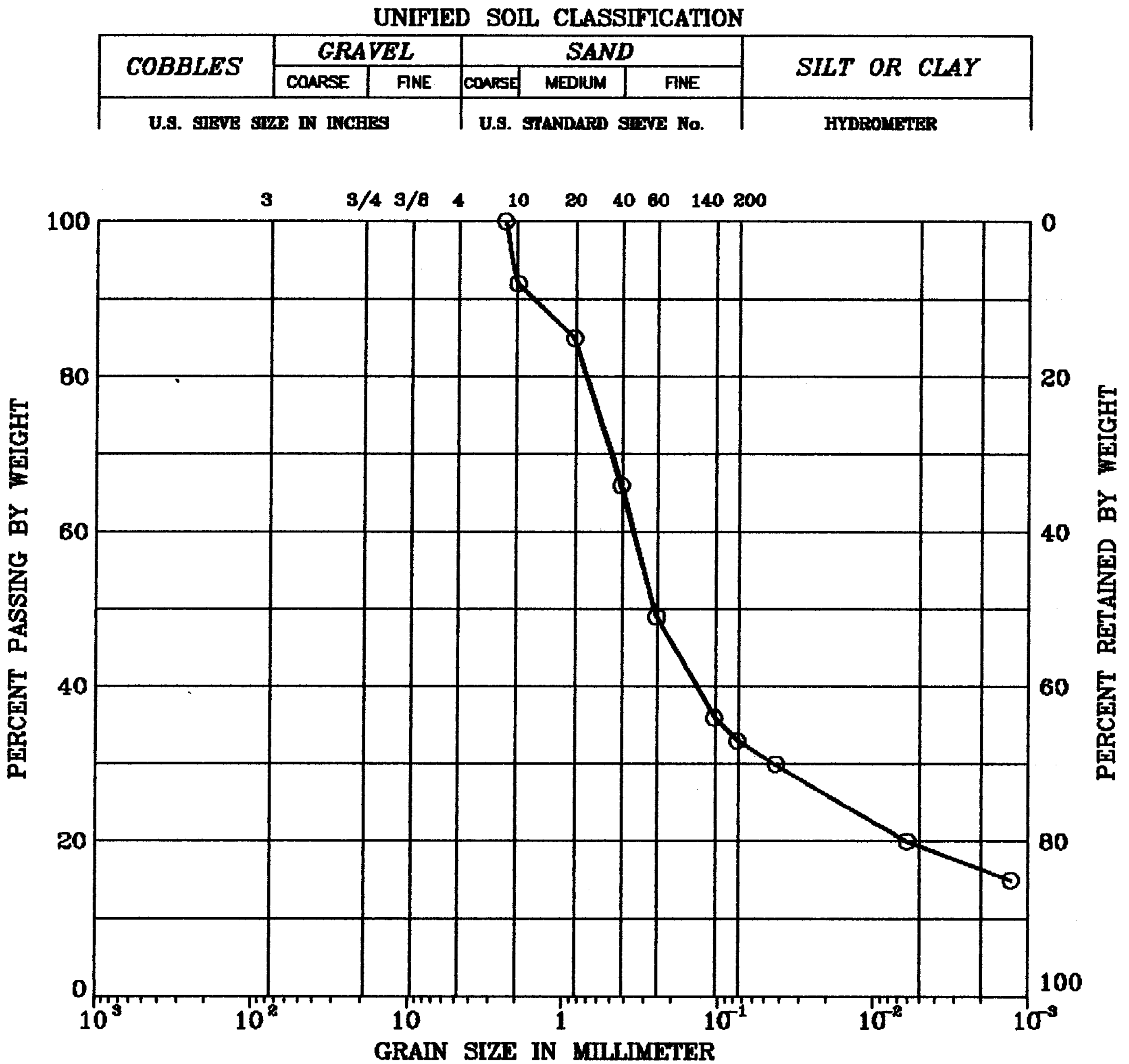
The results of laboratory tests on drive samples, except for direct shear tests, are shown with the penetration resistance of the sampler at the corresponding sample location on the logs, Figures A-2 through A-20. The grain size distribution curves are shown in Figure B-1. The results of the direct shear tests, are presented in Figures B-2 and B-3.



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	1-1		48	30	CLAYEY FINE SAND (SC) TO FINE SANDY LEAN CLAY (CL)
□	2-3-3		70	48	FINE SANDY FAT CLAY (CH)
△	3-2				SILTY FINE SAND (SM)
◊	4-2-4		35	7	SILTY FINE SAND (SM)

Remark :

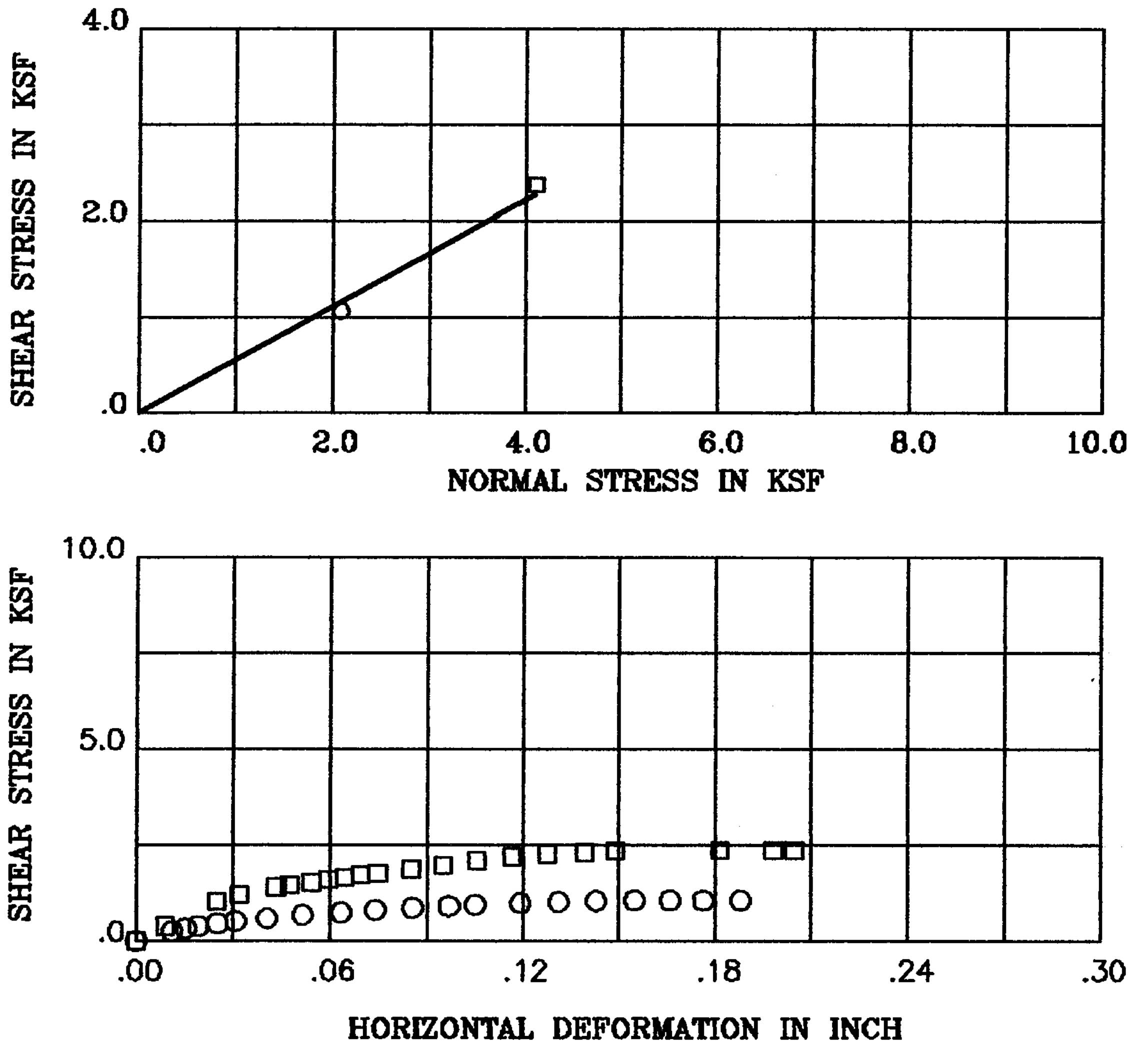
8851179W SI01	WEST RESIDENCE HALL
Woodward Clyde Consultants San Diego, CA	**GRAIN SIZE DISTRIBUTION** **Figure No.** B-1



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
O	7-2		40	22	CLAYEY SAND (SC)

Remark :

8851179W SI01	WEST RESIDENCE HALL
Woodward Clyde Consultants San Diego, CA	**GRAIN SIZE DISTRIBUTION** Figure No. B-2

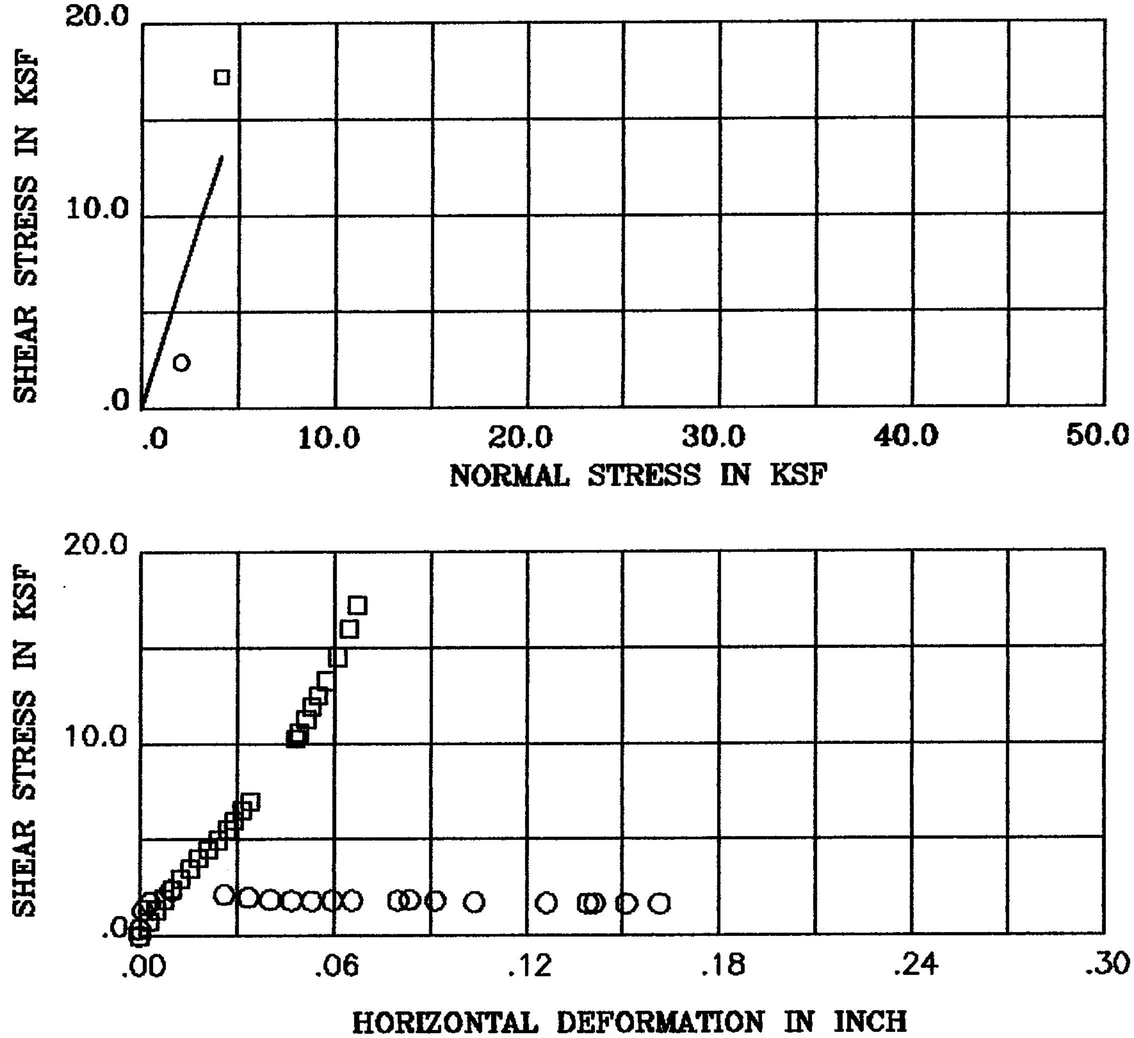


BORING/SAMPLE	: 4-2-4	**DEPTH (ft)**	:
DESCRIPTION	: SILTY FINE SAND (SM)		
STRENGTH INTERCEPT (C)	: .000	**KSF**	(PEAK STRENGTH)
FRICTION ANGLE (PHI)	: 29.0	**DEG**	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	NORMAL STRESS (ksf)	PEAK SHEAR (ksf)	RESIDUAL SHEAR (ksf)
O	29.1	90.3	.852	2.09	1.06	1.06
□	26.5	95.1	.759	4.12	2.37	2.37

Remark : INITIAL DD 90.0PCF,MC 13.6%

87851179W SI01	WEST RESIDENCE HALL
Woodward Clyde Consultants San Diego, CA	DIRECT SHEAR TEST Figure No. B-3



BORING/SAMPLE : 4-3-4 **DEPTH (ft)** :

DESCRIPTION :

STRENGTH INTERCEPT (C) : .000 **KSF** (PEAK STRENGTH)

FRICTION ANGLE (PHI) : 72.6 **DEG**

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	NORMAL STRESS (ksf)	PEAK SHEAR (ksf)	RESIDUAL SHEAR (ksf)
○	17.5	114.8	.456	2.05	2.37	1.65
□	13.1	131.2	.275	4.10	17.23	17.23

Remark :

8851179W SI01	WEST RESIDENCE HALL
Woodward Clyde Consultants San Diego, CA	**DIRECT SHEAR TEST** **Figure No.** B-4

LABORATORY REPORT

Telephone (619) 425-1993 Established 1928

CLARKSON LABORATORY AND SUPPLY INC.
350 Trousdale Dr. Chula Vista, Ca. 92010
ANALYTICAL AND CONSULTING CHEMISTS

Date: 06-29-88
Purchase Order Number: 8851179W-SI01
Account Number: WOOX
To:
--

WOODWARD CLYDE
3467 KURTZ STREET
SAN DIEGO, CA. 92110
Attn: R.P. White

Laboratory Number: SO-1965 Customers Phone No: 224-2911

Sample Designation:
--

One soil sample marked West Residence Hall 4-1
Job #8851179W SI01.

ANALYSIS: By Test Method No. Calif. 643-C October 2, 1972 State of California Department of Public Works Division of Highways Materials and Research Department Method for Estimating the Service Life of Metal Culverts.

SAMPLE

pH 6.5

Water Added (ml)	Resistivity (ohm-cm)
100	13270
50	3670
50	1330
50	530
50	370
50	340
50	300
50	280
50	290
50	290
50	330

The above results indicate 5 years to perforation for a 16 gauge metal culvert, and 15 years to perforation for a 8 guage metal culvert.

Water Soluble Sulfates 0.015%

Maria Louise Espino

Maria Louise Espino

MLE/as

Figure B-5

LABORATORY REPORT

Telephone (619) 425-1993 Established 1928

CLARKSON LABORATORY AND SUPPLY INC.
350 Trousdale Dr. Chula Vista, Ca. 92010
ANALYTICAL AND CONSULTING CHEMISTS

Date: 06-29-88
Purchase Order Number: 8851179W-SI01
Account Number: WOOX
To:

WOODWARD CLYDE
3467 KURTZ STREET
SAN DIEGO, CA. 92110
Attn: R.P. White

Laboratory Number: SO-1964 Customers Phone No: 224-2911

Sample Designation:

One soil sample marked West Residence Hall 1-1
Job #8851179W SI01.

ANALYSIS: By Test Method No. Calif. 643-C October 2, 1972 State of California Department of Public Works Division of Highways Materials and Research Department Method for Estimating the Service Life of Metal Culverts.

SAMPLE

pH 5.8

Water Added (ml)	Resistivity (ohm-cm)
100	5690
50	2090
50	1640
50	1010
50	630
50	430
50	430
50	380
50	410
50	410
50	440

The above results indicate less than 5 years to perforation for a 16 gauge metal culvert, and 8 years to perforation for a 8 guage metal culvert.

Water Soluble Sulfates 0.012%

Maria Louise Espino

MLE/as

Figure B-6

APPENDIX C

Guide Specifications for Subsurface Drains

I. DESCRIPTION

Subsurface drains consisting of filter gravel or clean gravel enclosed in filter fabric with perforated pipe shall be installed as shown on the plans in accordance with these specifications, unless otherwise specified by the engineer.

II. MANUFACTURE

Subsurface drain pipe shall be manufactured in accordance with the following requirements.

Perforated corrugated ADS pipe shall conform to ASTM Designation F405. Transite underdrain pipe shall conform to ASTM Designation C-508 (Type II). Perforated ABS and PVC pipe shall conform to ASTM Designations 2751 and 3033, respectively, for SDR35; and to ASTM Designations 2661 and 1785, respectively, for SDR21. The type pipe shall conform to the following table.

Pipe Material	Maximum Height Of Fill (feet)
ADS (Corrugated Polyethylene)	8
Transite "underdrain"	20
PVC or ABS:	
SDR35 or current equivalent	35
SDR21	100

III. FILTER MATERIAL

Filter material for use in backfilling trenches around and over drains shall consist of clean, coarse sand and gravel or crushed stone conforming to the following grading requirements:

Sieve Size	Percentage Passing Sieve
1"	100
3/4"	90 - 100
3/8"	40 - 100
4	25 - 40
8	18 - 33

30	5 - 15
50	0 - 7
200	0 - 3

This material generally conforms with Class II permeable material in accordance with Section 68-1.025 of the Standard Specifications of the State of California, Department of Transportation.

IV. FILTER FABRIC AND AGGREGATE

Filter fabric for use in drains shall consist of Mirafi 140S (Celanese), Typar (DuPont), or equivalent. The aggregate shall be 3/4-inch minimum to 1-1/2-inch maximum size, free draining aggregate. Filter fabric shall completely surround the aggregate.

V. LAYING

Trenches for drains shall be excavated to a minimum width of 2 feet and to a depth shown on the plans, or as directed by the engineer. The bottom of the trench shall then be covered full width by 4 inches of filter material or with filter fabric and 4 inches of aggregate, and the drain pipe shall be laid with the perforations at the bottom and sections shall be joined with couplers. The pipe shall be laid on a minimum slope of 0.2 percent and drained to curb outlet or storm drain.

After the pipe has been placed, the trench shall be backfilled with filter material, or 3/4-inch minimum to 1-1/2-inch maximum size free-draining aggregate if filter fabric is used, to the elevation shown on the plans, or as directed by the engineer.

APPENDIX D

GUIDE SPECIFICATIONS FOR EARTHWORK

SDSU West Residence Hall

NOTE: These specifications are provided as a guide for preparation of the final grading specifications for the project, which with the plans constitute the project documents. These guide specifications are not intended for use as final grading specifications.

1. GENERAL

1.1 The work of the Contractor covered by these specifications consists of furnishing labor and equipment and performing all operations necessary to remove deleterious and undesirable materials from areas of grading, to properly prepare areas to receive fill, and to excavate and fill to the lines and grades shown on the plans or as directed in writing by the (Owner) (Civil Engineer) (Architect).

1.2 The Contractor shall perform the work in strict accordance with these specifications and the Contractor shall be responsible for the quality of the finished product notwithstanding the fact that the earthwork may be observed and tests made by a Geotechnical Engineer. Deviations from these specifications will be permitted only upon written authorization from the (Owner) (Civil Engineer) (Architect).

1.3 The data contained in the geotechnical report and in any following addenda indicating subsurface conditions are not intended as representations or warranties of the accuracy or continuity of subsurface conditions between soils borings. It shall be expressly understood that the interpretations or conclusions drawn from such data are the responsibility of the Contractor.

2. DEFINITIONS

2.1 Contractor shall mean the contractor performing the earthwork.

2.2 Owner shall mean the owner of the property or the party on whose behalf the earthwork is being performed and who has contracted with the Contractor to have the earthwork performed.

2.3 (Civil Engineer) (Architect) shall mean the (engineer) (architect) who has prepared the grading plans and who is the Owner's representative concerning the configuration, quantities and dimensions of the earthwork and who usually sets basic surveying data at the site for the Contractor's conformance.

2.4 Geotechnical Engineer shall mean a licensed civil engineer authorized to use the title "Geotechnical Engineer" in accordance with Section 6736.1, Chapter 7, Division 3, State of California Business and Professions Code. The Geotechnical Engineer shall be responsible for having representatives on site to observe and test the Contractor's work for conformance with these specifications.

2.5 Green Book shall mean the most recent edition of the Standard Specifications for Public Works Construction, prepared by the Joint Cooperative Committee of the Southern California Chapter, American Public Works Association, and Southern California Districts, Associated Contractors of California.

2.6 Standard Special Provisions shall mean the most recent edition of the Standard Special Provisions, prepared by County of San Diego, Department of Public Works.

3. OBSERVING AND TESTING

3.1 The Geotechnical Engineer shall be the Owner's representative to observe and make tests during the foundation preparation, filling, and compacting operations.

3.2 The Geotechnical Engineer shall make field density tests in the compacted fill to provide a basis for expressing an opinion as to whether the fill material has been compacted to at least the minimum relative compaction specified. The basis for this opinion shall be that no tests in compacted or recompacted areas indicate a relative compaction of less than that specified. Density tests shall be made in the compacted material below any disturbed surface. When these tests indicate that the density of any layer of fill, or portion thereof, is below the specified density, the particular layer or area representative by the test shall be reworked until the specified density has been achieved.

3.3 Testing shall conform to the following standards as pertinent:

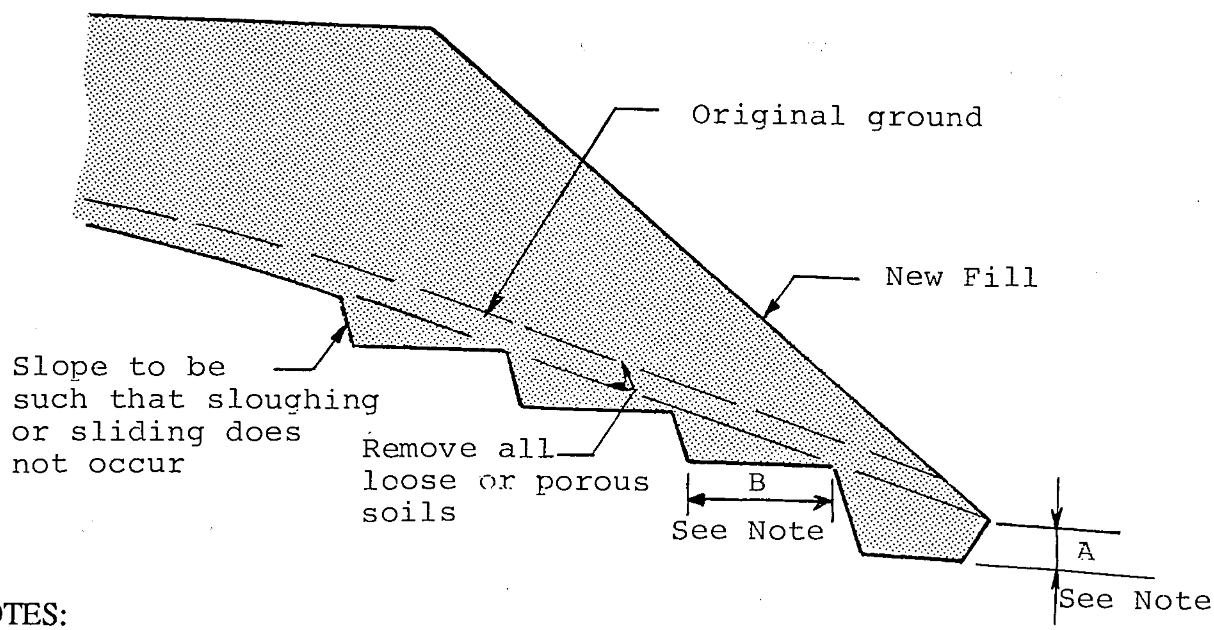
- ASTM D2922-81, "Density of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth)"
- ASTM D3017-78, "Moisture Content of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth)"
- ASTM D1556-82, "Density of Soil in place by the Sand-Cone Method"
- ASTM D1557-78, "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 10-lb. (4.54 kg) Rammer and 18-in. (457-mm) Drop," Methods A, B, and C.
- AASHTO T 224-86, "Correction for Coarse Particles in the Soil Compaction Test."

4. CLEARING AND PREPARING AREAS TO BE FILLED

4.1 Clearing and grubbing shall be in accordance with Section 300-1 of the Green Book and, in addition, all trees, brush, grass, and other objectionable material shall be collected from areas to receive fill and disposed of off-site prior to commencement of any earth moving so as to leave the areas that have been cleared with a neat and finished appearance free from debris.

4.2 All loose or porous soils shall be removed or compacted as specified for fill. The depth of removal and recompaction shall be approved in the field by the Geotechnical Engineer. Prior to placing fill, the surface to be filled shall be free from uneven features that would tend to prevent uniform compaction by the equipment to be used. It shall then be plowed or scarified to a depth as required and in no case less than a minimum depth of 6 inches.

4.3 Where the exposed slope is steeper than 6 horizontal to 1 vertical, or where specified by the Geotechnical Engineer, the slope of the original ground on which the fill is to be placed shall be stepped or keyed by the Contractor as shown on the figure below. The steps shall extend completely into the underlying formational materials or, where formational material is not present, into previously compacted fill.



NOTES:

The outside edge of bottom key "A" shall be not less than 2 feet in depth into formational soil or no less than 5 feet into previously compacted fill.

The minimum width of benches "B" shall be at least 1-1/2 times the width of the compaction equipment, and not less than 10 feet.

4.4 After the foundation for the fill has been cleared, plowed or scarified, it shall be disked or bladed by the Contractor until it is uniform and free from large clods, brought to the specified moisture content, and compacted as specified for fill.

5. SUBGRADE PREPARATION IN PAVEMENT AREAS

5.1 Subgrade preparation shall be in accordance with Section 301-1 of the Green Book, except that relative compaction of subgrade shall be in accordance with Section 12 of these specifications. Scarification and recompaction requirements may be waived by the Geotechnical Engineer in subgrade areas with naturally cemented formational soils.

5.2 All areas to be paved shall be proofrolled in accordance with Section 301-1.3 of the Standard Special Provisions.

6. MATERIALS - GENERAL FILL

6.1 Materials for compacted fill shall contain no rocks or hard lumps greater than 6 inches in maximum dimension and shall contain at least 40% of material smaller than 1/4 inch in size. Material of a perishable, spongy, or otherwise improper nature shall not be used in fills.

6.2 Select soil, to be used at finish grade to the depths and at the locations specified on the grading plans, shall consist of material that contains no rocks or hard lumps greater than 6 inches in maximum dimension and that has an Expansion Index of 50 or less when tested in accordance with UBC Standard 29-2.

6.3 Samples of materials to be used for fill shall be tested in the laboratory by the Geotechnical Engineer in order to evaluate the maximum density, optimum moisture content, classification of the soil, and expansion index, as required.

6.4 During earthwork operations, soil types other than those analyzed in the report of the geotechnical investigation may be encountered by the Contractor. The Geotechnical Engineer shall be consulted to determine the suitability of these soils.

7. MATERIALS - PAVEMENT SUBGRADE

7.1 Pavement subgrade shall be defined as the top 12 inches of soil, excluding aggregate base, in areas to be paved with asphalt concrete or Portland cement concrete.

7.2 Materials for pavement subgrade shall contain no rocks or hard lumps greater than 6 inches in maximum dimension, shall contain at least 40 percent of material smaller than 1/4 inch in size, and shall have an Expansion Index of 50 or less when tested in accordance with UBC Standard 29-2. Material of a perishable, spongy or otherwise improper nature shall not be used in fills.

8. MATERIALS - TRENCH BACKFILL

8.1 Trench backfill materials above pipe bedding shall be in accordance with Section 306-1.3 of the Green Book.

8.2 As an alternative, cement slurry may be used to backfill trenches. The slurry shall have a minimum cement content of two sacks per cubic yard within the building limits and zone of influence of foundations and other settlement-sensitive structures. A minimum one sack per cubic yard slurry shall be used elsewhere.

9. MATERIALS - WALL BACKFILL

9.1 Wall backfill materials shall be in accordance with Section 300-3.5 of the Green Book.

10. COMPACTION EQUIPMENT

10.1 Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of compaction equipment made specifically for the purpose of compacting soils. Equipment shall be of such a design that it will be capable of compacting the fill to the specified density at the specified moisture content.

11. PLACING, SPREADING, AND COMPACTING GENERAL FILL MATERIAL

11.1 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction that is indicated by test to be not less than 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill divided by the maximum laboratory dry density evaluated in accordance with the ASTM D1557-78. Unless otherwise specified, fill material shall be compacted by the Contractor while at a moisture content at or above the optimum moisture content determined in accordance with the above test method.

11.2 The fill material shall be placed by the Contractor in layers that, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of moisture and material in each layer. The entire fill shall be constructed as a unit, in nearly level lifts starting up from the lowest area to receive fill. Compaction shall be continuous over the entire area, and the equipment shall make sufficient uniform trips so that the desired density has been obtained throughout the entire fill.

11.3 When the moisture content of the fill material is <u>below</u> that specified by the Geotechnical Engineer, water shall be added by the Contractor until the moisture content is as specified.

11.4 When the moisture content of the fill material is <u>above</u> that specified by the Geotechnical Engineer or too wet to achieve proper compaction, the fill material shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the moisture content is as required to permit compaction.

11.5 Properly compacted fill shall extend to the design surfaces of fill slopes. The surface of fill slopes shall be compacted in accordance with Section 11.1 of these specifications.

12. PLACING, SPREADING, AND COMPACTING PAVEMENT SUBGRADE

12.1 Subgrade materials shall be placed, spread, and compacted in accordance with Section 11 of these specifications, except that the top 6 inches of subgrade material shall be compacted to a relative compaction that is indicated by test to be not less than 95 percent.

13. PLACING AND COMPACTING TRENCH BACKFILL

13.1 Backfilling and compacting shall be in accordance with Section 306-1.3 of the Green Book, except that jetting or flooding shall not be allowed and that all backfill shall be compacted to a relative compaction that is indicated by test to be not less than 90 percent.

13.2 All trenches 5 feet or more in depth shall be sloped or shored in accordance with OSHA safety requirements. Trenches less than 5 feet in depth shall also be so guarded when examination indicates hazardous ground movement may be expected.

13.3 No compaction testing shall be required for portions of trenches backfilled with cement slurry.

14. PLACING AND COMPACTING WALL BACKFILL

14.1 Backfilling and compacting shall be in accordance with Section 300-3.5 of the Green Book, except that jetting or flooding shall not be allowed.

14.2 The Contractor shall be responsible for using equipment capable of compacting the backfill to the specified relative compaction without damaging adjacent walls or other existing improvements.

15. PROTECTION OF WORK

15.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. When earthwork operations are interrupted, the Contractor shall reestablish specified compaction to the depth necessary before placing new fill. The Contractor shall control surface water to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas and until such time as permanent drainage and erosion control features have been installed.

15.2 After completion of the earthwork and when the Geotechnical Engineer has finished observation of the work, no further excavation or filling shall be done except under the observation of the Geotechnical Engineer.

APPENDIX E1
LATERALLY LOADED PIER ANALYSES

SDSU, 36-IN PIER, AXIAL=550k, LATERAL=40k, SLOPE=14 DEG

OUTPUT INFORMATION
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X,FT	Y,IN.	M,FT-KIPS	ES,LB/IN^2	P,LB/IN.	EI,LB-IN.^2
0.00	0.08	0.00	0.00	0.00	0.3001D+12
1.00	0.07	40.00	3188.43	-219.64	0.3001D+12
2.00	0.06	77.36	6752.70	-397.70	0.3001D+12
3.00	0.05	109.96	10880.77	-536.96	0.3001D+12
4.00	0.04	136.10	15870.45	-641.76	0.3001D+12
5.00	0.03	154.55	21046.83	-679.99	0.3001D+12
6.00	0.03	164.84	25256.20	-633.15	0.3001D+12
7.00	0.02	167.53	29465.57	-553.34	0.3001D+12
8.00	0.01	163.58	33674.93	-453.06	0.3001D+12
9.00	0.01	154.19	37884.30	-343.63	0.3001D+12
10.00	0.01	140.68	42093.67	-234.66	0.3001D+12
11.00	0.00	124.35	55473.69	-160.27	0.3001D+12
12.00	0.00	106.10	65021.39	-59.79	0.3001D+12
13.00	-0.00	87.14	74569.09	32.74	0.3001D+12
14.00	-0.00	68.56	84116.79	109.02	0.3001D+12
15.00	-0.00	51.30	93664.49	164.68	0.3001D+12
16.00	-0.00	36.00	103212.19	198.69	0.3001D+12
17.00	-0.00	23.10	112759.89	212.50	0.3001D+12
18.00	-0.00	12.74	122307.59	209.27	0.3001D+12
19.00	-0.00	4.90	131855.29	193.06	0.3001D+12
20.00	-0.00	-0.63	141402.99	168.14	0.3001D+12
21.00	-0.00	-4.14	150950.69	138.52	0.3001D+12
22.00	-0.00	-5.99	160498.40	107.55	0.3001D+12
23.00	-0.00	-6.55	170046.10	77.70	0.3001D+12
24.00	-0.00	-6.17	179593.80	50.56	0.3001D+12
25.00	-0.00	-5.19	189141.50	26.79	0.3001D+12
26.00	-0.00	-3.89	198689.20	6.28	0.3001D+12
27.00	0.00	-2.51	208236.90	-11.67	0.3001D+12
28.00	0.00	-1.27	217784.60	-28.15	0.3001D+12
29.00	0.00	-0.37	227332.30	-44.37	0.3001D+12
30.00	0.00	0.00	236880.00	-61.35	0.3001D+12

APPENDIX E2
LATERALLY LOADED PIER ANALYSES

SDSU, 36-IN PIER, AXIAL=550k, LATERAL=60k, SLOPE=14 DEG

OUTPUT INFORMATION
****

X,FT	Y,IN.	M,FT-KIPS	ES,LB/IN^2	P,LB/IN.	EI,LB-IN.^2
0.00	0.13	0.00	0.00	0.00	0.3001D+12
1.00	0.11	60.00	2527.26	-285.69	0.3001D+12
2.00	0.10	116.57	5566.08	-540.01	0.3001D+12
3.00	0.08	166.66	9043.93	-738.54	0.3001D+12
4.00	0.07	207.89	12858.02	-864.88	0.3001D+12
5.00	0.05	238.74	17456.01	-943.75	0.3001D+12
6.00	0.04	258.27	23314.86	-984.80	0.3001D+12
7.00	0.03	265.98	29465.57	-939.98	0.3001D+12
8.00	0.02	262.40	33674.93	-777.71	0.3001D+12
9.00	0.02	249.50	37884.30	-598.53	0.3001D+12
10.00	0.01	229.41	42093.67	-418.40	0.3001D+12
11.00	0.01	204.31	55473.69	-299.64	0.3001D+12
12.00	0.00	175.60	65021.39	-132.63	0.3001D+12
13.00	-0.00	145.31	74569.09	23.19	0.3001D+12
14.00	-0.00	115.29	84116.79	153.51	0.3001D+12
15.00	-0.00	87.12	93664.49	250.56	0.3001D+12
16.00	-0.00	61.95	103212.19	312.08	0.3001D+12
17.00	-0.00	40.53	112759.89	340.03	0.3001D+12
18.00	-0.00	23.19	122307.59	339.29	0.3001D+12
19.00	-0.00	9.91	131855.29	316.33	0.3001D+12
20.00	-0.00	0.44	141402.99	278.13	0.3001D+12
21.00	-0.00	-5.70	150950.69	231.31	0.3001D+12
22.00	-0.00	-9.06	160498.40	181.45	0.3001D+12
23.00	-0.00	-10.24	170046.10	132.78	0.3001D+12
24.00	-0.00	-9.83	179593.80	88.03	0.3001D+12
25.00	-0.00	-8.37	189141.50	48.44	0.3001D+12
26.00	-0.00	-6.32	198689.20	13.95	0.3001D+12
27.00	0.00	-4.11	208236.90	-16.51	0.3001D+12
28.00	0.00	-2.09	217784.60	-44.67	0.3001D+12
29.00	0.00	-0.61	227332.30	-72.51	0.3001D+12
30.00	0.00	0.00	236880.00	-101.68	0.3001D+12

APPENDIX E3
LATERALLY LOADED PIER ANALYSES

SDSU, 36-IN PIER, AXIAL=550k, LATERAL=80k, SLOPE=14 DEG

OUTPUT INFORMATION
****

X,FT	Y,IN.	M,FT-KIPS	ES,LB/IN^2	P,LB/IN.	EI,LB-IN.^2
0.00	0.19	0.00	0.00	0.00	0.3001D+12
1.00	0.17	80.00	2035.85	-337.05	0.3001D+12
2.00	0.14	155.96	4410.89	-629.31	0.3001D+12
3.00	0.12	224.36	7286.73	-879.40	0.3001D+12
4.00	0.10	282.21	10915.74	-1091.46	0.3001D+12
5.00	0.08	326.96	15114.42	-1223.05	0.3001D+12
6.00	0.06	357.04	19660.98	-1253.02	0.3001D+12
7.00	0.05	372.08	25542.20	-1241.34	0.3001D+12
8.00	0.04	372.22	33674.93	-1199.16	0.3001D+12
9.00	0.02	357.98	37884.30	-938.14	0.3001D+12
10.00	0.02	332.48	42093.67	-672.57	0.3001D+12
11.00	0.01	298.90	55473.69	-505.21	0.3001D+12
12.00	0.00	259.26	65021.39	-257.31	0.3001D+12
13.00	0.00	216.54	74569.09	-22.39	0.3001D+12
14.00	-0.00	173.55	84116.79	177.48	0.3001D+12
15.00	-0.00	132.68	93664.49	329.79	0.3001D+12
16.00	-0.00	95.78	103212.19	430.18	0.3001D+12
17.00	-0.00	64.03	112759.89	480.74	0.3001D+12
18.00	-0.00	38.06	122307.59	488.03	0.3001D+12
19.00	-0.00	17.94	131855.29	461.21	0.3001D+12
20.00	-0.00	3.36	141402.99	410.37	0.3001D+12
21.00	-0.00	-6.30	150950.69	345.25	0.3001D+12
22.00	-0.00	-11.82	160498.40	274.20	0.3001D+12
23.00	-0.00	-14.04	170046.10	203.68	0.3001D+12
24.00	-0.00	-13.83	179593.80	137.92	0.3001D+12
25.00	-0.00	-11.95	189141.50	79.02	0.3001D+12
26.00	-0.00	-9.13	198689.20	27.10	0.3001D+12
27.00	0.00	-5.98	208236.90	-19.24	0.3001D+12
28.00	0.00	-3.07	217784.60	-62.44	0.3001D+12
29.00	0.00	-0.90	227332.30	-105.34	0.3001D+12
30.00	0.00	0.00	236880.00	-150.39	0.3001D+12


LEGEND:
INDICATES APPROXIMATE LOCATION OF TEST BORING.
INDICATES APPROXIMATE LOCATION OF TEST PIT.
INDICATES APPROXIMATE LOCATION OF GEOLOGIC CONTACT.
Qf INDICATES APPROXIMATE LIMITS OF EXISTING FILL.
Tmv INDICATES APPROXIMATE LIMITS OF MISSION VALLEY FORMATION.
Tst INDICATES APPROXIMATE LIMITS OF STADIUM CONGLOMERATE.
SITE PLAN AND GEOLOGIC MAP
SDSU WEST RESIDENCE HALL
DRAWN BY: cb
CHECKED BY:
PROJECT NO: 8851129W-S101
DATE: 7-25-88
FIGURE NO: 1
WOODWARD-CLYDE CONSULTANTS
Tst
Tmv
Qf
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
P-10
P-11
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
350
325
375
400
425
service yard
elev. 424.0
RESIDENCE HALL
courtyard
bridge
PARKING LOT
elev. 426 - 424
BIKE LOCKERS (100)
NEW DRIVEWAY
REMINGTON ROAD
55th STREET
SITE PLAN
WEST RESIDENCE HALL - SDSU
1"=40'
5/18/88
RALPH BRADSHAW / RICHARD BUNDY
& ASSOCIATES 371 A EIGHTH AVE.
SAN DIEGO, CALIFORNIA 92101

January 24, 1989
Project No. 8851179W-SI01

California State University
P.O. Box 92229
Long Beach, California 90802

Attention: Ms. Sheila Chaffin, Assistant Vice Chancellor

REVIEW OF RECENT FOUNDATION PLANS
WEST RESIDENCE HALL - SDSU
SAN DIEGO, CALIFORNIA

Dear Ms. Chaffin:

In accordance with the request of Stedman & Dyson, the project structural engineer, we have reviewed tentative foundation plans for the subject site. The plans are two sheets, untitled and undated, but prepared by Stedman & Dyson and identified by "Basement Foundation Plan"; the plans show Sections A-A, B-B and C-C.

The plans indicate the structure has been moved a few feet to the south from that indicated in our soil report of August 1, 1988, and that a mat foundation is now proposed in lieu of a pier and grade beam foundation.

For the mat foundation design, we recommend:

- Using a vertical soil subgrade modulus (K_v) of 350 TCF;
- The soil bearing pressure on the mat not exceed 9,000 psf.
- A minimum embedment of 3 feet into the dense clayey to silty sands of the Mission Valley Formation. (As noted in our report the approximate elevation of the top of the Mission Valley Formation is 415 feet). We have no objection to stepping the mat foundation at the downhill side of the structure to meet this criteria.
- For the design of lateral resistance a friction value of .4 with no allowance for passive pressure.

If there are any questions concerning these recommendations, please call.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

Richard P. While

Richard P. While
G.E. 960

REGISTERED PROFESSIONAL ENGINEER
RICHARD P. WHILE
No. 960
Exp. 9/30/89
GEOTECHNICAL
STATE OF CALIFORNIA

RPW/dms

(5) Mr. Anthony Fulton, SDSU
(2) Mr. Ralph Bradshaw, Bradshaw-Bundy & Associates
(2) Mr. Bob Dyson, Stedman & Dyson

a/rpw9