GEOTECHNICAL ENGINEERING REPORT

FULLERTON COLLEGE NEW INSTRUCTIONAL BUILDING

LOCATED AT

321 E. CHAPMAN AVENUE
FULLERTON, CALIFORNIA

FOR

NORTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT
1830-B WEST ROMNEYA DRIVE
ANAHEIM, CALIFORNIA 92801

PROJECT FC-5180-06

MAY 18, 2017

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

Geotechnical Solutions, Inc.
Geotechnical, Structural & Environmental Engineering

May 18, 2017

Project No. FC-5180-06

North Orange County Community College District
c/o Campus Capital Projects
Fullerton College
321 East Chapman Avenue
Fullerton, California 92832-2095

Attention: Mr. Oscar Saghieh
Project Manager, Campus Capital Projects

Re: **Fullerton College**
New Instructional Building
321 East Chapman Avenue
Fullerton, California 92832

Gentlemen:

As authorized, we performed a geotechnical engineering study for the above referenced project. The accompanying Engineering Report presents the results of our subsurface exploration, laboratory testing and our conclusions and recommendations for the geotechnical engineering aspects of project design.

Planned construction consists of a new Instructional Building on the existing parking area situated between Building 1400 and Building 1200 and jest west of the existing baseball field within the Fullerton College Campus located at 321 E. Chapman Avenue, Fullerton, California.

Based on our evaluation of subsurface conditions, seismic considerations, and project location, the subject building is located outside a potential liquefaction zone and the possibility of liquefaction is considered low. The site is underlain by natural alluvial soils.

In our opinion, the use of spread footings on over-excavated and re-compacted site soils, designed for relatively light bearing pressures to control settlement, would provide adequate foundation support for the proposed structure.

The closest active fault to the site is the Puente Hills Blind Thrust fault, which is about 0.13 mile (0.21 km) to the northeast of the site. The site does not lie within an Alquist-Priolo Earthquake Fault Zone as designated by the California Geological Survey (CGS). Therefore, the potential for direct surface fault rupture at the site is considered unlikely.

Our investigation revealed that the site is suitable for the proposed development from a geotechnical engineering standpoint provided that the recommendations of this report are successfully implemented.

Our services were performed using the standard of care ordinarily exercised in this locality. This completes our scope of services for the initial design phase of the project. We have appreciated this opportunity to be of service to you on this project.

Respectfully Submitted,

Geotechnical Solutions, Inc.

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TABLE OF CONTENTS

Introduction *1*

Site Conditions *1*

Proposed Construction *2*

Geologic Setting *2*

Site Geologic Conditions *2*

Groundwater *4*

Faulting and Seismicity *5*

Field Investigation *8*

Soil Conditions *8*

Laboratory Testing *8*

- *Moisture and Density* *9*
- *Mechanical Analysis* *9*
- *Direct Shear* *9*
- *Consolidation* *9*
- *Expansion* *10*

Chemical Analysis *10*

- *Soluble Sulfates* *10*
- *Soluble Chlorides* *10*

Soil pH and Resistivity *11*

Design Values *11*

Seismic Factors *11*

Seismic Hazard Analysis *13*

Earthquake Induced Liquefaction Potential *13*

Conclusions and Recommendations *14*

Foundation Recommendations *14*

Spread Footing *14*

Slab on Grade *15*

Lateral Passive Resistance *16*

Active Earth Pressure *16*

Pavement Recommendations *17*

Exterior Concrete Flatwork *18*

Exterior Concrete for Vehicular Use *18*

Site Grading *18*

Surface Drainage *20*

Corrosivity *21*

Temporary Excavations *22*

Construction Observation *22*

Limitations *23*

References *25*

References *29*

Appendix A - Plates *29*

Appendix B – Previous Subsurface Data *30*

Appendix C – Seismic Data *31*

Appendix D - Grading Specifications *32*

Introduction

This report presents the results of a geotechnical engineering study performed for the proposed new Instructional Building to be located at the parking lot in between Building 1400 and Building 1200 and west of existing baseball field within the Fullerton College Campus located at 321 East Chapman Avenue in Fullerton, California. The vicinity of the project is shown on Plate A in Appendix A.

The primary objectives of this study were to explore subsurface conditions beneath the project site and to evaluate the existing earth materials relative to foundation support; lateral pressure design factors, seismic conditions and the potential for seismic hazards.

Specifically, the purpose of this study was to investigate underlying soils and groundwater conditions in order to evaluate the geotechnical and seismic conditions including liquefaction potential of the subject site, to assess the geotechnical suitability of the proposed development.

In general, the study objectives were met by means of site reconnaissance, exploratory drilling, sampling of the earth materials, laboratory testing, seismic study, and engineering analysis. The general scope and objectives of the study were established in collaboration with the client.

Site Conditions

The site is located inside the existing developed facility (Fullerton College Campus), located north of Chapman Avenue and east of Lemon Street west of Berkeley Street in Fullerton, California, as shown on Plate A. Existing topography of the site is relatively flat and the drainage is generally by sheet flow to the southeast.

The proposed new construction site for the Instructional Building is currently occupied by the asphalt concrete parking lot. The proposed building is located east of the existing Building 910, south of the newly constructed Classroom Office Building (COB, Building

1400), and north of Building 1200 as shown on Plot Plan and Boring Location Map (Plate B-2) in Appendix A. The site is generally level with slightly sloping towards southeast direction and is covered with asphalt concrete parking areas and driveways.

Proposed Construction

North Orange County Community College District (NOCCCD) intends to construct a three-story Instructional Building with approximately 24,000 square feet each floor within the existing asphalt concrete staff parking Lot B.

Geologic Setting

Fullerton Community College is located in the Central Block portion of the Los Angeles Basin just south of the Eastern Coyote Hills of Orange County as shown on Plate E (7.5 min. USGS La Habra Quadrangle map). The Los Angeles Basin is a broad, low relief northwest trending structural trough filled to capacity with about 14,000-feet of Tertiary age sedimentary bedrock and Quaternary alluvium. The Coyote Hills represents a mild structural bedrock uplift (an anticline) that has been faulted along its southerly flank by the Norwalk fault. Uplift of the hills is a result of structural shortening across the Los Angeles Basin and in response to continued movement along the San Andreas Fault Zone (a major tectonic plate boundary). Thick alluvial fan deposits of Quaternary age have formed along the southern flank of the hills and under the project site area.

The anticlinal structure projecting through the Eastern Coyote Hills has formed a structural trap for petroleum. The East Coyote Oil Field continues to be productive but no portion of the field lies directly beneath the site and no methane or other petroleum gases or liquids or petroleum pipelines were encountered, known, or expected to exist at the site.

Site Geologic Conditions

Site topography grades down to the south-southeast at a very mild angle and represents

the head of an alluvial fan issuing from the mouth of Brea Creek that lies just 500-feet to the west. Younger alluvium on-site has been derived from eroded clastic sediments within the East Coyote Hills that were transported southward and deposited on the fan surface. South facing slopes associated with the East Coyote Hills lie roughly 500-feet to the north and have slope ratios of 2 to 1 and less. Drainage in the area flows generally to the south and is locally controlled by paved surfaces and storm drain systems on campus. Minimal grading has been conducted in the site area that has amounted to clearing and leveling. Significant cuts or fills do not locally exist on or near the project site.

Five (5) hollow stem auger borings, up to depths of 51.5-feet, were drilled for this project. The boring locations are shown on Plate B-1. All of the borings encountered young alluvial fan deposits to the total depths drilled. The CGS La Habra Quadrangle Seismic Hazards Zoning Map (Report 009, page 7, 1997, Revised 2001) states, " the alluvial fan deposits consist of alternating beds of mixtures of clay, silt and fine to medium grained sand. Gravel layers are rare. Compactness of sand layers range from loose to dense as indicated by both lithologic descriptions and the penetration tests performed during drilling".

Logged data from the recently drilled on-site borings indicates the alluvium is generally silty sand, though individual horizons vary. Two geotechnical cross sections were drawn through the site from west to east and south to north (see Plates B-2 and B-3 in Appendix A). Changes in soil composition (grain size) are gradational both laterally and vertically over short distances. To infer any of the layers are continuous across the site is very questionable considering the meandering mode of alluvial fan deposition. Layering shown on the sections is considered at least partially diagrammatic and was an attempt to establish soil horizon continuity. Alluvial fan sediment layering is commonly quite varied with transitional contacts, layer thinning and thickening, buttress unconformities, over-bank deposition and facie changes. The physical soil parameters associated with the

alluvial sequence are provided in other sections of this report. Boring logs (soil descriptions) for each boring are provided on Plates K-1 through K-5.

Bedrock underlying the alluvial section is judged to lie in excess of 100-feet from the surface. Quaternary age bedrocks assigned to the La Habra and Coyote Hills Formations most likely are present and represent the shallowest bedrock. These are generally poorly indurated and easily erodable sands with silts and gravels that are extensively exposed in the hills to the north. Bedding is poorly developed and dips southward at 15 to nearly 40 degrees that represents the southerly flank of the Eastern Coyote Hills Anticline. Deep oil wells have been locally drilled to about 10,000 feet of depth into Cretaceous age sediments but basement rock is obviously deeper in this region. The buried bedrock surface beneath the alluvial sequence at the site deepens toward the south (basin-ward). The local and regional geology has been well documented by Tan, Russel, Miller and Evans (1984, CGS, OFR 84-24-LA), Yerkes (1972, USGS PP 420-C).

Groundwater

The project site lies within the Yorba Linda Subarea, just to the north of the Santa Ana Forebay, of the greater Orange County groundwater basin. Unconfined groundwater conditions prevail locally and direction of flow is down gradient toward the southwest (Mills, 1987). Generally, 1944 is considered the historic high groundwater table in the region which the depth in proximity to the site was 50-feet from the surface (DWR, 1967). By 1990, due to continuous basin water withdrawal and the lowering of the water table, the depth to water in the site area had dropped to elevation minus 20-feet (195-feet of depth). Borings drilled to a depth 51.5 feet for this project did not encounter the continuous unconfined groundwater table. Percent moisture content of all logged samples from the borings did not indicate any saturated soil conditions beneath the project site. The potential for groundwater to rise back to any historic high is considered quite unlikely.

The site plots on the border of and outside of a potential liquefaction zone, as shown on Plates G-1 and G-2. The historic high groundwater contour maps indicate a level slightly deeper than 40 feet (Plate H). As a conservative evaluation, a groundwater level of 40 feet has been assumed for our analysis.

Faulting and Seismicity

There are no known or mapped faults projecting towards or through the project site area (Tan, Miller and Evans, 1984). The college campus does not lie within an Alquist Priolo Earthquake Fault Zone as designated by the California Geological Survey (Hart, 1997, revised). There have been minor historic earthquakes measured locally, which are considered to be random events associated with structural adjustments in the earth's upper crust. The potential for direct surface ground rupture on the subject property is considered very unlikely.

The closest mapped fault is the Norwalk Fault, which trends roughly east-west and is located about 2000-feet to the south of the site. This fault is not exposed at the ground surface and for this reason it is poorly constrained however, it is believed to dip at a steep angle to the north and most likely produces reverse movement. For purposes of this study, the Norwalk fault is considered pre-Quaternary and potentially active but not a seismic constraint to the proposed project.

Located 3.1-miles to the northwest of the site is a minor 2000-foot long, north-south trending fault (unnamed) situated within the East Coyote Hills oil field. The fault is considered active (Alquist-Priolo) and it is the closest known active fault to the site. Several minor faults with similar trends have been mapped in this area (Yerkes, 1972) and are most likely associated with anticlinal uplift (folding). This particular active fault, designated as 1968, is judged to be too small or minor to produce a major independent earthquake but may rupture as a result of a major regional earthquake.

The closest known significant active surface fault is the Whittier fault, which trends to the northwest at the foot of Puente Hills about 4.72-miles or 7.55 km to the northeast of the site. This fault has produced several historic moderate and numerous minor earthquakes but there has been no recorded surface rupture in historic time. The fault dips northeastward and produces both right lateral and vertical (thrust) movement. The Puente Hills are in part a product of regional uplift along the Whittier Fault. The Whittier Fault has been assigned a maximum moment magnitude of 6.8. A regional fault map showing surface faults is provided on Plate J in Appendix A.

In 1987, a 5.9 magnitude earthquake occurred north of the Montebello Hills in South San Gabriel resulting in considerable structural damage. The particular fault that ruptured does not intercept the ground surface and was not a known feature prior to the event. Studies by many have shown this to be a north dipping thrust fault now referred to as the active Puente Hill Blind Thrust Fault or the Elysian Park Thrust. Deep reflection seismic lines (Shaw and Shearer, 1999, Fuis, et al, 2001) have shown this fault is quite significant and underlies a large portion of the Los Angeles Basin inclusive of the site region. The seismic data indicates the fault may interact with the San Andreas Fault via a deep very low angle decollement and a west rising ramp located basin-ward of the Puente Hills. Compression across the Los Angeles Basin, a continuing process, caused the 1987 Whittier Narrows Earthquake and will likely cause similar events on this and similar regional blind thrust features.

The three earthquake sources addressed above are the closest known to the project site. There are many other active faults in the region that are capable of generating significant earthquakes with resulting strong ground motions but not to the higher levels as the closer active faults. All known active faults located within a 100-mile radius of the site are summarized in the Appendix C showing distances and slip rate.

The closest recognized blind thrust fault, Puente Hills (Coyote Hills) is 0.13 mile

(0.21 kilometer) away from the site and has been assigned a maximum magnitude of 7.1 and has a slip rate of 0.7 mm/yr.

Revised version of the 2008 U.S.G.S. National Seismic Hazard Mapping Project (NSHMP) PSHA Interactive Deaggregation for the spectral period of 0 second (PGA) is used. The Peak Horizontal Ground Accelerations for 10% probability of exceedance in 50 years i.e. return period of 475 years, 10% probability of exceedance in 100 years i.e. return period of 975 years, and 2% probability of exceedance in 50 years i.e. return period of 2,475 years, are calculated as 0.4958g, 0.6612g and 0.9266g respectively.

In addition to possible strong earthquake ground motion at the site, the secondary effects of earthquake-induced liquefaction, and earthquake-induced landsliding, were considered. Guidelines for evaluating and mitigation seismic hazards in California (CGS, 2008, SP-117A) summarize procedures for evaluating the earthquake-induced landslide and liquefaction potential.

Liquefaction: The site is not within a zone mapped as requiring evaluation of earthquake-induced liquefaction potential per CGS SP-117A, 2008 (La Habra Quadrangle, April 15, 1998). Liquefaction is discussed in more details in the proceeding sections.

Induced Flooding: The site lies far and/or high enough from the coast or large inland body of water to preclude the hazards of tsunami or seiche waves or inundation from the rupture of an up gradient reservoir.

Landsliding: The site is not within a zone mapped as requiring evaluation of earthquake-induced landsliding potential (CGS, 2008, SP 117A). Since the site is far enough from steep slopes, landsliding will be unlikely.

Field Investigation

Five (5) hollow stem auger soil borings were drilled as part of the field investigation. In addition, our geotechnical investigation reports for previous developments within the college campus were also reviewed. A record of the materials encountered during drilling was made by our field representative and is presented in Appendix B.

The lines designating the interface between soil strata on the log of Test Holes represent approximate boundaries. The transition between strata may be gradual. Relatively undisturbed samples were secured at frequent intervals from various locations for laboratory testing. The relative sampler penetration resistance exhibited by the soils types encountered is tabulated in the blows per foot column of the Log of Test Holes.

Soil Conditions

1. Significant fill was not encountered within the boring holes.
2. Evaluation of the subsurface materials indicates that the underlying natural material is generally alluvium consisting of silt, sand, and clay mixtures. Generalized soil profiles (Cross Sections A-A' and B-B') are provided in Appendix A, Plates B-2 and B-3.
3. Caving did not occur and no groundwater was encountered within the full depth of exploration.
4. Soils can be cut and drilled by normal grading and drilling equipment.

Laboratory Testing

Laboratory testing was assigned following a review of the field investigation data and after considering the foundation elements to be evaluated. In general, this included physical testing to establish foundation bearing characteristics and selective classification tests.

A. Moisture and Density

In-situ moisture content and density values were determined for all the undisturbed core samples obtained during test boring operations. Test results are tabulated on the boring logs.

B. Mechanical Analysis

The texture composition of selected samples determined by the hydrometer test method is as follows:

Boring No.	Depth (ft)	Percent Sand	Percent Silt	Percent Clay
B-1	1-3	72	13	15
B-1	8-10	47	20	33
B-2	1-3	71	15	14
B-2	7-10	50	18	32
B-5	1-3	62	15	23

C. Direct Shear

Direct shear tests were performed on undisturbed natural soil samples encountered within the upper depths, and were considered most pertinent in the design of spread footing foundations. Test results are shown on Plates L-1 and L-2 in Appendix B.

D. Consolidation

Consolidation (load deformation) tests were performed on selected undisturbed samples. Plotted test results are provided on Plates M through R in Appendix B.

E. Expansion

Expansion Characteristics were determined by Expansion Index test method on a typical bulk soil sample. The Expansion results are as follows:

Boring No.	Depth (ft)	Moisture Content (%)	Dry Density (pcf)	Expansion Index
B-1	1-3	9.3	112.6	0
B-5	1-3	9.7	110.5	0

According to the test results, the underlying soils are classified as very low expansive.

F. Chemical Analysis

a. Soluble Sulfates

Results of our preliminary laboratory tests performed in accordance with California Test Method No. 417 indicate that the near-surface site soils contain water soluble sulfate contents of 220 parts per million (ppm). This shows negligible sulfate exposure to Portland cement concrete which is placed in contact with the onsite soils. However, we recommend Type II cement or equivalent to be used for concrete in contact with soil.

b. Soluble Chlorides

Chloride content of near-surface site soil was determined in accordance with California Test Method No. 422. Results of these tests indicate that the onsite soils contain water-soluble chlorides on the order of `175 parts per million (ppm) representing a low degree of corrosivity. As recommended previously, Type II cement or equivalent may be specified for concrete in contact with onsite soils with maximum water-cementation ratio of 0.50 (by weight) and a minimum concrete strength of 3,000 psi.

c. Soil pH and Resistivity

The results of preliminary testing of soil pH and resistivity indicate that onsite soil materials are generally mildly alkaline (pH values of 7.6) and the minimum soil resistivity is relatively low (2,400 ohm-cm). This indicates that the onsite soils may be moderately corrosive to ferrous metals and copper.

Design Values

Representative values were selected from the test data and other sources for design and is tabulated below:

Field Density (Average)	110.0	pcf
Expansion Index	0	
Angle of Internal Friction (Ult/Peak)	30/32, 28/29, 30/31, 28/29	deg.
Cohesion (Ult/Peak)	200/250, 300/350, 250/300 & 300/400	psf
Subgrade Reaction (K) value	100	pci
Subgrade (R) value	34	-

Seismic Factors

The following are the geotechnical parameters for earthquake design data in accordance with USGS Design Maps Summary Report:

Latitudes: 33.8760^0 and Longitudes: -117.9169^0

NO.	PARAMETERS	VALUES	REFERENCE
1	0.2-Second Mapped Spectral Response Accelerations, S_s for Site Class B	**1.780g**	Figure 22-1
2	1-Second Mapped Spectral Response	**0.646g**	Figure 22-2

	Accelerations, S_1 for Site Class B		
3	Site Class	**D**	Table 20.3-1
4	Site Coefficient, F_a	**1.000**	Table 11.4-1
5	Site Coefficient, F_v	**1.500**	Table 11.4-2
6	Maximum Considered Earthquake Spectral Acceleration for Short Period, S_{MS}	**1.780g**	Equation 11.4-1
7	Maximum Considered Earthquake Spectral Acceleration for 1-Second Period, S_{M1}	**0.970g**	Equation 11.4-2
8	5 % Damped Design Spectral Response Accelerations at Short Period, S_{DS}	**1.186g**	Equation 11.4-3
9	5 % Damped Design Spectral Response Accelerations at 1-Second Period, S_{D1}	**0.646g**	Equation 11.4-4

Other seismic parameters are as follows:

Closest Fault Distance	4.8 miles (7.7 km)
Fault Name	Puente Hills Thrust Fault
Earthquake Magnitude	7.1 M_w
Slip Rate (mm/year)	0.7
Largest PGA from ASCE-7, Figure 22.7	0.665g
10% Probability of exceedance in 50 years (475 Return Period)	0.4959g
5% Probability of exceedance in 50 years (975 Return Period)	0.6612g
2% Probability of exceedance in 50 years (2475 Return Period)	0.9266g
5% Damped Design Spectral Acceleration at short period, S_{DS}	1.186g
5% Damped Design Spectral Acceleration at 1-sec period, S_{D1}	0.646g

Seismic Hazard Analysis

Earthquake Induced Liquefaction Potential

Earthquake-induced vibrations can be the cause of several significant phenomena,

including liquefaction in fine silt and sands. Liquefaction results in a complete loss of strength and can cause structures to settle or even overturn, if it occurs in the bearing zone. If liquefaction occurs beneath sloping ground, phenomena known as Lateral Spreading can occur. Liquefaction is typically limited to the upper (50) feet of the subsurface of the soils.

Four items are generally considered to have the most significance in liquefaction:

1. Poorly graded fine and silty sands are the types of soils most susceptible to liquefaction. Soils that contain a wide range of soil particle sizes and coarse soils that drain freely are not generally susceptible to liquefaction.

2. The water table perched or otherwise usually must be within the upper (50) feet of soils, for liquefaction to occur. Soils above the water table do not liquefy.

3. Liquefaction has been shown to be unlikely where the relative density of the soils is greater than seventy (70%) percent. A soil that has relative density of less than seventy (70%) percent, may liquefy depending on a number of factors. The two most important of which are the strength and duration of the seismic shaking and the percentage of the soil particles that are silt and clay sized.

4. Clays with a PI < 12 and moisture content > 85% of the liquid limit are susceptible to liquefaction. Moreover, sensitive soils having PI > 18 can undergo severe strength loss.

The site will be susceptible to liquefaction, if all four items discussed above meet the criteria. An examination of the existing conditions at the site indicates that in view of the

deposits with high blow counts subgrade layers and groundwater is deeper than 50-feet, furthermore proposed development is not located within CGS Seismic Hazard zone map, the potential for liquefaction is very low at this site.

Statement

It is our professional opinion that the proposed construction will not be subject to geologic hazard from settlement, slippage, or landslide, provided the recommendations of this report are incorporated into the proposed construction. It is also our opinion that the proposed construction will not adversely affect the geologic stability of the site or adjacent properties provided the recommendations contained in this report are incorporated into the proposed construction.

Conclusions and Recommendations

Based on the findings of this investigation, it is concluded that the development of the proposed project is feasible relative to soil conditions, subject to complying with the recommendations of this report during design and construction.

Foundation Recommendations

Following are the foundation recommendations for various elements of the proposed development.

Spread Footing

To improve bearing conditions and control potential settlements, it is recommended to remove a minimum of 3 feet below the bottom of proposed footings, or 5 feet below existing or proposed grade, whichever is deeper, then to scarify 6" and compact the approved excavation bottom, and place minimum 95% compacted fill to proposed grade.

The proposed structure is recommended to be supported on continuous/ spread footings, designed for an allowable bearing value of 2,000 psf, bearing on newly 95 percent

compacted fill, with minimum depth and width of 24 inches. The basic allowable bearing value may be increased by 200 psf for each additional foot of increase in depth and 100 psf for each addition foot increase in width, to a maximum of 3,000 psf.

The bearing values are for dead, plus live loads and may be increased by one-third for momentary wind or seismic forces.

Total settlement is calculated under the full foundation loading of 3,000 psf to less than one inch for continuous or spread footings. Differential settlement is estimated to be less than one-half of an inch in a horizontal distance of 40 feet.

Slab on Grade

Slab on grade will be supported on newly 95 percent compacted fill as described in previous sections.

An estimated modulus of subgrade reaction for concrete slab-on-grade design on engineered fill is 100 pounds per cubic inch (pci). The thickness and reinforcement requirements of the slab should be evaluated by the project structural engineer.

It is recommended to maintain subgrade at optimum moisture content and provide a minimum reinforcing as directed by the structural engineer, but no less than # 3 bars 12 inches center to center cross pattern. The thickness of slab should not be less than 4-inches and it should be placed over approved subgrade.

It is also recommended to provide capillary moisture barrier under slab on grade, where moisture would be detrimental. It is further recommended that moisture retarder (Stego 15 mil or approved equivalent) be provided over a minimum of 6 inches of ¾" crush aggregate rock rolled and compacted to 95% relative compaction, with the gradation (90-100% passing on sieve ¾" size, 1-10% passing on No. 4 sieve, and 0-3% passing on No. 100 sieve) over the compacted fill subgrade compacted to 95% relative compaction. This

system has been proved to be better than using a vapor barrier consisting of minimum 10 mil visqueen with 1 to 2 inch clean sand above and below it.

Lateral Passive Resistance

For footings bearing in competent material, a passive earth pressure of 300 pounds per square foot per foot of depth, to a maximum value of 4,500 pounds per square foot may be used to determine lateral bearing resistance for footings. A coefficient of friction of 0.4 times the dead load forces may be used between concrete and the supporting soils to determine lateral sliding resistance for the building footings. The above lateral resistance values are based on footings placed directly against soil. In the case where footing sides are formed, all backfill placed against the footings should be compacted to at least 90 percent of maximum dry density.

Active Earth Pressure

Recommended active lateral soil pressure values for design of drained retaining wall are as follows:

Surface Slope of Retained Material (Horizontal:Vertical)	Equivalent Fluid Weight (pcf) (Native Backfill)	At Rest (Subterranean)
Level	40	60

A pipe and gravel drain (4" perforated PVC embedded in at least three cubic feet of filter gravel per lineal foot of pipe, both wrapped with geofabric) should be provided on the retained side located near the top of the footing base on the outside face. While all backfill should be compacted to the required degree, care should be taken when working close to the walls to prevent excessive pressure.

Pavement Recommendations:

"R" Value test was performed on a representative subgrade sample for pavement section determination. The test results are as follows:

Test No.	Moisture @ Compaction (%)	Dry Unit Wt. (pcf)	Exudation Pressure (psi)	Stabilometer "R" Value
a	10.8	116.3	270	28
b	10.2	113.2	440	48
c	11.3	115.5	370	41
				34*

*Interpolated 300 psi by exudation.

Subject to our review and testing of subgrade "R" values during grading, we recommend the following pavement section for the parking areas.

Traffic Condition	Assumed Traffic Index	A.C (in)	A.B. (in)
Parking stalls and driveway	5.5	4	6
Driveway for heavy trash trucks etc.	6.0	4	8

At the parking and driveway areas, the top 12 inches of subgrade should be excavated; moisture conditioned and recompacted immediately prior to placing the rock base and asphalt concrete. Rock-base material shall be class II aggregate base and to be compacted to 95 percent minimum. Asphalt concrete should be Performance Grade PG 64-10, 3/8" maximum aggregate size and compacted to 95 percent of Hveem laboratory test.

Exterior Concrete Flatwork

In order to reduce the potential for unsightly cracking, concrete sidewalks, patio-type slabs and concrete sub-slabs to be covered with decorative pavers should be at least 4 inches thick and provided with construction joints or expansion joints every 6 feet or less.

Exterior and Interior Concrete for Vehicular Use

Exterior concrete vehicular lanes including driveway slabs, curbs and gutters are subject to potential subgrade deflection and distress. It is recommended that these concrete elements be minimum 6 inches thick, reinforced with #4 bars at 12 inches on center and placed over 6 inches of crushed rock. Subgrade for these areas should be treated as mentioned in the asphalt concrete pavement section of our report.

Site Grading

The site grading may consist of earthwork for removal and recompaction as required.

Grading and excavations should be in accordance with General Earthwork Specifications provided in Appendix E of our report.

To improve bearing conditions and control potential settlements, it is recommended to remove a minimum of 3 feet below the bottom of proposed footings, or 5 feet below existing or proposed grade, whichever is deeper, then to scarify and compact the approved excavation bottom, and place minimum 95% compacted fill.

For the portions of the site located outside of the limits of proposed building where pavement or other hard surfaces may occur (i.e., concrete patio-type slabs, walkways, parking lots and driveways), the existing ground surface should be overexcavated to a minimum depth of 1.5 feet below the proposed finish subgrade or existing grade whichever is deeper, and the excavated materials should then be replaced as engineered fill compacted to 90% relative compaction. The horizontal limits of overexcavation

should extend to a minimum horizontal distance of 2 feet beyond the perimeter of the proposed flatwork improvements and minimum 5 feet beyond the building foundation perimeter.

Prior to placing fill, exposed bottom surfaces should be observed and approved by the Geotechnical Engineer of Record and then to be scarified to a depth of at least 6 inches, watered or air dried as necessary to achieve near optimum moisture conditions, and then compacted to a minimum relative compaction of 90 or 95 percent where applicable. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with Test Method ASTM D 1557.

Please note that the bottom of excavation may be too wet and in yielding condition, if that is the case it should be aerated by waiting and discing or stabilizing providing at least 12 inches of aggregate base subject to inspection and approval of Geotechnical engineer of Record.

Following are noted for site grading requirements:

1. Prior to any grading the existing building and its foundations, including tops of the existing piles should be cut, removed, and hauled off-site. All construction debris shall be removed and hauled away from the site.

2. Any excavations over 4-foot in depth and any site grading shall be performed under observation by a geotechnical engineer or engineering geologist.

3. Any new fill shall be brought to near optimum moisture, placed in layers not exceeding six inches thick, and compacted to at least 90 or 95 percent where applicable for subgrade per current ASTM-D1557 standards.

4. Any imported soil shall consist of clean, granular, non-expansive soil, free of vegetation and other debris with an Expansion Index of 20 or less. No soil or

aggregate base shall be imported to the site without prior approval by the Geotechnical Engineer.

5. No jetting or water tamping of fill soils shall be permitted.

6. At all times, the contractor shall have a responsible field superintendent on the project in full charge of the work, with authority to make decisions. He shall cooperate fully with the Geotechnical Engineer in carrying out the work.

7. No excavation should be performed and no fill should be placed, spread or rolled during unfavorable weather. If work is interrupted by rain, operations should not be resumed until the Geotechnical Engineer indicates that conditions will permit satisfactory results.

8. A pre-grading meeting should be established prior to grading, in the presence of the Owner, Architect, Geotechnical Engineer, Contractor and the controlling agency having jurisdiction, to review the project and schedule.

Surface Drainage

Positive surface drainage systems consisting of a combination of sloped concrete flatwork, sheet flow gradients, swales, surface area drains (where needed) should be provided around the building structure and within the recreation and parking areas to collect and direct all surface water to the adjacent streets. Ground surfaces should be at a minimum gradient of 2 percent away from building foundations and similar structures. Surface waters should not be allowed to collect or pond against building foundations, on paved areas, planter areas and any other level areas of the site.

Buildings should be provided with gutters and downspouts. Downspouts should be connected to area drains by pipes. Planters near the building should be avoided, and if used, the base of the planters should be water proofed. Landscape irrigation should be

controlled and proper drainage should be provided to avoid water intrusion beneath the structures.

Corrosivity

A major factor in determining soil corrosivity is electrical Resistivity. The electrical

Resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil Resistivity. Lower electrical resistivities result from higher moisture and chemical contents and indicate corrosive soil. Other soil characteristics that can influence corrosivity toward metals are pH, chemical content, soil types and site drainage.

Based on laboratory test results, the site soils have resistivity values of 2,400 ohm-cm, which is considered moderately corrosive to buried ferrous metals in contact with soil. Therefore, all piles, substructures, and slabs in contact with earth should have the minimum concrete cover over steel rebar, as required by the codes. Utility pipes and other elements should be protected as appropriate. As a minimum, all cast iron pipes and fittings in and below slab shall be wrapped with 20-mil polyethylene wrap. Pipes shall be covered with minimum 6-inches of clean sand all around, in compliance with ANSI / AWWA standard C105 / A21.5-82. A corrosion expert should be consulted if additional recommendations are needed.

The test results indicate that the concentrations of sulfate and chlorides in soil are negligible. However, we recommend that Type II cement and a maximum water-to-cement ratio of 0.50 be used for all concrete.

Please be advised that this firm does not practice corrosion engineering; therefore, we recommend that upon completion of precise grading, onsite soils be analyzed by a

qualified corrosion engineer to evaluate the impact of chemical activity of these soils on buried metallic pipes and other underground structures.

Temporary Excavations

Cuts shallower than 4 feet deep can be unsupported, provided there is no surcharge loading, structures, or utilities are in the immediate vicinity. Deeper excavations should be laid back 1:1, if space permits. For conditions not complying with these conditions, the Contractor should submit for our review, a temporary excavation support scheme. Excavations adjacent to existing buildings, traffic areas, and/or utilities are not allowed unless excavation plans are reviewed by this office and proper shoring or underpinning is designed as needed.

Excavations adjacent to existing building foundations should be done in a manner to protect the existing structure at all times.

Construction Observation

Construction observation and field testing services are an essential continuation of our prior studies to confirm and correlate our findings and recommendations with the actual subsurface conditions exposed during construction, and to confirm that suitable fill soils are placed and properly compacted.

At a minimum, we recommend that the Geotechnical Engineer and/or representative be present to observe and provide testing during the following construction activities:

- Pre-grade meeting;

- Site grading of cuts and fills;

- Overexcavation and bottom observations;

- Excavations for compacted fill;

- Observations of subgrade bearing materials;

- Placement of all fill, backfill, and pavement structural sections;

- Final excavations for foundations, retaining walls, and slab-on-grade; and

- Backfilling of utility trenches, pits, and trenches.

Limitations

This report is issued with the understanding that it is the responsibility of the owner or his representative to see that the information and recommendations contained herein are called to the attention of the other members of the design team for the project and that the applicable information is incorporated into the plans, and that the necessary steps are taken to see that the contractors and the subcontractors carry out such recommendations. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

The validity of the recommendations of this report assumes that Geotechnical Solutions, Inc. will be retained to provide these services.

The scope of our services did not include any investigation for the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site.

The Conclusions and recommendations contained herein are based on the findings and observations made at the test boring locations. It is not unusual to find conditions between and beyond such locations, which differ from the conditions encountered. If conditions are encountered during construction, which appear to differ from those

previously disclosed, this office should be notified so as to consider the need for modifications. On-site construction observations and wherever appropriate, tests should be performed during the course of construction by a representative of this office to evaluate compliance with the design concepts, specifications, and recommendations contained herein.

This report has been compiled for the exclusive use of the client, it shall not be transferred to, or used by, other parties, or applied to any project on this site other than described herein without consent and /or thorough review by this office.

Geotechnical Solutions, Inc.

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Appendix A

Vicinity Map

Site Plan & Boring Location Plan

Cross Section A-A' & B-B'

Site Topo Map

Google Map

Site Regional Geologic Maps

Seismic Hazard Zone Map

Historic High Groundwater Contour Map

Quaternary Geology Map

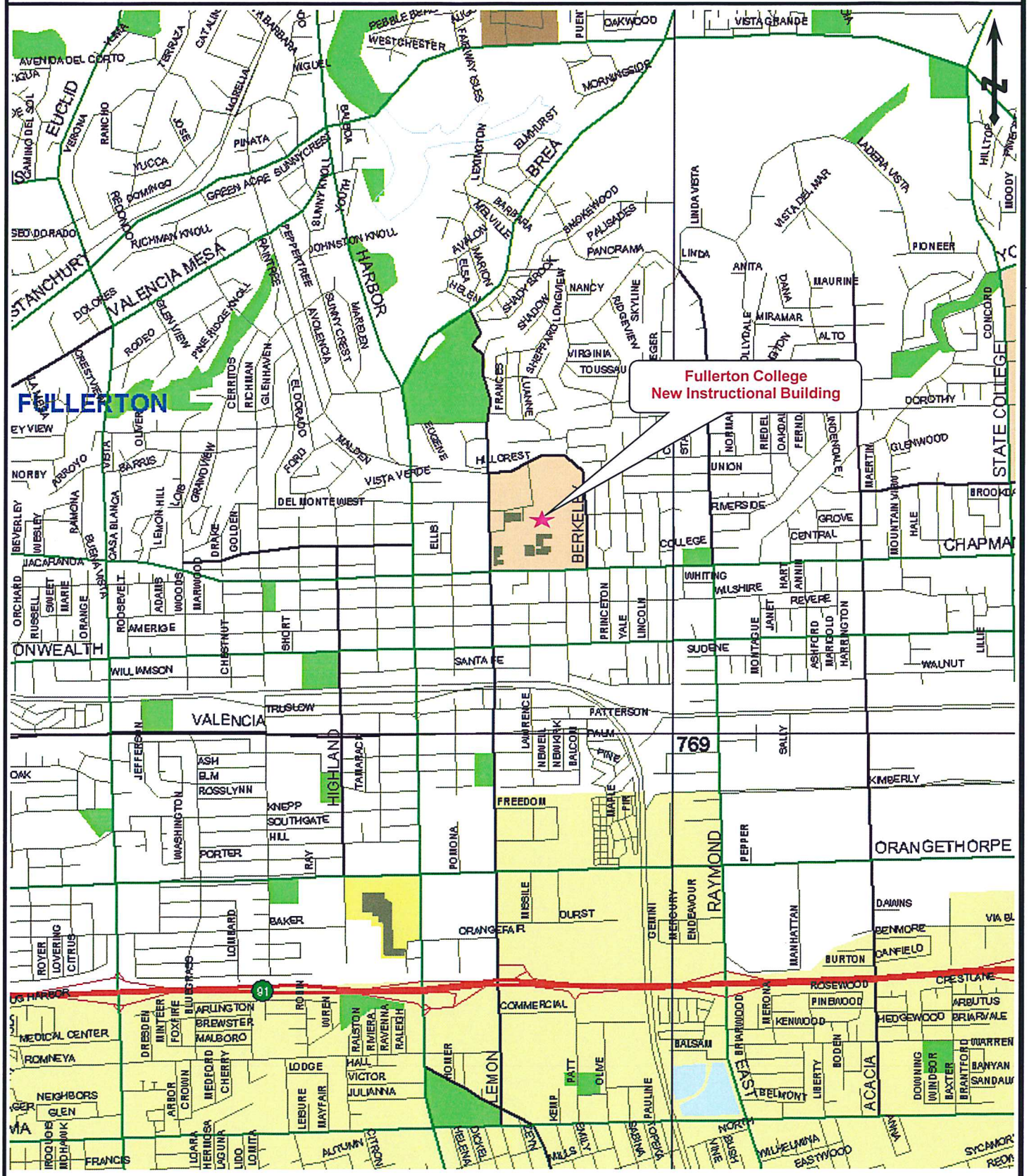
Regional Fault Map (Surface Faults)

Boring Logs

Direct Shear Tests

Consolidation Tests

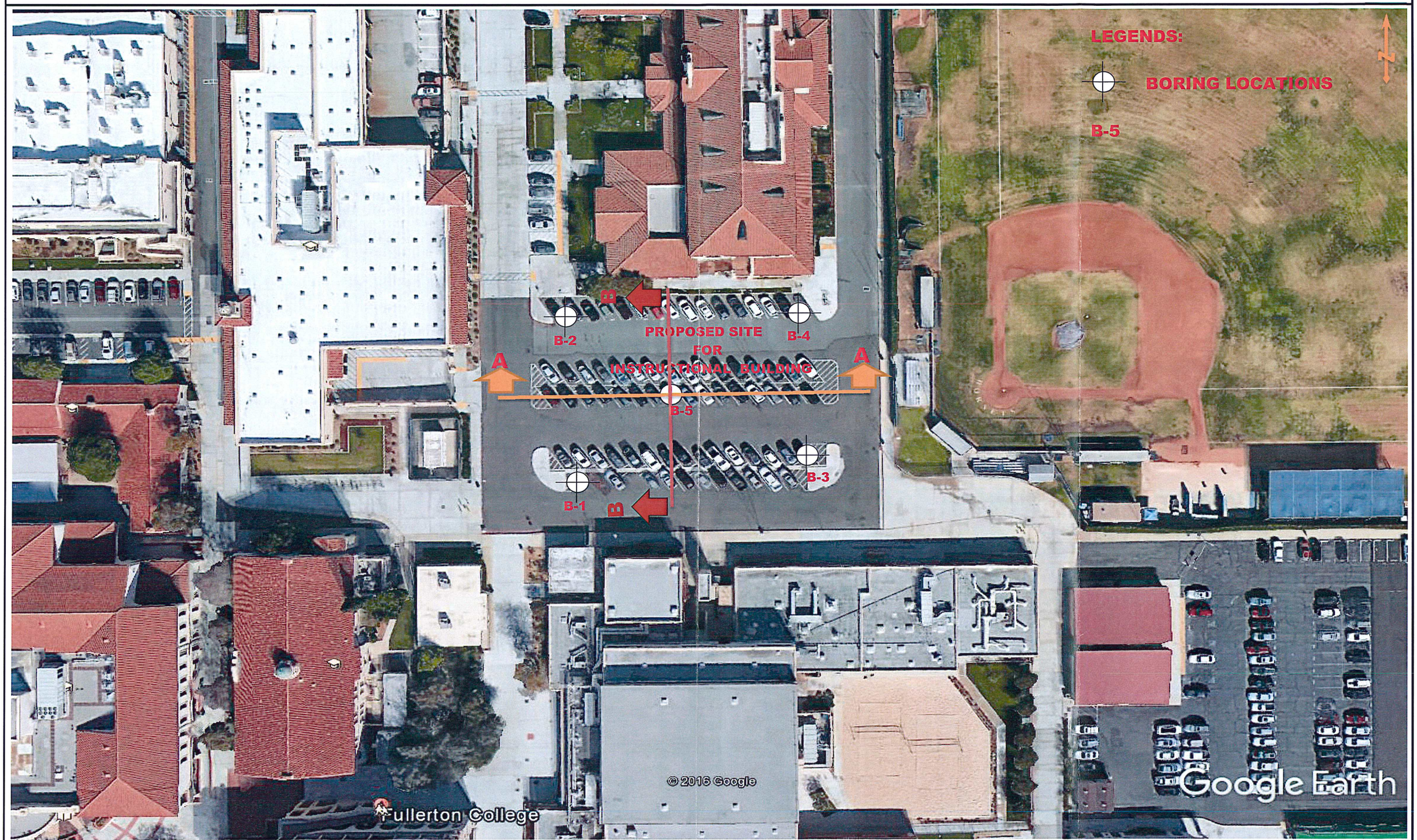
VICINITY MAP



Fullerton College- New Instructional Building 321 E. Chapman Avenue, Fullerton, California	Project No.	FC-5180-06
	Plate:	A

Geotechnical Solutions, Inc.

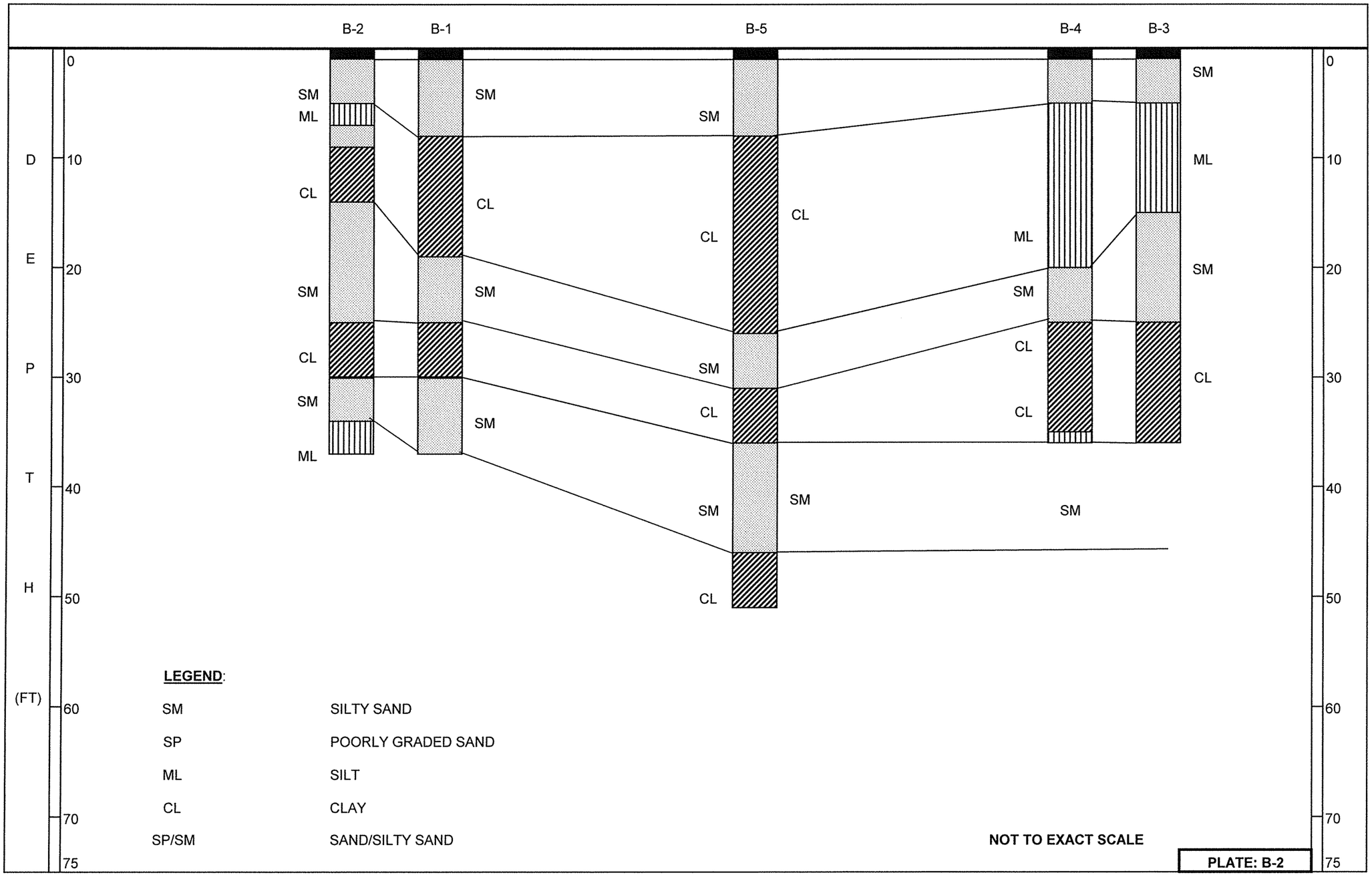
SITE PLAN & BORING LOCATION PLAN



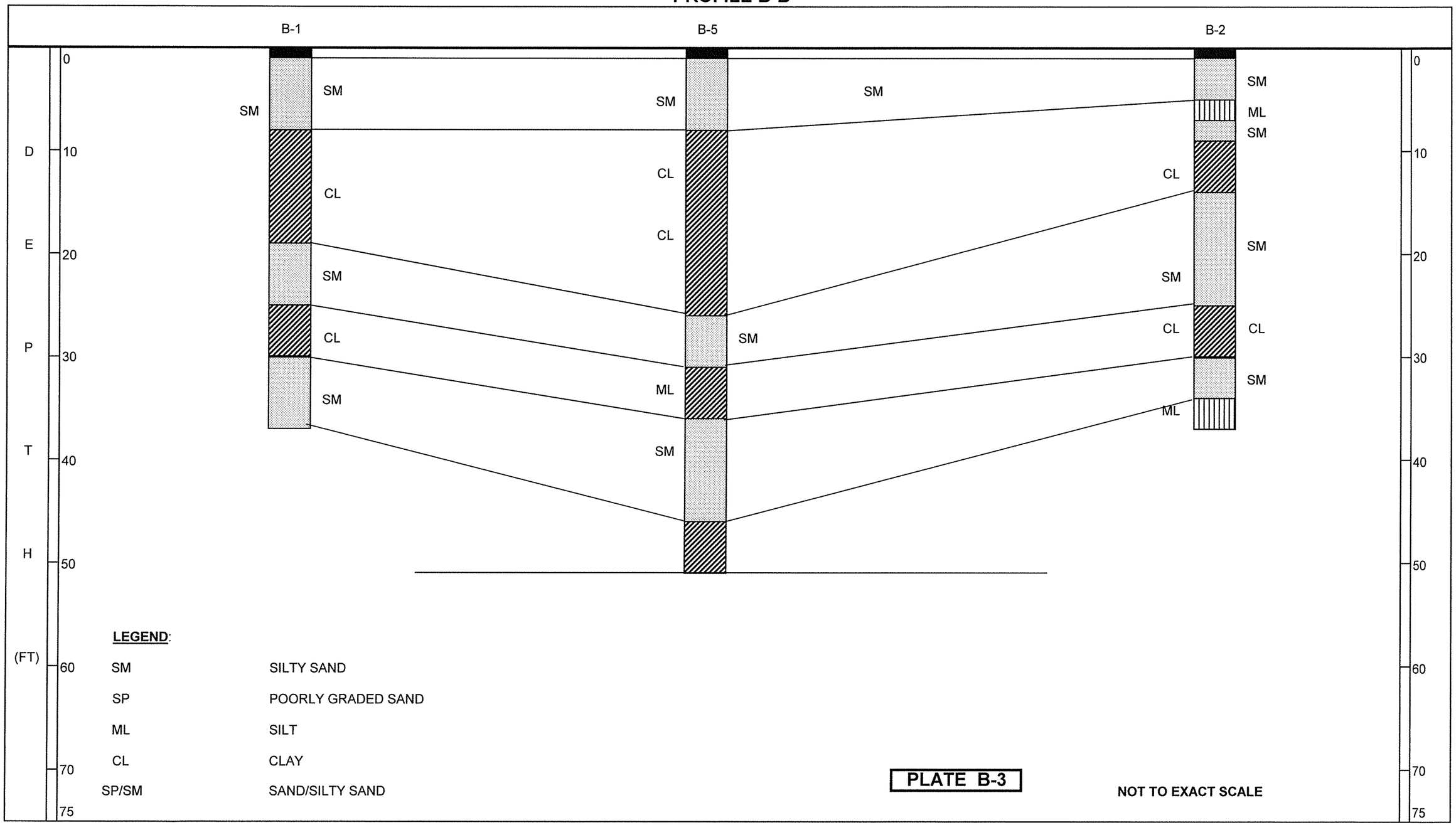
Fullerton College- New Instructional Building 321 E. Chapman Avenue, Fullerton, California	Project No.	FC-5180-06
	Plate:	B-1

Geotechnical Solutions, Inc.

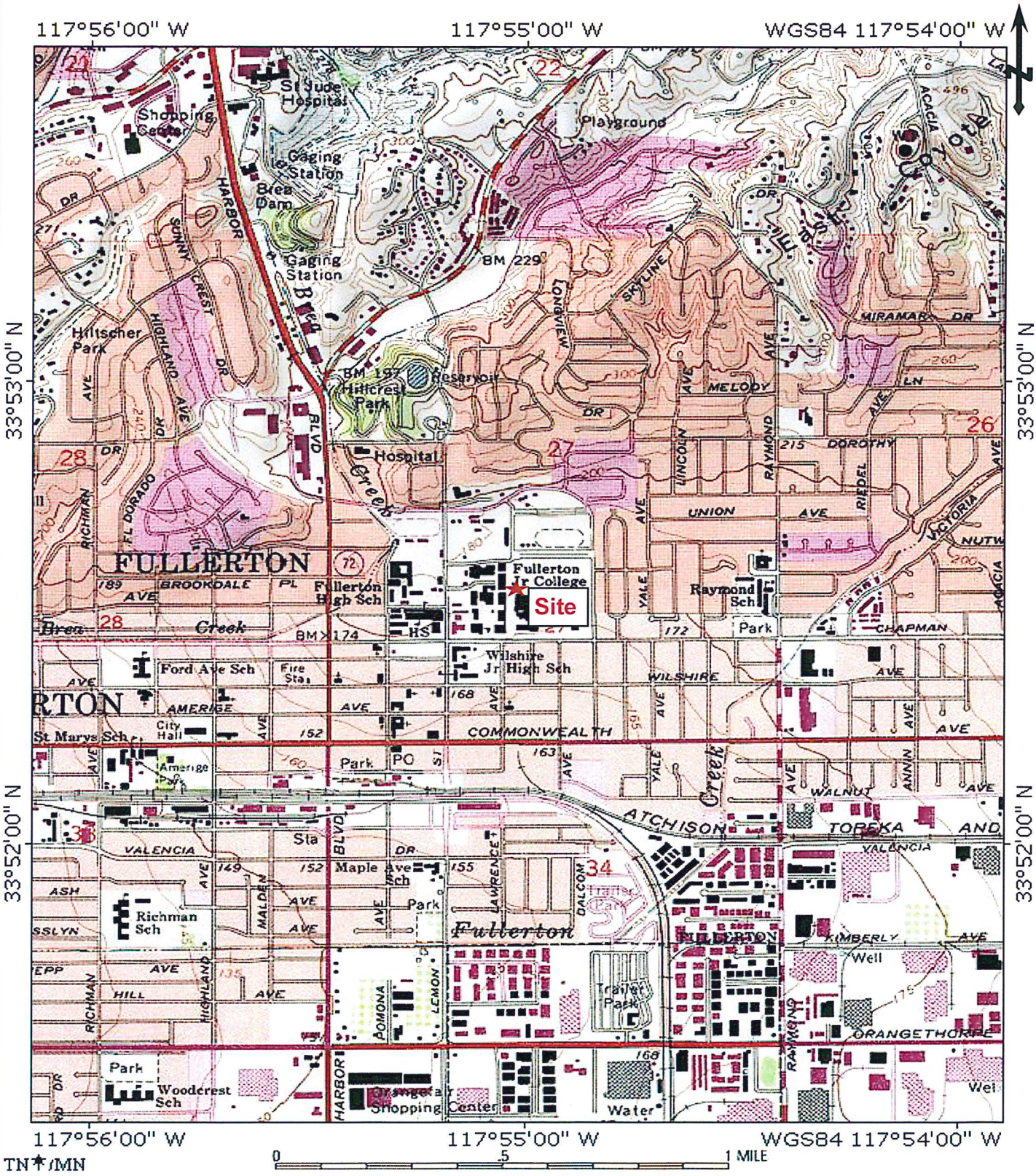
Fullerton College - Instructional Building
PROFILE A-A'



Fullerton College - Instructional Building
PROFILE B-B'



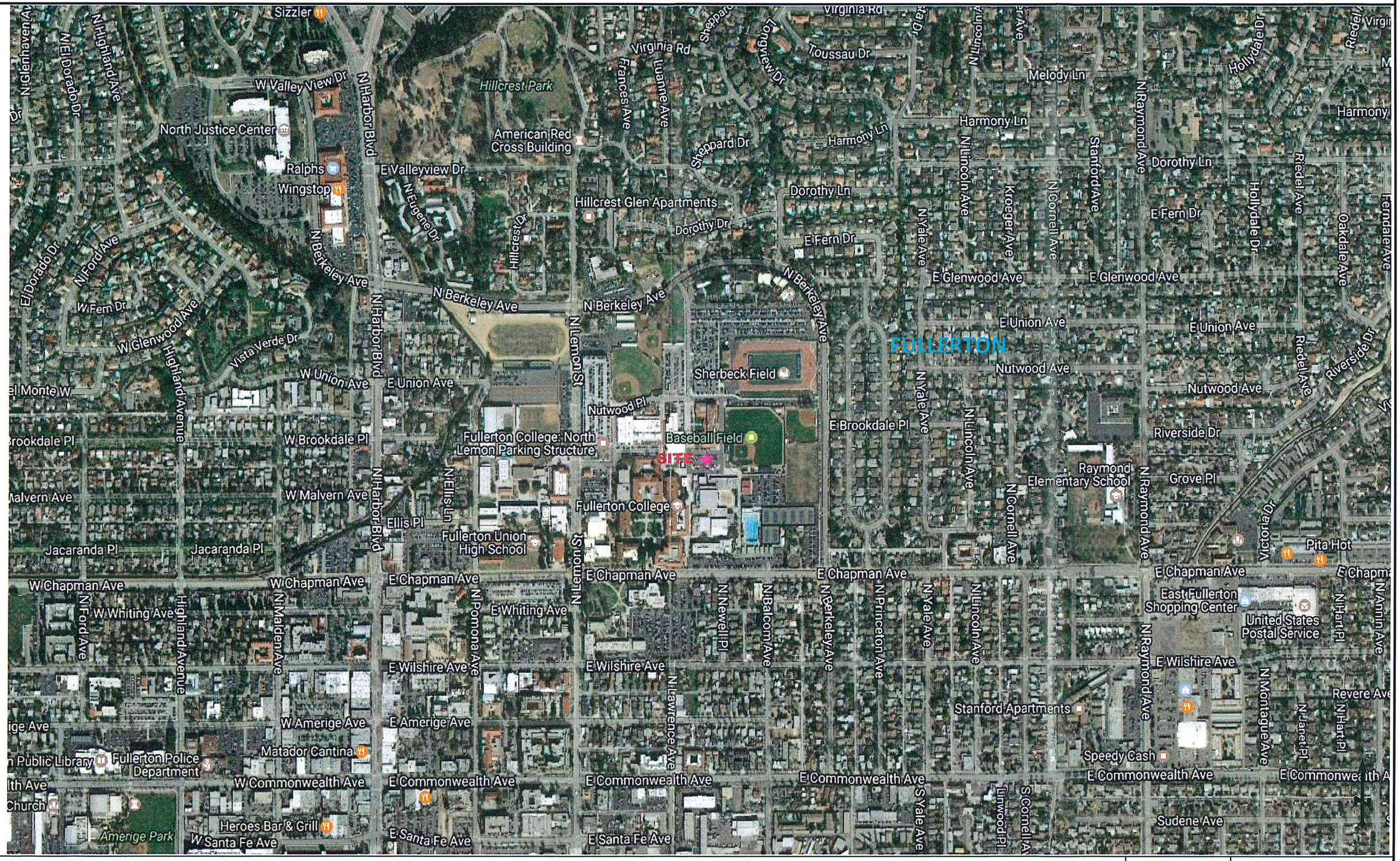
SITE TOPO MAP



Fullerton College- New Instructional Building 321 E. Chapman Avenue, Fullerton, California	Project No.	FC-5180-06
	Plate:	C

Geotechnical Solutions, Inc.

GOOGLE MAP



Fullerton College- New Instructional Building 321 E. Chapman Avenue, Fullerton, California	Project No.	FC-5180-06
	Plate:	D

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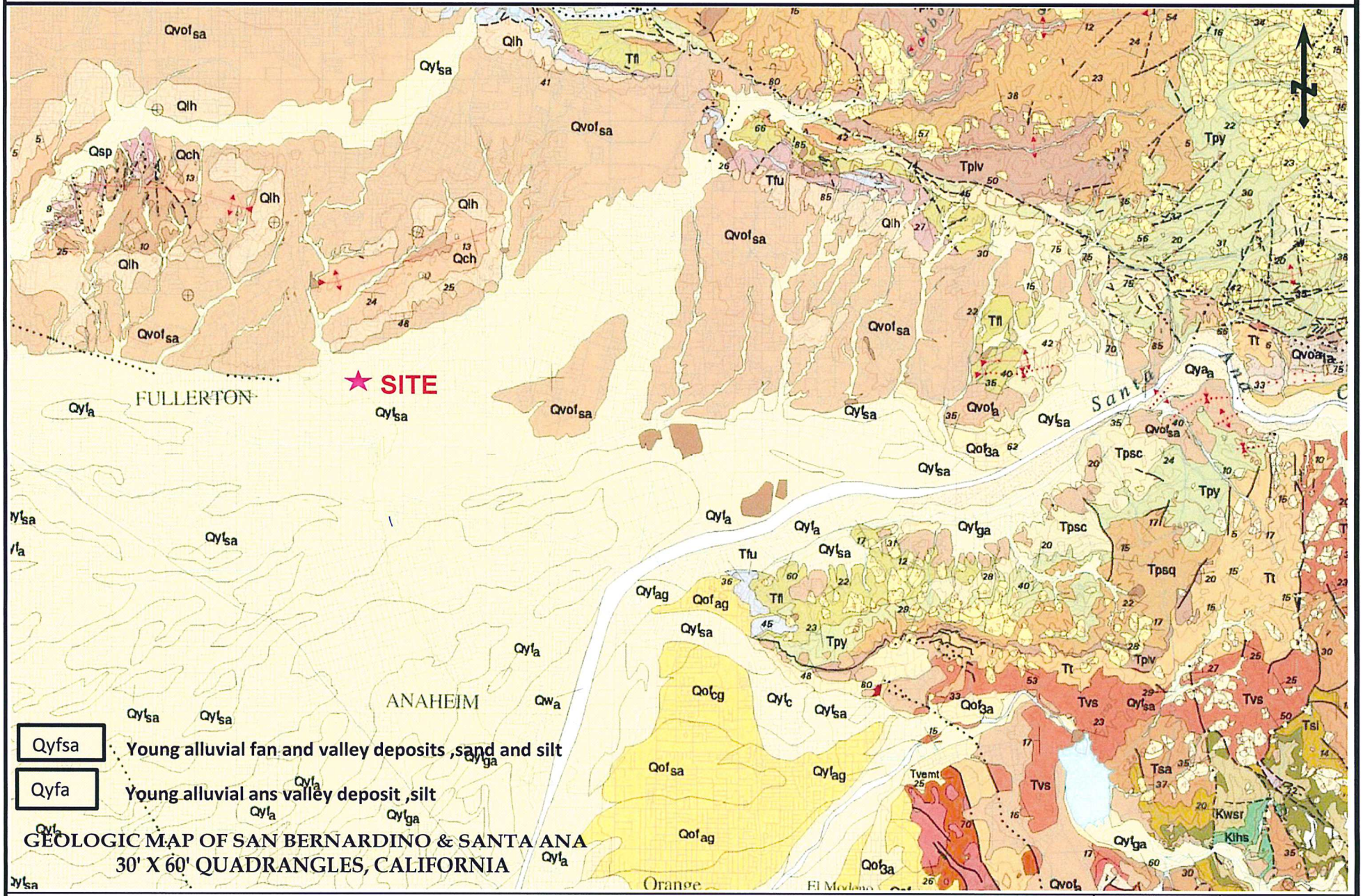
SITE REGIONAL GEOLOGY MAP



Fullerton College- New Instructional Building	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	E

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ALQUIST-PRIOLO FAULT ZONE MAP

MAP EXPLANATION

Potentially Active Faults

1906 C — Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.

STATE OF CALIFORNIA

SPECIAL STUDIES ZONES

Delineated in compliance with
Chapter 7.5, Division 2 of the California Public Resources Code
(Alquist-Priolo Special Studies Zones Act)

LA HABRA QUADRANGLE

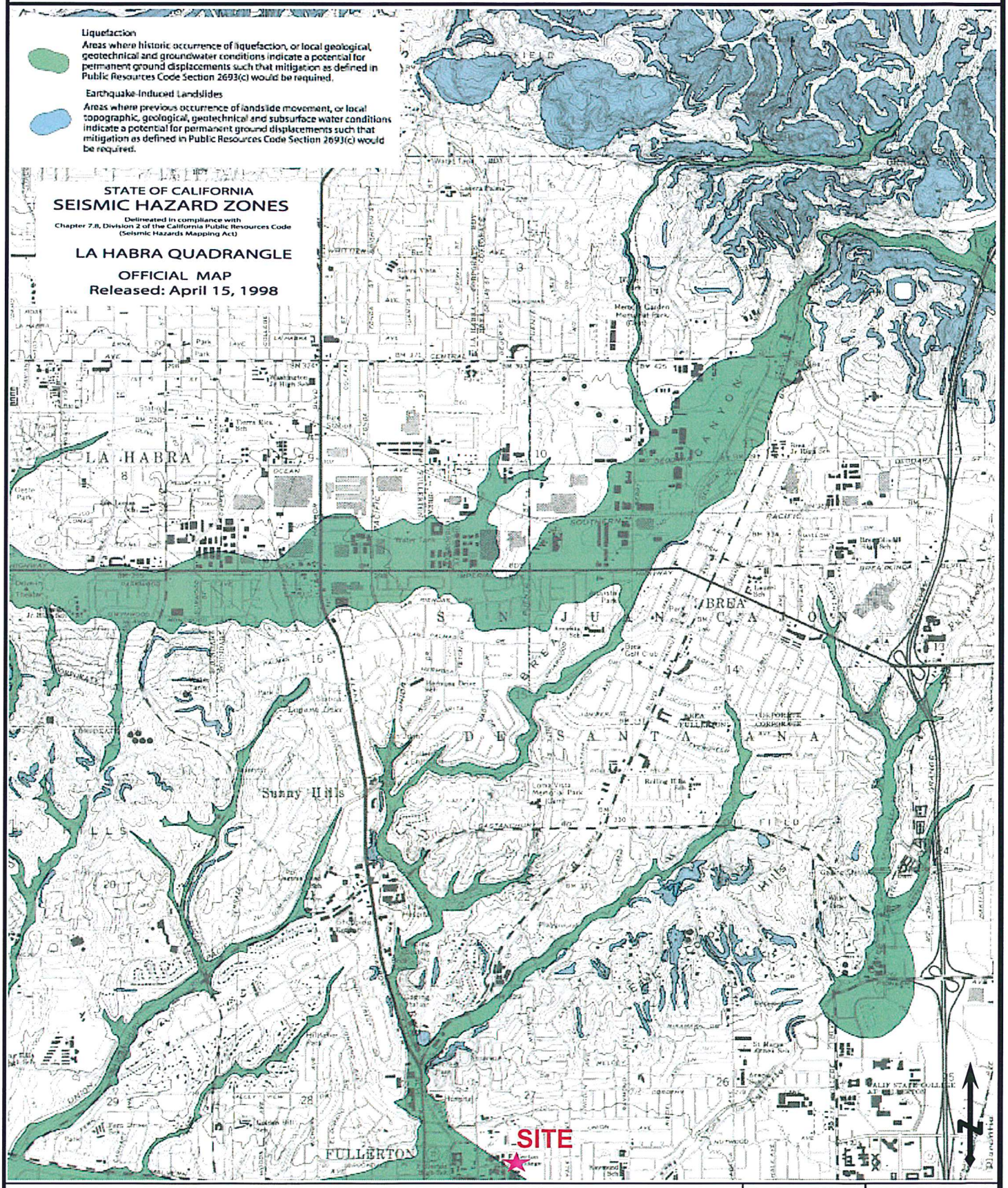
REVISED OFFICIAL MAP

Effective: November 1, 1991

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	F

Geotechnical Solutions, Inc.

SEISMIC HAZARD ZONE MAP - PART OF LA HABRA QUADRANGLE



Fullerton College- New Instructional Building 321 E. Chapman Avenue, Fullerton, California	Project No.	FC-5180-06
	Plate:	G-1

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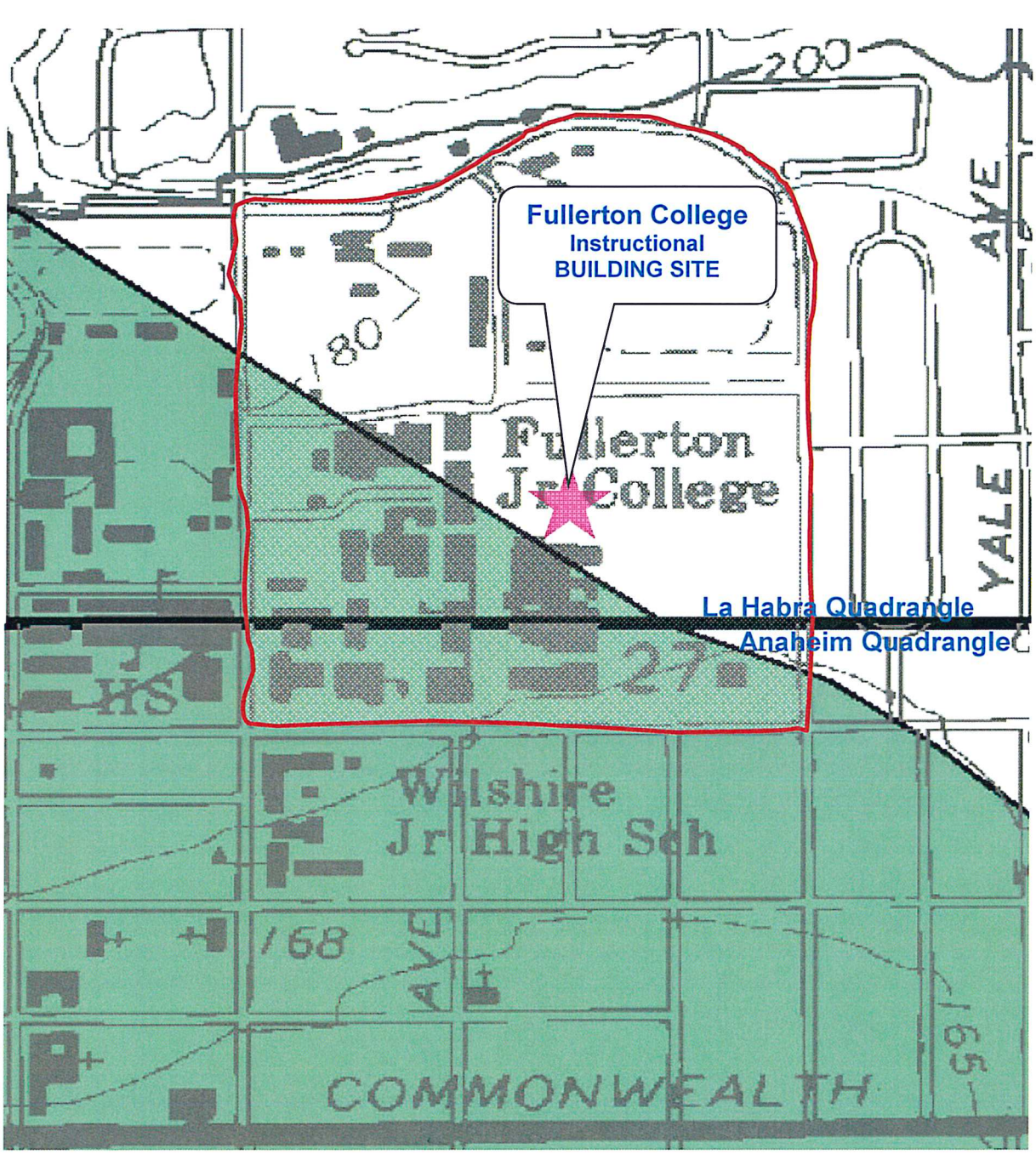
SEISMIC HAZARD ENLARGED MAP



Approx. Scale 1" = 1000'

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MAP EXPLANATION

Zones of Required Investigation:

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

Earthquake-Induced Landslides
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	G-2

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HISTORICAL HIGH GROUND WATER MAP

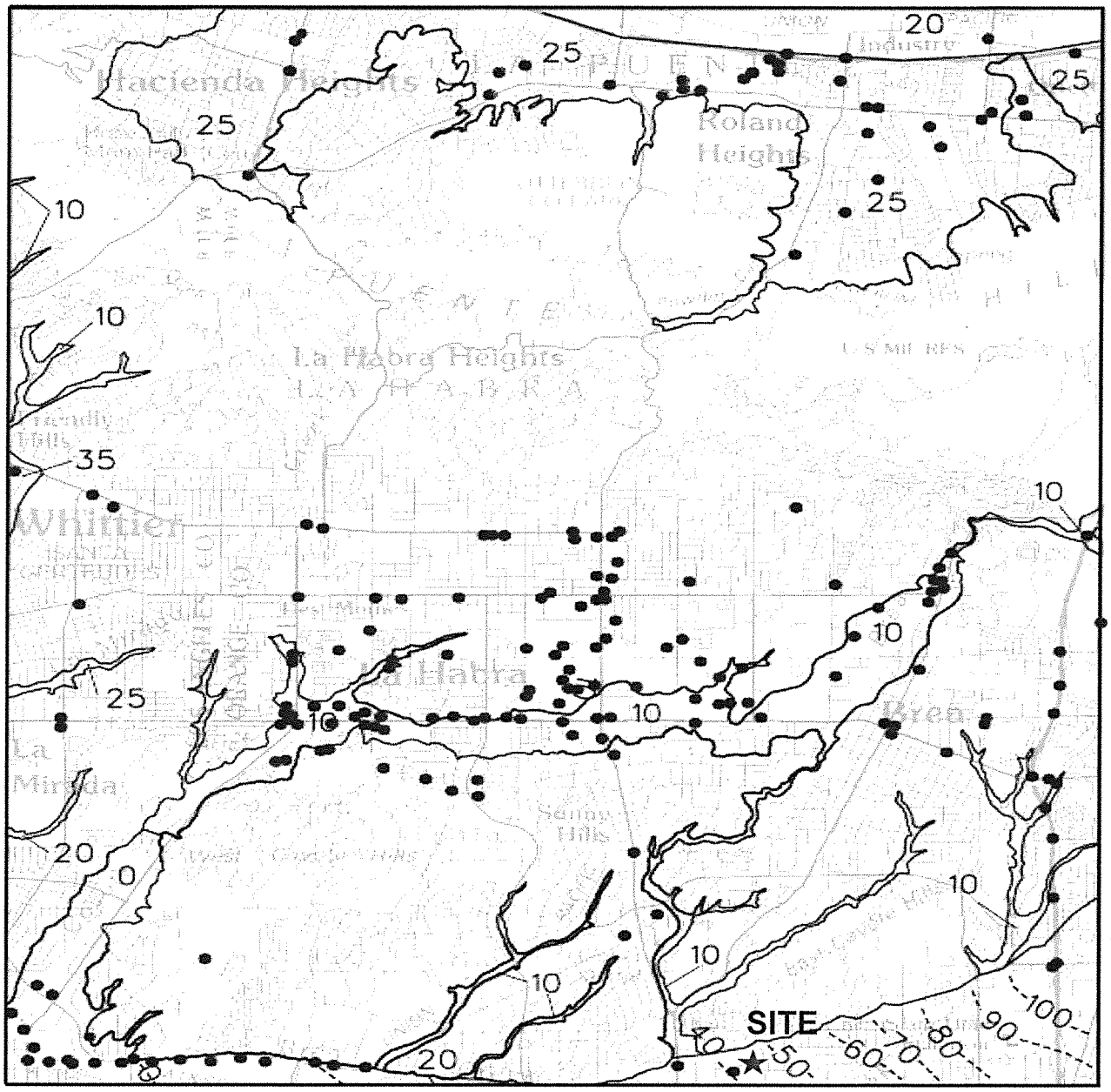

Plate 1.2 Map showing borehole locations and depths (in feet) to historically shallowest groundwater in areas underlain by younger Quaternary sediments in the La Habra quadrangle.

Scale
One Mile

EXPLANATION

20 — Contour interval depth (in feet) to historic high groundwater.

10 — Depth (in feet) to historic high groundwater within defined area.

• Borehole Location

N

Fullerton College- New Instructional Building	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	H

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QUATERNARY GEOLOGY MAP

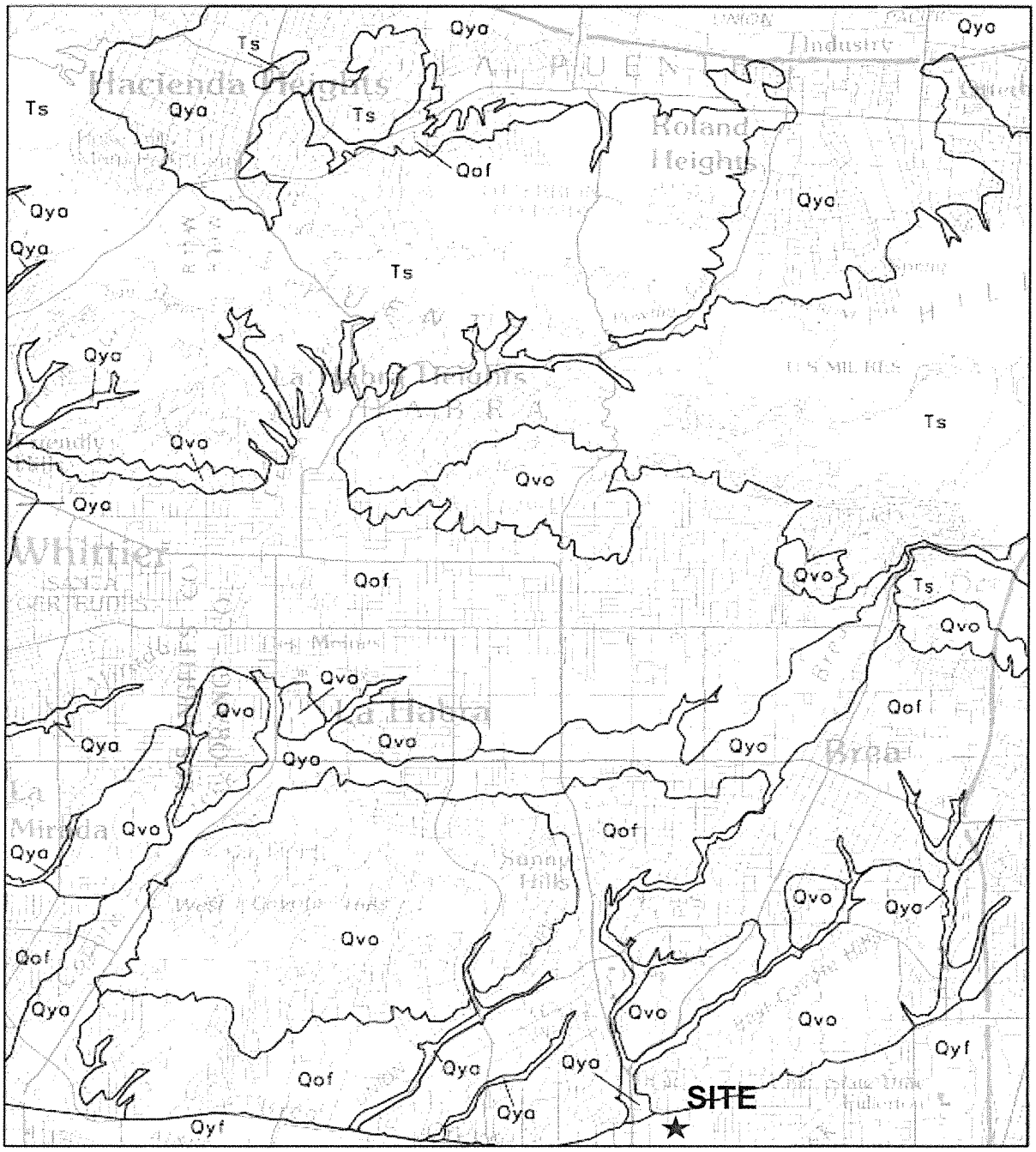

Plate 1.1. Quaternary geology of La Habra 7.5-minute quadrangle.

Scale

1 Mile

EXPLANATION

Qya: Younger Quaternary alluvium
Qyf: Younger Quaternary alluvial fan
Qof: Older Quaternary alluvial fan
Qvo: Very old Quaternary sediments
Ts: Tertiary sedimentary rocks

N

Fullerton College- New Instructional Building 321 E. Chapman Avenue, Fullerton, California	Project No.	FC-5180-06
	Plate:	I

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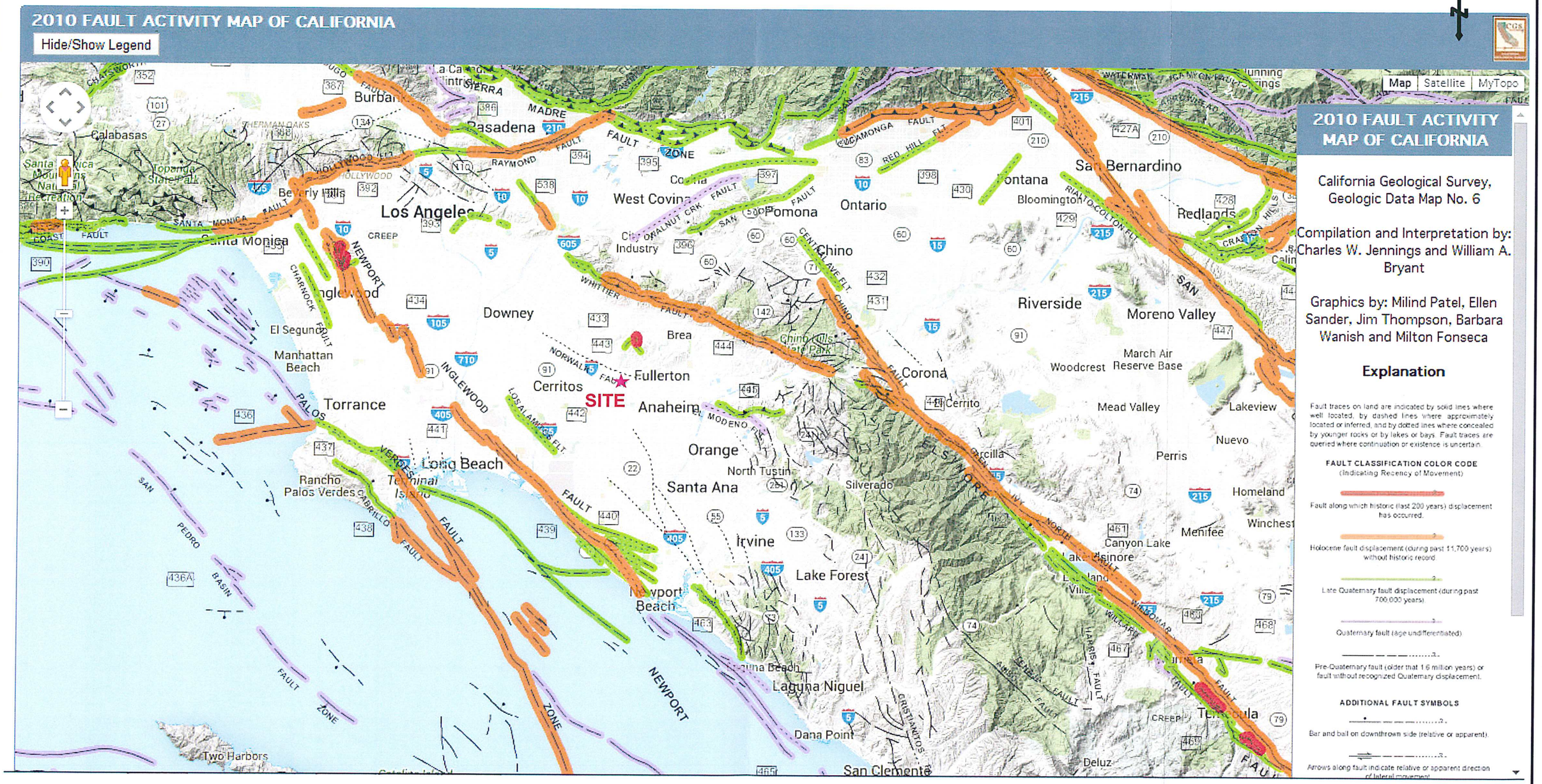
CGS 2010 FAULT MAP



Fullerton College- New Instructional Building 321 E. Chapman Avenue, Fullerton, California	Project No.	FC-5180-06
	Plate:	J

Geotechnical Solutions, Inc.

Project : Fullerton College- New Instructional Building Project Location: 321 E. Chapman Avenue, Fullerton, California Project Number: FC-5180-06	**Key to Log of Test Hole** **Plate No. K**

Elevation, feet	Depth, feet	SAMPLES			No Recovery (NR)	Blows / 12 in	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve	OTHER TESTS AND REMARKS
		Type	Number	Penetration Resistance, Blows / 6 in.							
1	2	3	4	5	6	7	8	9	10	11	12

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; "[NR]" after number indicates no sample recovery.

5 **Blows / 6 in.:** Number of blows to advance driven sampler each 6-inch drive interval, or distance notes, using a 140-lb hammer with a 30-inch drop (unless otherwise noted)

6 **No Recovery (NR)** No recovery of sample

7 **Blows / 12 in.:** Blows per 12" based on Col. 5 equal to uncorrected N-Value where SPT used

8 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density / consistency. Approx. "and" = 35%-50%; "some" = 20%-35%; "little" = 10%-20%; "trace" = 0%-10%.

9 **Moisture Content:** Moisture content of sample, as percentage of dry weight of soil, meausred in lab according to ASTM D2937.

10 **Dry Unit Weight:** Dry unit weight of soil sample, in pounds per cubic foot, measured in lab according to ASTM D422.

11 **Percent Passing No. 200 Sieve:** Percent of soil by weight finer than the No. 200 sieve according to ASTM D422.

12 **Other Tests and Remarks:** Comments and observations regarding drilling or sampling made by driller or field personnel. Other lab tests are indicated using abbreviations explained below.

TYPICAL SAMPLER GRAPHIC SYMBOLS

California (ring-lined)

Modified California (brass tube-lined)

Standard Penetration Test (SPT) split spoon

Shelby Tube

Bulk Sample

Grab Sample

OTHER LABORATORY TEST ABBREVIATIONS

AL	Atterberg Limits Test (ASTM D4318)
COMP	Compaction test by modified effort (ASTM D1557)
CONS	One-dimensional consolidation test (ASTM D2435)
DS	Direct shear test (ASTM D3080)
EI	Expansion index test (ASTM 4829), index at 50% saturation
HD	Hydrometer analysis (ASTM D422), %<5 micros
LL	Liquid Limit from Atterberg Limites test
PI	Plasticity Index from Atterberg Limits test
SA	Sieve analysis (ASTM D422), %<#200 sieve
SE	Sand equivalent test for fines contamination (ASTM D2419)
UC	Unconfined compressive strength test (ASTM D2166)
WA	Wash analysis (ASTM D422), %<#200 sieve

OTHER GRAPHIC SYMBOLS

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

Static water level measured at specified time after drilling

Change in material properties within a lithologic stratum

Inferred contact between soil strata or gradational lithologic change

Soil Classification are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. 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 between samples, at other locations, or times.

Project :	**Fullerton College- New Instructional Building**	**LOG OF TEST HOLE**	Borehole No. B-1
Project Location :	**321 E. Chapman Avenue, Fullerton, California**		Plate No. K-1
Project Number :	**FC-5180-06**		Page 1 of 1

Date(s) Drilled :	May 6, 2017	Logged By :	BA	Checked By :	Abraham Baha
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	36.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						4" AC over 4" AB				
			Bag #1				Brown clayey Sand, medium dense, slightly moist			28	HD: 72%-13%-15%
	2		R1	5-9-9		18	@2': Brown SILTY SAND (SM), slightly moist, medium dense, fine to coarse grained,	6	93		DS: P=Peak / Ult=Ultimate $\phi = 32^0$, c = 250 psf (P) $\phi = 30^0$, c = 200 psf (Ult)
165	5		R2	2-3-3		6	@5': Light Brown SAND (SP), very moist, very fine to fine, loose	21	90		$\phi = 29^0$, c = 350 psf (P) $\phi = 28^0$, c = 300 psf (Ult)
							@7': Sandy Clay (CL), medium stiff, moist, brown			53	HD: 47%-20%-33%
160	10		R3	2-4-5		9	@10': Brown Sandy Clay (CL), medium stiff, very moist, fine grained, medium plasticity	20	95		
155	15		S-4	3-3-4		7	@15': Brown Sandy Clay/clayey sand (CL/SC), medium stiff, fine grained, low plasticity, slightly moist	9	-		
150	20		S-5	7-14-21		35	@20': Silty Sand w / little Clay (SM), dense, medium grained, moist, brown	11	-		
145	25		S-6	7-7-9		16	@25': Brown Sandy Clay/Clayey Sand (CL/SC), moist, very very stiff, fine grained, medium plasticity	15	-		
140	30		S-7	5-7-11		18	@30': Brown SILTY SAND, moist, medium dense, fine grained	16	-		
135	35		S-8	6-8-12		20	@35': Brown Silty Sand (SM), moist, medium dense, fine to medium grained	14	-		
130	40						Total Depth = 36.5 feet No Groundwater encountered during drilling Backfilled w/Cuttings				
	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	**Fullerton College- New Instructional Building**	**LOG OF TEST HOLE**	Borehole No. B-2
Project Location :	**321 E. Chapman Avenue, Fullerton, California**		Plate No. K-2
Project Number :	**FC-5180-06**		Page 1 of 1

Date(s) Drilled :	May 6, 2017	Logged By :	BA	Checked By :	Abraham Baha
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	36.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						4" AC over 4" AB				
			Bag #1				Brown Clayey SAND (SC), medium dense, slightly moist			30	HD: 70%-14%-16%
	2		R1	5-8-9		17	@2': Brown SILTY SAND (SM), moist, medium dense, fine to coarse grained,	16	106		
165	5		R2	2-3-3		6	@5': Light Brown Clayey Silt (ML), very moist, very fine to fine, soft to medium stiff, fine grained, low plasticity	26	91		
							@7': Clayey Sand (SC), medium stiff, moist, brown			50	HD: 71%-15%-14%
160	10		R3	4-8-9		17	@10': Brown Silty Clay/Clayey Silt (CL/ML), moist, stiff, moist, medium plasticity	20	99		
155	15		S-4	3-5-8		13	@15': Brown Silty Sand (SM), slightly clayey, moist, medium dense, fine to medium grained	14	-		
150	20		S-5	6-13-19		32	@20': Same as above	10	-		
145	25		S-6	5-6-8		14	@25': Brown SANDY CLAY, moist, very stiff, medium plasticity, fine grained	17	-		
140	30		S-7	5-9-11		20	@30': Brown SILTY SAND, moist, medium dense, fine grained	11	-		
135	35		S-8	6-9-9		18	@35': Brown SANDY SILT, moist, stiff, fine grained	18	-		
130	40						Total Depth = 36.5 feet No Groundwater encountered during drilling Backfilled w/Cuttings				
	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	Fullerton College- New Instructional Building	LOG OF TEST HOLE	Borehole No. B-3
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-3
Project Number :	FC-5180-06		Page 1 of 1

Date(s) Drilled :	May 6, 2017	Logged By :	BA	Checked By :	Abraham Baha
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	36.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						4" AC over 4" AB				
			Bag #1				Brown Clayey SAND (SC), medium dense, slightly moist				
	2		R1	11-9-11		20	@2': Brown SAND (SP), silty, very moist, medium dense, fine to coarse grained,	16	103		
165	5		R2	2-4-5		9	@5': Brown Sandy Silt (ML), clayey, very moist, very fine grained, low Plasticity	24	95		
160	10		R3	5-8-10		18	@10': Brown Silt (ML), clayey/sandy, very moist, stiff, medium plasticity	30	92		
155	15		S-4	6-9-14		23	@15': Brown Silty Sand (SM), slightly clayey, moist	12	-		
150	20		S-5	7-10-16		26	@20': Same as above	14	-		
145	25		S-6	4-8-13		21	@25': Brown SANDY CLAY, moist, very stiff, medium plasticity, fine grained	16	-		
140	30		S-7	3-4-4		8	@30': Same as above, medium stiff to stiff	18	-		
135	35		S-8	6-10-10		20	@35':Same as above, very stiff	15	-		
130	40						Total Depth = 36.5 feet No Groundwater encountered during drilling Backfilled w/Cuttings				
	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	Fullerton College- New Instructional Building	LOG OF TEST HOLE	Borehole No. B-4
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-4
Project Number :	FC-5180-06		Page 1 of 1

Date(s) Drilled :	May 6, 2017	Logged By :	BA	Checked By :	Abraham Baha
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	36.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						4" AC over 4" AB				
			Bag #1				Brown Clayey SAND (SC), medium dense, slightly moist				
	2		R1	5-9-9		18	@2': Brown SILTY SAND (SM), slightly moist, medium dense, fine to coarse grained,	5	99		DS: P=Peak / Ult=Ultimate $\phi = 31^0$, c = 300 psf (P) $\phi = 30^0$, c = 250 psf (Ult)
165	5		R2	3-3-3		6	@5': Light Brown Sany Silt (ML), very moist, very fine to fine, soft to medium @7': Sandy SILT (ML) w/Clay, medium stiff, moist, brown	21	93		
160	10		R3	3-5-7		12	@10': Brown Silt (ML), clayey/sandy, moist, medium stiff, medium plasticity	24	95		DS: P=Peak / Ult=Ultimate $\phi = 29^0$, c = 400 psf (P) $\phi = 28^0$, c =300 psf (Ult)
155	15		S-4	3-4-6		10	@15': Brown Sandy Silt (ML), slightly clayey, moist, stiff	14	-		
150	20		S-5	9-10-18		28	@20': Brown Silty Sand (SM), moist, medium dense, fine to medium grained.	14	-		
145	25		S-6	7-8-10		18	Brown SANDY CLAY, moist, very stiff, medium plasticity, fine grained	14	-		
140	30		S-7	5-10-11		21	@30': Same as above	18	-		
135	35		S-8	6-9-11		20	@35': Brown SANDY SILT, moist, stiff, fine grained	13	-		
130	40						Total Depth = 36.5 feet No Groundwater encountered during drilling Backfilled w/Cuttings				
	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	Fullerton College- New Instructional Building	LOG OF TEST HOLE	Borehole No. B-5
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-5
Project Number :	FC-5180-06		Page 1 of 2

Date(s) Drilled :	May 6, 2017	Logged By :	BA	Checked By :	Abraham Baha
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						4" AC over 4" AB				
	2		Bag #1				@0-2': Brown Cayey Sand, medium dense, slightly moist			38	HD: 62%-15%-23%
			R1	7-9-7		16	@2': Brown SAND (SP), slightly silty, moist, medium dense, fine to coarse grained,	15	96		
165	5		R2	7-3-4		7	@5': Silty Sand (SM)/ Sandy Silt (ML), clayey, brown, loose/ soft, fine grained, very moist	22	99		
160	10		R3	4-7-9		16	@10': Brown Silty/Sandy CLAY, very moist, stiff, med plasticity	24	91		
155	15		S-4	6-7-10		17	@15': Brown SANDY CLAY, very moist, very stiff, low to med plasticity, silty	23	-		
150	20		S-5	7-10-15		25	@20': Brown Sandy Clay at top followed by SILTY SAND, moist, medium dense	18	-		
145	25		S-6	4-7-10		17	@25': Brown Silty SAND (SM), moist, medium dense, moist, fine to medium grained	16	-		
140	30		S-7	5-11-12		23	@30': Olive brown Sandy Clay (CL), moist, very stiff, fine grained, med plasticity	18	-		
135	35		S-8	6-9-11		20	@35': Brown Silty SAND (SM), moist, medium dense, moist,	17	-		
130	40		S-9	7-10-17		27	@40': Same as above	12	-		
	45						**Continued on Next page .....**	-	-		

Project :	**Fullerton College- New Instructional Building**	**LOG OF TEST HOLE**	Borehole No. B-5
Project Location :	**321 E. Chapman Avenue, Fullerton, California**		Plate No. K-5
Project Number :	**FC-5180-06**		Page 2 of 2

Date(s) Drilled :	May 6, 2017	Logged By :	BA	Checked By :	Abraham Baha
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	45										
			S-10	6-9-11		20	@45': Grayish brown SANDY SILT, very moist, very stiff, low plasticity	14	-		
165	50										
			S-11	10-14		24	@50': Same as above, clayey	23	-		
160							End of Boring at 51.5' No groundwater encountered Backfilled w/soil cuttings				

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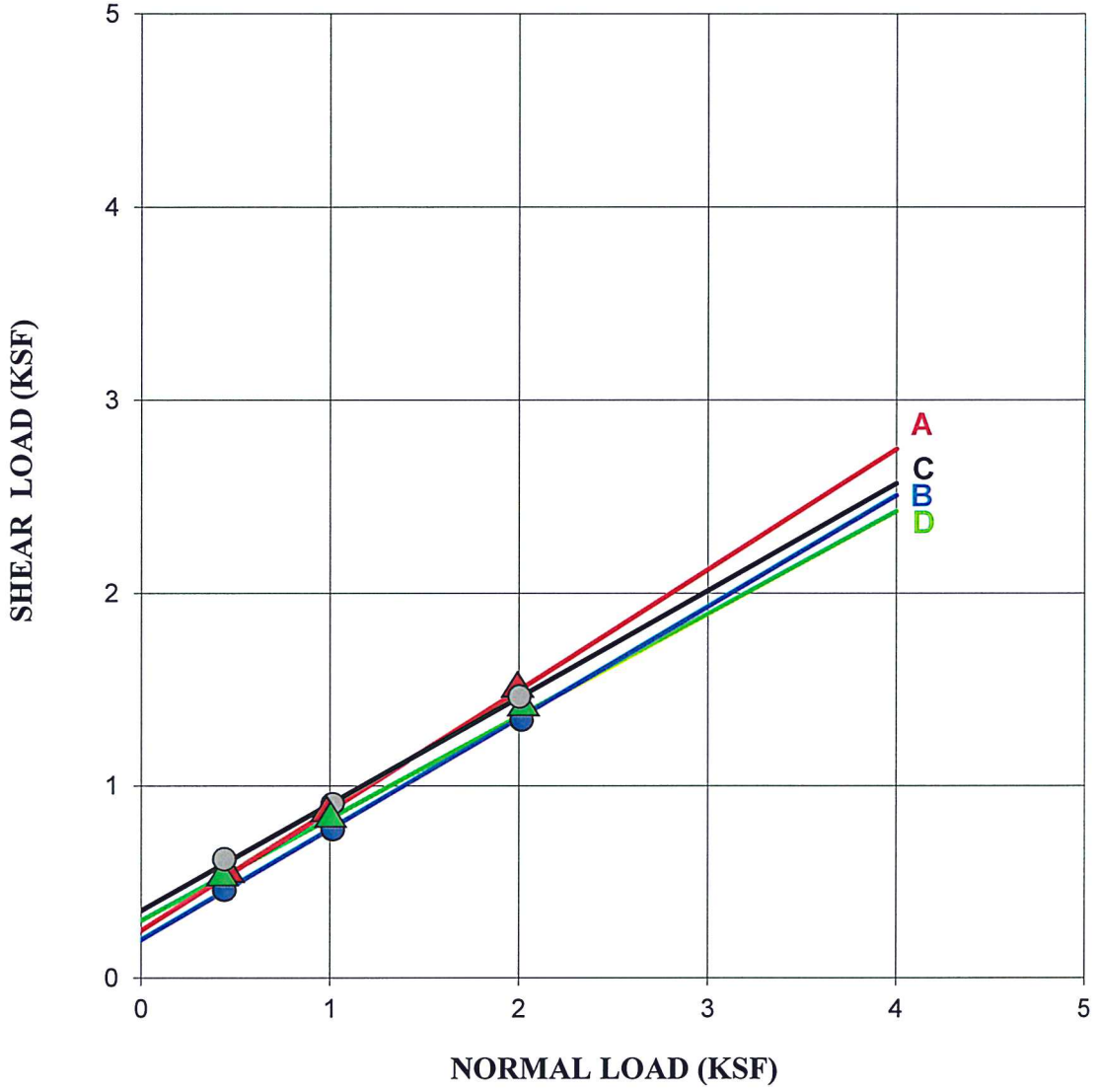
DIRECT SHEAR



SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION		COHESION (PSF)	FRICTION (DEG)
A	B-1	2'	Saturated - Drained	Peak	250	32
B	B-1	2'	Saturated - Drained	Ultimate	200	30
C	B-1	5'	Saturated - Drained	Peak	350	29
D	B-1	5'	Saturated - Drained	Ultimate	300	28

Fullerton College- New Instructional Building	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	L-1

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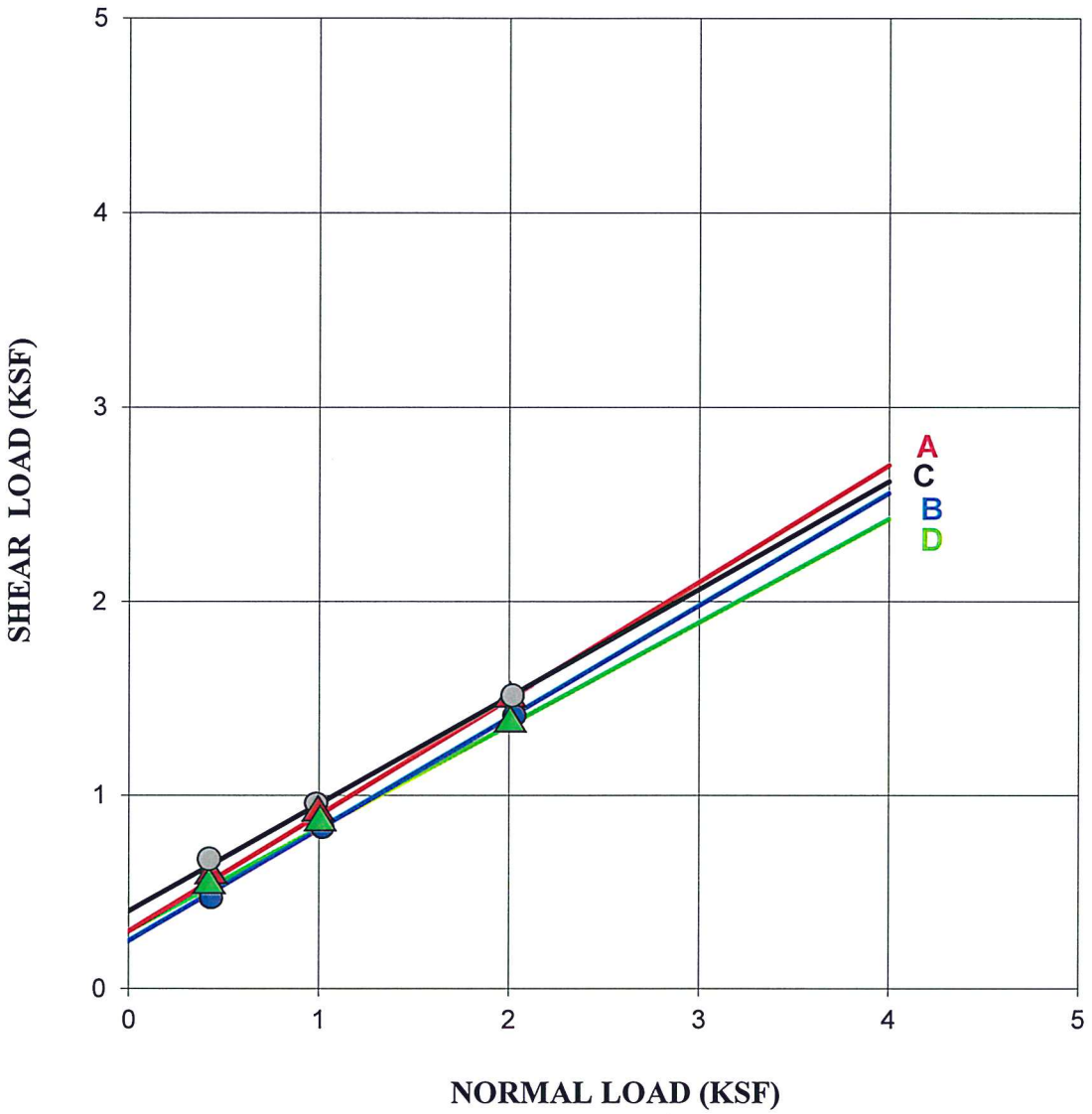
DIRECT SHEAR



SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION		COHESION (PSF)	FRICTION (DEG)
A	B-4	2'	Saturated - Drained	Peak	300	31
B	B-4	2'	Saturated - Drained	Ultimate	250	30
C	B-4	10'	Saturated - Drained	Peak	400	29
D	B-4	10'	Saturated - Drained	Ultimate	300	28

Fullerton College- New Instructional Building	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	L-2

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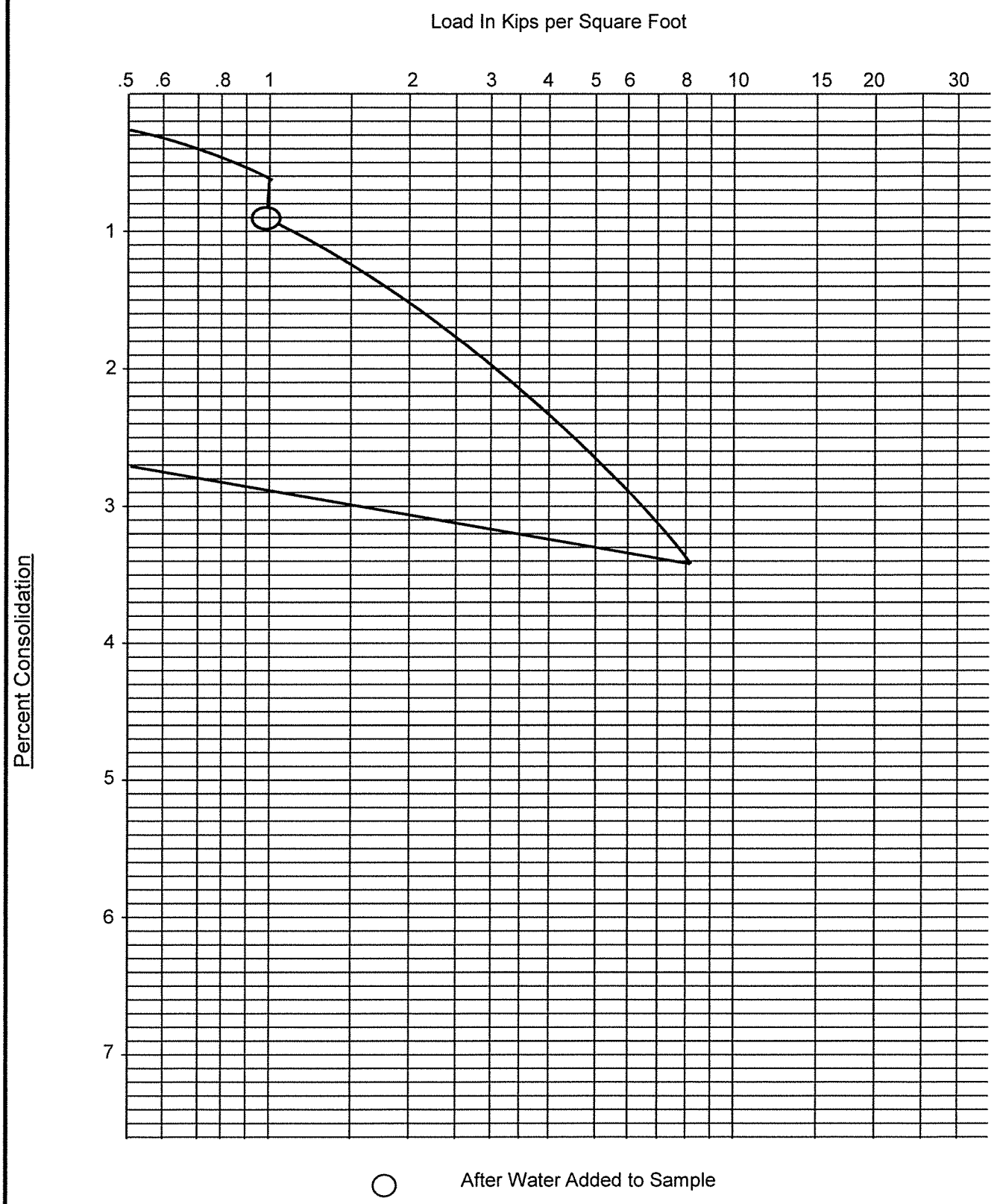
CONSOLIDATION



B-1 @ 2'

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	M

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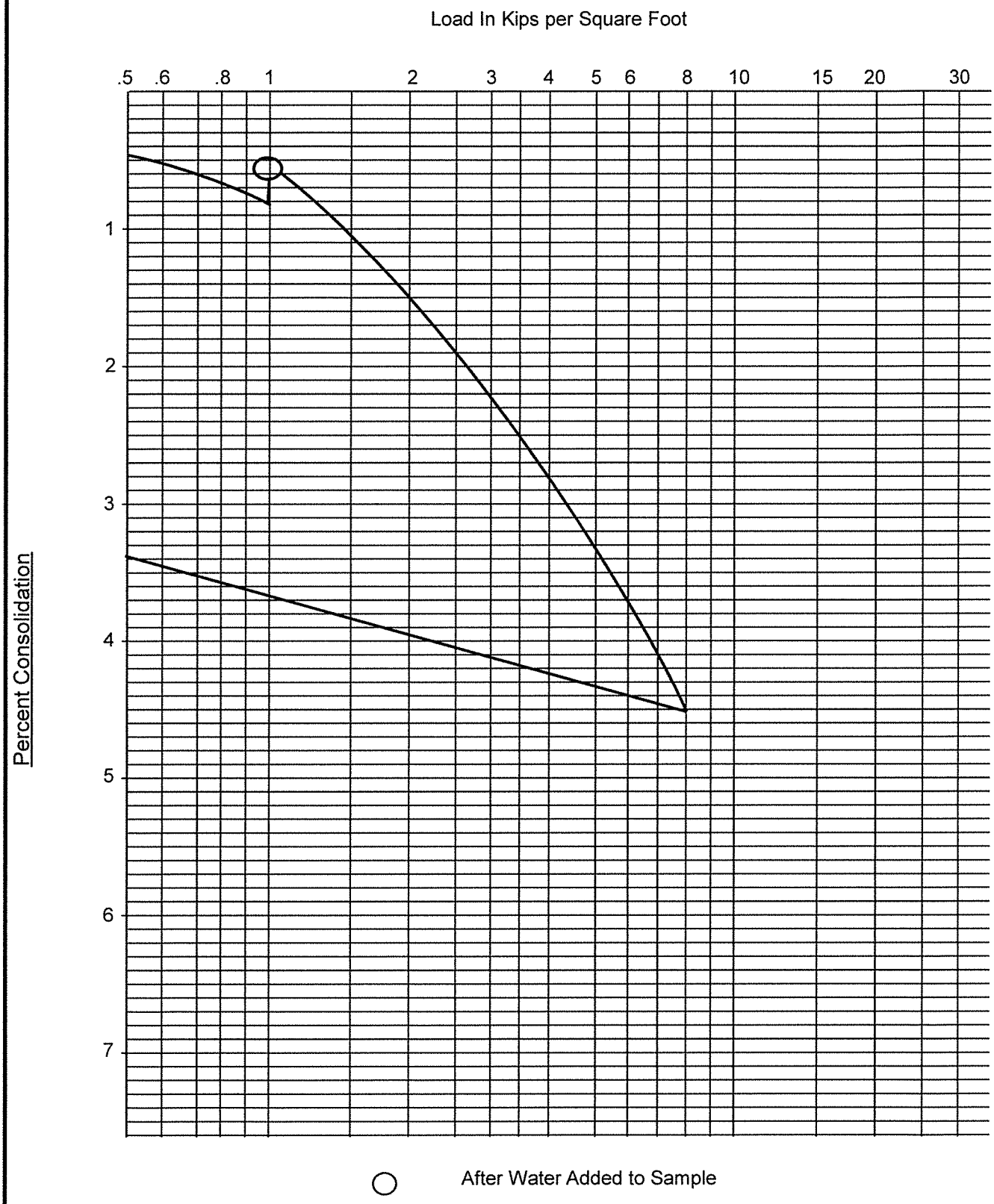
CONSOLIDATION

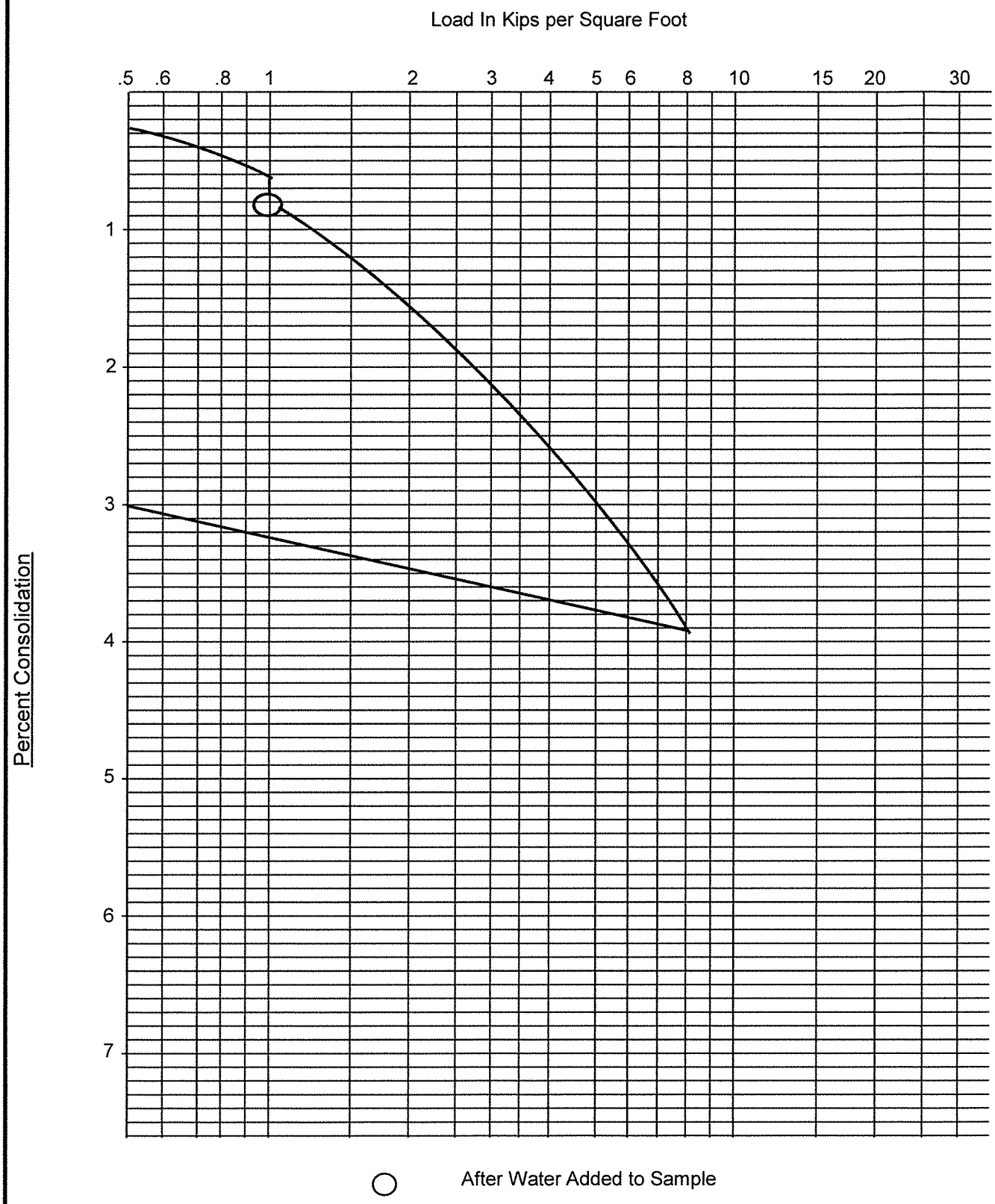


B-1 @ 10'

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	N

Geotechnical Solutions, Inc.

CONSOLIDATION

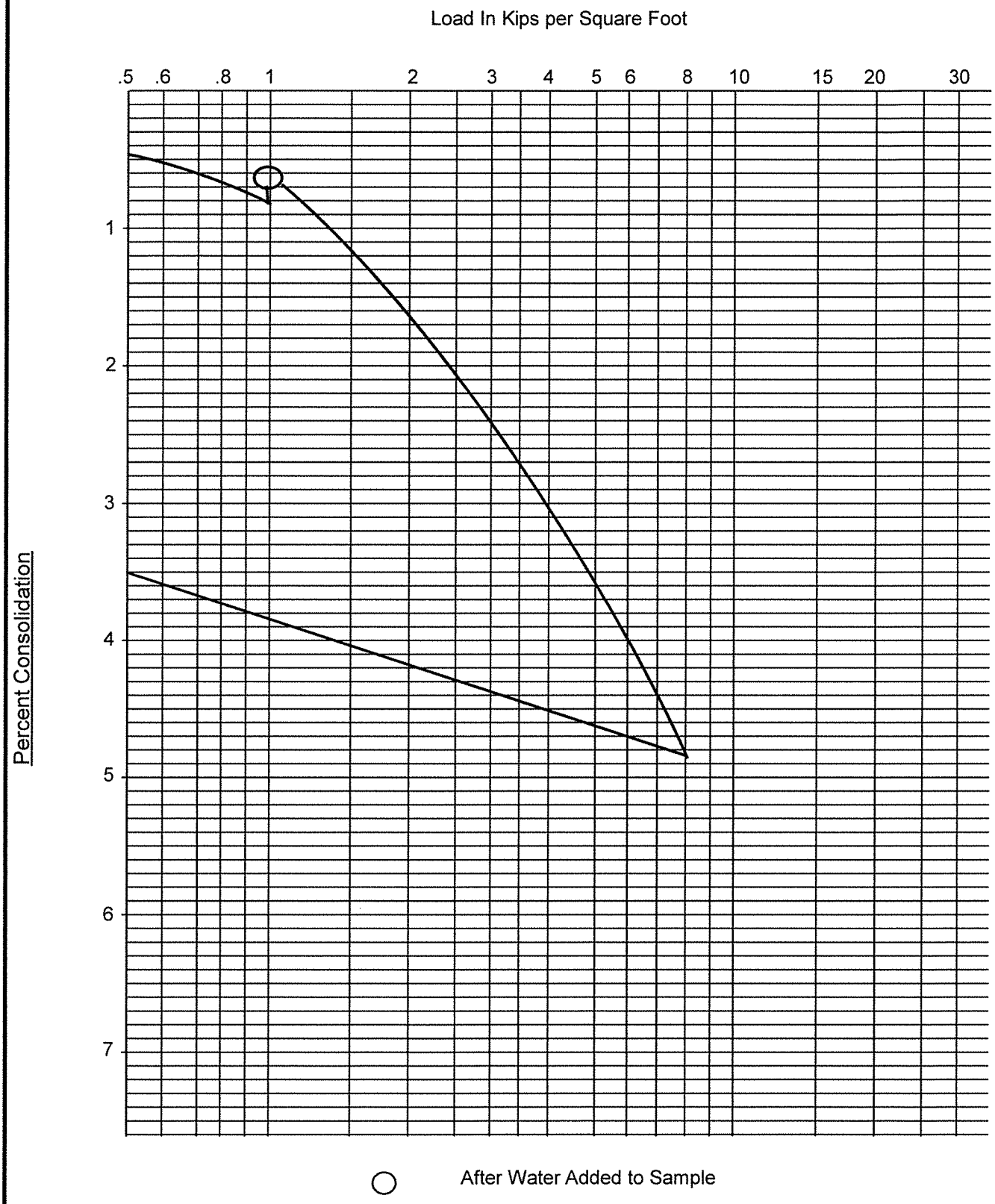


B-2 @ 5'

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	O

Geotechnical Solutions, Inc.

CONSOLIDATION

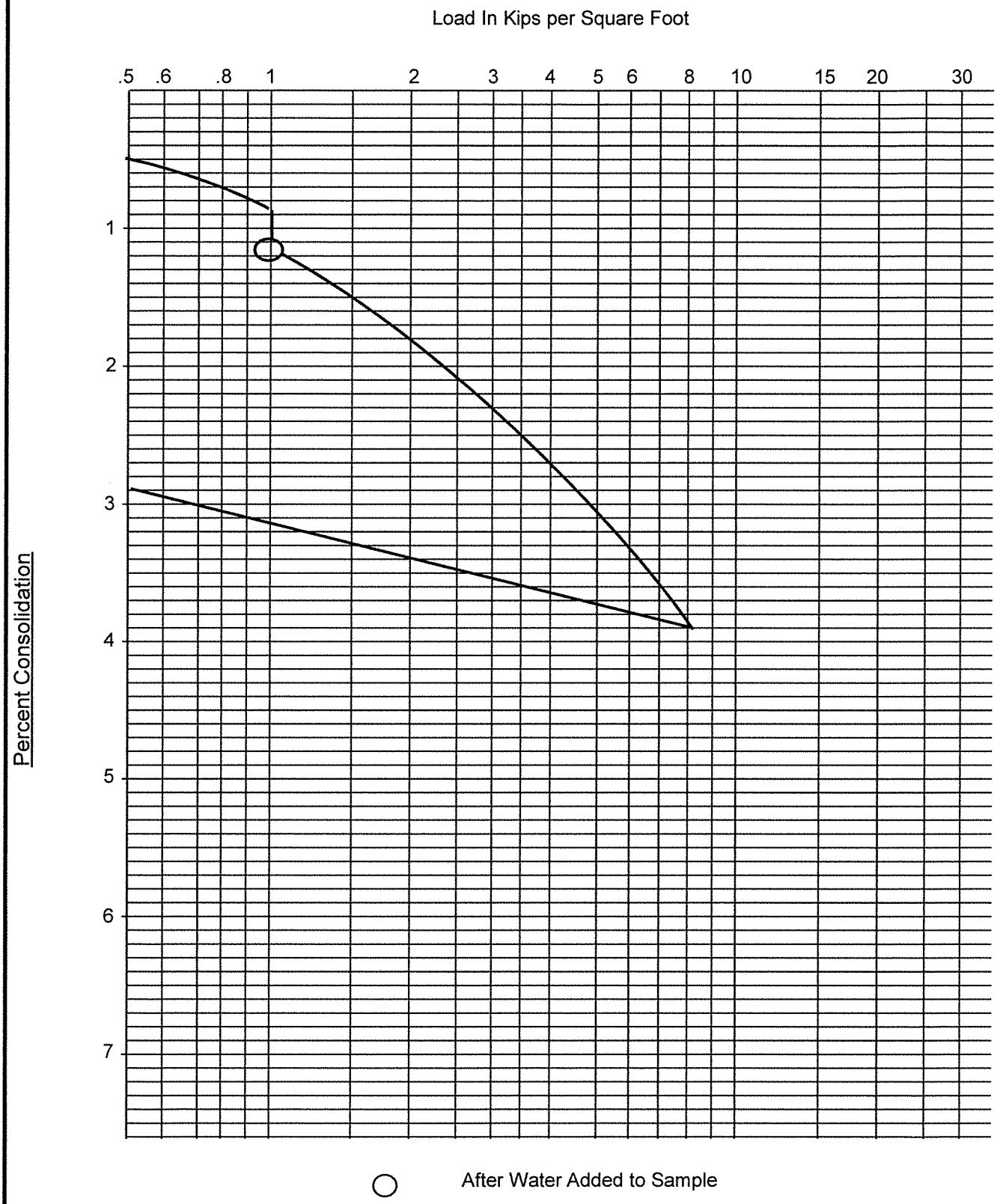


B-2 @ 10'

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	P

Geotechnical Solutions, Inc.

CONSOLIDATION

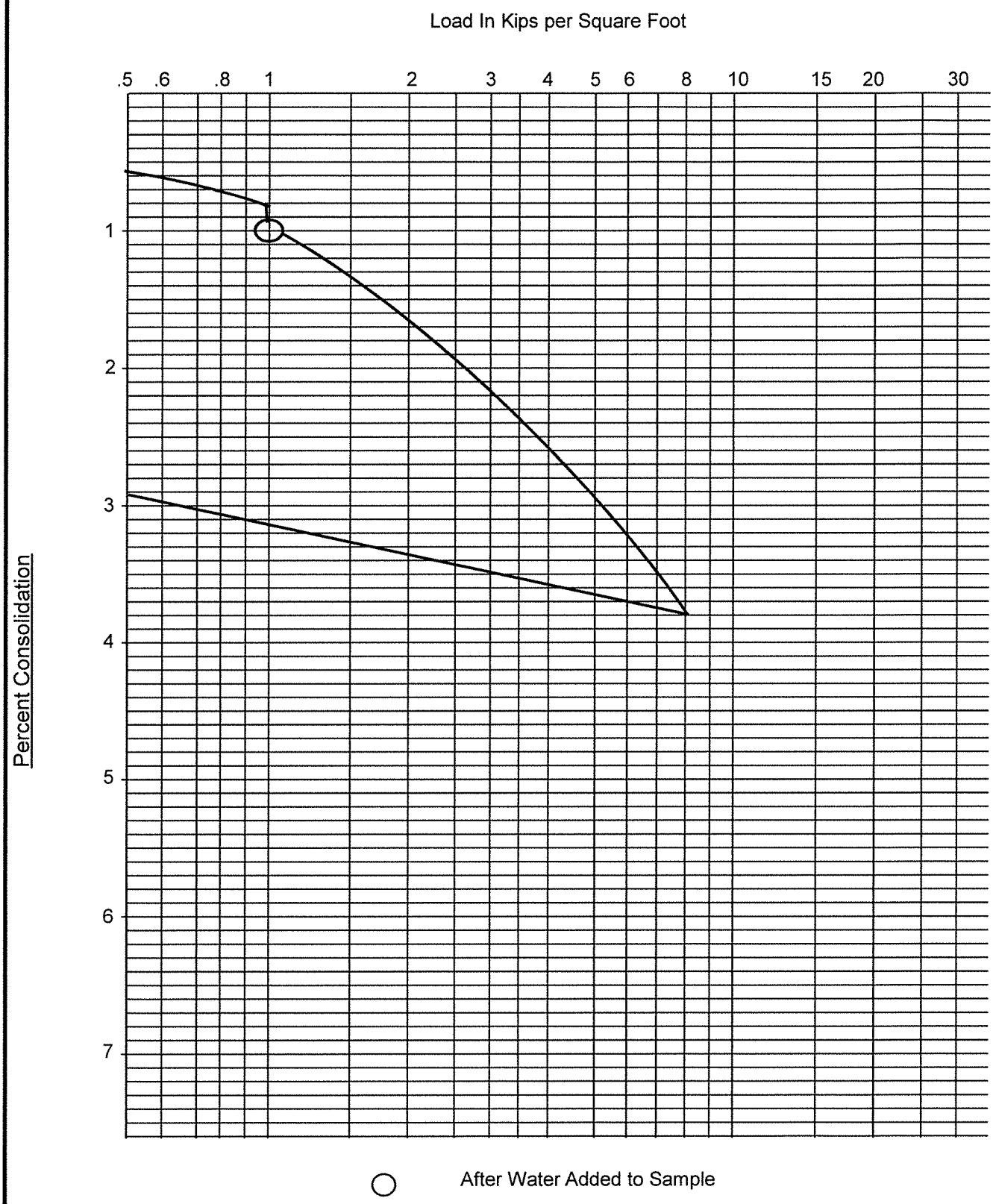


B-3 @ 5'

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	Q

Geotechnical Solutions, Inc.

CONSOLIDATION



B-3 @ 10'

FULLERTON COLLEGE- NEW INSTRUCTIONAL BUILDING	Project No.	FC-5180-06
321 E. Chapman Avenue, Fullerton, California	Plate:	R

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Appendix B

Test Boring Logs & Laboratory Tests

(Excerpts from Previous Studies)

Project :	FULLERTON COLLEGE - OFFICE & CLASSROOMS	Key to Log of Test Hole
Project Location:	321 E. Chapman Avenue, Fullerton, California	Plate No. K
Project Number:	SF-2165-06	

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Penetration Resistance, Blows / 6 in.	No Recovery (NR)	Blows / 12 in	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve	OTHER TESTS AND REMARKS
1	2	3	4	5	6	7	8	9	10	11	12

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; "[NR]" after number indicates no sample recovery.

5 **Blows / 6 in.:** Number of blows to advance driven sampler each 6-inch drive interval, or distance notes, using a 140-lb hammer with a 30-inch drop (unless otherwise noted)

6 **No Recovery (NR)** No recovery of sample

7 **Blows / 12 in.:** Blows per 12" based on Col. 5 equal to uncorrected N-Value where SPT used

8 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density / consistency. Approx. "and" = 35%-50%; "some" = 20%-35%; "little" = 10%-20%; "trace" = 0%-10%.

9 **Moisture Content:** Moisture content of sample, as percentage of dry weight of soil, meausred in lab according to ASTM D2937.

10 **Dry Unit Weight:** Dry unit weight of soil sample, in pounds per cubic foot, measured in lab according to ASTM D422.

11 **Percent Passing No. 200 Sieve:** Percent of soil by weight finer than the No. 200 sieve according to ASTM D422.

12 **Other Tests and Remarks:** Comments and observations regarding drilling or sampling made by driller or field personnel. Other lab tests are indicated using abbreviations explained below.

TYPICAL SAMPLER GRAPHIC SYMBOLS

- California (ring-lined)
- Modified California (brass tube-lined)
- Standard Penetration Test (SPT) split spoon
- Shelby Tube
- Bulk Sample
- Grab Sample

OTHER LABORATORY TEST ABBREVIATIONS

AL	Atterberg Limits Test (ASTM D4318)
COMP	Compaction test by modified effort (ASTM D1557)
CONS	One-dimensional consolidation test (ASTM D2435)
DS	Direct shear test (ASTM D3080)
EI	Expansion index test (ASTM 4829), index at 50% saturation
HD	Hydrometer analysis (ASTM D422), %<5 micros
LL	Liquid Limit from Atterberg Limites test
PI	Plasticity Index from Atterberg Limits test
SA	Sieve analysis (ASTM D422), %<#200 sieve
SE	Sand equivalent test for fines contamination (ASTM D2419)
UC	Unconfined compressive strength test (ASTM D2166)
WA	Wash analysis (ASTM D422), %<#200 sieve

OTHER GRAPHIC SYMBOLS

- First water encountered at time of drilling and sampling (ATD)
- Static water level measured at specified time after drilling
- Change in material properties within a lithologic stratum
- Inferred contact between soil strata or gradational lithologic change

Soil Classification are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. 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 between samples, at other locations, or times.

Project :	FULLERTON COLLEGE - OFFICE & CLASSROOMS	LOG OF TEST HOLE	Borehole No. B-1
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-1a
Project Number :	SF-2165-06		Page 1 of 2

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	Osman Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						Asphalt				
			Bag #1				Brown Silty Sand				HD: 80%-12%-8%
	2		R1	2-3-3		6	Brown SILTY SAND to SANDY SILT, moist, soft, fine grained	15	83		CN
165	5		R2	2-3-5		8	Brown SILTY CLAY, very moist, medium stiff, med. Plasticity	29	90		CN
160	10		R3	3-3-5		8	Brown Silty/Sandy CLAY, moist, medium stiff, med plasticity	17	103		CN
155	15		S-4	3-5-11		16	Brown SANDY CLAY, moist, very stiff, low to medium plasticity silty	15	-		
150	20		S-5	5-11-15		26	Brown Sandy Clay at top followed by SILTY SAND, moist, medium dense	16	-		
145	25		S-6	4-9-18		27	Brown SANDY CLAY, moist, very stiff, medium plasticity, fine grained	17	-		
140	30		S-7	5-11-12		23	Brown SILTY SAND, moist, medium dense, fine grained	14	-	19	HD: 70:18:12
135	35		S-8	6-9-14		23	Brown SANDY SILT, moist, stiff, fine grained	16	-		HD: 33:65:2
130	40		S-9	7-10-11		21	Gray SILTY SAND, moist, medium dense, fine grained, mica	9	-	29	HD: 63:30:7
	45		S-10	6-9-11		20		26	-		

Continued on Next page .....

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 E. Chapman Avenue, Fullerton, California Project Number : SF-2165-06	LOG OF TEST HOLE	Borehole No. B-1 Plate No. K-1b Page 2 of 2	

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	45										
			S-10	6-9-11		20	Grayish brown SANDY SILT, very moist, very stiff, low plasticity	26	-		HD: 12:81:7
165	50										
			S-11	7-13-19		32	Same as above, hard, clayey	23	-		HD: 28:45:27
160							End of Boring at 51.5' No groundwater encountered Backfilled w/soil cuttings				

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 E. Chapman Avenue, Fullerton, California Project Number : SF-2165-06		BORING LOG	Borehole No. B-2 Plate No. K-2a Page 1 of 2
Date(s) Drilled : August 21, 2004	Logged By : Marcelo Marciani		Checked By : O. Pekin
Drilling Method : Hollow-Stem Auger	Drill Bit Size / Type : 8-inch-OD rock bit		Total Depth of Borehole, feet : 51.5
Drill Rig Type : CME 75	Drilling Contractor : Redman		Approx. Surface Elevation, feet : 170 feet MSL
Groundwater Level and Date Measured: Not encountered ATD	Sampling Method : SPT w/ring, California (ring), bulk		Hammer Data : CME auto-trip hammer; 140 lbs / 30-inch drop
Borehole Backfill : Drill cuttings to surface	Comments : Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						Asphalt				
			BAG 1								
165	5		R-1	3-3-4		7	Brown, CLAYEY SAND w/Silt, fine grained, soft	30	87		CN, HD: 45:27:28
160	10		R-2	4-4-5		9	Brown SILTY SAND w/clay, fine grained, moist, loose	14	106		CN
155	15		R-3	6-8-13		21	Same as above, medium dense .	11	-		CN
150	20		S-4	6-8-10		18	Same	-	-		
145	25		S-5	7-9-10		19	Brown SILTY CLAY, very moist, fine grained, low to medium plasticity, very stiff	21	-		
140	30		S-6	5-6-9		15	Brown SAND, moist, fine grained, medium dense	9	-		
135	35		S-7	4-5-10		15	some silt	10	-		HD: 78:12:10
130	40		S-8	10-11-14		25	gray SILTY SAND, fine to coarse grained, moist	15	-		HD: 48:44:8
125	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	FULLERTON COLLEGE - OFFICE & CLASSROOMS	LOG OF TEST HOLE	Borehole No. B-2
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-2b
Project Number :	SF-2165-06		Page 2 of 2

Date(s) Drilled :	August 21, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
125	45										
			S-9	10-12-15		27	Grayish brown SILTY SAND, moist, medium dense	11	-		HD: 48:44:8
120	50										
			S-10	6-9-15		24	No Recovery	-	-		
115							End of Boring at 51.5' No groundwater encountered Backfilled w/soil cuttings				

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 East Chapman Avenue, Fullerton Project Number : SF-2165-06		BORING LOG	Borehole No. 3 Plate No. K-3a Page 1 of 2
Date(s) Drilled : August 16, 2004	Logged By : MO		Checked By : O. Pekin
Drilling Method : Hollow-Stem Auger	Drill Bit Size / Type : 8-inch-OD rock bit		Total Depth of Borehole, feet : 101
Drill Rig Type : CME 75	Drilling Contractor : Cal PAC Drilling		Approx. Surface Elevation, feet : 170 feet MSL
Groundwater Level and Date Measured: Not encountered during drilling	Sampling Method : California (ring), bulk		Hammer Data : CME auto-trip hammer, 140 lbs / 30-inch drop
Borehole Backfill : Drill cuttings to surface	Comments : Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						Asphalt				
	2		bag 1 R-1	2-3-3		6	Brown SANDY SILT, some clay, moist, fine grained, very moist soft	35	82		CN
165	5		R-2	2-3-3		6	Same as above	21	100		CN
160	10		R-3	4-4-7		11	Brown SILTY CLAY, very moist, medium stiff, low to medium plasticity	26	93		CN
155	15		R-4	4-7-13		20	same, moist	14	122		
150	20		S-5	4-9-12		21	same with fine grained sand	20	-		
145	25		S-6	4-6-13		19	same as above	18	-		
140	30		S-7	7-10-13		23	Brown SILTY SAND, moist, fine grained, medium dense	14	-		
135	35		S-8	7-9-13		22	Brown SANDY SILT, fine grained, moist, very stiff, low plasticity	17	-		HD: 37:56:7
130	40		S-9	9-14-22		36	gray SILTY SAND, fine grained, moist, dense	11	-		HD: 55:38:7
125	45										

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 E. Chapman Avenue, Fullerton, California Project Number : SF-2165-06	LOG OF TEST HOLE	Borehole No. B-3 Plate No. K-3b Page 2 of 2	

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
125	45										
			S-10	4-7-10		17	Brownish gray SANDY SILT w/ clay, low plasticity, very stiff	24	-		HD: 32:41:27
120	50										
			S-11	5-7-11		18	Gray SILTY SAND w/ Clay, medium dense, moist	24	-		#200: 36 %
115							End of Boring at 51.5' No groundwater encountered Backfilled w/soil cuttings				

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 East Chapman Avenue, Fullerton Project Number : SF-2165-06		BORING LOG	Borehole No. B-4 Plate No. K-4a Page 1 of 2

Date(s) Drilled :	October 11, 2002	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	101
Drill Rig Type :	CME 75	Drilling Contractor :	Cal PAC Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	Not encountered ATD	Sampling Method :	California (ring), bulk	Hammer Data :	CME auto-trip hammer; 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings to surface	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						Asphalt				
	2		Bag 1								HD: 60:32:8
			R-1	3-3-3		6	Brown SILTY SAND, loose, very moist, fine grained	18	93		CN
165	5		R-2	2-2-3		5	Clayey,	19	95		CN
160	10		R-3	2-3-7		10	Brown SILTY CLAY, medium stiff, fine grained, low to medium plasticity	25	97		CN
155	15		R-4	4-5-10		15	Same	16	109		
150	20		S-5	8-14-19		33	SANDY CLAY, low plasticity, very stiff, fine grained	25	106		
145	25										
140	30		S-6	3-4-9		13	Brown SILTY SAND w/clay, medium dense, moist, fine to medium grained	16	-		HD: 48:32:20
135	35										
130	40		S-7	9-20-23		43	gray SAND, silty, moist, dense, fine to coarse grained	12	-		HD: 42:41:17
125	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	FULLERTON COLLEGE - OFFICE & CLASSROOMS	LOG OF TEST HOLE	Borehole No. B-4
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-4b
Project Number :	SF-2165-06		Page 2 of 2

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
125	45										
120	50		S-8	7-7-12		19	greenish gray CLAYEY SILT, very stiff, very moist, low plastic	21	-		HD: 13:50:37
115							End of Boring at 51.5' No groundwater encountered Backfilled w/soil cuttings				

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 East Chapman Avenue, Fullerton Project Number : SF-2165-06		BORING LOG	Borehole No. B-5 Plate No. K-5a Page 1 of 2

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	101
Drill Rig Type :	CME 75	Drilling Contractor :	Cal PAC Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	Not encountered during drilling	Sampling Method :	California (ring), bulk	Hammer Data :	CME auto-trip hammer; 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings to surface	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						Asphalt				
			bag 1				0-2': SAND				HD: 88:5:7
	2		R-1	3-3-4		7	Gray SANDY CLAY, fine grained, soft, low to medium plasticity	34	79		CN
165	5		R-2	3-3-3		6	Same as above, silty	27	93		CN
160	10		R-3	3-5-9		14	same as above, stiff	29	88		CN
155	15		R-4	5-7-7		14	Brown SILTY SAND, slightly clayey, moist, fine grained, loose	14	-		
150	20		S-5	4-7-12		19	Brown SILTY CLAY w/sand, moist, low to medium plasticity, very stiff	23	-		
145	25		S-6	4-6-12		18	same as above	20	-		
140	30		S-7	4-6-7		13	Brown SILTY SAND, moist, fine grained, medium dense	13	-		
135	35		S-8	8-10-13		23	Same as above	16	-		HD: 42:35:23
130	40		S-9	11-15-18		33	gray SAND, silty, fine grained, moist, dense	10	-		HD: 83:10:7
125	45										

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 E. Chapman Avenue, Fullerton, California Project Number : SF-2165-06	LOG OF TEST HOLE	Borehole No. B-5 Plate No. K-5b Page 2 of 2	

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
125	45		S-10	6-9-11		20	Gray CLAYEY SILT w/sand, low plasticity, very moist, fine to medium grained	24	-		HD: 13:70:17
120	50		S-11	6-7-10		17	Light brown SILTY CLAY, very moist, fine grained, medium plasticity, very stiff	24	-		HD: 17:33:50
115							End of Boring at 51.5' No groundwater encountered Backfilled w/soil cuttings				

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 East Chapman Avenue, Fullerton Project Number : SF-2165-06	BORING LOG	Borehole No. B-6 Plate No. K-6a Page 1 of 2	

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	101
Drill Rig Type :	CME 75	Drilling Contractor :	Cal PAC Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	Not encountered during drilling	Sampling Method :	California (ring), bulk	Hammer Data :	CME auto-trip hammer; 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings to surface	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						Asphalt				
			bag 1				0-2': SAND				HD: 88:5:7
	2		R-1	3-3-5		8	Light brown SAND, silty, fine to medium grained, very moist loose	6	98		CN
165	5		R-2	3-3-5		8	Light brown SILTY CLAY, fine grained sand, low to medium plasticity, medium stiff, very moist	40	81		CN
160	10		R-3	2-2-4		6	same as above	21	96		CN
155	15		S-4	3-5-9		14	Brown SILTY SAND, moist, fine grained, medium dense	11	-		
150	20		S-5	15-18-23		41	Brown SAND, dense, moist, fine to medium grained	12	-		
145	25		S-6	5-6-8		14	Brown SILTY SAND, moist, fine grained, medium dense	12	-		
140	30		S-7	5-7-13		20	Brown SILTY SAND, slightly clayey, moist, fine grained, medium dense	16	-		
135	35		S-8	4-5-11		16	Brown SILTY SAND, slightly clayey, moist, fine grained, medium dense	17	-		HD: 38:35:27
130	40		S-9	6-8-23		31	gray SILTY SAND, fine grained, moist, dense	12	-		HD: 58:30:12
125	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	FULLERTON COLLEGE - OFFICE & CLASSROOMS	LOG OF TEST HOLE	Borehole No. B-6
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-6b
Project Number :	SF-2165-06		Page 2 of 2

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pakin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
125	45										
			S-10	5-8-11		19	Gray SILTY SAND, moist, fine to medium grained	10	-		HD: 63:29:8
120	50										
			S-11	6-8-12		20	Gray CLAYEY SILT, low plasticity, fine to medium grained very moist	23	-		HD: 18:42:40
115							End of Boring at 51.5' No groundwater encountered Backfilled w/soil cuttings				

GEOTECHNICAL SOLUTIONS, INC.

Project : FULLERTON COLLEGE - OFFICE & CLASSROOMS Project Location : 321 East Chapman Avenue, Fullerton Project Number : SF-2165-06	BORING LOG	Borehole No. B-7 Plate No. K-7a Page 1 of 2	

Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	101
Drill Rig Type :	CME 75	Drilling Contractor :	Cal PAC Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	Not encountered during drilling	Sampling Method :	California (ring), bulk	Hammer Data :	CME auto-trip hammer; 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings to surface	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
170	0						Asphalt				
			bag 1				0-2": SAND				HD: 75:17:8
	2		R-1	4-3-3		6	Light brown SAND, silty, fine to medium grained, very moist very loose	14	90		CN
165	5		R-2	2-2-3		5	Brown SANDY CLAY, fine grained sand, low to medium plasticity, soft, very moist	26	91		CN
160	10		R-3	3-4-9		13	same as above	27	96		CN
155	15		S-4	4-5-8		13	Brown SILTY SAND, moist, fine grained, medium dense	12	-		
150	20		S-5	6-14-24		38	dense	13	-		
145	25		S-6	5-7-12		19	Brown SILTY SAND, clayey, moist, fine grained, medium dense	18	-		
140	30		S-7	4-10-15		25	Brown SANDY CLAY, moist, fine grained, medium plasticity, very stiff	17	-		
135	35		S-8	4-6-16		22	Brown SILTY SAND, slightly clayey, moist, fine grained, medium dense	17	-		HD: 50:33:17
130	40		S-9	8-11-15		26	gray SILTY SAND, fine grained, moist, medium dense	11	-		HD: 57:35:8
125	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	FULLERTON COLLEGE - OFFICE & CLASSROOMS	LOG OF TEST HOLE	Borehole No. B-7
Project Location :	321 E. Chapman Avenue, Fullerton, California		Plate No. K-7b
Project Number :	SF-2165-06		Page 2 of 2

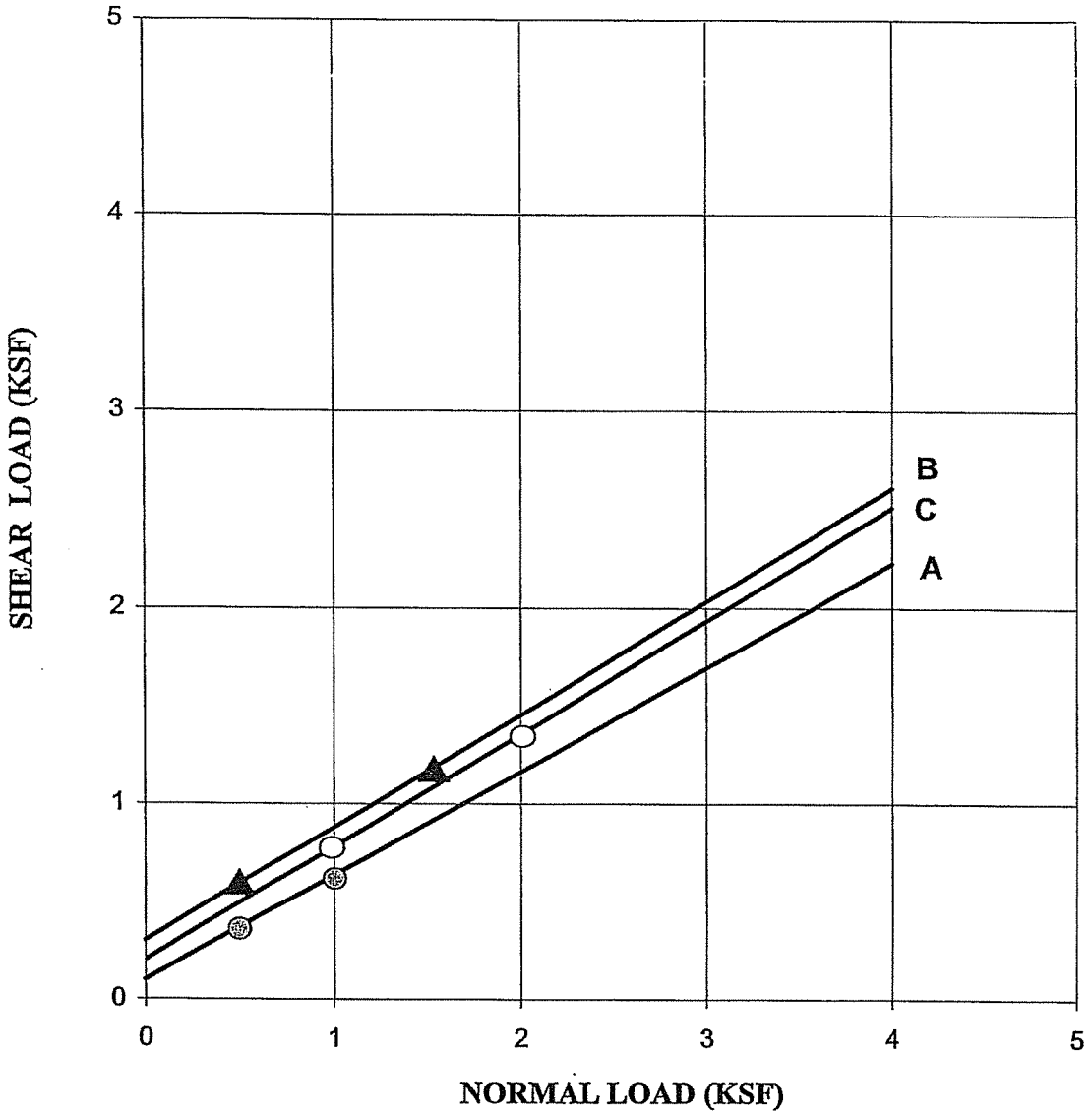
Date(s) Drilled :	August 16, 2004	Logged By :	MO	Checked By :	O. Pekin
Drilling Method :	Hollow-Stem Auger	Drill Bit Size / Type :	8-inch-OD rock bit	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	CME-75	Drilling Contractor :	Redman Drilling	Approx. Surface Elevation, feet :	170 feet MSL
Groundwater Level and Date Measured:	No Groundwater encountered	Sampling Method :	SPT, California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
125	45										
			S-10	8-10-10		20	Gray SILTY SAND, moist, fine to medium grained medium dense	10	-		HD: 77:15:8
120	50										
			S-11	5-5-11		16	Gray CLAYEY SILT, moist, fine grained, low plasticity	22	-		HD: 17:51:32
115	55										
				8-12-27		39	Gray SILTY SAND, fine grained, moist, dense	13	-		HD: 53:37:10
110	60										
-5				11-13-29		42	Gray SANDY SILT, fine grained, moist, hard	11	-		HD: 40:53:7
105	65										
				4-6-10		16	Brown SILTY SAND, fine grained, moist, medium dense	21	-		
100	70										
				8-13-27		40	Same as above, dense	16	-		

End of Boring at 71.5'
No groundwater encountered
Backfilled w/soil cuttings

GEOTECHNICAL SOLUTIONS, INC.

DIRECT SHEAR



SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION	COHESION (PSF)	FRICTION (DEG)
A	Boring 4	2'	Saturated - Drained	100	28
B	Boring 4	20'	Saturated - Drained	300	30
C	Boring 6	10'	Saturated - Drained	200	30

FULLERTON COLLEGE - OFFICE & CLASSROOMS	Project No.	SF-2165-06
321 E. Chapman Avenue, Fullerton, California	Plate:	L

Geotechnical Solutions, Inc.

Log of Test Hole No. B-1

Drilling Equipment: 8" Hollowstem Auger — Drilling Date: 5/4/2007

Driving Weight: 140 lbs. @ 30" Drop

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
			Concrete							
2			SAND, some silt, fine grained	10	98	15		17	Yellowish brown	loose
5			Silty Sand, clayey	8	93	14		35	dark brown	
10			Silty Sand, fine	12	114	18		22	brown	
15			Same as above	11	106	21		25	Dark brown	medium dense
20			Silty Sand, Slightly Clayey	31	-	20		38	brown	
25			Same as above, more clay	17	-	17		40		
30			Same	20	-	17		45		
35			Silty SAND, fine to medium grained,	21	-	9		36	brown	
			Continued on next page...							

Legend:

S Calif.Mod Core Sample
N Number of Blows
D Dry Density
W Field Moisture Content
SPT Sampling & Blow counts.

B Bulk Sample
#4 % Passing Sieve No. 4
#200 % Passing Sieve No. 200

C Color
F Firmness

FULLERTON COLLEGE - SCIENCE BUILDING-400

321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	K

Geotechnical Solutions, Inc.

Log of Test Hole No.B-1, Cont..

Drilling Equipment: 8" Hollowstem Auger — Drilling Date: 5/4/2007

Driving Weight: 140 lbs. @ 30" Drop

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
40	▦		Silty SAND, fine to medium grained	14	-	13		37	gray	medium dense
45	▦		Same	18	-	14		38		
50	▦		Clayey Sand	20	-	31		48		
55	▦		Same, fine grained	28	-	27		45		
			End of boring at 56.5-ft. No Groundwater encountered No Caving							
60										
70										
80										
90										
100										

Legend:

S ▩ Calif.Mod Core Sample
N Number of Blows
D Dry Density
W Field Moisture Content
▦ SPT Sampling & Blow counts.

B Bulk Sample
#4 % Passing Sieve No. 4
#200 % Passing Sieve No. 200

C Color
F Firmness

FULLERTON COLLEGE - SCIENCE BUILDING-400

321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	K-1

Geotechnical Solutions, Inc.

Log of Test Hole No. B-2

Drilling Equipment: 8" Hollowstem Auger — Drilling Date: 5/4/2007

Driving Weight: 140 lbs. @ 30" Drop

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
			Planter							
2			Silty Sand	8	100	13			brown	loose
5			Silty clayey Sand	9	96	16			dark brown	
10			Same as above	10	110	22			brown	
15			Silty Sand	13	102	19			Dark brown	medium dense
20			Sandy SILT	25	-	21			brown	
25			Same as above	16	-	14				
30			Same	17	-	13				
35			Silty Sand, fine to medium	22	-	11			brown	
			Same as above	15		10				

End of Boring @ 40 feet, No Cavong & No groundwater

Legend:

S Calif.Mod Core Sample

N Number of Blows

D Dry Density

W Field Moisture Content

SPT Sampling & Blow counts.

B Bulk Sample

#4 % Passing Sieve No. 4

#200 % Passing Sieve No. 200

C Color

F Firmness

FULLERTON COLLEGE - SCIENCE BUILDING-400

321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	L

Geotechnical Solutions, Inc.

Log of Test Hole No. B-3

Drilling Equipment: 8" Hollowstem Auger — Drilling Date: 5/4/2007

Driving Weight: 140 lbs. @ 30" Drop

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
			Planter							
2			Silty Sand	6	102	16			brown	loose
5			Silty Clayey Sand	7	95	17			dark brown	very soft
10			Silty, clayey Sand	11	108	20			brown	soft
15			Same as above	14	100	22			brown	medium stiff
20			Silty Sand	20	-	20				very stiff
25			Same as above	33	-	18				
30			Same	16	-	12				
35			Silty SAND, fine to medium	18	-	10				
			Same	21		16				

Legend: **End of Boring @ 40 feet, No Cavong & No roundwater**

S Calif.Mod Core Sample
N Number of Blows
D Dry Density
W Field Moisture Content
SPT Sampling & Blow counts.

B Bulk Sample
#4 % Passing Sieve No. 4
#200 % Passing Sieve No. 200

C Color
F Firmness

FULLERTON COLLEGE - SCIENCE BUILDING-400

321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	M

Geotechnical Solutions, Inc.

Log of Test Hole No. B-4

Drilling Equipment: 8" Hollowstem Auger — Drilling Date: 5/4/2007

Driving Weight: 140 lbs. @ 30" Drop

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
			Planter							
			SAND, clayey, sliightly silt, fine graine	9	100	9		17	Yellowish brown	loose
5			Silty Clayey Sand	12	96	19		65	dark brown	very soft
10			Same as above	9	97	23		45	brown	soft
15			Same as above	13	100	20		37	Dark brown	medium stiff
20			Silty Clayey Sand	34	-	16		37	brown	very stiff
25			Same as above with calcite	16	-	17		37		
30			Same	20	-	13		35		
35			Silty SAND, fine to medium grained,	23	-	14		35	brown	loose

Continued on next page...

Legend:

S Calif.Mod Core Sample
N Number of Blows
D Dry Density
W Field Moisture Content
SPT Sampling & Blow counts.

B Bulk Sample
#4 % Passing Sieve No. 4
#200 % Passing Sieve No. 200

C Color
F Firmness

FULLERTON COLLEGE - SCIENCE BUILDING-400

321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	N

Geotechnical Solutions, Inc.

Log of Test Hole No.B-4, Cont..

Drilling Equipment: 8" Hollowstem Auger Drilling Date: 5/4/2007

Driving Weight: 140 lbs. @ 30" Drop

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
40	▦		Silty SAND, fine to medium grained	31	-	12	35		gray	medium dense
45	▦		Same	10	-	17	45			loose
50	▦		slightly clayey	15	-	19	45			medium dense
55	▦		Silty Sand	28	-	13	45			
			End of boring at 56.5-ft. No Groundwater encountered No Caving							
60										
70										
80										
90										
100										

Legend:

S ▩ Calif.Mod Core Sample
N Number of Blows
D Dry Density
W Field Moisture Content
▦ SPT Sampling & Blow counts.

B Bulk Sample
#4 % Passing Sieve No. 4
#200 % Passing Sieve No. 200

C Color
F Firmness

FULLERTON COLLEGE - SCIENCE BUILDING-400

321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	N-1

Geotechnical Solutions, Inc.

Log of Test Hole No. B-5

Drilling Equipment: 8" Hollowstem Auger
Driving Weight: 140 lbs. @ 30" Drop

Drilling Date: 5/4/2007

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
			Concrete							
2			Silty Sand, moist, fine grained,	25	114	11		15	light brown	medium dense
5			Same as above	13	97	10		15		loose
			Sand, slightly Silty							
10			Sandy Silt, moist, fine	14	107	14		52	brown	medium stiff to stiff
15			Same	11	-	9		52		
20			Silty Sand, some clay, moist	13	-	14		20	light brown	medium dense
25			Same as above	12	-	15		20	"	"
30			Same, little clay	24	-	15		35	"	"
35			SILTY SAND, moist, fine grained	21	-	10		35	brown	medium dense
40			Continued on next page…							

Legend:

S Calif.Mod Core Sample
N Number of Blows
D Dry Density
W Field Moisture Content
SPT Sampling & Blow counts.

B Bulk Sample
#4 % Passing Sieve No. 4
#200 % Passing Sieve No. 200

C Color
F Firmness

FULLERTON COLLEGE - SCIENCE BUILDING-400
321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	O

Geotechnical Solutions, Inc.

Log of Test Hole No.B-5, Cont..

Drilling Equipment: 8" Hollowstem Auger Drilling Date: 5/4/2007

Driving Weight: 140 lbs. @ 30" Drop

Depth (ft)	S	B	Description	N	D	W	#4	#200	C	F
40	▦		Silty Sand, fine grain	16	-	15		35	gray	medium dense
45	▦		Same	23	-	14		45		loose
50	▦		Same as above	22	-	24		45		medium dense
			End of boring at 51.5-ft. No Groundwater encountered No Caving							
55										
60										
70										
80										
90										
100										

Legend:

S ▩ Calif.Mod Core Sample
N Number of Blows
D Dry Density
W Field Moisture Content
▦ SPT Sampling & Blow counts.

B Bulk Sample
#4 % Passing Sieve No. 4
#200 % Passing Sieve No. 200

C Color
F Firmness

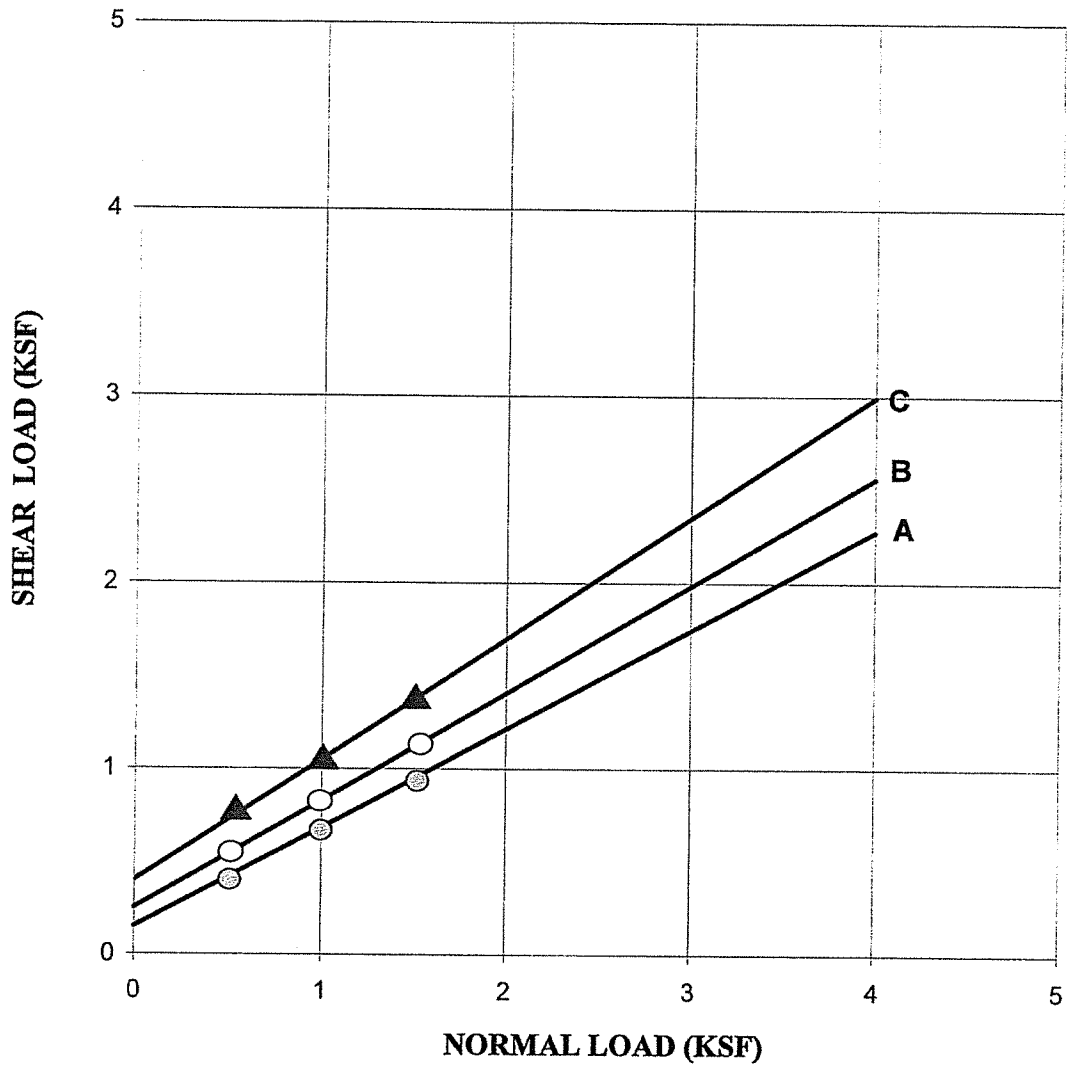
FULLERTON COLLEGE - SCIENCE BUILDING-400

321 E. Chapman Avenue, Fullerton, California

Project No.	SF-3457-06
Plate:	O-1

Geotechnical Solutions, Inc.

DIRECT SHEAR



SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION	COHESION (PSF)	FRICTION (DEG)
A	Boring 1	5'	Saturated - Drained	150	28
B	Boring 4	10'	Saturated - Drained	250	30
C	Boring 2	5	Remold 95 %	400	33

FULLERTON COLLEGE - SCIENCE BUILDING-400	Project No.	SF-3457-06
321 E. Chapman Avenue, Fullerton, California	Plate:	P

Geotechnical Solutions, Inc.

APPENDIX C

Seismic Data

- Table 1: Fault Source Parameters
- Unified Hazard Curve - Deaggregation
- USGS Design Maps & 2016 CBC Seismic Design Provisions

TABLE - 1
2008 National Seismic Hazard Maps - Source Parameters

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
0.13	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15	17
4.72	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
4.72	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
4.72	Elsinore;W+GI	CA	n/a	81	NE	strike slip	0	14	83
4.72	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
4.72	Elsinore;W	CA	2.5	75	NE	strike slip	0	14	46
6.98	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11
11.46	San Jose	CA	0.5	74	NW	strike slip	0	15	20
12.5	San Joaquin Hills	CA	0.5	23	SW	thrust	2	13	27
13.31	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11	208
13.35	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11	208
13.35	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15	65
13.45	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24
13.57	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
13.66	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15	22
16.95	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15	20
18.54	Sierra Madre	CA	2	53	N	reverse	0	14	57
18.54	Sierra Madre Connected	CA	2	51		reverse	0	14	76
19.02	Elsinore;GI+T	CA	5	90	V	strike slip	0	14	78
19.02	Elsinore;GI+T+J	CA	n/a	86	NE	strike slip	0	17	153
19.02	Elsinore;GI+T+J+CM	CA	n/a	86	NE	strike slip	0	16	195
19.02	Elsinore;GI	CA	5	90	V	strike slip	0	13	37

19.63	Newport-Inglewood (Offshore)	CA	1.5	90	V	strike slip	0	10	66
19.8	Raymond	CA	1.5	79	N	strike slip	0	16	22
20.27	Cucamonga	CA	5	45	N	thrust	0	8	28
21.33	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14	16
21.37	Palos Verdes	CA	3	90	V	strike slip	0	14	99
21.37	Palos Verdes Connected	CA	3	90	V	strike slip	0	10	285
22.26	Verdugo	CA	0.5	55	NE	reverse	0	15	29
24.63	Hollywood	CA	1	70	N	strike slip	0	17	17
26.55	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11	93
31.42	Santa Monica, alt 1	CA	1	75	N	strike slip	0	18	14
31.42	Santa Monica Connected alt 1	CA	2.6	51		strike slip	0	16	79
33.56	Elsinore;T+J	CA	n/a	86	NE	strike slip	0	17	127
33.56	Elsinore;T	CA	5	90	V	strike slip	0	14	52
33.56	Elsinore;T+J+CM	CA	n/a	85	NE	strike slip	0	16	169
35.02	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
35.02	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
35.02	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
35.02	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
35.02	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
35.02	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
35.02	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
35.24	Sierra Madre (San Fernando)	CA	2	45	N	thrust	0	13	18
36.53	Malibu Coast, alt 2	CA	0.3	74	N	strike slip	0	16	38
36.53	Malibu Coast, alt 1	CA	0.3	75	N	strike slip	0	8	38
36.6	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
36.6	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243

36.6	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
36.6	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
36.6	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
36.6	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303
36.6	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
36.6	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
36.6	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
36.6	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
36.6	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
36.6	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
36.6	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
36.6	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
36.6	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
36.6	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184

36.6	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306
36.6	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
36.6	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
36.6	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340
36.6	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
36.6	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
36.6	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
36.6	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
36.6	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
36.6	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
36.6	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
36.6	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
36.6	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
36.6	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279

36.92	San Gabriel	CA	1	61	N	strike slip	0	15	71
36.93	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
36.93	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
36.93	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
36.93	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136
37.86	Anacapa-Dume, alt 2	CA	3	41	N	thrust	1.2	12	65
39.63	Cleghorn	CA	3	90	V	strike slip	0	16	25
39.94	Northridge	CA	1.5	35	S	thrust	7.4	17	33
40.2	San Jacinto;SJV	CA	18	90	V	strike slip	0	16	43
40.2	San Jacinto;SJV+A	CA	n/a	90	V	strike slip	0	17	89
40.2	San Jacinto;SJV+A+C	CA	n/a	90	V	strike slip	0	17	136
40.2	San Jacinto;SJV+A+CC	CA	n/a	90	V	strike slip	0	16	136
40.2	San Jacinto;SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	170
40.2	San Jacinto;SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	196
41.08	Coronado Bank	CA	3	90	V	strike slip	0	9	186
44.09	S. San Andreas;SSB+BG+CO	CA	n/a	77		strike slip	0.2	12	170
44.09	S. San Andreas;SSB	CA	16	90	V	strike slip	0	13	43
44.09	S. San Andreas;SSB+BG	CA	n/a	71		strike slip	0	13	101
45.36	Anacapa-Dume, alt 1	CA	3	45	N	thrust	0	16	51
45.37	Santa Susana, alt 1	CA	5	55	N	reverse	0	16	27
46.44	San Jacinto;A+CC+B	CA	n/a	90	V	strike slip	0.1	15	152
46.44	San Jacinto;A	CA	9	90	V	strike slip	0	17	71
46.44	San Jacinto;A+C	CA	n/a	90	V	strike slip	0	17	118
46.44	San Jacinto;A+CC	CA	n/a	90	V	strike slip	0	16	118
46.44	San Jacinto;A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	178
47.97	North Frontal (West)	CA	1	49	S	reverse	0	16	50
52.01	Holser, alt 1	CA	0.4	58	S	reverse	0	19	20
53.58	Simi-Santa Rosa	CA	1	60		strike slip	1	12	39
58.58	Oak Ridge Connected	CA	3.6	53		reverse	0.6	15	94
58.58	Oak Ridge (Onshore)	CA	4	65	S	reverse	1	19	49
59.2	Rose Canyon	CA	1.5	90	V	strike slip	0	8	70
61.97	San Cayetano	CA	6	42	N	thrust	0	16	42
64.04	Elsinore;J	CA	3	84	NE	strike slip	0	19	75

64.04	Elsinore;J+CM	CA	3	84	NE	strike slip	0	17	118
64.27	S. San Andreas;BG	CA	n/a	58		strike slip	0	13	56
64.27	S. San Andreas;BG+CO	CA	n/a	72		strike slip	0.3	12	125
66.06	S. San Andreas;PK+CH+CC+BB+NM	CA	n/a	90	V	strike slip	0.1	12	245
66.06	S. San Andreas;CC+BB+NM	CA	n/a	90	V	strike slip	0	15	146
66.06	S. San Andreas;BB+NM	CA	n/a	90	V	strike slip	0	15	87
66.06	S. San Andreas;NM	CA	27	90	V	strike slip	0	15	37
66.06	S. San Andreas;CH+CC+BB+NM	CA	n/a	90	V	strike slip	0	14	208
66.87	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13	114
69.76	Pinto Mtn	CA	2.5	90	V	strike slip	0	16	74
71.45	North Frontal (East)	CA	0.5	41	S	thrust	0	16	27
74.7	Santa Ynez (East)	CA	2	70	S	strike slip	0	13	68
74.7	Santa Ynez Connected	CA	2	70		strike slip	0	11	132
77.27	Pitas Point Connected	CA	1	55		reverse	1.2	13	78
77.27	Ventura-Pitas Point	CA	1	64	N	reverse	1	15	44
77.57	Santa Cruz Island	CA	1	90	V	strike slip	0	13	69
78.06	Channel Islands Thrust	CA	1.5	20	N	thrust	5	12	59
79.96	Lenwood-Lockhart-Old Woman Springs	CA	0.9	90	V	strike slip	0	13	145
82.03	Oak Ridge (Offshore)	CA	3	32	S	thrust	0	8	38
82.48	Mission Ridge-Arroyo Parida-Santa Ana	CA	0.4	70	S	reverse	0	8	69
83.52	Garlock;GC+GW	CA	n/a	90	V	strike slip	0.4	12	210
83.52	Garlock;GE+GC+GW	CA	n/a	90	V	strike slip	0.3	12	256
83.52	Garlock;GW	CA	6	90	V	strike slip	0.7	14	98
83.75	Johnson Valley (No)	CA	0.6	90	V	strike slip	0	16	35
83.95	San Jacinto;CC+B+SM	CA	n/a	90	V	strike slip	0.2	14	103
83.95	San Jacinto;CC	CA	4	90	V	strike slip	0	16	43
83.95	San Jacinto;CC+B	CA	n/a	90	V	strike slip	0.2	14	77
85	S. San Andreas;CH+CC+BB	CA	n/a	90	V	strike slip	0	14	171
85	S. San Andreas;BB	CA	34	90	V	strike slip	0	15	50
85	S. San Andreas;CC+BB	CA	n/a	90	V	strike slip	0	15	109

85	S. San Andreas;PK+CH+CC+BB	CA	n/a	90	V	strike slip	0.1	12	208
85.09	San Jacinto;C	CA	14	90	V	strike slip	0	17	47
85.73	Red Mountain	CA	2	56	N	reverse	0	14	101
87.04	Landers	CA	0.6	90	V	strike slip	0	15	95
87.26	Burnt Mtn	CA	0.6	67	W	strike slip	0	16	21
88.61	Gravel Hills-Harper Lk	CA	0.7	90	V	strike slip	0	11	65
88.98	Eureka Peak	CA	0.6	90	V	strike slip	0	15	19
90.51	Earthquake Valley	CA	2	90	V	strike slip	0	19	20
90.78	So Emerson-Copper Mtn	CA	0.6	90	V	strike slip	0	14	54
91.41	Pleito	CA	2	46	S	reverse	0	14	44
91.76	North Channel	CA	1	26	N	thrust	1.1	5	51
91.9	Pitas Point (Lower)-Montalvo	CA	2.5	16	N	thrust	0.4	13	30
93.14	Blackwater	CA	0.5	90	V	strike slip	0	12	60
95.43	Calico-Hidalgo	CA	1.8	90	V	strike slip	0	14	117
96.23	S. San Andreas;CO	CA	20	90	V	strike slip	0.6	11	69
97.21	Garlock;GC	CA	7	90	V	strike slip	0	12	111
97.21	Garlock;GE+GC	CA	n/a	90	V	strike slip	0	12	156
97.95	So Sierra Nevada	CA	0.1	50	E	normal	0	14	112

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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Input

Edition

Dynamic: Conterminous U.S. 2014 (v4.1

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

33.876

Time Horizon

Return period in years

475

Longitude

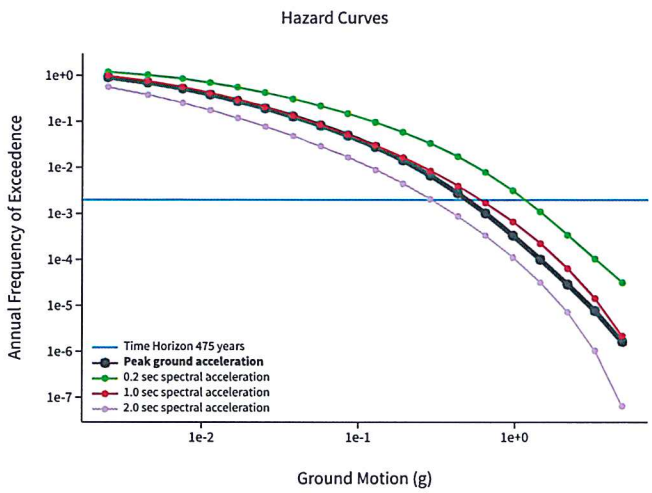
Decimal degrees, negative values for western longitudes

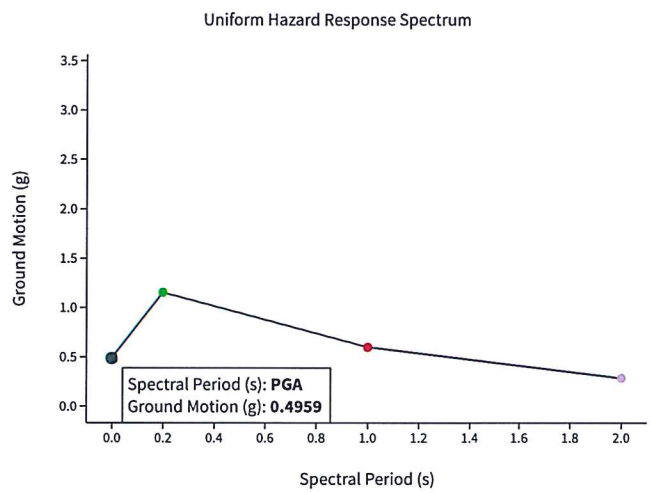
-117.9169

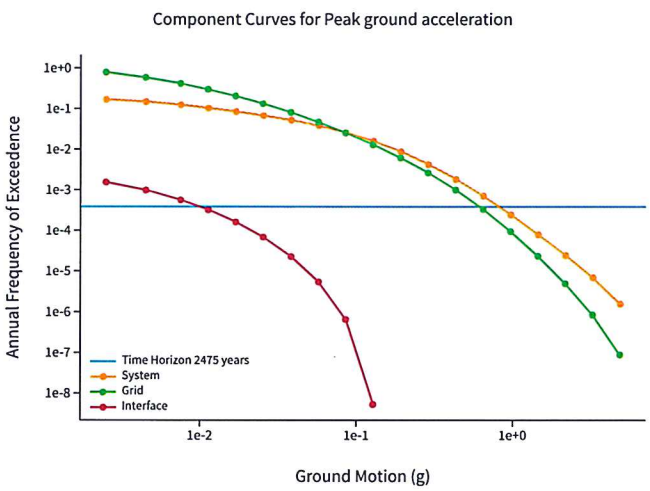
Site Class

259 m/s (Site class D)

Hazard Curve





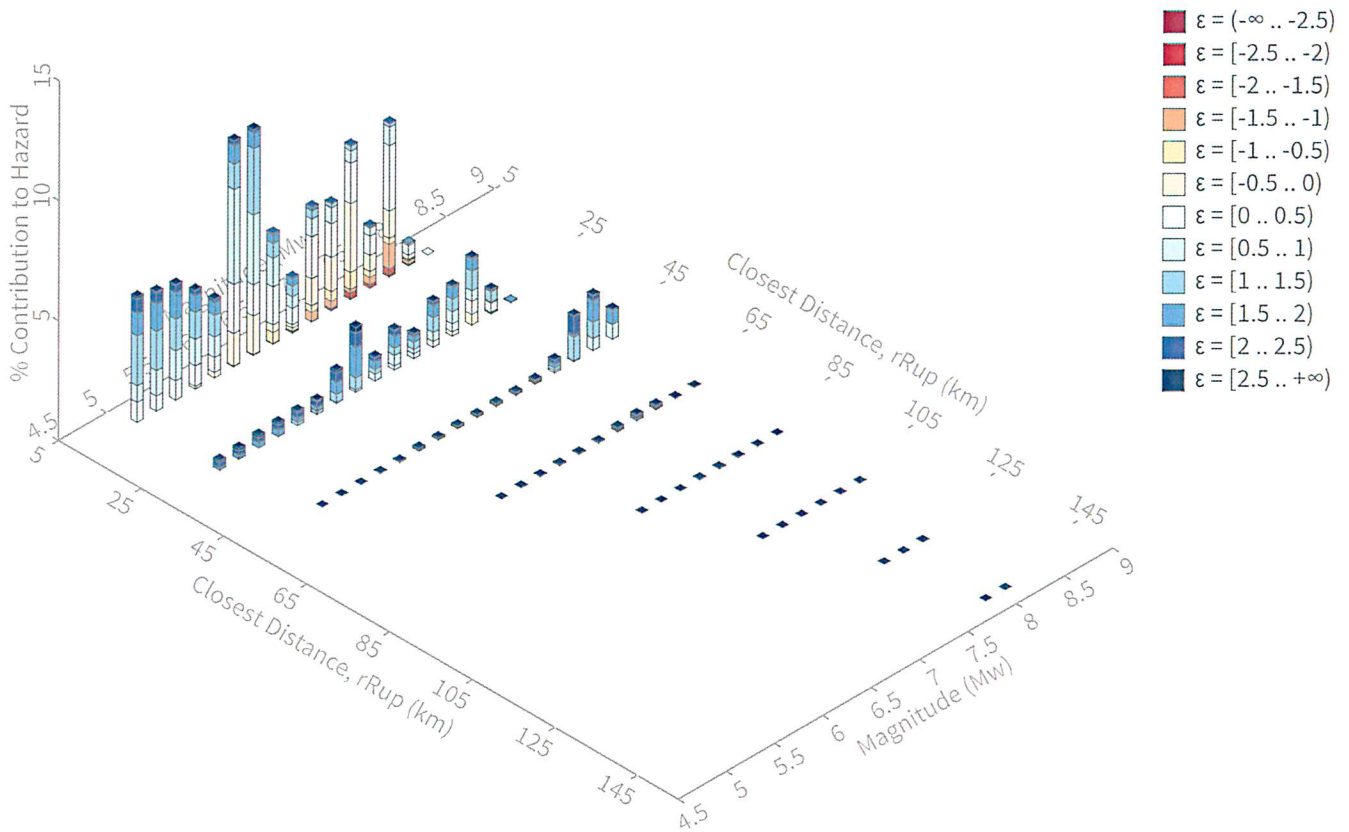


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr^{-1}
PGA ground motion: 0.49585859 g

Recovered targets

Return period: 506.57893 yrs
Exceedance rate: 0.001974026 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.22 %

Mean (for all sources)

r: 16.92 km
m: 6.6
ε_0: 0.8 σ

Mode (largest r-m bin)

r: 9.14 km
m: 6.13
ε_0: 0.63 σ
Contribution: 9.41 %

Mode (largest ε_0 bin)

r: 8.44 km
m: 6.13
ε_0: 0.72 σ
Contribution: 3.96 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							33.31
Whittier alt 1 [5]		8.20	7.03	0.24	117.892°W	33.946°N	16.59	6.15
Compton [0]		13.55	7.20	-0.12	118.060°W	33.713°N	216.28	2.29
Peralta Hills [1]		4.17	6.81	-0.13	117.885°W	33.854°N	130.07	2.27
Chino alt 1 [1]		16.83	6.44	1.17	117.716°W	33.964°N	62.10	2.14
Whittier alt 1 [6]		9.24	6.21	0.77	117.931°W	33.957°N	351.74	1.84
San Andreas (Mojave S) [13]		59.02	7.98	1.61	117.621°W	34.347°N	27.40	1.64
Newport-Inglewood alt 1 [2]		21.45	7.51	0.71	118.075°W	33.735°N	223.06	1.40
Elsinore (Glen Ivy) rev [0]		30.67	6.55	1.78	117.590°W	33.829°N	99.75	1.25
Puente Hills [0]		9.42	7.15	0.13	117.914°W	33.943°N	2.08	1.19
Anaheim [1]		10.50	6.86	0.16	117.990°W	33.818°N	226.63	1.17
UC33brAvg_FM32	System							32.67
Richfield [1]		5.63	6.23	0.27	117.870°W	33.882°N	81.27	4.08
Whittier alt 2 [4]		8.14	7.27	0.11	117.886°W	33.943°N	21.03	3.86
Puente Hills (Coyote Hills) [0]		4.45	7.20	-0.29	117.922°W	33.893°N	345.60	3.63
Compton [0]		13.55	7.24	-0.13	118.060°W	33.713°N	216.28	2.39
San Andreas (Mojave S) [13]		59.02	7.98	1.61	117.621°W	34.347°N	27.40	1.68
Peralta Hills [1]		4.17	7.25	-0.33	117.885°W	33.854°N	130.07	1.55
Elsinore (Glen Ivy) rev [0]		30.67	6.54	1.79	117.590°W	33.829°N	99.75	1.27
Anaheim [1]		10.50	6.90	0.12	117.990°W	33.818°N	226.63	1.19
Chino alt 2 [0]		19.86	6.79	1.10	117.717°W	33.972°N	59.91	1.15
Newport-Inglewood alt 2 [2]		21.41	7.49	0.72	118.088°W	33.746°N	227.61	1.07
UC33brAvg_FM32 (opt)	Grid							17.56
PointSourceFinite: -117.917, 33.907		6.26	5.54	0.66	117.917°W	33.907°N	0.00	2.59
PointSourceFinite: -117.917, 33.907		6.26	5.54	0.66	117.917°W	33.907°N	0.00	2.59
PointSourceFinite: -117.917, 33.952		9.47	5.70	0.97	117.917°W	33.952°N	0.00	2.05
PointSourceFinite: -117.917, 33.952		9.47	5.70	0.97	117.917°W	33.952°N	0.00	2.05
PointSourceFinite: -117.917, 33.979		12.24	5.62	1.28	117.917°W	33.979°N	0.00	1.23
PointSourceFinite: -117.917, 33.979		12.24	5.62	1.28	117.917°W	33.979°N	0.00	1.23
UC33brAvg_FM31 (opt)	Grid							16.46
PointSourceFinite: -117.917, 33.907		6.27	5.52	0.68	117.917°W	33.907°N	0.00	2.25
PointSourceFinite: -117.917, 33.907		6.27	5.52	0.68	117.917°W	33.907°N	0.00	2.25
PointSourceFinite: -117.917, 33.952		9.48	5.70	0.98	117.917°W	33.952°N	0.00	1.87
PointSourceFinite: -117.917, 33.952		9.48	5.70	0.98	117.917°W	33.952°N	0.00	1.87
PointSourceFinite: -117.917, 33.979		12.26	5.61	1.29	117.917°W	33.979°N	0.00	1.22
PointSourceFinite: -117.917, 33.979		12.26	5.61	1.29	117.917°W	33.979°N	0.00	1.22

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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Input

Edition

Dynamic: Conterminous U.S. 2014 (v4.1

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

33.876

Time Horizon

Return period in years

975

Longitude

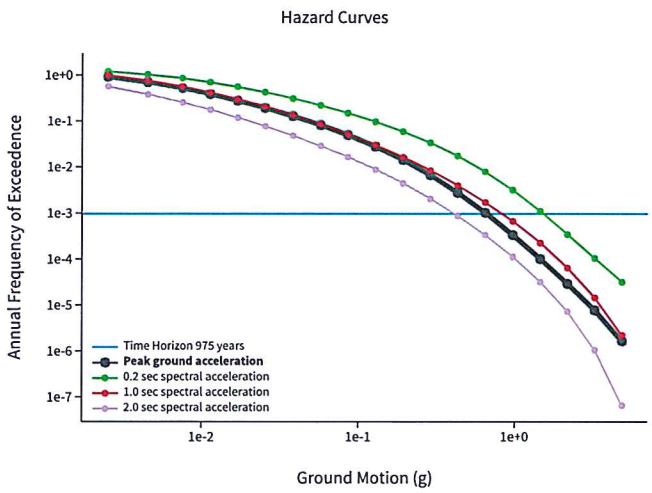
Decimal degrees, negative values for western longitudes

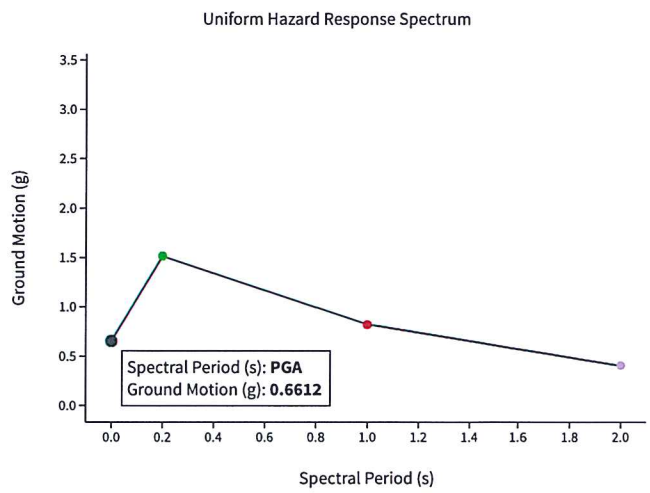
-117.9169

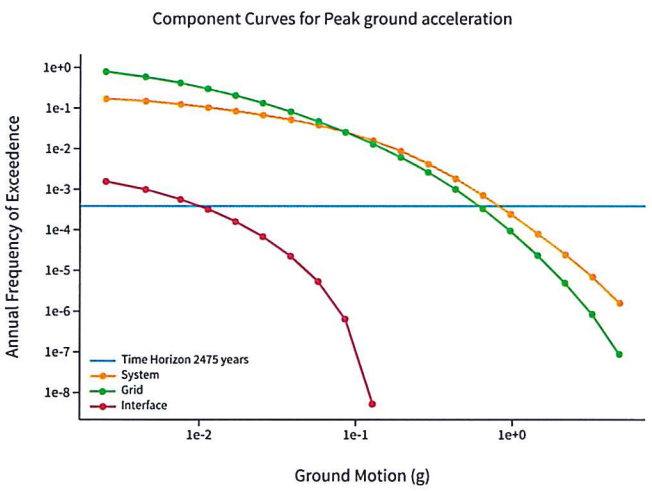
Site Class

259 m/s (Site class D)

Hazard Curve





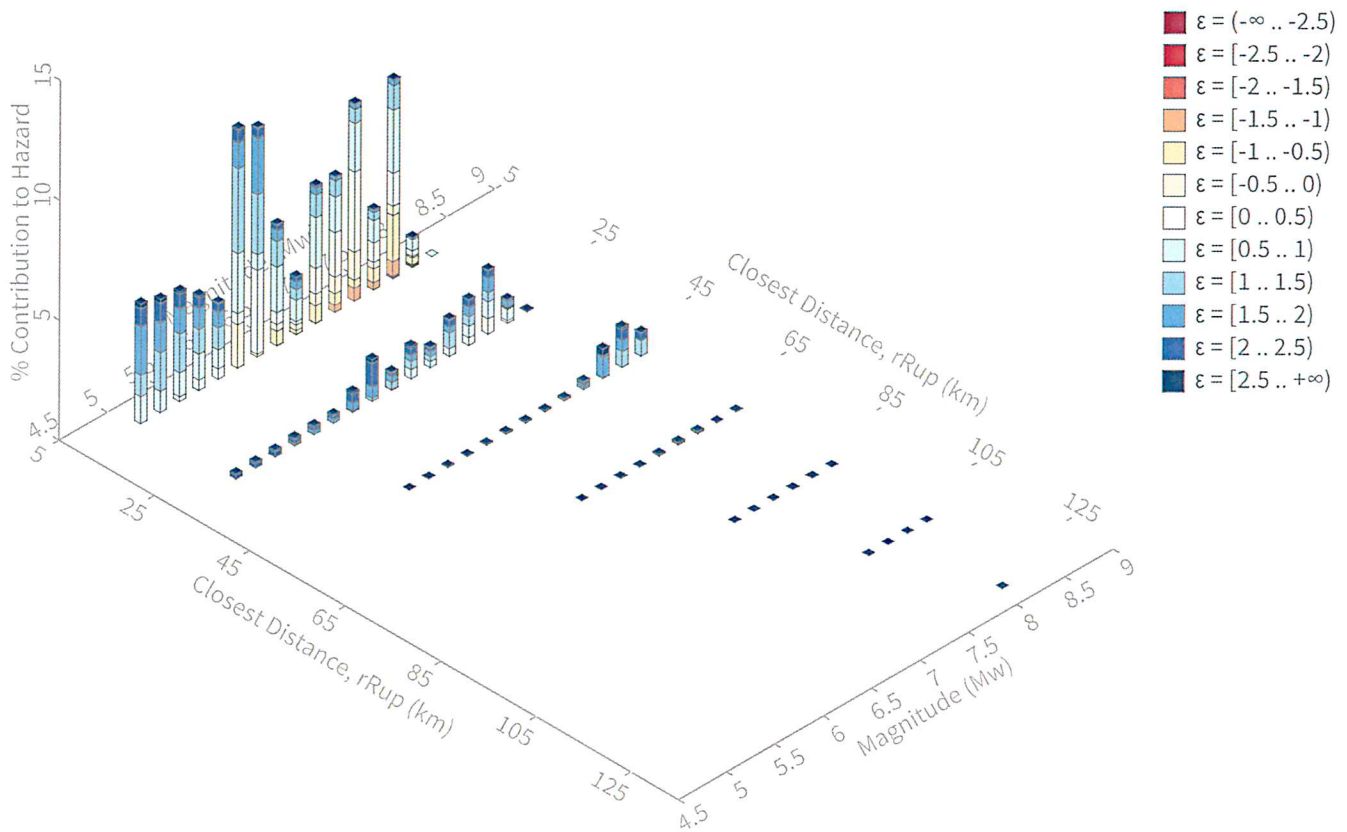


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 975 yrs
Exceedance rate: 0.001025641 yr^{-1}
PGA ground motion: 0.6612221 g

Recovered targets

Return period: 1080.8683 yrs
Exceedance rate: 0.00092518206 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.16 %

Mean (for all sources)

r: 14.34 km
m: 6.64
ε_0: 0.96 σ

Mode (largest r-m bin)

r: 8.6 km
m: 6.13
ε_0: 0.92 σ
Contribution: 9.97 %

Mode (largest ε_0 bin)

r: 9.08 km
m: 6.13
ε_0: 1.19 σ
Contribution: 3.56 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM32	System							34.72
Puente Hills (Coyote Hills) [0]		4.45	7.21	0.07	117.922°W	33.893°N	345.60	4.92
Richfield [1]		5.63	6.24	0.63	117.870°W	33.882°N	81.27	4.78
Whittier alt 2 [4]		8.14	7.31	0.39	117.886°W	33.943°N	21.03	4.69
Compton [0]		13.55	7.25	0.37	118.060°W	33.713°N	216.28	3.08
Peralta Hills [1]		4.17	7.27	0.05	117.885°W	33.854°N	130.07	2.12
Anaheim [1]		10.50	6.98	0.51	117.990°W	33.818°N	226.63	1.45
San Andreas (Mojave S) [13]		59.02	8.02	1.88	117.621°W	34.347°N	27.40	1.11
Newport-Inglewood alt 2 [2]		21.41	7.51	1.00	118.088°W	33.746°N	227.61	1.07
Whittier alt 2 [5]		8.56	6.43	0.86	117.915°W	33.952°N	1.43	1.02
Chino alt 2 [0]		19.86	6.84	1.37	117.717°W	33.972°N	59.91	1.02
UC33brAvg_FM31	System							33.85
Whittier alt 1 [5]		8.20	7.08	0.51	117.892°W	33.946°N	16.59	7.23
Compton [0]		13.55	7.21	0.39	118.060°W	33.713°N	216.28	2.95
Peralta Hills [1]		4.17	6.83	0.24	117.885°W	33.854°N	130.07	2.94
Whittier alt 1 [6]		9.24	6.21	1.06	117.931°W	33.957°N	351.74	1.88
Chino alt 1 [1]		16.83	6.48	1.42	117.716°W	33.964°N	62.10	1.87
Puente Hills [0]		9.42	7.16	0.46	117.914°W	33.943°N	2.08	1.44
Newport-Inglewood alt 1 [2]		21.45	7.52	0.99	118.075°W	33.735°N	223.06	1.41
Anaheim [1]		10.50	6.92	0.55	117.990°W	33.818°N	226.63	1.40
San Andreas (Mojave S) [13]		59.02	8.02	1.88	117.621°W	34.347°N	27.40	1.09
UC33brAvg_FM32 (opt)	Grid							16.31
PointSourceFinite: -117.917, 33.907		6.24	5.56	1.00	117.917°W	33.907°N	0.00	2.87
PointSourceFinite: -117.917, 33.907		6.24	5.56	1.00	117.917°W	33.907°N	0.00	2.87
PointSourceFinite: -117.917, 33.952		9.36	5.74	1.26	117.917°W	33.952°N	0.00	2.03
PointSourceFinite: -117.917, 33.952		9.36	5.74	1.26	117.917°W	33.952°N	0.00	2.03
PointSourceFinite: -117.917, 33.979		12.15	5.64	1.55	117.917°W	33.979°N	0.00	1.10
PointSourceFinite: -117.917, 33.979		12.15	5.64	1.55	117.917°W	33.979°N	0.00	1.10
UC33brAvg_FM31 (opt)	Grid							15.12
PointSourceFinite: -117.917, 33.907		6.26	5.53	1.01	117.917°W	33.907°N	0.00	2.48
PointSourceFinite: -117.917, 33.907		6.26	5.53	1.01	117.917°W	33.907°N	0.00	2.48
PointSourceFinite: -117.917, 33.952		9.37	5.73	1.26	117.917°W	33.952°N	0.00	1.85
PointSourceFinite: -117.917, 33.952		9.37	5.73	1.26	117.917°W	33.952°N	0.00	1.85
PointSourceFinite: -117.917, 33.979		12.17	5.63	1.56	117.917°W	33.979°N	0.00	1.09
PointSourceFinite: -117.917, 33.979		12.17	5.63	1.56	117.917°W	33.979°N	0.00	1.09

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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Input

Edition

Dynamic: Conterminous U.S. 2014 (v4.1

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

33.876

Time Horizon

Return period in years

2475

Longitude

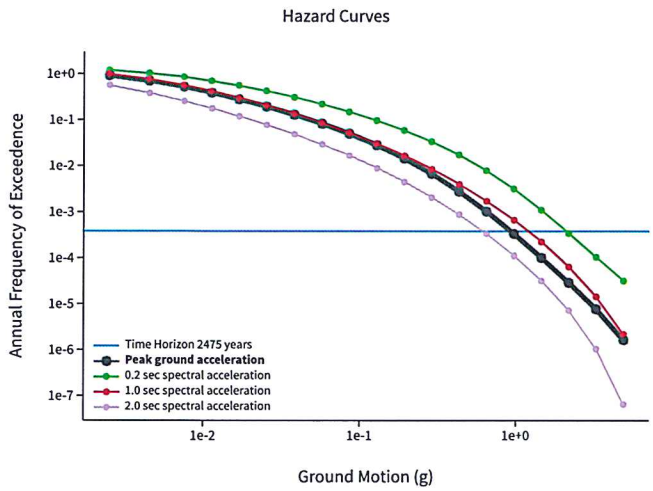
Decimal degrees, negative values for western longitudes

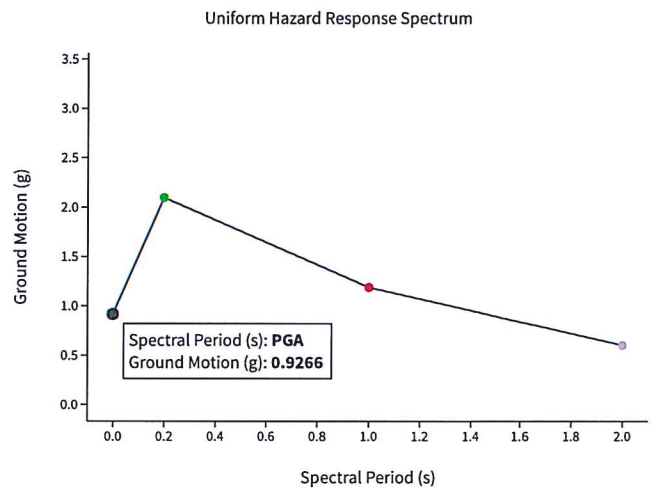
-117.9169

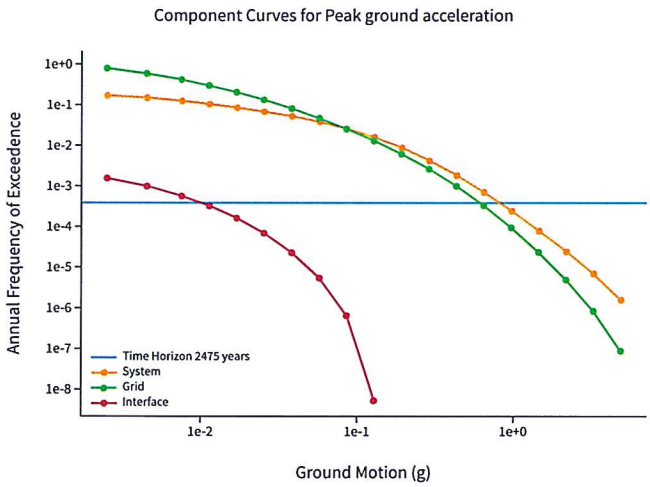
Site Class

259 m/s (Site class D)

Hazard Curve





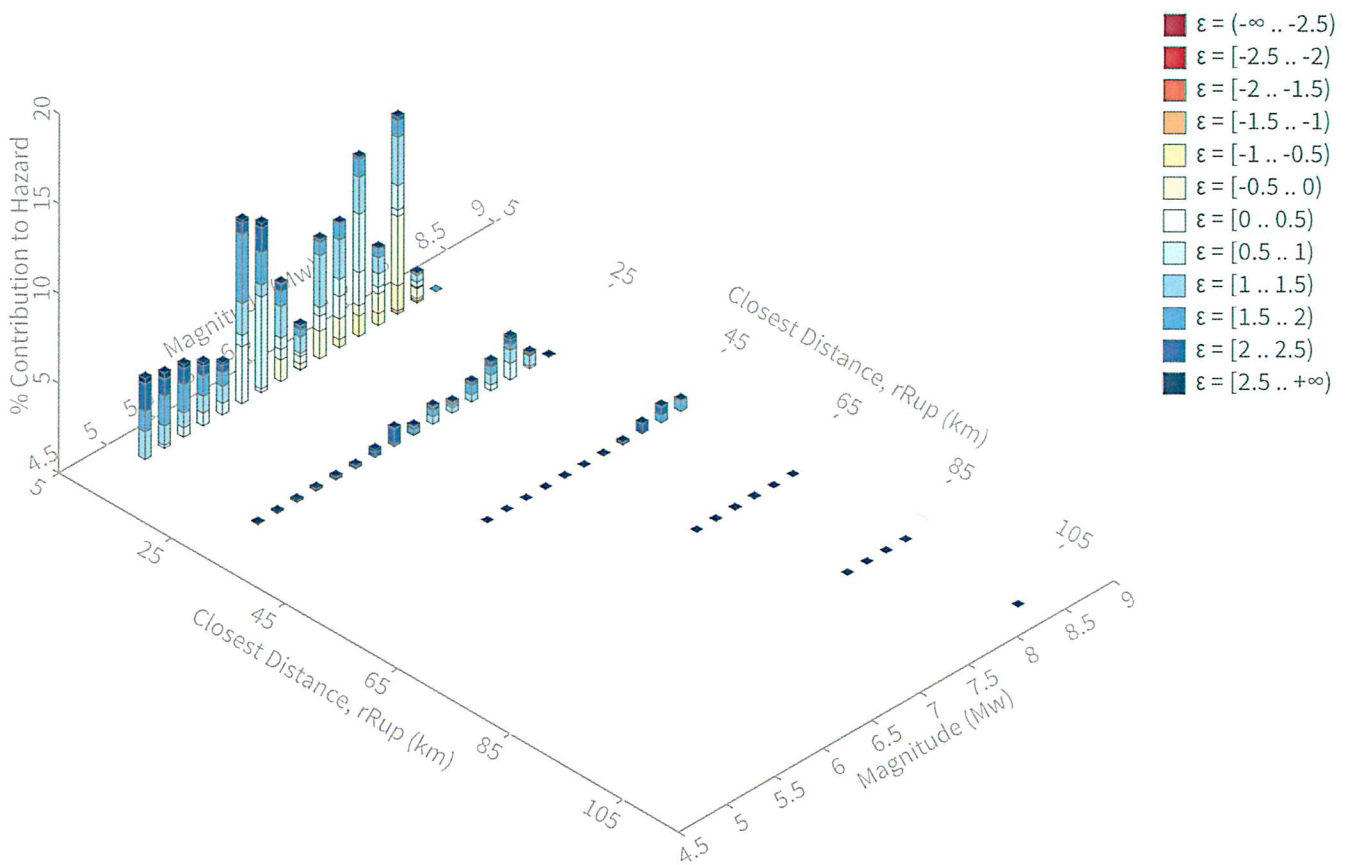


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.92663104 g

Recovered targets

Return period: 2835.0021 yrs
Exceedance rate: 0.00035273343 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.1 %

Mean (for all sources)

r: 11.91 km
m: 6.7
ε_0: 1.11 σ

Mode (largest r-m bin)

r: 7.99 km
m: 7.73
ε_0: 0.39 σ
Contribution: 10.99 %

Mode (largest ε_0 bin)

r: 8.62 km
m: 6.26
ε_0: 0.83 σ
Contribution: 5.11 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

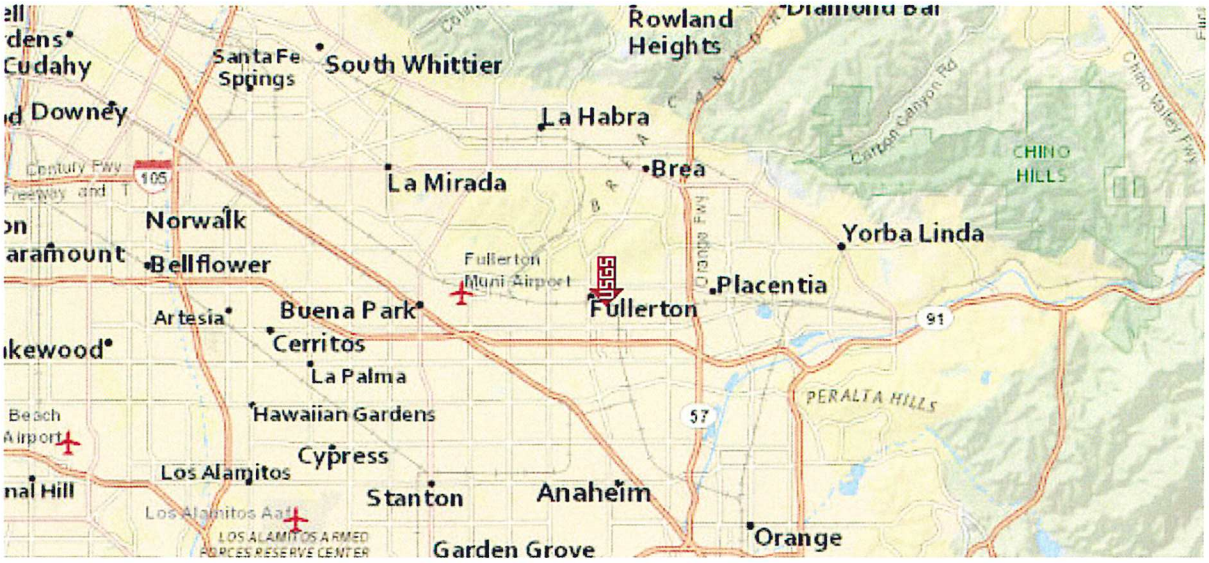
Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM32	System							37.50
Puente Hills (Coyote Hills) [0]		4.45	7.22	0.35	117.922°W	33.893°N	345.60	6.68
Whittier alt 2 [4]		8.14	7.36	0.58	117.886°W	33.943°N	21.03	5.83
Richfield [1]		5.63	6.25	0.93	117.870°W	33.882°N	81.27	5.49
Compton [0]		13.55	7.26	0.92	118.060°W	33.713°N	216.28	3.55
Peralta Hills [1]		4.17	7.28	0.34	117.885°W	33.854°N	130.07	2.88
Anaheim [1]		10.50	7.04	0.92	117.990°W	33.818°N	226.63	1.66
Yorba Linda [0]		3.52	7.51	0.14	117.889°W	33.858°N	126.72	1.21
Whittier alt 2 [5]		8.56	6.45	1.09	117.915°W	33.952°N	1.43	1.08
Newport-Inglewood alt 2 [2]		21.41	7.52	1.28	118.088°W	33.746°N	227.61	1.03
UC33brAvg_FM31	System							34.64
Whittier alt 1 [5]		8.20	7.15	0.71	117.892°W	33.946°N	16.59	8.66
Peralta Hills [1]		4.17	6.86	0.51	117.885°W	33.854°N	130.07	3.78
Compton [0]		13.55	7.22	0.95	118.060°W	33.713°N	216.28	3.37
Whittier alt 1 [6]		9.24	6.21	1.31	117.931°W	33.957°N	351.74	1.86
Puente Hills [0]		9.42	7.17	0.73	117.914°W	33.943°N	2.08	1.72
Anaheim [1]		10.50	6.98	0.96	117.990°W	33.818°N	226.63	1.58
Chino alt 1 [1]		16.83	6.55	1.64	117.716°W	33.964°N	62.10	1.51
Newport-Inglewood alt 1 [2]		21.45	7.53	1.27	118.075°W	33.735°N	223.06	1.35
Yorba Linda [0]		3.52	7.37	0.20	117.889°W	33.858°N	126.72	1.22
Whittier alt 1 [3]		10.74	6.97	0.97	117.814°W	33.920°N	62.59	1.07
UC33brAvg_FM32 (opt)	Grid							14.54
PointSourceFinite: -117.917, 33.907		6.21	5.57	1.35	117.917°W	33.907°N	0.00	3.03
PointSourceFinite: -117.917, 33.907		6.21	5.57	1.35	117.917°W	33.907°N	0.00	3.03
PointSourceFinite: -117.917, 33.952		9.19	5.79	1.52	117.917°W	33.952°N	0.00	1.90
PointSourceFinite: -117.917, 33.952		9.19	5.79	1.52	117.917°W	33.952°N	0.00	1.90
UC33brAvg_FM31 (opt)	Grid							13.32
PointSourceFinite: -117.917, 33.907		6.23	5.55	1.36	117.917°W	33.907°N	0.00	2.61
PointSourceFinite: -117.917, 33.907		6.23	5.55	1.36	117.917°W	33.907°N	0.00	2.61
PointSourceFinite: -117.917, 33.952		9.19	5.79	1.52	117.917°W	33.952°N	0.00	1.73
PointSourceFinite: -117.917, 33.952		9.19	5.79	1.52	117.917°W	33.952°N	0.00	1.73

USGS Design Maps Summary Report

User–Specified Input

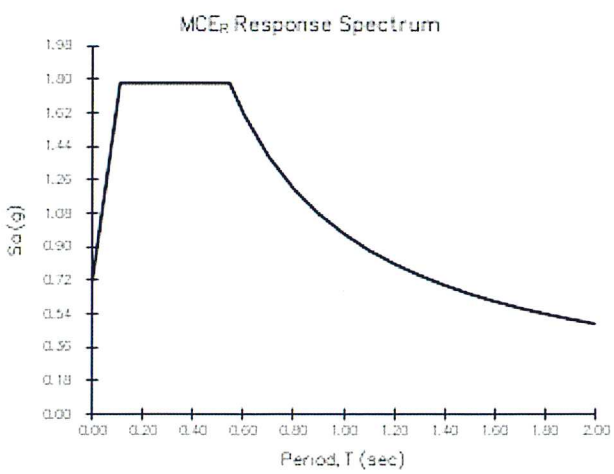
Report Title	Fullerton College Tue April 11, 2017 19:47:58 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.876°N, 117.9169°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

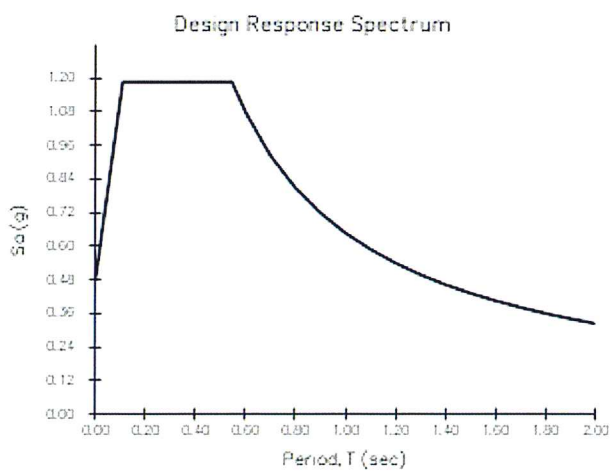


USGS–Provided Output

S_S =	1.780 g	S_{MS} =	1.780 g	S_{DS} =	1.186 g
S_1 =	0.646 g	S_{M1} =	0.970 g	S_{D1} =	0.646 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (33.876°N, 117.9169°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] S_S = 1.780 g

From Figure 22-2 [2] S_1 = 0.646 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.780 g, F_a = 1.000

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.646 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_a S_S = 1.000 \times 1.780 = 1.780$ g

Equation (11.4–2): $S_{M1} = F_v S_1 = 1.500 \times 0.646 = 0.970$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

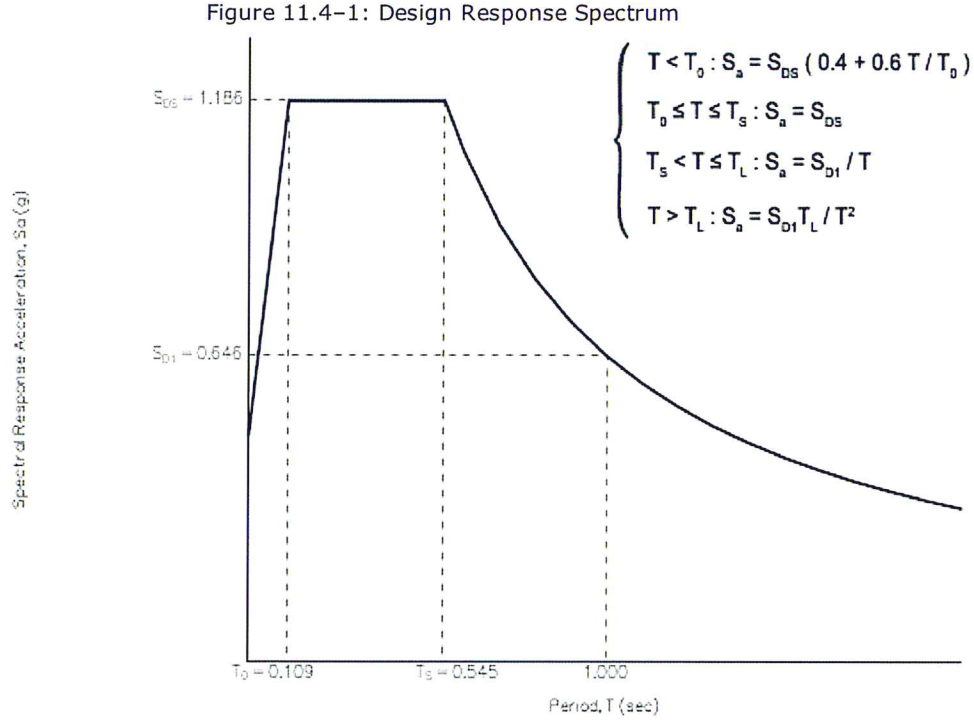
Equation (11.4–3): $S_{DS} = ⅔\ S_{MS} = ⅔ \times 1.780 = 1.186$ g

Equation (11.4–4): $S_{D1} = ⅔\ S_{M1} = ⅔ \times 0.970 = 0.646$ g

Section 11.4.5 — Design Response Spectrum

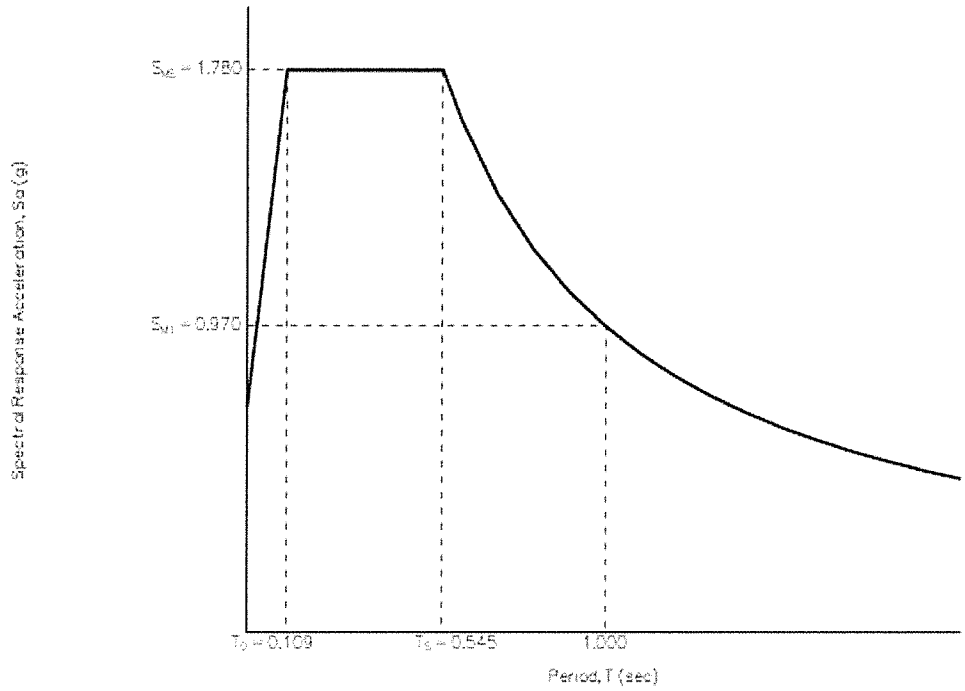
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.665

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.665 = 0.665$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.665 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.985

From Figure 22-18 [6] C_{R1} = 1.011

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.186 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.646 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

Appendix D

Grading Specifications

SUGGESTED INPUT FOR ENGINEERED FILL SPECIFICATIONS

1.0 General

1.1 Description

1.1.1 These specifications cover preparation of the subject site to receive fills, the type of soils suitable for use in fills, the compaction standards, and the methods of testing compacted fills.

1.1.2 The Contractor shall furnish all labor, supervision, equipment, operations, and materials to excavate to the required grade, support existing underground facilities, stockpile material, compact fill and backfill, and fine grade. The work of the Contractor shall include all clearing and grubbing, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled and all other work necessary to complete the grading of the filled areas. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans or as directed in writing by the Civil Engineer.

1.1.3 Deviations from these specifications will be permitted only upon written authorization from the Owner or his representative.

1.2 Role of the Geotechnical Engineer

1.2.1 Construction - The Owner will employ a Geotechnical Consultant to observe and test this work as it is being performed. The Contractor shall cooperate with the Geotechnical Consultant and allow his unrestricted access to the site as required for the performance of his duties.

The Contractor shall provide a minimum notice of 48 hours to the Geotechnical Engineer before beginning or restarting earthwork operations that will require the presence of the Geotechnical Engineer or his representative on site.

1.2.2 Subsurface Investigations - A geotechnical engineering report for design purposes was prepared by Geotechnical Solutions, Inc., Irvine, California. Any recommendations made in the geotechnical report or subsequent reports are made part of these specifications. These reports are available for review upon request to the Owner.

1.2.3 Observation and Testing - The Geotechnical Engineer's representative shall observe the clearing and grubbing, excavation, filling and compacting operations and shall take density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. All fill will be tested shortly after its placement to ascertain that the required compaction is achieved. A minimum of one density test will be made on each 500 cubic yards of fill placed, with a minimum of at least one test per every 2 feet of vertical height of fill. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or water content of any layer of fill or portion thereof does not meet the specified density or water content, the particular layer or portions thereof shall be reworked until the specified density and water content have been obtained.

After the completion of grading, the Geotechnical Engineer will prepare a written opinion of grading. Neither the testing performed by the Geotechnical Consultant nor his opinion as to whether or not the fill was constructed in accordance with these Specifications shall relieve the Contractor of his responsibility to construct the fills in accordance with the Contract Documents.

1.3 Reference Standards

The following ASTM (American Society for Testing and Materials) codes and standards shall be used to the extent indicated by references herein. The most recent revision of the standards shall be used.

D422 - "Standard Test Method for Particle Size Analysis of Soils"

D 1556 - "Standard Test Method for Density of Soil in Place by the Sand Cone Method"

D1557 - "Standard Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 kg) and 18 inch (457 mm) Drop"

D2216 - "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures"

D2922 - "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)"

D3017 - "Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)"

D4318 - "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

D4718 - "Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles"

D4829 - "Standard Test Method for Expansion Index of Soils"

D4944 - "Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method."

1.4 Degree of Fill Compaction

The degree to which fill is to be compacted is expressed in terms of "relative compaction." Relative compaction is defined as the ratio; expressed in percent, of the in

place dry density of the compacted fill to the reference maximum dry density. The reference maximum dry density shall be obtained following ASTM D1557. Optimum water content shall be obtained in the same test used to obtain the reference maximum dry density. Correction of the maximum dry density and optimum water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate. The in-place density shall be obtained following ASTM D1556 (sand cone method) or ASTM D2922 (nuclear method-shallow depth) test method. The in-place water content shall be obtained following ASTM D4944 (calcium carbide gas pressure meter), ASTM D3017 (nuclear method-shallow depth), or ASTM D2216 (oven drying). Correction of the in-place density and water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate.

If any of the test methods specified in this section are judged by the Geotechnical Engineer to be impractical or unreliable because the material has a coarse particle size distribution, or for other reasons, the Geotechnical Engineer shall establish other procedures to obtain the required soil characteristics.

2.0 Products

2.1 Materials

2.1.1 General - During grading operations, soil types other than those identified in the geotechnical investigation report may be encountered by the Contractor. Consult the Geotechnical Consultant for his evaluation of the suitability of using these soils a fill material prior to placement or disposal.

2.1.2 General Fill - Materials for compacted fill shall consist of material imported from outside the site or excavated from the site that, in the opinion of the Geotechnical Engineer, is suitable for use in constructing engineered fills. The material shall not

contain rocks or hard lumps greater than 6 inches in maximum dimension, and at least 70 percent (by weight) of its particles shall pass through a U.S. Standard 3/8 inch sieve. Material greater than 3 inches, but less than 6 inches in maximum dimension, shall be placed by the Contractor so that it is completely surrounded by compacted, finer material; no nesting of rocks shall be permitted. Do not use any perishable, spongy, hazardous, or other undesirable materials as fill.

2.1.3 Select Fill - Select fill shall meet all criteria for general fill but shall also contain no rocks or hard lumps greater than 3 inches in maximum dimension, and at least 80 percent (by weight) shall pass through a U.S. Standard 3/8 inch sieve. The expansion index of select material shall be less than 50 (i.e., 5.0 percent swell) when tested in accordance with ASTM D4829.

3.0 Execution

3.1 Clearing and Grubbing

Within the project limits, tile Contractor shall demolish structures as specified on the Drawings.

Unless otherwise indicated on the Drawings or by the Owner in writing, the Contractor shall clear and grub all trees, stumps, roots, brush, grass, and other vegetation within construction, fill and stockpile areas to a minimum depth of 3 feet below the existing ground surface or below finished grade, whichever is deeper, unless otherwise recommended by the Geotechnical Engineer's Field Representative.

Remove cleared and grubbed materials from the site and dispose of them legally. No onsite burning or burying of cleared and grubbed materials is permitted. No placement of cleared and grubbed materials in topsoil stockpiles is permitted. No mulching of branches or roots is permitted. Incorporating vegetative matter into stockpiled materials which are to be used in fill is not permitted.

Stockpile organic-laden topsoil separate from other fill materials.

Remove any remaining vegetative matter from the deeper excavated soils, which may result from roots deeper than those encountered during clearing and grubbing operations. All material thereby removed shall be piled at a location away from the immediate work area so as to avoid burying of piled material.

3.2 Compacted Fills

3.2.1 Preparing Areas to be Filled - Brush, grass, and other objectionable materials shall be collected, piled, and disposed of as indicated in Section 3.1 by the Contractor so as to leave the areas that have been cleared with a neat and finished appearance, free from unsightly debris.

Remove all loose soil, uncertified fill, landslide debris, and weathered bedrock to firm material or in-situ bedrock, as approved by the Geotechnical Consultant. The Contractor shall obtain approval from the Geotechnical Engineer or his representative of stripping and site preparation before the compaction of any fill subgrade begins. The surface shall then be scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used, and shall be brought to the specified water content and relative compaction. Compact scarified materials to a minimum relative compaction of 90 percent, relative to ASTM D1557, prior to placement of any fill material.

3.2.2 Placing, Spreading, and Compacting, Fill Material - Onsite soil obtained from removals, borrow, or cut areas may be reused as compacted fill provided it is free from deleterious debris and meets the other requirements of the "Materials" portion of this Specification Section.

Use of soil containing deleterious debris from the clearing and grubbing operation or from other sources is not permitted. The fill materials shall be placed by the Contractor in

horizontal layers not greater than 8 inches thick, measured before compaction. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material and moisture in each layer. The moisture content of material used for compacted fill should be adjusted to be at or above optimum water content as determined by ASTM D1557. When the water content of the fill material is too high, the fill materials shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the water content is as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent of the maximum dry density as determined by ASTM D1557 for general fill, and 95 percent of the maximum dry density as determined by ASTM D1557 for select fill, compacted fill pads, and the upper 1 foot of pavement subgrade. Compaction shall be accomplished by: sheepsfoot rollers; vibratory rollers; multiple wheel, pneumatic tired rollers; or other types of acceptable compacting equipment. Equipment shall be of such design that it is able to compact the fill to the specified density. Compaction shall be continuous over the entire area, and the equipment shall make sufficient passes to obtain the desired density uniformly. All fill placed on site shall be treated in like manner until finished grades are attained. Jetting, puddling, and hydro consolidation techniques shall not be used, including backfill of utility trenches.

The placement of topsoil is subject to the approval of the Geotechnical Engineer. Topsoil shall not be placed beneath concrete flatwork, beneath or behind retaining walls, or within structural fill. All topsoil material is subject to the same moisture conditioning, placement, and compaction requirements as General Fill. Roots, branches and other organic debris are not permitted within the compacted topsoil layer.

When backfilling around footings and compacting behind retaining walls and flexible retaining structures, the Contractor shall use lightweight compaction equipment such as hand-operated equipment, shoring, or other means to avoid over-stressing structural

walls. When using lightweight compaction equipment, the fill materials shall be spread in horizontal layers not greater than 6 inches thick, measured before compaction.

As an alternative, sand-cement slurry may be used to backfill trenches. The slurry shall have minimum cement content of 3 sacks per cubic yard within the zone of influence of foundations and other settlement sensitive structures. A minimum of 2 sacks per cubic yard of slurry shall be used elsewhere within building limits, and a minimum of one sack per cubic yard of slurry shall be used elsewhere. Slurry shall not be used in those areas where such placement would result in the obstruction of water flow, and is subject to the approval of the Geotechnical Engineer.

3.3 Protection of Work and Adjacent Properties

3.3.1 During Construction The Contractor shall grade all excavated surfaces to provide good drainage away from construction slopes and prevent ponding of water. He shall control surface water and the transport of silt and sediment 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 until such time as permanent drainage and erosion control measures have been installed.

Dispose of all water resulting from dewatering operations legally and in ways that will not cause damage to public or private property, or constitute a nuisance or menace to the public, in accordance with municipal requirements.

The Contractor shall make every effort to minimize the amount of dust raised in excavating, on haul roads and access roads, and all other work areas in the course of construction activities.

Protect benchmarks, monuments, and other reference points against displacement or damage. Repair or replace benchmarks, monuments, and other permanent survey data that become displaced or damaged due to the performance of this work.

3.3.2 After Completion After earthwork is completed and the, Geotechnical Engineer has finished his observations of the work, no further excavation, filling or backfilling shall be performed except under the observation of the Geotechnical Engineer.