GEOTECHNICAL INVESTIGATION

Cupertino, California

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1.0 INTRODUCTION

This report presents the results of the geotechnical investigation by Langan for the proposed The Hills at Vallco project at 10000 North Wolfe Road in Cupertino, California. The approximate location of the project is shown on Figure 1.

The site is north of the intersection of N. Wolfe Road and Stevens Creek Boulevard and encompasses approximately 30 acres. It is bound by Stevens Creek Boulevard to the south, Perimeter Road and residential housing to the west, Interstate 280 to the north and commercial buildings to the east, as shown on Figure 2. N. Wolfe Road runs north-south through the site.

Currently, the site is occupied by the Vallco Shopping Center. The shopping center includes a two-level shopping center building, multi-level parking structures, surface parking lots, a pedestrian bridge spanning N. Wolfe Road, a vehicular tunnel crossing below N. Wolfe Road, and several stand-alone buildings. We understand the existing shopping center will be razed. The demolition may occur in phases in order to accommodate existing tenants while the new development is constructed.

Based on schematic design drawings (Rafael Viñoly Architects, 2016), the proposed buildings will be laid out in urban style street grid forming 17 blocks. The proposed development is separated into two areas designated West of N. Wolfe Road and East of N. Wolfe Road. The following provides a brief description of each area:

- **West of N. Wolfe Road**: Four- to five-story residential and retail buildings over one to two levels of below grade parking. Approximate excavation depths for the below-grade parking levels will be approximately 10 to 20 feet below existing ground surface (bgs).
- **East of N. Wolfe Road**: Six-story office buildings over three to four levels of below grade parking. Approximate excavation depths for the below-grade parking levels will be approximately 40 to 60 feet bgs.

In addition, a 30-acre base-isolated green roof structure is planned over the development. Slope inclinations up to 22 percent for the roof and up to 40 percent for the soil are proposed.

Based on a topographic survey of the project site (Sandis, 2016), the existing ground surface elevations range from Elevation 176.4 feet[1] at the north side of the project to Elevation 198.4 feet at the southwestern portion of the project.

2.0 SCOPE OF SERVICES

Our scope of services was outlined in our proposal dated 10 August 2016. We reviewed available subsurface information for the site and vicinity from our files and further explored subsurface conditions at the site by drilling borings and advancing cone penetrometer tests (CPTs). We conducted laboratory tests on samples recovered from the borings and used the results from our field exploration to perform engineering analyses and develop conclusions and recommendations regarding:

- anticipated subsurface conditions including groundwater levels;
- 2013 California Building Code (CBC) site classification, mapped values S_S and S_1, modification factors F_a and F_v and S_{MS} and S_{M1};
- site seismicity and potential for seismic hazards including liquefaction, lateral spreading, fault rupture;
- appropriate foundation type(s) including shallow foundations and alternatives for deep foundations, as necessary;
- design parameters for the recommended foundation type(s), including vertical and lateral capacities and associated estimated settlements;
- lateral earth pressures for temporary shoring;
- lateral earth pressures for permanent basement walls;
- subgrade preparation for slab-on-grade floors and exterior slabs and flatwork, including sidewalks;
- site preparation, grading, and excavation, including criteria for fill quality and compaction;
- corrosivity, including a corrosion evaluation report;
- design criteria for roof shear keys;
- construction considerations.

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[1] All elevations reference North American Vertical Datum of 1988 (NAVD88).

3.0 FIELD EXPLORATION AND LABORATORY TESTING

We began our investigation by reviewing previous geotechnical investigations performed at or in the vicinity of the site. To further investigate subsurface conditions at the site, we drilled five test borings, and performed five CPTs.

Prior to performing the field exploration, we:

- obtained a soil boring/monitoring well permit from the Santa Clara Valley Water District (SCVWD);
- notified Underground Service Alert;
- checked the boring locations for underground utilities using a private utility locator.

Details of the field exploration activities and laboratory testing are described in the remainder of this section.

3.1 Previous Investigation

We reviewed existing subsurface information from a report titled "Preliminary Geotechnical Investigation, The Hills at Vallco, Cupertino, California", dated 19 November 2015, by TRC.

We used the information provided on the boring logs from the above referenced report to supplement the information developed from our exploration of the site. The approximate locations of the previously drilled borings by TRC are shown on Figure 2. Logs of borings and the associated laboratory test results presented in the TRC report are presented in Appendix A.

3.2 Borings

Our field exploration included drilling five borings. The borings, designated as B-1 through B-5, were drilled at the site at the approximate locations shown on Figure 2. Borings B-1 and B-2 were drilled using truck mounted rotary wash drilling equipment from 6 through 8 September 2016 by Pitcher Drilling Company. The borings were drilled to a depth of approximately 100 to 140 feet bgs. Borings B-3 to B-5 were drilled using truck mounted hollow stem auger drilling equipment on 13 and 14 September 2016 by Exploration Geoservices. The borings were drilled to a depth of approximately 50 to 100 feet bgs.

During drilling, our field engineer logged the borings and obtained representative samples of soil encountered for visual classification and laboratory testing.

Logs of the borings are presented in Appendix B on Figures B-1 through B-5. The soil encountered in the borings was classified in accordance with the Classification Chart, presented on Figure B-6.

Samples were obtained using the following split-barrel sampler types.

- Sprague & Henwood (S&H) sampler with a 3.0-inch outside diameter and 2.5-inch inside diameter, lined with steel or brass tubes with an inside diameter of 2.43 inches
- Standard Penetration Test (SPT) sampler with a 2.0-inch outside diameter and 1.5-inch inside diameter, without liners.

The sampler types were chosen on the basis of soil type and desired sample quality for laboratory testing. In general, the S&H sampler was used to obtain samples in medium stiff to very stiff cohesive soils. The SPT sampler was used to evaluate the relative density of granular soils.

For the rotary wash borings (Borings B-1 and B-2), the SPT and S&H samplers were driven with a 140-pound, above-ground, automatic safety hammer falling 30 inches. The blow counts required to drive the S&H and SPT samples were converted to approximate SPT N-values using factors of 0.7 and 1.1, respectively, to account for sample type and hammer energy and are shown on the boring logs.

For the hollow stem auger borings (Borings B-3 to B-5), the SPT and S&H samplers were driven with a 140-pound, downhole, wireline safety hammer falling 30 inches. The blow counts required to drive the S&H and SPT samples were converted to approximate SPT N-values using factors of 0.6 and 1.0, respectively, to account for sample type and hammer energy and are shown on the boring logs. Boring B-4 was drilled with two different drilling rigs due to equipment issues. The conversion factors to account for sample type and hammer energy were similar between the both drilling rigs and hammers.

The SPT and S&H samplers were driven up to 18 inches and the hammer blows required to drive the samplers every six inches of penetration were recorded and are presented on the boring logs. A "blow count" is defined as the number of hammer blows per six inches of penetration or less if the blow count approached 50 blows. The driving of sampler was discontinued if the observed (recorded) blow count was 50 for six inches or less of penetration.

The blow counts used for this conversion were: 1) the last two blow counts if the sampler was driven more than 12 inches, 2) the last one blow count if the sampler was driven more than six inches but less than 12 inches, and 3) the only blow count if the sampler was driven six inches or less.

NorCal Geophysical was retained to perform in-situ downhole suspension logging to measure the shear wave velocity of the subsurface materials within boring B-1. The details of the suspension logging methodology, procedures, and the results are presented in Appendix C.

Upon completion of drilling or suspension logging, the borings were backfilled with grout consisting of cement, bentonite, and water in accordance with the requirements of SCVWD. The borings were completed at the ground surface with cold patch asphalt. The soil cuttings and drilling fluid were placed in 55-gallon drums stored temporarily at the site, tested, and have been transported off-site for proper disposal.

3.3 Laboratory Testing

The soil samples recovered from the field exploration program were re-examined in the office for soil classification, and representative samples were selected for laboratory testing. The laboratory testing program was designed to evaluate engineering properties of the soil at the site. Samples were tested to measure moisture content, dry density, plasticity (Atterberg Limits), gradation, shear strength, and compressibility, where appropriate. Results of the laboratory testing are included on the boring logs and in Appendix D on Figures D-1 through D-15.

3.4 Cone Penetration Test

To supplement the soil boring data, five CPTs, designated as CPT-1 through CPT-5, were performed on 29 and 30 September 2016 by Gregg Drilling and Testing (Gregg) at the approximate locations shown on Figure 2. The CPTs were advanced to depths of approximately 75 feet bgs.

The CPTs were performed by hydraulically pushing a 1.4-inch-diameter, cone-tipped probe, with a projected area of 15 square centimeters, into the ground. The cone tip measures tip resistance, and the friction sleeve behind the cone tip measures frictional resistance. Electrical strain gauges or load cells within the cone continuously measured the cone tip resistance and frictional resistance during the entire depth of each probing. Accumulated data was processed by computer to provide engineering information, such as the types and approximate strength characteristics of the soil encountered. The CPT logs, showing tip resistance and friction ratio by depth, as well as interpreted SPT N-Values, friction angle, soil strength parameters, and interpreted soil classification, are presented in Appendix E on Figures E-1 through E-5. Soil types were estimated using the classification chart shown on Figure E-6.

After completion, the CPTs were backfilled with cement-bentonite grout in accordance SCVWD requirements. The CPTs were completed at the ground surface with cold patch asphalt.

3.5 Soil Corrosivity Testing

To evaluate the corrosivity of the soil near the foundation subgrade, we performed corrosivity tests on samples obtained at depths of 18½ feet, 26 feet and 63½ feet. The corrosivity of the soil samples was evaluated by CERCO Analytical using the following ASTM Test Methods:

- Redox – ASTM D1498
- pH – ASTM D4972
- Resistivity (100% Saturation) – ASTM G57
- Sulfide – ASTM D4658M
- Chloride – ASTM D4327
- Sulfate – ASTM D4327

The laboratory corrosion test results and a brief corrosivity evaluation by JDH Corrosion are presented in Appendix F.

4.0 SITE AND SUBSURFACE CONDITIONS

The existing site and subsurface conditions observed and encountered at the site, respectively, are discussed in this section.

4.1 Site Conditions

The existing shopping center includes a two-level shopping center located on the east and west sides of N. Wolfe Road, multi-level parking structures, surface parking lots, a pedestrian bridge spanning N. Wolfe Road, a vehicular tunnel crossing below N. Wolfe Road, and several stand-alone buildings. Based on a topographic survey of the project site (Sandis, 2011), the range of existing ground surface elevations is presented below:

- West of N. Wolfe Road: Ground surface elevations range from Elevation 178.1 feet at the northern portion of the parcel to 198.4 feet at the southwest corner of the parcel;

- East of N. Wolfe Road: Ground surface elevations range from Elevation 176.4 feet at the northwest corner of the parcel to Elevation 197.5 at the eastern portion of the parcel.

4.2 Subsurface Conditions

Where asphalt pavement was encountered, the section consists of 1½ to 6 inches of asphalt concrete (AC) over 3 to 10 inches of aggregate base (AB). In general, the project site is underlain by alluvial deposits consisting of stiff to hard clays and sandy clays and medium dense to very dense sand and gravel. TRC (as Lowney Associates) encountered 1½ and 4½ feet of clay fill in borings LB-6 and LB-8, respectively. The surficial clayey soil has moderate to high expansion potential[2]; where tested, the upper clay layers have plasticity indices of 25 and 39. Where tested, laboratory test results of the undrained shear strength of relatively undisturbed samples of the alluvium ranges from 1,220 to 4,750 pounds per square foot (psf). An undrained shear strength of 640 psf was recorded during testing of a disturbed sample collected from boring B-1 at a depth of 75½ feet bgs. In addition, the consolidation laboratory test results indicate the alluvium is overconsolidated[3] and has compression ratios ranging from 0.1 to 0.12.

Idealized subsurface profiles (Figures 3 and 4, to be included at a later date) illustrate the general subsurface conditions at the site

Based on our review of published maps (California Division of Mines and Geology, 2002), historic high groundwater in the project vicinity is deeper than 50 feet bgs. Based on previous geotechnical investigation at or nearby the project site, (Langan Treadwell Rollo, 2014 and TRC, 2015), groundwater was encountered at depths of approximately 65 to 75 feet bgs. During our current investigation, the groundwater levels were measured at depths of approximately 48 and 96 bgs (corresponding to Elevations 146 to 86 feet) at Borings B-1 and B-4, respectively. However, this depth was measured during drilling and may not represent a stabilized ground water level. Groundwater levels may fluctuate due to seasonal rainfall.

Pore-pressure dissipation tests[4] (PPDTs) were attempted at CPT-1 through CPT-5 at depths of approximately 62 feet to 75 feet bgs; groundwater was not encountered at those depths.

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[2] Highly expansive soil undergoes large volume changes with changes in moisture content.

[3] An overconsolidated clay has experienced a pressure greater than its current load.

[4] PPDTs are conducted at various depths to measure hydrostatic water pressures and to determine the approximate depth of the groundwater level. The variation of pore pressure with time is measured behind the tip of the cone and recorded.

Groundwater depth and elevation data from the current and prior investigations are summarized in Table 1.

TABLE 1
Summary of Groundwater Depth and Elevation Data

Consultant	Location	Year of Exploration	Ground Surface Elevation (ft)	Exploration Depth (ft)	Groundwater Depth (ft)	Groundwater Elevation (ft)
Langan	B-1	2016	194.2	141	48	146.2
	B-2	2016	197.6	101.5	-	
	B-3	2016	196.1	50	-	
	B-4	2016	182.4	100	96	86.4
	B-5	2016	179.8	50	-	
	CPT-1	2016	195.4	75.3	-	
	CPT-2	2016	194.2	75.3	-	
	CPT-3	2016	194.0	75.5	-	
	CPT-4	2016	176.4	75.3	-	
	CPT-5	2016	189.2	75.5	-	
TRC (as Lowney Associates)	EB-9	2004	184.2	84.5	68	116.2

Notes:
1. Groundwater level obscured by drilling method in Boring B-2.
2. Groundwater not encountered in Borings B-3, B-5, and CPT-1 to CPT-5.
3. TRC (as Lowney Associates or Lowney Kaldveer Associates) borings that did not encounter groundwater are not included.

Downhole suspension logging was performed in Boring B-1. Shear wave velocities ranged from about 790 to 2,498 feet per second in the alluvial deposits. A plot of shear wave velocity with depth is presented in Appendix C.

5.0 REGIONAL SEISMICITY

The major active faults in the area are the San Andreas, Monte Vista-Shannon, Hayward, and Calaveras faults. These and other faults of the region are shown on Figure 5. For each of the active faults within approximately 100 km from the site, the distance from the site and estimated mean characteristic Moment magnitude[5] [2007 Working Group on California Earthquake Probabilities (WGCEP) (2008) and Cao et al. (2003)] are summarized in Table 2.

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[5] Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

TABLE 2
Regional Faults and Seismicity

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude
Monte Vista-Shannon	4.8	Southwest	6.50
N. San Andreas - Peninsula	10.6	Southwest	7.23
N. San Andreas (1906 event)	10.6	Southwest	8.05
N. San Andreas - Santa Cruz	17	South	7.12
Total Hayward	20	Northeast	7.00
Total Hayward-Rodgers Creek	20	Northeast	7.33
Total Calaveras	22	Northeast	7.03
Zayante-Vergeles	27	South	7.00
San Gregorio Connected	33	West	7.50
Monterey Bay-Tularcitos	46	South	7.30
Greenville Connected	46	East	7.00
Mount Diablo Thrust	48	Northeast	6.70
Great Valley 7	63	Northeast	6.90
Green Valley Connected	64	North	6.80
Ortigalita	65	East	7.10
N. San Andreas - North Coast	71	Northwest	7.51
Quien Sabe	73	Southeast	6.60
SAF - creeping segment (jl0.sa-creep, modified)	75	Southeast	6.70
Rinconada	76	Southeast	7.50
Great Valley 8	77	East	6.80
Great Valley 5, Pittsburg Kirby Hills	78	North	6.70
Rodgers Creek	92	Northwest	7.07
Great Valley 9	94	East	6.80
West Napa	95	North	6.70
Point Reyes	100	Northwest	6.90

Figure 5 also shows the earthquake epicenters for events with magnitude greater than 5.0 from January 1800 through December 2000. Since 1800, four major earthquakes have been recorded on the San Andreas Fault. In 1836 an earthquake with an estimated maximum intensity of VII on the Modified Mercalli (MM) scale (Figure 6) occurred east of Monterey Bay on the San Andreas Fault (Toppozada and Borchardt 1998). The estimated Moment magnitude, $M_{w,}$ for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to a M_w of about 7.5. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the

San Andreas Fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), a M_w of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The most recent earthquake to affect the Bay Area was the Loma Prieta Earthquake of 17 October 1989, in the Santa Cruz Mountains with a M_w of 6.9, approximately 34 km from the site.

In 1868 an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated M_w for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably a M_w of about 6.5) was reported on the Calaveras Fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake ($M_w = 6.2$).

The 2014 Working Group for California Earthquake Probabilities (WGCEP) at the U.S. Geologic Survey (USGS) predicted a 72 percent chance of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area in 30 years (WGCEP 2015). More specific estimates of the probabilities for different faults in the Bay Area are presented in Table 3.

TABLE 3
WGCEP (2015) Estimates of 30-Year Probability (2014 to 2043) of a Magnitude 6.7 or Greater Earthquake

Fault	Probability (percent)
Hayward-Rodgers Creek	32
N. San Andreas	33
Calaveras	25

6.0 GEOLOGIC HAZARDS

During a major earthquake on a segment of one of the nearby faults, strong to very strong shaking is expected to occur at the site. Strong shaking during an earthquake can result in ground failure such as that associated with soil liquefaction[6], lateral spreading[7], and seismic

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[6] Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

densification[8]. Each of these conditions has been evaluated based on our literature review, field investigation, and analyses, and is discussed in this section.

6.1 Liquefaction and Associated Hazards

When saturated soil with little to no cohesion liquefies during a major earthquake, it experiences a temporary loss of shear strength as a result of a transient rise in excess pore water pressure generated by strong ground motion. Flow failure, lateral spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction.

The site is not within a zone designated for liquefaction, as identified by the California Geologic Survey (CGS) in a map titled, *State of California Seismic Hazard Zones, Cupertino Quadrangle*, prepared by the California Geologic Survey, dated September 23, 2002 (CGS 2002a).

Saturated loose sand was not encountered in the borings and CPTs drilled at the site. The high groundwater level observed at the site is approximately 48 feet bgs, corresponding to Elevation 146.2 feet. Blow count data indicates the cohesionless soil below the groundwater table is dense to very dense. Therefore, we conclude the potential for liquefaction and liquefaction-induced failures including lateral spreading is nil.

6.2 Seismic Densification

Seismic densification (also referred to as cyclic densification and differential compaction) can occur during strong ground shaking in loose, clean granular deposits above the water table, resulting in ground surface settlement. Up to five feet of medium dense clayey sand and silty sand was encountered in B-1 and B-2 above the groundwater table. This layer may densify in a major earthquake. Using the Tokimatsu and Seed (1984) method for evaluating seismically-induced settlement in dry sand, we estimate settlement will be less than ½ inch. The soil above the groundwater table encountered in the other borings is either very clayey or has sufficient density to resist seismic densification; therefore, we conclude the potential for seismic densification to occur is low at these locations.

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[7] Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

[8] Seismic densification (also referred to as Differential Compaction) is a phenomenon in which non-saturated, cohesionless soil is densified by earthquake vibrations, causing ground-surface settlement.

6.3 Fault Rupture

Historically, ground surface ruptures closely follow the trace of geologically young faults. The site is not within an Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no known active or potentially active faults exist on the site. Additionally, the site is not within an area mapped has having the fault rupture potential (County of Santa Clara, 2015). Therefore, we conclude the risk of fault offset through the site from a known active fault is low. In a seismically active area, the remote possibility exists for future faulting in areas where no faults previously existed; however, we conclude that the risk of surficial ground deformation from faulting at the site is low.

7.0 DISCUSSION AND CONCLUSIONS

We conclude the proposed development is feasible from a geotechnical standpoint, provided the recommendations presented in this report are incorporated into the project plans and implemented during construction. Excavations of 10 to 60 feet bgs will be required to achieve the proposed foundation subgrades for the proposed buildings. Temporary shoring will be required to brace the excavations. The primary geotechnical issues for this project include:

- presence of moderately to highly expansive clay at the ground surface
- selection of an appropriate foundation system to support the building loads and accommodate estimated static and seismic settlements
- support for proposed excavations and adjacent structures during construction
- providing a stable subgrade and adequate working surface at the base of the excavation
- reducing the potential for sliding of the soil on the roof.

Our conclusions regarding these and other geotechnical issues are discussed in the remainder of this section.

7.1 Expansive Soil Considerations

The existing near-surface soil has moderate to high expansion potential. Moisture fluctuations in near-surface expansive soil could cause the soil to shrink or swell resulting in movement and potential damage to improvements that overlie them. Potential causes of moisture fluctuations include drying during construction, and subsequent wetting from rain, capillary rise, landscape irrigation, and type of plant selection.

The excavation for the basement levels will be below the zone of seasonal moisture change and expansive soil, if present, should not impact the foundations or slab. For improvements at-grade, the volume changes from expansive soils can cause cracking of foundations, floor slabs and exterior flatwork. Therefore, foundations, slabs and concrete flatwork near existing grades should be designed and constructed to resist the effects of the expansive soil. These effects can be mitigated by moisture conditioning the expansive soil and providing select, non-expansive fill below interior and exterior slabs and supporting foundations below the zone of severe moisture change.

In addition, the expansive clay may be susceptible to pumping and rutting during construction, especially if it becomes wet. If localized soft or wet areas of material are encountered it may be necessary to overexcavate the material 18 to 24 inches, place a geotextile fabric such as Mirafi 500X or its equivalent, and backfill with granular material to stabilize the area and bridge the soft material.

An alternative to importing select fill includes lime treatment of the near surface soil. The addition of lime can reduce the swell potential and increase the shear strength of the soil. Lime stabilization of the subgrade for exterior concrete flatwork may be a cost-effective means of improving on-site soils for use as non-expansive fill beneath the improvements. In addition if the surface soil becomes wet, it may be difficult to compact during the winter. Lime treatment could be used to winterize the site and to aid in compaction.

The degree to which lime will react with soil depends on such variables as type of soil, minerals present, quantity of lime, and the length of time the lime-soil mixture is cured. The quantity of lime added generally ranges from 5 to 7 percent by weight and should be determined by laboratory testing. If lime is intended to reduce swelling potential and/or increase the strength of the soil, the lime treatment contractor should collect a bulk sample of the soil and perform laboratory tests to determine if the lime will react with the soil, the amount of lime required and the resulting plasticity index. We should be provided with the results to evaluate the effectiveness of the lime.

7.2 Foundations

Based on the schematic drawings (Rafael Viñoly Architects, 2016), we understand the retail and residential buildings west of N. Wolfe will have one- or two- basement levels and the office buildings east of N. Wolfe road will have a three- to four-level basement levels.

The current design schematics (Rafael Viñoly Architects, 2016) indicate the basement finished floor will be approximately 10 to 60 feet below the ground level finish floor elevation. Using the existing grades presented on the topographic map (Sandis, 2016), the bottom of excavation elevation is estimated as summarized in Table 4.

TABLE 4
Summary of Buildings with Basement Elevations

Parcel	Existing Ground Surface Elevation[2] (feet)	Approximate Depth of Excavation[1] (feet)	Proposed Basement Finished Floor Elevation[2] (feet)	Anticipated Stress Reduction (psf)
West of N. Wolfe Road	176 to 198	10 to 20	156 to 188	1,200 to 2,400
East of N. Wolfe Road	176 to 198	40 to 60	116 to 158	4,800 to 7,200

Notes: 1. Some excavations may be deeper due to site topography.
2. All elevations reference NAVD 88.

We judge the soil at the bottom of both proposed excavations will consist of very stiff to hard clay and dense to very dense sand and gravel. Therefore, we conclude that buildings with basements can be supported on spread footings or mat foundations. Design recommendations for the building foundations are presented in Section 8.2.

Laboratory test results indicate the clay below the proposed bottom of the excavations is overconsolidated, with an overconsolidation ratio of 2.1 to 2.9. Table 4 provides the stress reduction from the anticipated excavation for the various basement levels. If the average uniform pressure from the weight of the structures is less than the estimated stress reduction from the basement excavations then static settlements should be limited to recompression.

Initially, as the proposed excavations are made, we expect the removal of soil will create pressure relief and the base of the excavation should rebound (rise), especially near the center of the excavation. We estimate rebound of about ¾-inch near the center of the excavation after excavation of the basement. After the new foundation is constructed and new building loads are applied, the pressure will increase and the clay layer should partially recompress. The settlement associated with this recompression in excavated areas could range between ¾- to 1¼-inch. We estimate post-construction differential static settlement between columns may be on the order of ½ inch; this estimate does not include the rigidity of a mat foundation system, which would tend to reduce the differential.

Footings supporting at-grade structures designed in accordance with these recommendations should not settle more than 1 inch; differential settlement between adjacent footings, typically 30 feet apart, should not exceed ½ inch. Design recommendations for building footings are presented in Section 8.2.1.

7.3 Groundwater Considerations

Groundwater levels were encountered in the borings range from Elevation 146 feet at B-1 to Elevation 86 feet at B-4. On the basis of our knowledge of groundwater in the area, we conclude a design groundwater elevations on the project site can be linearly interpolated between Elevation 146 feet at the southwest end and Elevation 86 feet at the northeast end .

7.4 Shoring Considerations

The excavation for the basement may be sloped back, if there is sufficient space. Alternatively, during excavation of the basement, the adjacent property and streets may be supported by temporary shoring. There are several key considerations in selecting a suitable shoring system. Those we consider to be primary concerns are:

- protection of surrounding improvements, including roadways, utilities, and adjacent structures
- penetration of shoring supports into the predominantly sand and gravel soils below the bottom of the excavation
- proper construction of the shoring system to reduce the potential for ground movement
- cost.

Based on our experience on projects with similar excavation depths, soldier pile and lagging systems or with overlapping soil-cement-mixed columns in lieu of lagging may be the most economical shoring system for the excavations for this project. Excavations deeper than about 10 to 15 feet may require tiebacks or internal bracing.

Soldier pile and lagging: consists of soldier piles placed in predrilled holes, which are backfilled with concrete or installed with a soil-cement mixing drill rig. Wood lagging should be placed between the soldier beams as the excavation proceeds. Drilling of the shafts for the soldier piles may require casing and/or the use of drilling mud to prevent caving of any sand layers that are present. The contractor should be made aware of the dense to very dense sands and gravels that will likely be encountered.

Alternatively overlapping soil-cement-mixed columns between soldier piles may be in lieu of wood lagging. Soil-cement-mixed columns are installed by advancing hollow-stem augers and pumping cement slurry through the tips of the augers during auger penetration. The soil is mixed with the cement slurry in situ, forming continuous overlapping soil-cement columns or continuous walls. The contractor should be made aware of the dense to very dense sands and gravels that will likely be encountered. Steel beams may be placed in the soil-cement columns at locations of soldier piles.

The shoring will likely require either post grouted tiebacks or internal bracing for lateral support. The adjacent property owners should be notified of the planned excavation and consulted regarding any special requirements they may have for construction. It may be difficult to obtain permission to install tiebacks on their property.

We estimate a properly installed shoring system will limit lateral movements and settlements to adjacent improvements to less than 1½ inches. The settlement should decrease linearly with distance from the excavation, and should be relatively insignificant at a distance twice the excavation depth.

The soil cement-mixed columns would be relatively rigid compared to wood lagging and could further limit lateral deflections and ground subsidence related to the shoring. Where movements could be detrimental to adjacent existing improvements the soil cement mixed columns could be used. A combination of the soldier pile and lagging and soil cement mixed column systems could be used depending on the required performance along the various excavation faces.

The selection, design, construction, and performance of the shoring and underpinning system (see section 7.5) should be the responsibility of the contractor. A civil engineer knowledgeable in this type of construction should be retained to design the shoring. We should review the final shoring plans to check that they are consistent with the recommendations presented in this report.

7.5 Underpinning

Because the project may be constructed in phases, several of the existing buildings will remain. Where the proposed excavation extends deeper than the foundations of adjacent existing buildings or where adjacent foundations are above an imaginary 1:1 (horizontal to vertical) line extending up from the base of the excavation, underpinning should be provided to support the adjacent building loads or the shoring should be designed to support the surcharge loads from the foundations.

Underpinning could consist of steel piles installed in slant-drilled shafts (slant piles) or intermittent hand-excavated piers that extend at least two feet below the planned bottom of excavation. The underpinning piles/piers should be designed to resist vertical building loads, vertical tieback loads (if tiebacks are used), and lateral earth pressures. Hand excavated underpinning piers are usually about 30 by 48 inches in plan and are reinforced with steel and filled with concrete; slant piles are generally 30 to 48 inches in diameter. The piers/piles should be pre-loaded by jacking against the foundation, and the top of the pier/pile dry-packed to fit tightly with the base of the underpinned foundation. Underpinning piers should act in end bearing in the bearing strata below the depth of the proposed excavation, while slant piles gain their capacity in friction along the sides of the shaft.

The excavation face between the underpinning piles/piers should be retained using lagging, provided the existing footing can span between piers. Alternatively, similar to the shoring system, soil cement columns could be used between slant piles in lieu of wood lagging.

During excavation, the shoring system is expected to yield and deform, which could cause surrounding improvements to settle and move. The magnitude of shoring movements and resulting settlements are difficult to estimate because they depend on many factors, including the method and the shoring contractor's skill in the installation. If cohesionless layers are encountered, some caving may occur while lagging boards are installed. To reduce movements and caving, it may be necessary to limit the unsupported height of the excavation to the height of the lagging boards.

7.6 Excavation and Monitoring

The soil to be excavated from the site consists of materials that can be excavated with conventional earthmoving equipment such as loaders and backhoes, except where foundations and slabs of existing buildings are encountered. Removal of these may require the use of jackhammers or hoe-rams. Excavations resulting from the removal of foundations, slabs and underground utilities that extend below the bottom of the proposed foundation/floor level should be cleaned of any loose soil/debris and backfilled with lean concrete or properly compacted fill.

The surficial soil is clayey and moderately to highly plastic. If earthwork is performed in wet weather conditions, it may be difficult to compact the soil; it may need to be aerated during dry weather. Light grading equipment may be needed to avoid damaging the subgrade.

During excavation, the shoring system is expected to yield and deform, which would cause surrounding improvements to settle. The magnitude of shoring movements and resulting settlements are difficult to estimate because they depend on many factors, including the method of installation and the contractor's skill in installing the shoring. Typical maximum movement for a properly designed and constructed shoring system should be within about 1½ inches. A monitoring program should be established to evaluate the effects of the construction on surrounding improvements. The Contractor should install surveying points to monitor the movement of shoring and settlement of adjacent structures and the ground surface during excavation. The monitoring should provide timely data which can be used to modify the shoring system if needed.

Existing basement walls and footings that interfere with the shoring system would need to be removed prior to installing the shoring.

7.7 Corrosion Potential

Because corrosive soil can adversely affect underground utilities and foundation elements, laboratory testing was performed to evaluate the corrosivity of the near surface soil.

CERCO Analytical performed tests on soil samples to evaluate corrosion potential to buried metals and concrete. The results of the tests are presented in Table 5 and Appendix F.

TABLE 5
Summary of Corrosivity Test Results

Test Boring	Sample Depth (feet)	pH	Sulfates (mg/kg)	Resistivity (ohms-cm)	Redox (mV)	Chlorides (mg/kg)
B-3	18.5	7.56	210	1,200	350	32
B-4	63.5	7.77	N.D.	3,900	350	N.D.
B-5	26	7.95	21	1,700	350	21

N.D. = None Detected

Based upon resistivity measurements, the soil samples tested are classified as “moderately corrosive” to “corrosive” to buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron. The chemical analysis indicates reinforced concrete and cement mortar coated steel, will be affected by the corrosivity of the soil. To protect reinforcing steel from corrosion, adequate coverage should be provided as required by the building code. Corrosivity test results are presented in Appendix F.

8.0 RECOMMENDATIONS

Recommendations for site preparation foundation design, temporary shoring and other geotechnical aspects of this project are presented in the following sections.

8.1 Earthwork

The following subsections present recommendations for site preparation and lime treatment.

8.1.1 Site Preparation

Demolition in areas to be developed should include removal of existing pavement and underground obstructions, including foundations of existing structures. Any vegetation and organic topsoil should be stripped in areas to receive new site improvements. Stripped organic soil can be stockpiled for later use in landscaped areas, if approved by the owner and architect; organic topsoil should not be used as compacted fill.

Demolished asphalt and concrete at the site may be crushed to provide recycled construction materials, including sand, free-draining crushed rock, and Class 2 aggregate base (AB) provided it is acceptable from an environmental standpoint.

Existing underground utilities beneath areas to receive new improvements should be removed or abandoned in-place by filling them with grout. The procedure for in-place abandonment of utilities should be evaluated on a case-by-case basis, and will depend on location of utilities relative to new improvements. However, in general, existing utilities within four feet of final grades should be removed, and the resulting excavation should be properly backfilled.

We recommend at least 18 inches of select material be placed beneath slab-on-grades for proposed at-grade structures that will at or near existing grades and 12 inches beneath exterior concrete flatwork.. Materials for capillary break (sand and gravel) should not count as part of the select fill. The select fill should extend at least five feet beyond structure footprints and two feet beyond exterior concrete flatwork. Criteria for select fill are presented later in this section. Prior to placing fill, the subgrade exposed after stripping and site clearing, as well as other portions of the site that will receive new fill or site improvements, should be scarified to a depth of at least eight inches, moisture-conditioned to at least three percent above the optimum moisture content, and compacted to at least 88 percent relative compaction[9], where the exposed material consists of moderately to highly expansive soil. Expansive surface soil that has a moisture content of less than 20 percent (the approximate plastic limit of the soil) should be excavated, moisture-conditioned to at least three percent above optimum moisture content, and recompacted to between 88 and 93 percent relative compaction to reduce its expansion potential. Where lean clay or sandy soil are encountered during grading, the scarified surface should be moisture-conditioned to above the optimum moisture content and compacted to at least 90 percent relative compaction. An exception to this general procedure is within any proposed at grade vehicle pavement areas supported on soil, where the upper six inches of the pavement subgrade should be compacted to at least 95 percent relative compaction regardless of expansion potential.

Heavy construction equipment should not be allowed directly on the final basement subgrade. The clay or sand exposed at the foundation/basement level may be susceptible to disturbance under construction equipment loads. It may be necessary to place a minimum 12-inch working pad consisting of crushed rock on top of the subgrade to minimize disturbance; the need for a working pad should be evaluate during construction as the bottom of the excavation is reached.

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[9] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the ASTM D1557-12 laboratory compaction procedure.

Any select fill placed during grading should meet the following criteria:

- be free of organic matter
- contain no rocks or lumps larger than three inches in greatest dimension
- have a low expansion potential (defined by a liquid limit of less than 40 and plasticity index lower than 12)
- have a low corrosion potential[10]
- be approved by the geotechnical engineer.

All fill placed beneath the basement and other improvements should meet the criteria for select fill. All select fill should be moisture-conditioned to above optimum moisture content, placed in horizontal lifts not exceeding eight inches in loose thickness, and be compacted to at least 90 percent relative compaction, except for fill that is placed within the proposed pavement areas. In these situations, the upper six inches of the final soil subgrade and aggregate baserock should be compacted to at least 95 percent relative compaction. Where used, sand containing less than 10 percent fines (particles passing the No. 200 sieve) should also be compacted to at least 95 percent relative compaction. Samples of on-site and proposed import fill materials should be submitted to Langan for approval at least three business days prior to use at the site.

8.1.2 Lime Treatment (Optional)

Alternatively, the upper 18-inches of the existing surface soil may be lime treated to reduce the expansion potential and help winterize the site. We recommend that at least 5 percent lime by weight of the soil be used to treat the upper 18-inches of native soil for at-grade structures. A specialty contractor should be engaged to evaluate the type and amount of lime needed to reduce the plasticity index of the soil to meet the select fill criteria and provide laboratory test results to confirm the plasticity index of the soil after treatment.

Lime treatment of fine-grained soils generally includes site preparation, application of lime, mixing, compaction, and curing of the lime treated soil. Field quality control measures should include checking the depth of lime treatment, degree of pulverization, lime spread rate measurement, lime content measurement, and moisture content and density measurements,

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[10] Low corrosion potential is defined as a minimum resistivity of 2,000 ohms-cm and maximum sulfate and chloride concentrations of 250 parts per million.

and mixing efficiency. Quality control will also include laboratory tests for unconfined compressive strength tests on representative samples.

The lime treatment process should be designed by a contractor specializing in its use and who is experienced in the application of lime in similar soil conditions. Based on our experience with lime treatment, we judge that the specialty contractor should be able to treat the moderate to highly expansive on-site material to produce a non-expansive fill for building subgrade.

If the lime treatment alternative is selected, we recommend that the specialty contractor prepare a treatment specification for our review prior to construction.

8.2 Foundations

The following section provides recommendations for spread footings and mat foundation for buildings with basements.

8.2.1 Spread Footing Foundations

A firm subgrade should be exposed at the bottom of the proposed footing excavations. If isolated areas of soft material are encountered in the bottom of the excavation, they should be removed to expose firm material. Resulting overexcavations should be backfilled with lean or structural concrete.

For footings within the excavation for the structure, we recommend spread footings have a minimum embedment of 18-inches below the lowest adjacent soil subgrade. With the recommended minimum embedment depth, the recommended bearing capacities are presented in Table 6A.

TABLE 6A

Recommended Capacities for Spread Footings – Below Grade Structure

Parcel[1]	**Allowable Dead Plus Live Load Bearing Pressure**[2] **(psf)**
West of N. Wolfe Road	5,000
East of N. Wolfe Road	8,000

Notes:
1. Assumes parcel west of N. Wolfe Road will have excavation depths of approximately 10 to 20 feet bgs and parcel east of N. Wolfe Road will have excavation depths of 40 to 60 feet bgs.
2. Bearing pressure may have a one-third increase for total loads, including wind and/or seismic loads.

For footings supporting at-grade structures, we recommend spread footings have a minimum embedment of 36-inches below the lowest adjacent soil subgrade. For the recommended minimum embedment, the footings bearing on firm native soil or engineered fill may be designed for an allowable bearing pressure of 3,000 pounds per square foot (psf) for dead plus live loads, with a one-third increase for total loads, including wind and/or seismic loads.

Footings should be at least 18 inches wide for continuous footings and 24 inches for isolated spread footings. Footings adjacent to utility trenches (or other footings) should bear below an imaginary 1.5:1 (horizontal to vertical) plane projected upward from the bottom edge of the utility trench (or adjacent footings).

Lateral forces can be resisted by a combination of friction along the base of the footing, and passive resistance against the vertical faces of the foundation and, where applicable, the basement walls perpendicular to the direction of earthquake shaking. Frictional resistance should be computed using a base friction coefficient of 0.30. If waterproofing is used, the allowable friction factor will depend on the type of waterproofing used at the base of the foundation. For bentonite-based waterproofing membranes, such as Paraseal and Voltex, a friction factor of 0.15 should be used. Friction factors for other types of waterproofing membranes should be provided by the manufacturer. If passive pressure on the walls is relied upon for lateral resistance, the walls should be designed to resist the passive pressure. To calculate the passive resistance against the vertical faces of the basement walls or footings, we recommend an equivalent fluid weight of 400 pounds per cubic foot (pcf) with a maximum value of 2,000 pcf. The upper foot should be ignored unless confined by a slab. The values for the friction coefficient and passive pressures include a factor of safety of 1.5.

If weak soil is encountered at the bottom of the footing excavation, it should be overexcavated and replaced with engineered fill or lean concrete. The bottom and sides of the footing excavations should be wetted following excavation and maintained in a moist condition until concrete is placed. If the foundation soil dries during construction, the foundation will heave when exposed to moisture, which may result in cracking and distress.

We should observe the footing subgrade prior to placement of reinforcing steel. The excavation for the footings should be free of standing water, debris, and disturbed materials prior to placing concrete.

8.2.2 Mat Foundation

The recommended allowable dead plus live bearing pressures and corresponding design moduli of subgrade reaction for mats are presented in Table 7.

TABLE 7
Mat Foundations

Area[1]	**Allowable Dead Plus Live Bearing Pressure (psf)**	**Modulus of Subgrade Reaction (kcf)**
West of N. Wolfe Road	5,000	60
East of N. Wolfe Road	8,000	100

Notes: 1. Assumes area west of N. Wolfe Road will have excavation depths of approximately 10 to 20 feet bgs and area east of N. Wolfe Road will have excavation depths of 40 to 60 feet bgs.

The moduli values are representative of the anticipated settlement under the building loads. After the mat analysis is completed, we should review the computed settlement and bearing pressure profiles to check that the modulus value is appropriate. Higher bearing pressures than those presented in Table 7 may be used; however, the corresponding modulus may need to be revised. The allowable bearing pressure may be increased by one-third for total loads including wind or seismic.

Resistance to lateral loads can be mobilized by a combination of passive pressure acting against the vertical faces of the mat and friction along the base of the mat. Passive resistance may be calculated using lateral pressures corresponding to an equivalent fluid weight of 400 pcf; the upper foot of soil should be ignored unless confined by a concrete slab or pavement. If waterproofing is used, the allowable friction factor will depend on the type of waterproofing used at the base of the foundation. For bentonite-based waterproofing membranes, such as Paraseal and Voltex, a friction factor of 0.15 should be used. Friction factors for other types of waterproofing membranes should be provided by the manufacturer. If waterproofing is not used, frictional resistance should be computed using a base friction coefficient of 0.3. These values include a factor of safety of about 1.5 and may be used in combination without reduction.

If weak soil is encountered in the mat excavation bottom, it should be over-excavated and replaced with engineered fill or lean concrete. The bottom and sides of mat excavations should be wetted following excavation and maintained in a moist condition until concrete is placed. If the foundation soil dries during construction, the foundation will heave when exposed to moisture, which may result in cracking and distress.

We should observe mat subgrade prior to placement of reinforcing steel. The excavation for the mat should be free of standing water, debris, and disturbed materials prior to placing concrete.

8.3 Floor Slab

The subgrade soil for buildings with basements should be very stiff or dense; therefore, we conclude the basement slabs can be supported on grade. Where soft or loose soil is present at the basement slab subgrade, the weak soil should be removed and replaced with engineered fill or lean concrete.

Where slab-on-grade floors are to be cast, the soil subgrade should be scarified to a depth of six inches, moisture conditioned to near (or above) optimum moisture content, and rolled to provide a firm, non-yielding surface compacted to at least 90 percent relative compaction. Lime treated soil should be compacted to at least 90 percent relative compaction. If the subgrade is disturbed during excavation for footings and utilities, it should be re-rolled. Loose, disturbed materials should be excavated, removed, and replaced with engineered fill during final subgrade preparation.

Moisture is likely to condense on the underside of the slabs, even though they will be above the design groundwater table. Consequently, a moisture barrier should be installed beneath the slabs if movement of water vapor through the slabs would be detrimental to its intended use. A moisture barrier is generally not required beneath parking garage slabs, except for areas beneath mechanical, electrical, and storage rooms. A typical moisture barrier consists of a capillary moisture break and a water vapor retarder.

The capillary moisture break should consist of at least four inches of clean, free-draining gravel or crushed rock. The vapor retarder should meet the requirements for Class C vapor retarders stated in ASTM E1745-97. The vapor retarder should be placed in accordance with the requirements of ASTM E1643-98. These requirements include overlapping seams by six inches, taping seams, and sealing penetrations in the vapor retarder. The particle size of the gravel/crushed rock should meet the gradation requirements presented in Table 8.

TABLE 8
Gradation Requirements for Capillary Moisture Break

Sieve Size	Percentage Passing Sieve
Gravel or Crushed Rock	
1 inch	90 – 100
3/4 inch	30 – 100
1/2 inch	5 – 25
3/8 inch	0 – 6

Concrete mixes with high water/cement (w/c) ratios result in excess water in the concrete, which increases the cure time and results in excessive vapor transmission through the slab. Therefore, concrete for the floor slab should have a low w/c ratio - less than 0.45. Water should not be added in the field. If necessary, workability should be increased by adding plasticizers. In addition, the slab should be properly cured. Before the floor covering is placed, the contractor should check that the concrete surface and the moisture emission levels (if emission testing is required) meet the manufacturer’s requirements.

8.4 Permanent Below-Grade Wall Design

To construct the basement walls, the site may be open cut and/or temporarily shored. It is the responsibility of the contractor to determine the safe excavation slopes; however, we recommend cuts greater than 4 feet be no steeper than 1.5:1 (horizontal:vertical).

Because the on-site soil is expansive, we recommend designing below grade walls for at-rest lateral pressures corresponding to equivalent fluid unit weights of 70 pcf and 90 pcf for drained and undrained conditions, respectively. Because the site is in a seismically active area, the design should also be checked for seismic conditions. Under seismic loading conditions, there will be an added seismic increment that should be added to active earth pressures (Sitar et al. 2012). We used the procedures outlined in Sitar et al. (2012) and the peak ground acceleration based on the DE ground motion level (see Section 8.6) to compute the seismic pressure increment. Basement walls should be designed for the equivalent fluid weights and pressures presented in Table 9A.

TABLE 9A

Basement Wall Design Earth Pressures Backfilled with Native Soil (Drained Conditions Above Design Groundwater Level)

	Static Conditions		**Seismic Conditions[1]**
	Unrestrained Walls – Active (pcf[3])	**Restrained Walls – At-rest (pcf)**	**Total Pressure – Active Plus Seismic Pressure Increment (pcf)**
Drained Condition[2]	45	70	80
Undrained Condition	80	90	100

Notes:
1. The more critical condition of either at-rest pressure for static conditions or active pressure plus a seismic pressure increment for seismic conditions should be checked.
2. Applicable to walls that are backdrained to prevent the buildup of hydrostatic pressure.
3. pcf = pounds per cubic foot

If open cuts are made for the basement walls and select fill is used as backfill, then the walls may be designed with the earth pressures presented in Table 9B.

TABLE 9B

Basement Wall Design Earth Pressures with Select Fill Backfill (Drained Conditions Above Design Groundwater Level)

	Static Conditions		**Seismic Conditions[1]**
	Unrestrained Walls – Active (pcf[3])	**Restrained Walls – At-rest (pcf)**	**Total Pressure – Active Plus Seismic Pressure Increment (pcf)**
Drained Condition[2]	35	55	70
Undrained Condition	80	90	100

Notes:
1. The more critical condition of either at-rest pressure for static conditions or active pressure plus a seismic pressure increment for seismic conditions should be checked.
2. Applicable to walls that are backdrained to prevent the buildup of hydrostatic pressure.
3. pcf = pounds per cubic foot

Non-expansive wall backfill should consist of select fill, as described in Section 8.1. For cantilever walls retaining level backfill (i.e. landscape walls), the pressures presented on Table 9A or Table 9B may be used and will depend if the wall retains native soil (expansive) or select fill.

We understand that portions of the shoring will support buildings that will remain occupied during Phase 1 of the project. Based on the footing geometry and distances from the shoring provided by the structural engineer, we recommend that the shoring at the remaining buildings be designed for at-rest pressures and include additional surcharge pressures from the nearby footings.

If surcharge loads occur above an imaginary 45-degree line projected up from the bottom of a retaining wall, a surcharge pressure should be included in the wall design. If this condition exists, we should be consulted to estimate the added pressure on a case-by-case basis. Where truck traffic will pass within 10 feet of retaining walls, temporary traffic loads should be considered in the design of the walls. Traffic loads may be modeled by a uniform pressure of 100 pounds per square foot applied in the upper 10 feet of the walls.

The lateral earth pressures recommended for the sections above the water table are applicable to walls that are backdrained to prevent the buildup of hydrostatic pressure. One acceptable method for backdraining the wall is to place a prefabricated drainage panel against the back of the wall. The drainage panel should extend down to a four-inch-diameter perforated PVC collector pipe at the base of the walls. The pipe should be surrounded on all sides by at least four inches of Caltrans Class 2 permeable material (see Caltrans Standard Specifications Section 68-1.025) or wrapped in filter fabric (Mirafi 140N or equivalent). We should check the manufacturer’s specifications regarding the proposed prefabricated drainage panel material to verify it is appropriate for its intended use. The pipe should be connected to a suitable discharge point. As an alternative to using prefabricated drainage panel, the wall may be drained using Caltrans Class 2 permeable material (Caltrans Standard Specifications Section 68-1.025) or clean drain rock wrapped in a geotextile filter fabric (Mirafi 140N or equivalent). The gravel drain should be at least 12 inches wide and should extend up the back of the wall to about 2 feet below the ground surface; the upper 2 feet should be covered with a clay cap to reduce infiltration of surface water. A four-inch-diameter perforated PVC collector pipe should be placed within the gravel blanket near the base of the wall to drain the water to a suitable discharge. The pipe should be surrounded on all sides by at least four inches of Caltrans Class 2 permeable material or drain rock, and should be connected to a suitable discharge point.

Wall backfill should be compacted to at least 90 percent relative compaction using light compaction equipment. Wall backfill with less than 10 percent fines, or deeper than five feet, should be compacted to at least 95 percent relative compaction for its entirety. If heavy equipment is used, the wall should be appropriately designed to withstand loads exerted by the equipment and/or temporarily braced.

8.5 Concrete Pavement and Exterior Slabs

Differential ground movement due to expansive soil and settlement will tend to distort and crack the pavements and exterior improvements such as courtyards and sidewalks. Periodic repairs and replacement of exterior improvements should be expected during the life of the project. Mastic joints or other positive separations should be provided to permit any differential movements between exterior slabs and the buildings.

To reduce the potential for cracking related to expansive soil, we recommend exterior concrete flatwork be underlain by at least 12-inches of select fill, of which the upper four inches should consist of aggregate base compacted to at least 95 percent relative compaction. The subgrade should be compacted to at least 90 percent relative compaction and should provide a smooth, non-yielding surface for support of the concrete slabs.

Where rigid pavement is required for loading and service areas, we recommend a minimum of six inches of concrete for medium traffic and a minimum of eight inches of concrete for heavy traffic. The upper six inches of subgrade should be compacted to at least 95 percent relative compaction and should provide a smooth, non-yielding surface. The concrete should be underlain by at least 6 inches of Class 2 Aggregate base. Aggregate base material should conform to the current State of California Department of Transportation (Caltrans) Standard Specifications.

8.6 Seismic Design

The following subsections present the recommended site-specific response spectra and time histories (Section 8.6.1) and the code based mapped values per 2013 CBC (Section 8.6.2).

8.6.1 Site-Specific Response Spectra and Time Histories

We expect this site will experience strong ground shaking during a major earthquake on any of the nearby faults. To estimate ground shaking at the site, we developed site-specific response spectra. To estimate the ground shaking at the site, we performed a Probabilistic Seismic Hazard Analysis (PSHA) and deterministic analysis to develop site-specific horizontal response spectra for two levels of shaking corresponding to the Risk-targeted Maximum Considered Earthquake (MCE_R) and the Design Earthquake (DE) per the 2016 CBC. The MCE_R is defined in the 2016 CBC as the lesser of the probabilistic spectrum having 2 percent probability of exceedance in 50 years or the 84th percentile deterministic event on the governing fault both in the maximum direction; the DE is defined as 2/3 of the MCE_R.

The probabilistic seismic hazard analysis (PSHA) was performed using the computer code EZFRISK 8.00 (Risk Engineering 2015). This approach is based on the probabilistic seismic hazard model developed by Cornell (1973) and McGuire (1976). Our analysis modeled the faults in the Bay Area as linear sources and earthquake activities were assigned to the faults based on historical and geologic data.

Details of our analyses are presented in Appendix G. The recommended horizontal ground surface spectra are shown on Figure 7. Digitized values of the recommended MCE_R and DE spectra for the site and a damping ratio of 5 percent are presented in Table 10.

TABLE 10
Digitized Values of the Recommended MCE_R and DE Spectra

Period (seconds)	MCE_R	DE
0.01	0.817	0.545
0.10	1.607	1.071
0.20	2.027	1.351
0.30	1.964	1.309
0.40	1.774	1.182
0.50	1.620	1.080
0.60	1.450	0.966
0.75	1.254	0.836
1.00	1.005	0.670
1.50	0.708	0.472
2.00	0.542	0.361
3.00	0.387	0.254
4.00	0.288	0.192

Because site-specific procedure was used to determine the recommended MCE_R and DE response spectra, the corresponding values of S_{MS}, S_{M1}, S_{DS} and S_{D1} per Section 21.4 of ASCE 7-10 should be used as shown in Table 11.

TABLE 11
Design Spectral Acceleration Value

Parameter	**Spectral Acceleration Value (g's)**
S_{MS}	2.027
S_{M1}	1.084*
S_{DS}	1.351
S_{D1}	0.722*

* S_{M1} and S_{D1} are based on the site-specific response spectra and are governed by the spectral acceleration at a period of two seconds.

8.6.2 Code Based Mapped Values

For seismic design in accordance with the provisions of 2016 CBC/ASCE 7-10, we recommend the following:

- Risk Targeted Maximum Considered Earthquake (MCE_R) S_s and S_1 of 1.604g and 0.641g, respectively.
- Site Class C
- Site Coefficients F_A and F_V of 1.0 and 1.3
- Maximum Considered Earthquake (MCE) spectral response acceleration parameters at short periods, S_{MS}, and at one-second period, S_{M1}, of 1.604g and 0.833g, respectively.
- Design Earthquake (DE) spectral response acceleration parameters at short period, S_{DS}, and at one-second period, S_{D1}, of 1.069g and 0.555g, respectively.
- PGA_M is 0.611g

8.7 Shoring Design

As discussed in Section 7.4, a soldier-pile-and-lagging system or soil-cement-mixed columns between soldier piles are acceptable methods to retain the excavation where open cuts are not feasible. The lateral pressures recommended for designing tied-back or braced shoring systems are presented on Figures 8 and 9 for soldier pile with wood lagging and soldier pile with soil-cement columns, respectively. The passive pressures presented on Figures 8 and 9 include a safety factor of 1.5. The additional surcharge pressures from the existing footings are presented in Figures 10 and 11 and are based on a 1,000 psf uniform load and should be scaled up or down as appropriate based on the actual footing load. A cantilever soldier-pile-and-lagging shoring system can be designed to resist an active earth pressure of 35 pcf and may be designed using the same passive pressures presented on Figure 8.

The soldier piles should extend below the excavation bottom a minimum of five feet and be sufficient to achieve lateral stability and resist the downward loading of the tiebacks. Recommendations for computing penetration depth of soldier piles to resist vertical loads are presented in Section 8.7.3.

If traffic occurs within 10 feet of the shoring, a uniform surcharge load of 100 psf should be added to the design. An increase in lateral design pressure for the shoring may be required where heavy construction equipment or stockpiled materials are within a distance equal to the shoring depth. Construction equipment should not be allowed within five feet from the edge of the excavation unless the shoring is specifically designed for the appropriate surcharge. The increase in pressure should be computed after the surcharge loads are known. The anticipated deflections of the shoring system should be estimated to check if they are acceptable.

The shoring system should be designed by a licensed civil engineer experienced in the design of retaining systems, and installed by an experienced shoring specialty contractor. The shoring engineer should be responsible for the design of temporary shoring in accordance with applicable regulatory requirements. Control of ground movement will depend as much on the timeliness of installation of lateral restraint as on the design. We should review the shoring plans and a representative from our office should observe the installation of the shoring.

8.7.1 Tieback Design Criteria and Installation Procedure

Temporary tiebacks may be used to restrain the shoring. The vertical load from the temporary tiebacks should be accounted for in the design. Design criteria for tiebacks are presented on Figures 8 and 9.

Tiebacks should derive their load-carrying capacity from the soil behind an imaginary line sloping upward from a point 0.2H feet away from the bottom of the excavation and sloping upwards at 60 degrees from the horizontal, where H is the wall height in feet. Tiebacks should have a minimum unbonded length of 15 feet. All tiebacks should have a minimum bonded length of 15 feet and spaced at least four feet on center. The bottom of the excavation should not extend more than two feet below a row of unsecured tiebacks.

Tieback allowable capacity will depend upon the drilling method, hole diameter, grout pressure, and workmanship. The existing sandy soils may cave, therefore, solid flight augers should not be used for tieback installation. We recommend a smooth cased tieback installation method (such as a Klemm type rig) be used. For estimating purposes, we recommend using the skin friction values presented on Figures 8 and 9. These values include a factor of safety of about 1.5. Higher skin friction values may be used if confirmed with pre-production performance tests.

The contractor should be responsible for determining the actual length of tiebacks required to resist the lateral earth pressures imposed on the temporary retaining systems. Determination of the tieback length should be based on the contractor's familiarity with his installation method. The computed bond length should be confirmed by a performance- and proof-testing program under the observation of an engineer experienced in this type of work. Replacement tiebacks should be installed for tiebacks that fail the load test.

The first two production tiebacks and two percent of the remaining tiebacks should be performance-tested to at least 1.25 times the design load. All other temporary tiebacks should be proof-tested to at least 1.25 times the design load. Recommendations for tieback testing are presented in Section 7.7.2. The performance tests will be used to determine the load carrying capacity of the tiebacks and the residual movement. The performance-tested tiebacks should be checked 24 hours after initial lock off to confirm stress relaxation has not occurred. The geotechnical engineer should evaluate the results of the performance tests and determine if creep testing is required and select the tiebacks that should be creep tested. If any tiebacks fail to meet the proof-testing requirements, additional tiebacks should be added to compensate for the deficiency, as determined by the shoring designer.

8.7.2 Tieback Testing

We should observe tieback testing. The first two production tiebacks and two percent of the remaining tiebacks should be performance-tested to at least 1.25 times the design load. The remaining tiebacks should be confirmed by proof tests also to at least 1.25 times the design load.

The movement of each tieback should be monitored with a free-standing, tripod-mounted dial gauge during performance and proof testing. The performance test is used to verify the capacity and the load-deformation behavior of the tiebacks. It is also used to separate and identify the causes of tieback movement, and to check that the designed unbonded length has been established. In the performance test, the load is applied to the tieback in several cycles of incremental loading and unloading. During the test, the tieback load and movement are measured. The maximum test load should be held for a minimum of 10 minutes, with readings taken at 0, 1, 3, 6, and 10 minutes. If the difference between the 1- and 10-minute reading is less than 0.04 inch during the loading, the test is discontinued. If the difference is more than 0.04 inch, the holding period is extended by 50 minutes to 60 minutes, and the movements should be recorded at 15, 20, 25, 30, 45, and 60 minutes.

A proof test is a simple test used to measure the total movement of the tieback during one cycle of incremental loading. The maximum test load should be held for a minimum of 10 minutes, with readings taken at 0, 1, 2, 3, 6, and 10 minutes. If the difference between the 1- and 10-minute reading is less than 0.04 inch, the test is discontinued. If the difference is more than 0.04 inch, the holding period is extended by 50 minutes to 60 minutes, and the movements should be recorded at 15, 20, 25, 30, 45, and 60 minutes.

We should evaluate the tieback test results and determine whether the tiebacks are acceptable. A performance- or proof-tested tieback with a ten-minute hold is acceptable if the tieback carries the maximum test load with less than 0.04 inch movement between one and 10 minutes, and total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

A performance- or proof-tested tieback with a 60-minute hold is acceptable if the tieback carries the maximum test load with less than 0.08 inch movement between six and 60 minutes, and total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length. Tiebacks that failed to meet the first criterion will be assigned a reduced capacity.

If the total movement of the tiebacks at the maximum test load does not exceed 80 percent of the theoretical elastic elongation of the unbonded length, the contractor should replace the tiebacks.

8.7.3 Penetration Depth of Soldier Piles

The shoring designer should evaluate the required penetration depth of the soldier piles. The soldier piles should have sufficient axial capacity to support the vertical load component of the tiebacks and the vertical load acting on the piles, if any. To compute the axial capacity of the piles, we recommend using an allowable friction of 1,000 psf on the perimeter of the piles below the excavation level.

8.8 Green Roof

The project will include the construction of an approximately 30 acre, base isolated green roof over the majority of the proposed buildings. The green roof will include slopes up to about 22 percent and is proposed to include pedestrian trails, meadows, orchards, gardens, and a children's play area. As currently proposed, the roof will include shear keys to retain a combination of lightweight expanded polystyrene (EPS) foam blocks and soil.

The shear keys should be designed to resist the potential sliding mass of the soil and EPS foam blocks.

The estimated sliding forces assuming an average soil thickness of 20 inches and horizontal and vertical acceleration at the roof surface of 0.5g and 0.2g, respectively, are presented in Table 12.

TABLE 12
Sliding Forces on Roof Shear Keys

Roof Slope	Net Load to Resist (lb/ft/ft)[1]
22	107
20	104
15	97
10	90
5	83

Notes: 1. Net loads do not include a factor of safety and should be applied at the mid-height of the shear key.

8.9 Asphalt Pavements

The State of California flexible pavement design method was used to develop the recommended asphalt concrete pavement sections. We expect the final soil subgrade in asphalt-paved areas will generally consist of fill. On the basis of the laboratory test results on this soil, we selected an R-value of 9 for design. If the existing subgrade will be raised beneath the paved areas, the fill material should have an R-value of 9 or higher. Therefore, additional tests should be performed on the proposed fill to measure its R-value prior to the fill being imported onto the site. Depending on the results of the tests, the pavement design may need to be revised.

For our calculations, we assumed a Traffic Index (TI) of 4 for automobile parking areas with occasional trucks, and 5 and 6 for driveways and truck-use areas; these TIs should be confirmed by the project civil engineer. Table 13 presents our recommendations for asphalt pavement sections.

TABLE 13
Pavement Section Design

TI	Asphaltic Concrete (inches)	Class 2 Aggregate Base R = 78 (inches)
4	2.5	7
5	3	9
6	4	11

Pavement components should conform to the current Caltrans Standard Specifications. The upper six inches of the soil subgrade in pavement areas should be moisture-conditioned to above optimum and compacted to at least 95 percent relative compaction and rolled to provide a smooth non-yielding surface. Aggregate base should be compacted to at least 95 percent relative compaction.

8.10 Utilities

The corrosivity report provided in Appendix F of this report should be reviewed and corrosion protection measures used if needed. A corrosion engineer should be retained if detailed recommendations are needed.

Utility trenches should be excavated a minimum of four inches below the bottom of pipes or conduits and have clearances of at least four inches on both sides. Where necessary, trench excavations should be shored and braced, in accordance with all safety regulations, to prevent cave-ins. If sheet piling is used as shoring, and is to be removed after backfilling, it should be placed a minimum of two feet away from the pipes or conduits to prevent disturbance to them as the sheet piles are extracted. It may be difficult to drive sheet piles if cobbles, coarse grained gravel layers or buried obstructions are encountered.

Backfill for utility trenches should be compacted according to the recommendations presented for the general site fill. Jetting of trench backfill should not be permitted. To provide uniform support, pipes or conduits should be bedded on a minimum of four inches of sand or fine gravel. After pipes and conduits are tested, inspected (if required), and approved, they should be covered to a depth of six inches with sand or fine gravel, which should then be mechanically tamped or compacted with a vibratory plate. Backfill should be placed in lifts of eight inches or less, moisture-conditioned, and compacted to at least 90 percent relative compaction. If sand or gravel with less than 10 percent fines (particles passing the No. 200 sieve) is used, it should be compacted to 95 percent relative compaction.

Special care should be taken in controlling utility backfilling in pavement areas. Poor compaction may cause excessive settlements, resulting in damage to exterior improvements.

Where utility trenches backfilled with sand or gravel enter the building pads, an impermeable plug consisting of low-expansion potential clay or lean concrete, at least five feet in length, should be installed at the building line. Further, where sand- or gravel-backfilled trenches cross planter areas and pass below asphalt or concrete pavements, a similar plug should be placed at the edge of the pavement. The purpose of these plugs is to reduce the potential for water to become trapped in trenches beneath the building or pavements. This trapped water can cause heaving of soils beneath slabs and softening of subgrade soil beneath pavements.

8.11 Site Drainage

Positive surface drainage should be provided around the building to direct surface water away from the existing building foundations. To reduce the potential for water ponding adjacent to the buildings, we recommend the ground surface within a horizontal distance of five feet from the buildings be designed to slope down and away from the buildings with a surface gradient of at least two percent in unpaved areas and one percent in paved areas. In addition, roof downspouts should be discharged into controlled drainage facilities to keep the water away from the foundations.

8.12 Bioretention Systems

Bioretention areas are landscaping features used to treat stormwater runoff within a development site. They are commonly located in parking lot islands and landscape areas. Surface runoff is directed into shallow, landscaped depressions, which usually include mulch and a prepared soil mix. Typically, the filtered runoff is collected in a perforated underdrain beneath the bioretention system and returned to the storm drain system. For larger storms, runoff is generally diverted past the bioretention areas to the storm drain system.

The soil within a bioretention system should typically have an infiltration rate sufficient to draw down any pooled water within 48 hours after a storm event. Based on the "Bioretention Manual" prepared by The Prince George's County (2007), the infiltration rate of the bioretention soil is recommended to exceed ½ inch per hour; cohesionless soils like sand meet this criterion. Cohesive soils like clay and silts do not meet the infiltration rate requirement and are considered unsuitable in a bioretention system, particularly when they are expansive. For areas where there are unsuitable in-situ soils, the bioretention system can be created by importing a suitable soil mix and providing an underdrain. Based on our observation of the soil at the site, the in-situ clays are relatively impervious and do not meet the infiltration rate requirements. The bioretention system will need to be constructed with suitable imported soil and include an underdrain system.

Underdrains are typically at the invert of the bioretention system to intercept water that does not infiltrate into the surrounding soils. Underdrains consist of a perforated PVC pipe in a gravel blanket. The gravel should be virgin rock, double washed, uniformly graded and should be ½ inch to 1½ inches in diameter. It should also be wrapped in a filter fabric (Mirafi 140N or equivalent). The perforated PVC pipe cross-section area should be determined based on the desired hydraulic conductivity of the underdrain. The PVC pipe should be bedded on two to three inches of gravel and covered with gravel and a filter fabric (Mirafi 140NC or equivalent).

Because of the presence of near surface expansive soil, bioretention systems should be set back a minimum of five feet from building foundations, slabs, concrete flatwork or pavements. If the five feet setback cannot be maintained and the bioretention system needs to be closer, then footings within 5 feet of bioretention systems should extend at least 12 inches below the bottom of the bioretention system and the bioretention area should be lined with a High-Density polyethylene (HDPE) liner and an underdrain be included. Overflow from bioretention areas should be directed to the storm drain system away from building foundations and slabs.

Typically, the bottom of the bioretention system is recommended to be a minimum of two feet or more above the groundwater table.

8.13 Construction Monitoring

The conditions of existing buildings and other improvements within 100 feet of the site should be photographed and surveyed prior to the start of construction and monitored periodically during construction.

To monitor ground movements, groundwater levels, and shoring movements, we recommend installing survey points on the adjacent buildings and streets that are within 100 feet of the site. In addition, survey points should be installed at the tops of the shoring walls at 20-foot-spacing.

The survey points should be read regularly and the results should be submitted to us in a timely manner for review. For estimating purposes, assume that the survey points will be read as follows:

- after installing soldier piles
- weekly during excavation work
- after the excavation reaches the planned excavation level
- every two weeks until the street-level floor slab is constructed

9.0 ADDITIONAL GEOTECHNICAL SERVICES

During final design we should be retained to consult with the design team as geotechnical questions arise. Prior to construction, we should review the project plans and specifications to check their conformance with the intent of our recommendations. We should also review shoring design and installation submittals. During construction, we should observe site preparation, excavation, shoring installation, tieback testing, compaction of fill and backfill, preparation of mat subgrade and subgrade of footing excavations.. These observations will allow us to compare the actual with the anticipated soil conditions and to check that the contractors' work conforms to the geotechnical aspects of the plans and specifications.

10.0 LIMITATIONS

The conclusions and recommendations provided in this report result from our interpretation of the geotechnical conditions existing at the site inferred from a limited number of borings as well as architectural information provided by Rafael Vinoly Architects. Actual subsurface conditions could vary. Recommendations provided are dependent upon one another and no recommendation should be followed independent of the others. Any proposed changes in structures, depths of excavation, or their locations should be brought to Langan's attention as soon as possible so that we can determine whether such changes affect our recommendations. Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of investigation. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation, as they may affect our recommendations.

This report has been prepared to assist the Owner, architect, and structural engineer in the design process and is only applicable to the design of the specific project identified. The information in this report cannot be utilized or depended on by engineers or contractors who are involved in evaluations or designs of facilities on adjacent properties which are beyond the limits of that which is the specific subject of this report.

Environmental issues (such as permitting or potentially contaminated soil and groundwater) are outside the scope of this study and should be addressed in a separate evaluation.

REFERENCES

Abrahamson, N.A., Silva, W.J., and Kamai, R. (2014). Summary of the ASK14 ground-motion relation for active crustal regions: Earthquake Spectra, v. 30, n. 3, p. 1025-1055.

Abrahamson, N. A. (2000). "Effect of rupture directivity on probabilistic seismic hazard analysis." Proceedings of Sixth International Conference on Seismic Zonation, Palm Springs, California, November.

ASCE/SEI 7-10 (2010). Minimum Design Loads for Buildings and Other Structures.

Bozorgnia, Y. and Campbell, K. W. (2004). "The vertical-to-horizontal response spectra ratio and tentative procedures for developing simplified V/H and vertical design spectra" Journal of Earthquake Engineering, 8(2), 175-207.

Boore, D.M., Stewart, J.P., Seyhan, E., and Atkinson, G.M. (2014). NGA-West 2 equations for predicting PGA, PGV, and 5%-damped PSA for shallow crustal earthquakes, Earthquake Spectra, v. 30, n. 3, p. 1057-1085.

California Building Standards Commission (2013). California Building Code.

California Department of Conservation Division of Mines and Geology (1997). *Guidelines for Evaluating and Mitigating Seismic Hazards in California*. Special Publication 117.

California Division of Mines and Geology (1996). *Probabilistic Seismic Hazard Assessment for the State of California*, CDMG Open-File Report 96-08.

California Division of Mines and Geology (1974). "State of California Special Studies Zones, Cupertino Quadrangle", prepared by the California Geologic Survey.

California Division of Mines and Geology (2002a). "Seismic Hazard Zone Report for the Cupertino 7.5-Minute Quadrangle, Santa Clara County, California, prepared by the California Geologic Survey", Seismic Hazard Zone Report 068.

California Division of Mines and Geology (2002b). "State of California Seismic Hazard Zones, Cupertino Quadrangle", prepared by the California Geologic Survey.

Campbell, K.W., and Bozorgnia, Y. (2014). NGA-West2 ground motion model for the average horizontal components of PGA, PGV, and 5%-damped linear acceleration response spectra: Earthquake Spectra, v. 30, n. 3, p. 1087-1115.

Chiou, B.S.-J. and Youngs, R.R. (2014). Update of the Chiou and Youngs NGA model for the average horizontal component of peak ground motion and response spectra, Earthquake Spectra, v. 30, n. 3, p. 1117-1153.

Cao, T., Bryant, W. A., Rowshandel, B., Branum D. and Wills, C. J. (2003). "The Revised 2002 California Probabilistic Seismic Hazard Maps."

REFERENCES
(Continued)

Chiou, B. S.-J., and Youngs, R. R. (2008). “An NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra”. Earthquake Spectra, 24(1), 173-215.

Cornell, C. A. (1968). “Engineering Seismic Risk Analysis.” Bulletin of the Seismological Society of America, 58(5).

County of Santa Clara (2015). “Geologic Hazard Zones” Maps. Scale 1:24,000.

Holzer, T.L. et al. (2008). “Liquefaction Hazard Maps for Three Earthquake Scenarios for the Communities of San Jose, Campbell, Cupertino, Los Altos, Los Gatos, Milpitas, Mountain View, Palo Alto, Santa Clara, Saratoga and Sunnyvale, Northern Santa Clara County.” USGS Open File Report 2008-1270.

Idriss, I.M. and Boulanger, R.W. (2008). “Soil Liquefaction During Earthquakes.” Earthquake Engineering Research Institute. Monograph MNO-12.

Idriss, I. M. (1993). “Procedures for Selecting Earthquake Ground Motions at Rock Sites.” National Institute of Standards and Technology, NIST GCR 93-625, 12 p. plus appendix.

Lienkaemper, J. J. (1992). “Map of recently active traces of the Hayward Fault, Alameda and Contra Costa counties, California.” Miscellaneous Field Studies Map MG-2196.

McGuire, R. K. (1976). “FORTRAN computer program for seismic risk analysis.” U.S. Geological Survey, Open-File Report 76-67.

Pradel, Daniel (1998). “Procedure to Evaluate Earthquake-Induced Settlements in Dry Sand,” Journal of Geotechnical and Geoenvironmental Engineering, April, and errata October 1998, pp1048.

Nichols, D.R., and N.A. Wright (1971). “Preliminary map of historic margins of marshland, San Francisco Bay, California: USGS Open-File-Report.

Rafael Viñoly Architects (2016). “The Hills at Vallco” Sheets A-A1101 through A-A1111, A3-101 through A-3103, Schematic Design Documents, dated 8/12/16.

Risk Engineering Inc. (2015). “EZFRISK computer program.” Version 8.00

Sandis (2016). “The Hills at Vallco, Demolition Package, Cupertino, CA, Topography Survey”, Sheets CD.00.01.00, CD.02.01.01, CD.02.01.02, CD.01.01.03 through CD.01.01.07, dated 9/20/16

REFERENCES
(Continued)

Seed, H.B. and Idriss, I.M. (1971). "Simplified Procedure for Evaluating Soil Liquefaction during Earthquakes," Journal of Geotechnical Engineering Division, ASCE, 97 (9), 1249-1273.

Seed, H.B., R.B. Seed, L.F. Harder and H.L. Jong, 1988, "Re-evaluation of the Slide in the Lower San Fernando Dam in the Earthquake of February 9, 1971." Report No. UCB/EERC-88/04, University of California, Berkeley, April.

Shahi, S. K. and Baker J. W. (2014). "NGA-West 2 Models for Ground Motion Directionality." *Earthquake Spectra*. Volume 30. No. 3. Pages 1285-1300.

Sitar, N., E.G. Cahill and J.R. Cahill (2012). "Seismically Induced Lateral Earth Pressures on Retaining Structures and Basement Walls."

Treadwell & Rollo (2013). "Geotechnical Data Report, Pruneridge Theatre Site, Cupertino, California."

Tokimatsu, K. and Seed, H.B. (1987). "Evaluation of Settlements in Sand due to Earthquake Shaking." Journal of Geotechnical Engineering, Vol. 113, No. 8, pp. 861-878.

Toppozada, T. R. and Borchardt G. (1998). "Re-Evaluation of the 1836 "Hayward Fault" and the 1838 San Andreas Fault earthquakes." Bulletin of Seismological Society of America, 88(1), 140 159.

Townley, S. D. and Allen, M. W. (1939). "Descriptive catalog of earthquakes of the Pacific coast of the United States 1769 to 1928." Bulletin of the Seismological Society of America, 29(1).

TRC (2015). "Preliminary Geotechnical Investigation, The Hills at Vallco, Cupertino, California." Report Number 228550.

Wells, D. L. and Coppersmith, K. J. (1994). "New Empirical Relationships among Magnitude, Rupture Length, Rupture Width, Rupture Area, and Surface Displacement." Bulletin of the Seismological Society of America, 84(4), 974-1002.

Wesnousky, S. G. (1986). "Earthquakes, Quaternary Faults, and Seismic Hazards in California." Journal of Geophysical Research, 91(1312).

2014 Working Group on California Earthquake Probabilities, 2015, "UCERF3: A new earthquake forecast for California's complex fault system", U.S. Geological Survey 2015–3009, 6 p., http://dx.doi.org/10.3133/fs20153009.

Working Group on California Earthquake Probabilities (WGCEP) (2003). "Summary of Earthquake Probabilities in the San Francisco Bay Region: 2002 to 2031." Open File Report 03-214.

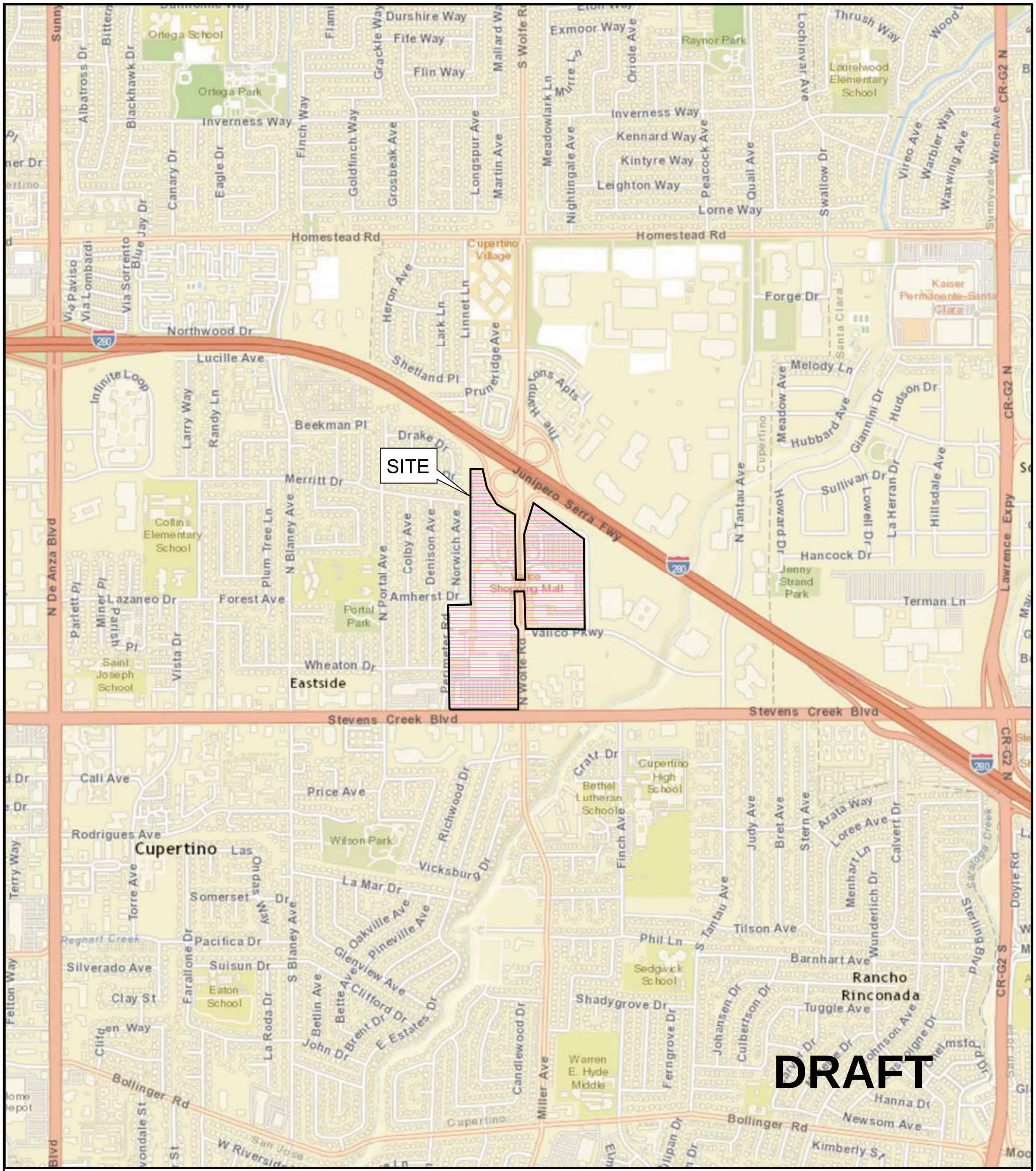
REFERENCES
(Continued)

Youd, T.L., and Idriss, I.M. (2001). "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils," Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 4.

Youd, T.L., and Garris, C.T. (1995). "Liquefaction-induced ground-surface disruption." Journal of Geotechnical Engineering, American Society of Civil Engineers, Vol. 121, 805-809.

Youngs, R. R., and Coppersmith, K. J. (1985). "Implications of fault slip rates and earthquake recurrence models to probabilistic seismic hazard estimates." Bulletin of the Seismological Society of America, 75( ), 939-964.

FIGURES



NOTES:

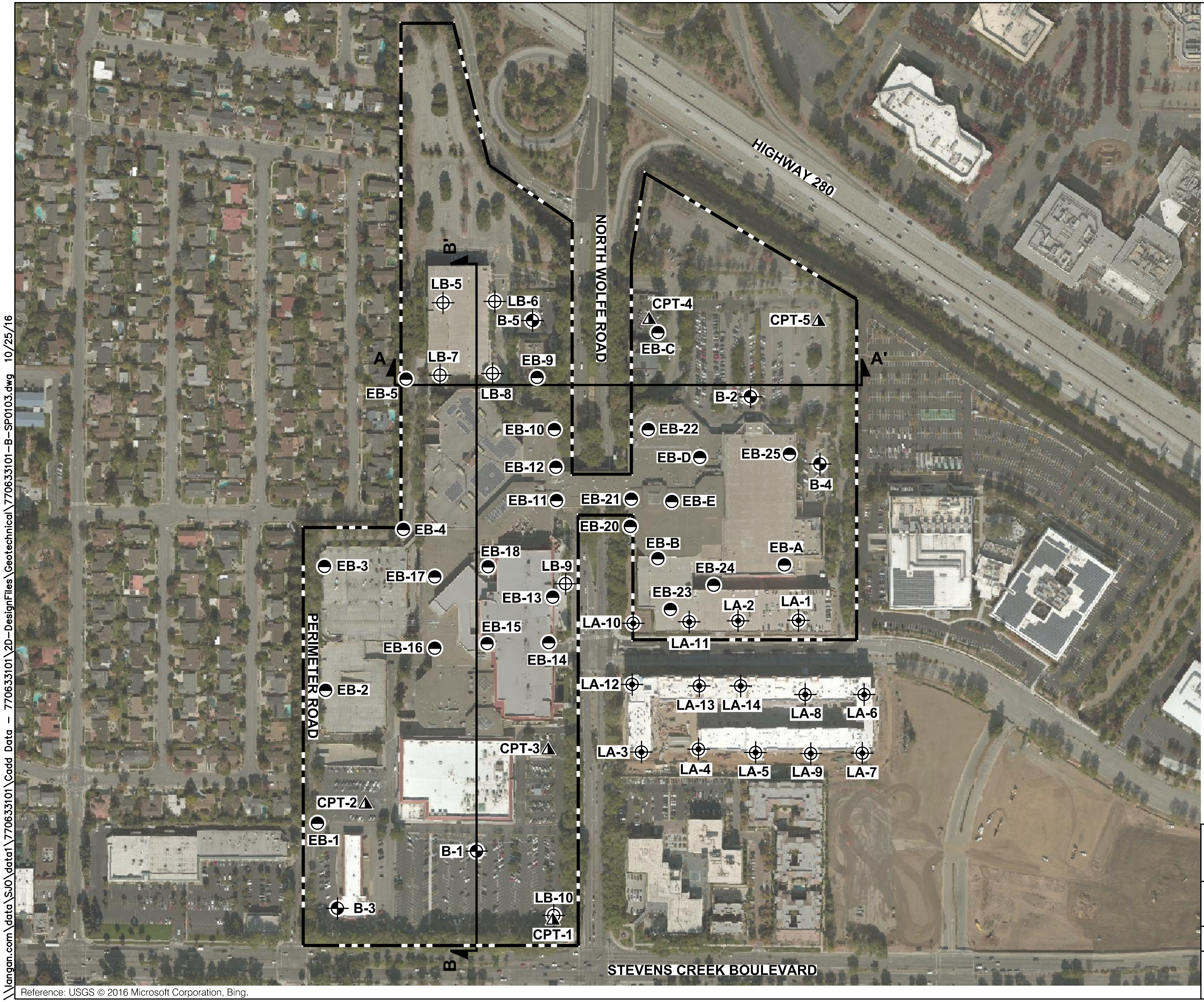
World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online.
Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

THE HILLS AT VALLCO
Cupertino, California

LANGAN

SITE LOCATION MAP

Date 10/17/16	Project No. 770633101	Figure 1



Reference: USGS © 2016 Microsoft Corporation, Bing.

EXPLANATION

B-1 ⊕	Approximate location of boring by Langan Treadwell Rollo, September 2016
CPT-1 ▲	Approximate location of cone penetration test by Langan Treadwell Rollo, September 2016
LB-5 ⊕	Approximate location of boring by Lowney Associates, 2005
LA-1 ⊕	Approximate location of boring by Lowney Associates, 1999
EB-1 EB-A ◒	Approximate location of boring by Lowney-Kaldveer Associates, 1974
━ ━ ━	Approximate site boundary
A A'	Idealized subsurface profile location

DRAFT

0 300 Feet
Approximate scale

THE HILLS AT VALLCO
Cupertino, California

SITE PLAN

Date 09/29/16	Project No. 770633101	Figure 2

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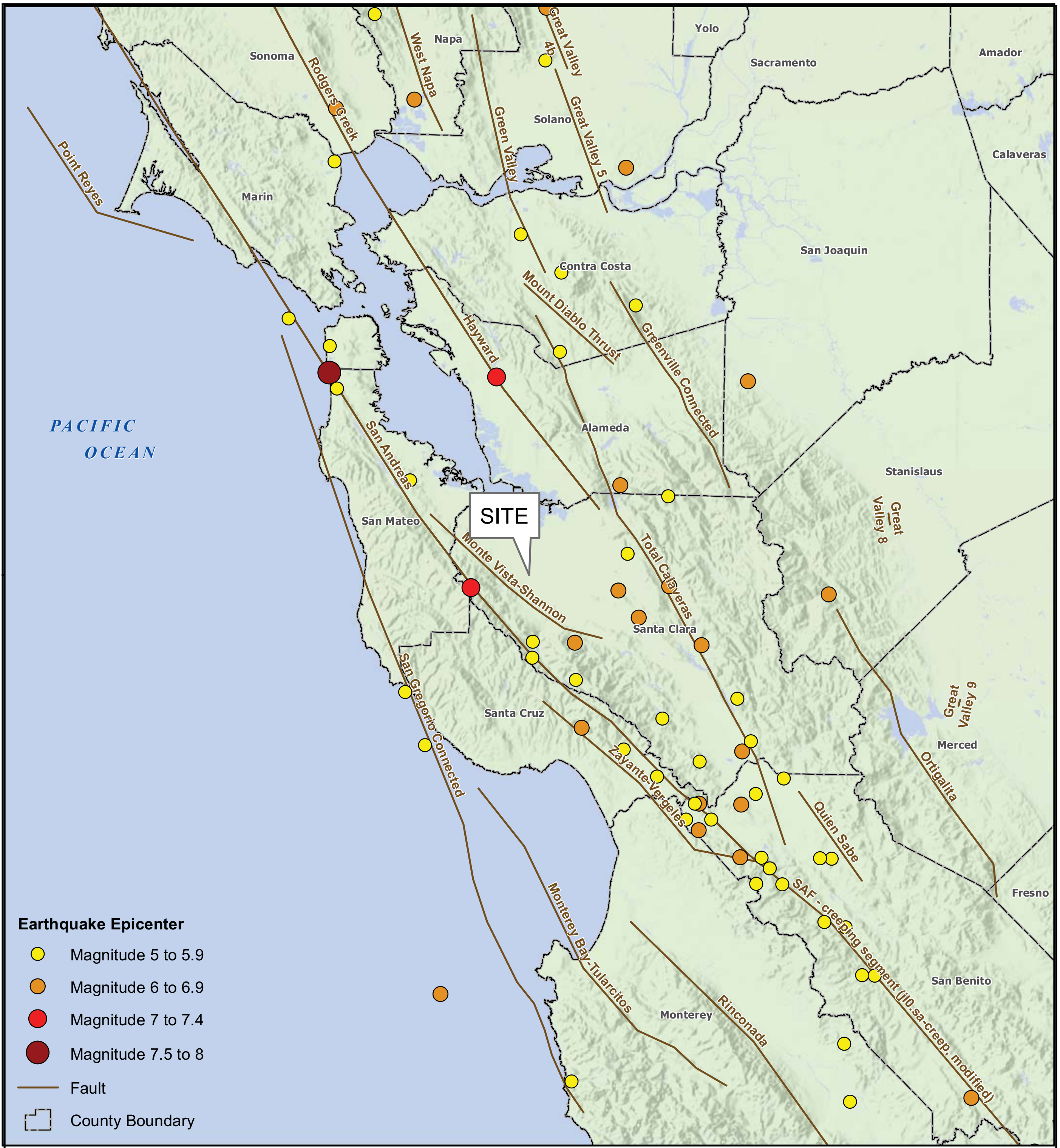
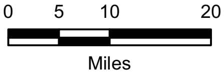


Notes:

1. Quaternary fault data displayed are based on a generalized version of USGS Quaternary Fault and fold database, 2010. For cartographic purposes only.
2. The Earthquake Epicenter (Magnitude) data is provided by the U.S Geological Survey (USGS) and is current through 08/26/2014.
3. Basemap hillshade and County boundaries provided by USGS and California Department of Transportation.
4. Map displayed in California State Coordinate System, California (Teale) Albers, North American Datum of 1983 (NAD83), Meters.



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THE HILLS AT VALLCO
Cupertino, California

LANGAN

MAP OF MAJOR FAULTS AND EARTHQUAKE EPICENTERS IN THE SAN FRANCISCO BAY AREA

Date 10/19/16	Project No. 770633101	Figure 5

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I **Not felt by people, except under especially favorable circumstances. However, dizziness or nausea may be experienced.**

Sometimes birds and animals are uneasy or disturbed. Trees, structures, liquids, bodies of water may sway gently, and doors may swing very slowly.

II **Felt indoors by a few people, especially on upper floors of multi-story buildings, and by sensitive or nervous persons.**

As in Grade I, birds and animals are disturbed, and trees, structures, liquids and bodies of water may sway. Hanging objects swing, especially if they are delicately suspended.

III **Felt indoors by several people, usually as a rapid vibration that may not be recognized as an earthquake at first. Vibration is similar to that of a light, or lightly loaded trucks, or heavy trucks some distance away. Duration may be estimated in some cases.**

Movements may be appreciable on upper levels of tall structures. Standing motor cars may rock slightly.

IV **Felt indoors by many, outdoors by a few. Awakens a few individuals, particularly light sleepers, but frightens no one except those apprehensive from previous experience. Vibration like that due to passing of heavy, or heavily loaded trucks. Sensation like a heavy body striking building, or the falling of heavy objects inside.**

Dishes, windows and doors rattle; glassware and crockery clink and clash. Walls and house frames creak, especially if intensity is in the upper range of this grade. Hanging objects often swing. Liquids in open vessels are disturbed slightly. Stationary automobiles rock noticeably.

V **Felt indoors by practically everyone, outdoors by most people. Direction can often be estimated by those outdoors. Awakens many, or most sleepers. Frightens a few people, with slight excitement; some persons run outdoors.**

Buildings tremble throughout. Dishes and glassware break to some extent. Windows crack in some cases, but not generally. Vases and small or unstable objects overturn in many instances, and a few fall. Hanging objects and doors swing generally or considerably. Pictures knock against walls, or swing out of place. Doors and shutters open or close abruptly. Pendulum clocks stop, or run fast or slow. Small objects move, and furnishings may shift to a slight extent. Small amounts of liquids spill from well-filled open containers. Trees and bushes shake slightly.

VI **Felt by everyone, indoors and outdoors. Awakens all sleepers. Frightens many people; general excitement, and some persons run outdoors.**

Persons move unsteadily. Trees and bushes shake slightly to moderately. Liquids are set in strong motion. Small bells in churches and schools ring. Poorly built buildings may be damaged. Plaster falls in small amounts. Other plaster cracks somewhat. Many dishes and glasses, and a few windows break. Knickknacks, books and pictures fall. Furniture overturns in many instances. Heavy furnishings move.

VII **Frightens everyone. General alarm, and everyone runs outdoors.**

People find it difficult to stand. Persons driving cars notice shaking. Trees and bushes shake moderately to strongly. Waves form on ponds, lakes and streams. Water is muddied. Gravel or sand stream banks cave in. Large church bells ring. Suspended objects quiver. Damage is negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Plaster and some stucco fall. Many windows and some furniture break. Loosened brickwork and tiles shake down. Weak chimneys break at the roofline. Cornices fall from towers and high buildings. Bricks and stones are dislodged. Heavy furniture overturns. Concrete irrigation ditches are considerably damaged.

VIII **General fright, and alarm approaches panic.**

Persons driving cars are disturbed. Trees shake strongly, and branches and trunks break off (especially palm trees). Sand and mud erupts in small amounts. Flow of springs and wells is temporarily and sometimes permanently changed. Dry wells renew flow. Temperatures of spring and well waters varies. Damage slight in brick structures built especially to withstand earthquakes; considerable in ordinary substantial buildings, with some partial collapse; heavy in some wooden houses, with some tumbling down. Panel walls break away in frame structures. Decayed pilings break off. Walls fall. Solid stone walls crack and break seriously. Wet grounds and steep slopes crack to some extent. Chimneys, columns, monuments and factory stacks and towers twist and fall. Very heavy furniture moves conspicuously or overturns.

IX **Panic is general.**

Ground cracks conspicuously. Damage is considerable in masonry structures built especially to withstand earthquakes; great in other masonry buildings - some collapse in large part. Some wood frame houses built especially to withstand earthquakes are thrown out of plumb, others are shifted wholly off foundations. Reservoirs are seriously damaged and underground pipes sometimes break.

X **Panic is general.**

Ground, especially when loose and wet, cracks up to widths of several inches; fissures up to a yard in width run parallel to canal and stream banks. Landsliding is considerable from river banks and steep coasts. Sand and mud shifts horizontally on beaches and flat land. Water level changes in wells. Water is thrown on banks of canals, lakes, rivers, etc. Dams, dikes, embankments are seriously damaged. Well-built wooden structures and bridges are severely damaged, and some collapse. Dangerous cracks develop in excellent brick walls. Most masonry and frame structures, and their foundations are destroyed. Railroad rails bend slightly. Pipe lines buried in earth tear apart or are crushed endwise. Open cracks and broad wavy folds open in cement pavements and asphalt road surfaces.

XI **Panic is general.**

Disturbances in ground are many and widespread, varying with the ground material. Broad fissures, earth slumps, and land slips develop in soft, wet ground. Water charged with sand and mud is ejected in large amounts. Sea waves of significant magnitude may develop. Damage is severe to wood frame structures, especially near shock centers, great to dams, dikes and embankments, even at long distances. Few if any masonry structures remain standing. Supporting piers or pillars of large, well-built bridges are wrecked. Wooden bridges that "give" are less affected. Railroad rails bend greatly and some thrust endwise. Pipe lines buried in earth are put completely out of service.

XII **Panic is general.**

Damage is total, and practically all works of construction are damaged greatly or destroyed. Disturbances in the ground are great and varied, and numerous shearing cracks develop. Landslides, rock falls, and slumps in river banks are numerous and extensive. Large rock masses are wrenched loose and torn off. Fault slips develop in firm rock, and horizontal and vertical offset displacements are notable. Water channels, both surface and underground, are disturbed and modified greatly. Lakes are dammed, new waterfalls are produced, rivers are deflected, etc. Surface waves are seen on ground surfaces. Lines of sight and level are distorted. Objects are thrown upward into the air.

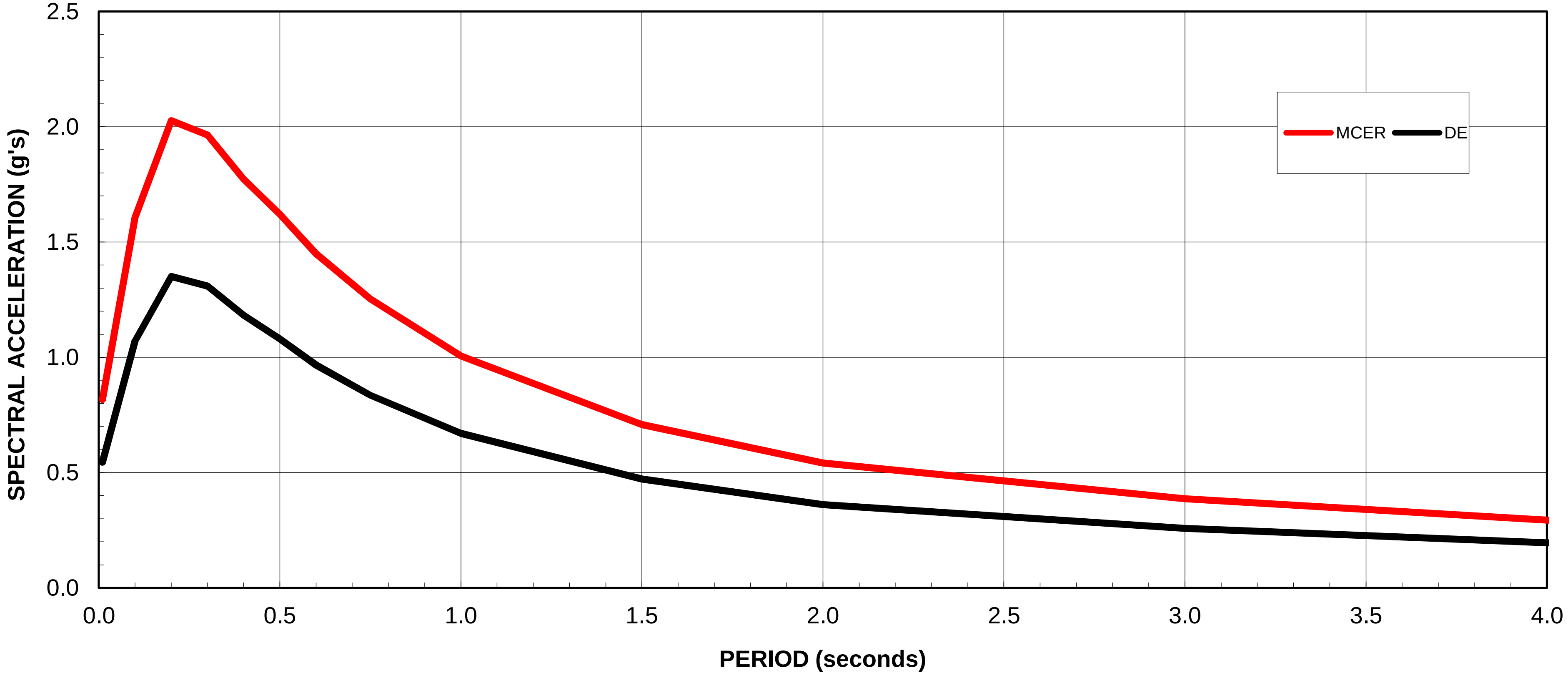
DRAFT

THE HILLS AT VALLCO
Cupertino, California

MODIFIED MERCALLI INTENSITY SCALE

LANGAN

Date 10/19/16 | Project No. 770633101 | Figure 6



Damping Ratio = 5%

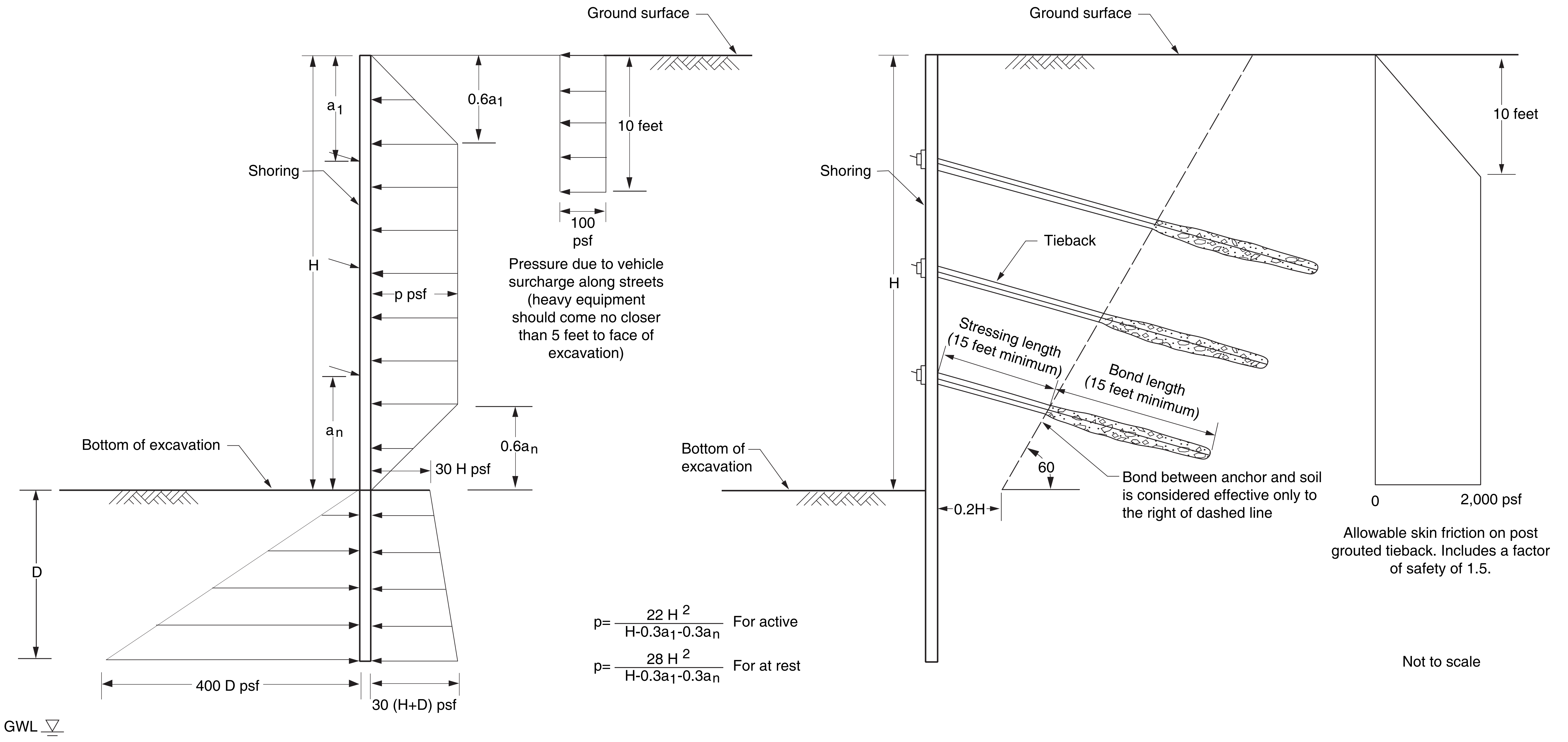
DRAFT

THE HILLS AT VALLCO
Cupertino, California

RECOMMENDED SPECTRA

Date 10/07/14	Project No. 770633101	Figure 7

LANGAN



$$p=\frac{22\ H^2}{H-0.3a_1-0.3a_n}\quad \text{For active}$$

$$p=\frac{28\ H^2}{H-0.3a_1-0.3a_n}\quad \text{For at rest}$$

DRAFT

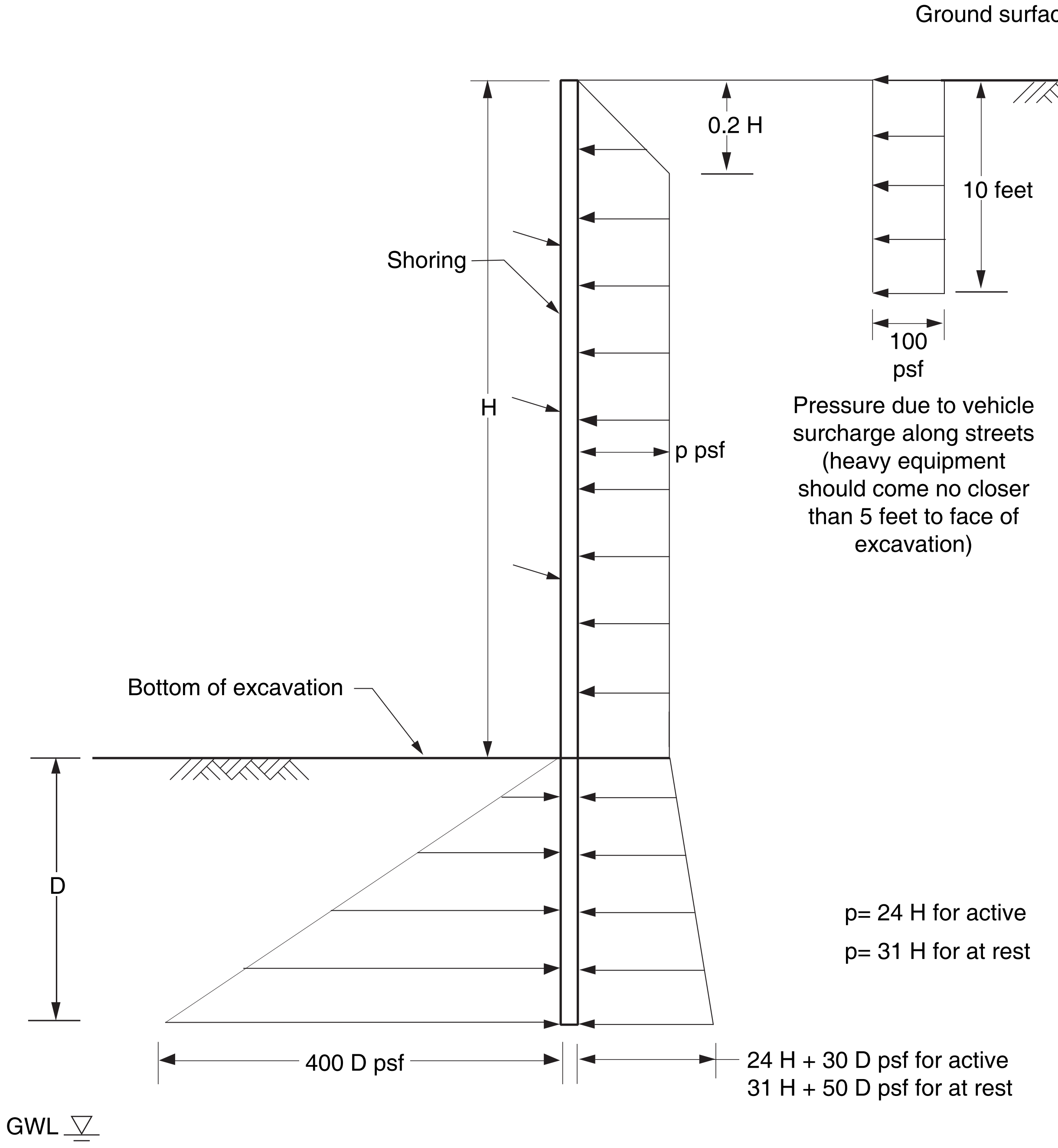
Notes:
1. Passive pressure includes a factor of safety of about 1.5.
2. For soldier piles spaced at more than three times the soldier pile diameter, the passive pressure should be assumed to act over three diameters.
3. Active pressure below the excavation should be assumed to act over one pile diameter.
4. For shoring that will support long term excavations add a seismic lateral earth pressure of 32 pcf (equivalent fluid weight) to the active condition and design for the larger of either active plus seismic or at-rest cases.
5. Where the shoring is adjacent to buildings, the shoring should be designed for the additional building surcharge loads presented on Figures 8 and 9.

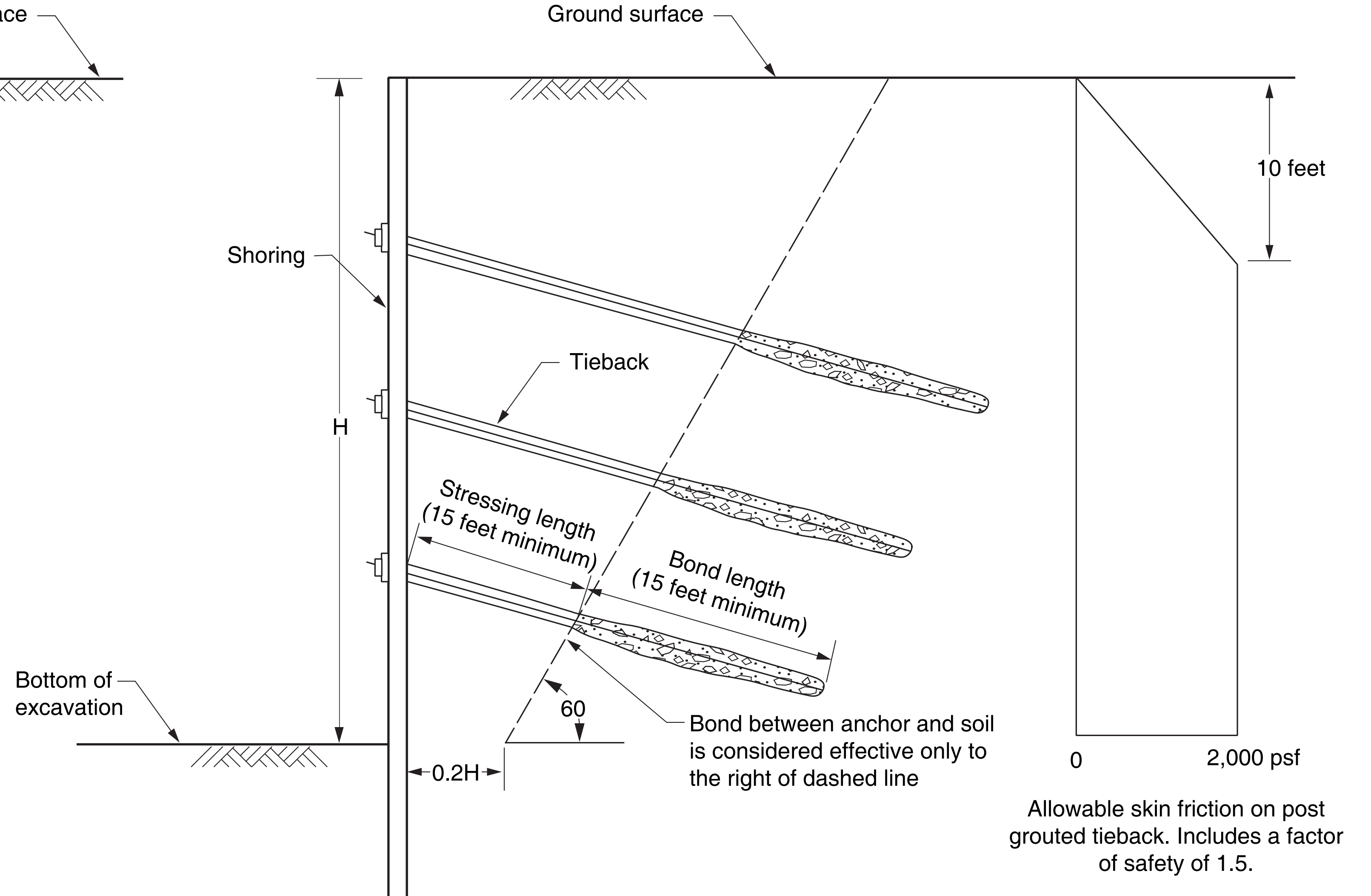
THE HILLS AT VALLCO
Cupertino, California

DESIGN PARAMETERS FOR
SOLDIER-PILE-AND-LAGGING SHORING SYSTEM

Date 10/13/16 | Project No. 770633101 | Figure 8

LANGAN





Not to scale

DRAFT

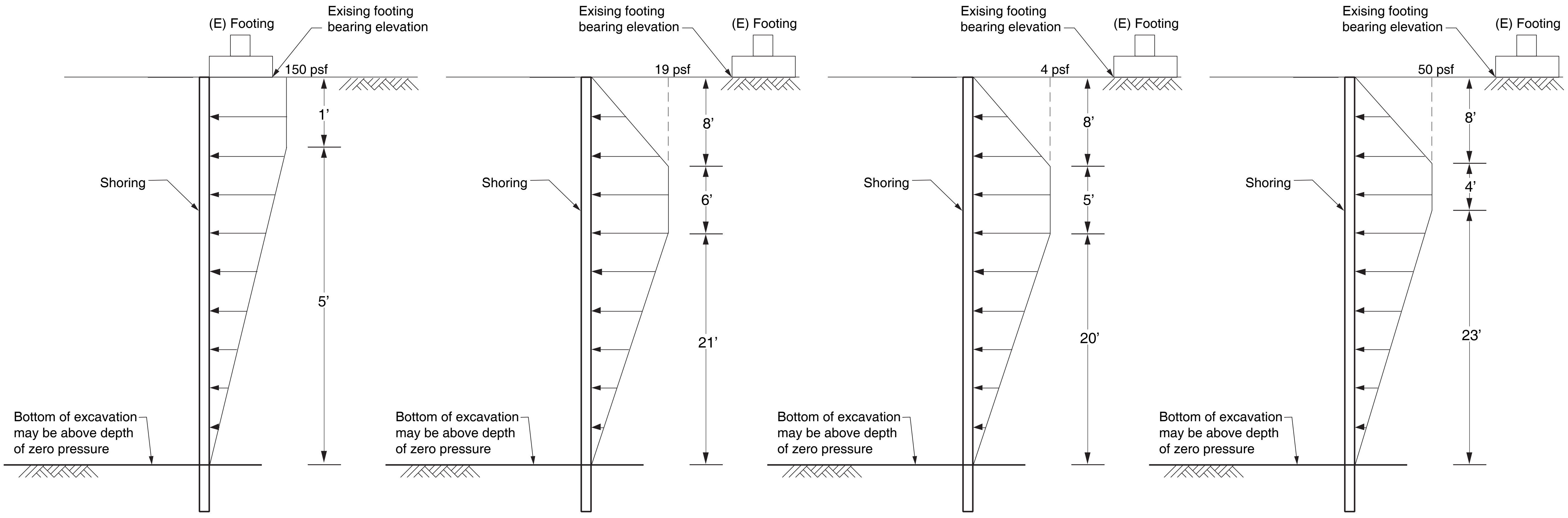
Notes:
1. Passive pressure includes a factor of safety of about 1.5.
2. For soldier piles spaced at more than three times the soldier pile diameter, the passive pressure should be assumed to act over three diameters.
3. Active pressure below the excavation should be assumed to act over one pile diameter.
4. For shoring that will support long term excavations add a seismic lateral earth pressure of 32 pcf (equivalent fluid weight) to the active condition and design for the larger of either active plus seismic or at-rest cases.
5. Where the shoring is adjacent to buildings, the shoring should be designed for the additional building surcharge loads presented on Figures 8 and 9.

THE HILLS AT VALLCO
Cupertino, California

DESIGN PARAMETERS FOR SOLDIER-PILE-AND-SOIL-CEMENT SHORING SYSTEM

Date 10/13/16	Project No. 770633101	Figure 9

LANGAN



CASE A
4-FOOT SQUARE FOOTING
AT SHORING

CASE B
9-FOOT 9-INCH SQUARE FOOTING
AT 14-FEET FROM SHORING

CASE C
4-FOOT SQUARE FOOTING
AT 16-FEET FROM SHORING

CASE D
16-FOOT SQUARE FOOTING
AT 11-FEET FROM SHORING

DRAFT

Not To Scale

Note:

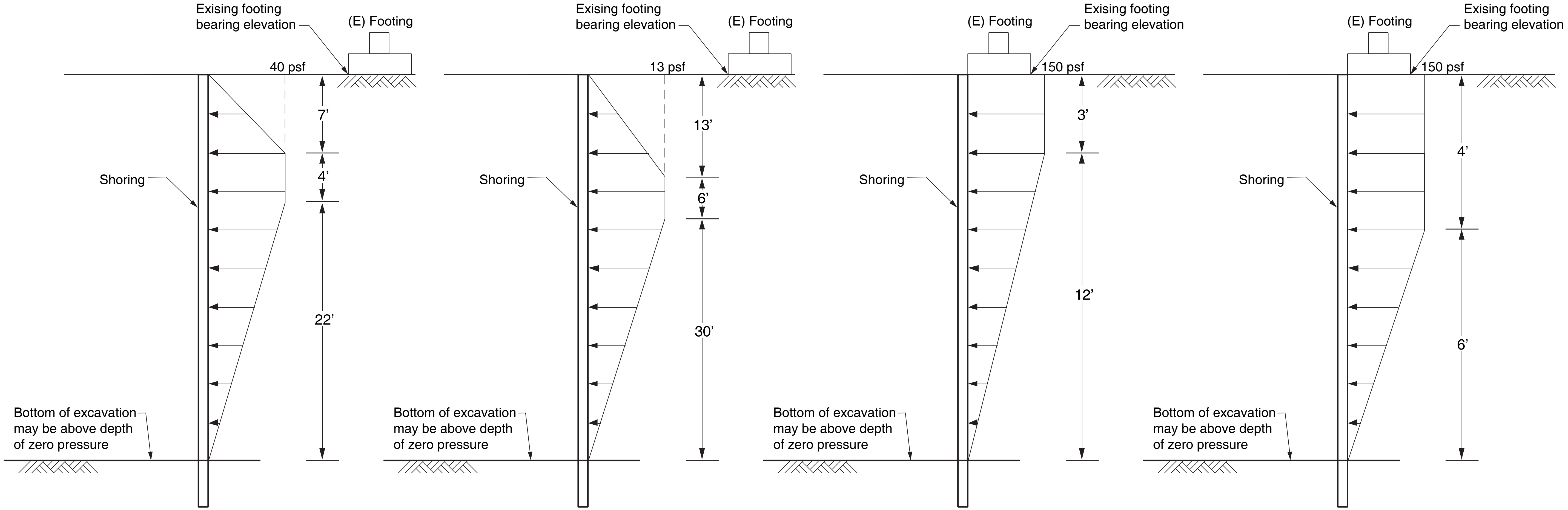
1. Horizontal pressures calculated based on 1 ksf uniform bearing pressure from foottinng.
2. Apply surcharge pressures over a distance of 14 feet from either side of the footing.

THE HILLS AT VALLCO
Cupertino, California

SURCHARGE PRESSURE FROM
EXISTING FOOTING ON PROPOSED SHORING

Date 10/04/16	Project No. 770633101	Figure 10

LANGAN



CASE E
12-FOOT 9-INCH SQUARE FOOTING
AT 10-FEET FROM SHORING

CASE F
12-FOOT SQUARE FOOTING
AT 22-FEET FROM SHORING

CASE G
9-FOOT 9-INCH SQUARE FOOTING
AT SHORING

CASE H
6-FOOT STRIP FOOTING
AT SHORING

DRAFT

Not To Scale

Note:
1. Horizontal pressures calculated based on 1 ksf uniform bearing pressure from foottting.
2. Apply surcharge pressures over a distance of 14 feet from either side of the footing.

THE HILLS AT VALLCO
Cupertino, California

SURCHARGE PRESSURE FROM
EXISTING FOOTING ON PROPOSED SHORING

Date 10/04/16 | Project No. 770633101 | Figure 11

LANGAN

APPENDIX A

BORING LOGS AND LABORATORY TEST RESULTS FROM PREVIOUS INVESTIGATIONS

PRIMARY DIVISIONS			SOIL TYPE		SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (Less than 5% Fines)	GW	●	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	○	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES	GM	○	Silty grovels, gravel-sand-silt mixtures, plastic fines
			GC	▨	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (Less than 5% Fines)	SW	⁙	Well graded sands, gravelly sands, little or no fines
			SP	⁘	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES	SM	▥	Silty sands, sand-silt-mixtures, non-plastic fines
			SC	▨	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50 %		ML	▥	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	☰	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50 %		MH	▥	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	▨	Inorganic clays of high plasticity, fat clays
			OH	≋	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	⁑	Peat and other highly organic soils

DEFINITION OF TERMS

U.S. STANDARD SIEVE SIZE — 200 — 40 — 10 — 4

CLEAR SQUARE SIEVE OPENINGS — 3/4" — 3" — 12"

SILTS AND CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

0.08 — 0.4 — 2 — 5 — 19 — 76mm

GRAIN SIZES

☒ TERZAGHI SPLIT SPOON STANDARD PENETRATION	⧗ MODIFIED CALIFORNIA	▯ D&M UNDERWATER SAMPLER	■ SHELBY TUBE	○ NO RECOVERY

SAMPLERS

SAND AND GRAVEL	BLOWS/FOOT*
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

RELATIVE DENSITY

SILTS AND CLAYS	STRENGTH+	BLOWS/FOOT*
VERY SOFT	0-1/4	0-2
SOFT	1/4-1/2	2-4
MEDIUM STIFF	1/2-1	4-8
STIFF	1-2	8-16
VERY STIFF	2-4	16-32
HARD	OVER 4	OVER 32

CONSISTENCY

*Number of blows of 140 pound hammer falling 30 inches to drive a 2-inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).
+Unconfined compressive strength in tons/sq.ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

KEY TO EXPLORATORY BORING LOGS

Unified Soil Classification System (ASTM D-2487)

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EXPLORATORY BORING: EB-5

Sheet 1 of 1

DRILL RIG: MOBILE B-53
BORING TYPE: 8 INCH HOLLOW-STEM AUGER
LOGGED BY: BM
START DATE: 8-3-04 FINISH DATE: 8-3-04

PROJECT NO: 259-5E
PROJECT: VALLCO
LOCATION: CUPERTINO, CA
COMPLETION DEPTH: 25.0 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION: 178 FT. (+/-)	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
178.0	0		6 inches asphalt concrete							
177.5			**SANDY LEAN CLAY (CL)** hard, moist, brown, fine sand, some fine gravel, low plasticity	CL	54		9	117		○
					30		8	113		○
	5				52		14	115		○
					31		11	109		○
	10									
					42					
	15									
160.0			**CLAYEY SAND (SC)** dense, moist, brown, fine to coarse sand	SC						
158.8			**LEAN CLAY (CL)** hard, moist, brown, some fine sand, low plasticity	CL	61		10	117		○
	20									
156.0			**POORLY GRADED SAND WITH CLAY (SP-SC)** very dense, moist, brown, fine sand, some medium to coarse sand, some fine gravel	SP-SC	59		3			
153.0	25		Bottom of Boring at 25 feet							
	30									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

Northing: 1,945,612
Easting: 6,120,917

LA CORP.GDT 2/11/05 MV FLL

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-6

Sheet 1 of 2

DRILL RIG: MOBILE B-53
BORING TYPE: 8 INCH HOLLOW-STEM AUGER
LOGGED BY: BM
START DATE: 8-3-04 FINISH DATE: 8-3-04

PROJECT NO: 259-5E
PROJECT: VALLCO
LOCATION: CUPERTINO, CA
COMPLETION DEPTH: 34.5 FT.

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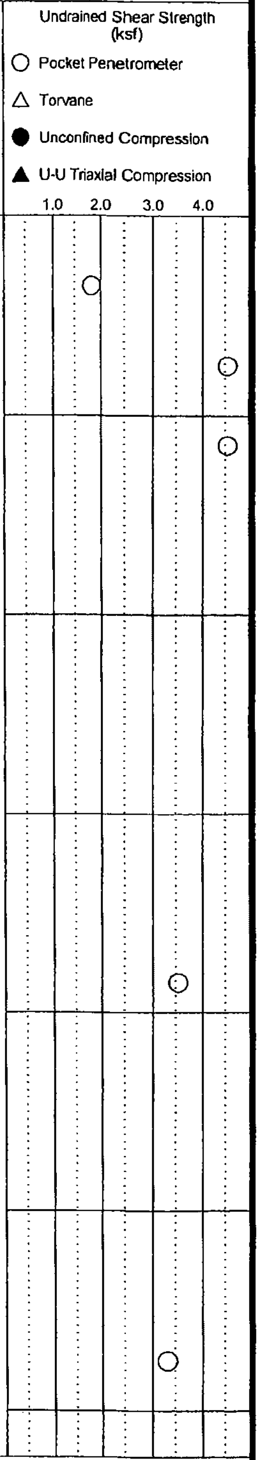
ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
176.0	0	SURFACE ELEVATION: 176 FT. (+/-)					
175.9		1½ inches asphalt concrete over 3½ inches aggregate base					
175.5		**LEAN CLAY WITH SAND (CL) [FILL]** stiff, moist, olive green, fine sand, moderate to high plasticity	CL, FILL	16	12	120	
174.0		**LEAN CLAY WITH SAND (CL)** hard, moist, brown, fine sand, some fine gravel, low plasticity	CL	15	15	118	
	5			40	14	114	
167.0	10	**CLAYEY SAND (SC)** loose, moist, brown, fine to medium sand, some coarse sand	SC	7	12	94	42
		medium dense		26	9		
161.0	15	**SANDY LEAN CLAY (CL)** very stiff, moist, brown, fine to coarse sand, low plasticity	CL	19	14		
				25	18	106	
156.8	20	**LEAN CLAY WITH SAND (CL)** very stiff, moist, brown, fine sand, low plasticity	CL				
153.5	25	**CLAYEY SAND (SC)** medium dense, moist, brown, fine to coarse sand, some fine gravel	SC	65	7	122	
149.0		**LEAN CLAY (CL)** very stiff, moist, brown, some fine sand, low plasticity	CL	35	23	98	
146.8			SP-SM				
146.0	30	*Continued Next Page*					



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

Northing: 1,945,590
Easting: 6,121,038

LA CORP.GDT 2/11/05 MV* FLL

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

LB-6

EXPLORATORY BORING: EB-6 Cont'd

Sheet 2 of 2

DRILL RIG: MOBILE B-53
BORING TYPE: 8 INCH HOLLOW-STEM AUGER
LOGGED BY: BM
START DATE: 8-3-04 FINISH DATE: 8-3-04

PROJECT NO: 259-5E
PROJECT: VALLCO
LOCATION: CUPERTINO, CA
COMPLETION DEPTH: 34.5 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
146.0	30		**POORLY GRADED SAND WITH SILT (SP-SM)** medium dense, moist, brown, fine to medium sand, some fine gravel	SP-SM						
143.0			**CLAYEY SAND WITH GRAVEL (SC)** very dense, moist, brown, fine to coarse sand, fine to coarse gravel	SC	50/6"	☒				
141.5	35		Bottom of Boring at 34½ feet							
	40									
	45									
	50									
	55									
	60									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

Northing: 1,945,590
Easting: 6,121,038

LA CORP.GDT 2/11/05 MV* FLL

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EXPLORATORY BORING: EB-7

Sheet 1 of 2

DRILL RIG: MOBILE B-53	PROJECT NO: 259-5E
BORING TYPE: 8 INCH HOLLOW-STEM AUGER	PROJECT: VALLCO
LOGGED BY: BM	LOCATION: CUPERTINO, CA
START DATE: 8-3-04 FINISH DATE: 8-3-04	COMPLETION DEPTH: 35.0 FT.

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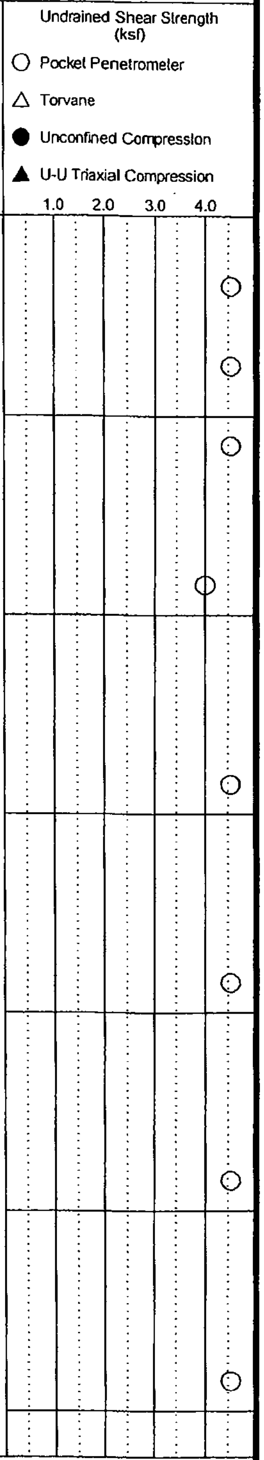
ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
182.0	0	SURFACE ELEVATION: 182 FT. (+/-)					
181.9		1½ inches asphalt concrete over 3½ inches aggregate base					
181.5		**SANDY LEAN CLAY (CL)** hard, moist, brown, fine to coarse sand, some fine gravel, low plasticity	CL	40 42 24 19 34	9 7 6 9 7	125 111 107 96 106	
165.0		**CLAYEY SAND (SC)** medium dense, moist, light brown, fine sand, some fine gravel	SC				
162.8	20	**SANDY LEAN CLAY (CL)** hard, moist, brown, fine sand, some medium to coarse sand, some fine and coarse gravel, low plasticity	CL	40	10	112	
160.0	25	**LEAN CLAY WITH SAND (CL)** hard, moist, brown, fine to medium sand, low plasticity	CL	40	15	112	
155.0		**LEAN CLAY (CL)** hard, moist, brown, some fine sand, low plasticity	CL	46	23	106	
152.0	30	*Continued Next Page*					



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

Northing: 1,945,434
Easting: 6,120,918

LA_CORP.GDT 2/11/05 MV* FLL

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Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-7 Cont'd

Sheet 2 of 2

DRILL RIG: MOBILE B-53	PROJECT NO: 259-5E
BORING TYPE: 8 INCH HOLLOW-STEM AUGER	PROJECT: VALLCO
LOGGED BY: BM	LOCATION: CUPERTINO, CA
START DATE: 8-3-04 FINISH DATE: 8-3-04	COMPLETION DEPTH: 35.0 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
152.0	30	▨	**LEAN CLAY (CL)** hard, moist, brown, some fine sand, low plasticity	CL						
150.5		▨	**CLAYEY SAND (SC)** medium dense, moist, brown, fine sand	SC						
148.0		▨	**LEAN CLAY (CL)** very stiff, moist, brown, some fine sand, low plasticity	CL	29	⧗	25	98		○
147.0	35		Bottom of Boring at 35 feet							
	40									
	45									
	50									
	55									
	60									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

Northing:	1,945,434
Easting:	6,120,918

LA CORP.GDT 2/11/05 MV* FLL

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

LB-8

EXPLORATORY BORING: EB-8

Sheet 1 of 1

DRILL RIG: MOBILE B-53
BORING TYPE: 8 INCH HOLLOW-STEM AUGER
LOGGED BY: BM
START DATE: 8-3-04 FINISH DATE: 8-3-04

PROJECT NO: 259-5E
PROJECT: VALLCO
LOCATION: CUPERTINO, CA
COMPLETION DEPTH: 16.5 FT.

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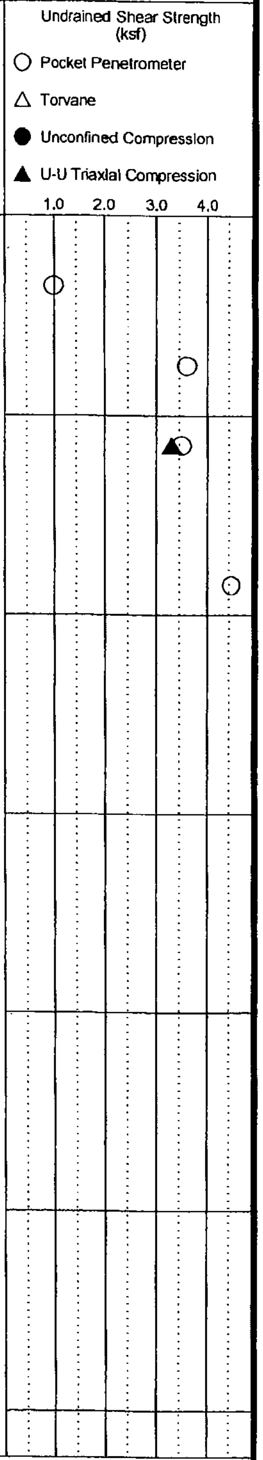
ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
182.0	0	SURFACE ELEVATION: 182 FT. (+/-)					
181.8		2 inches asphalt concrete over 3½ inches aggregate base					
181.5		**LEAN CLAY (CL) [FILL]** stiff, moist, olive green, trace fine sand, some organics, moderate to high plasticity	CL, FILL	15	17	98	
				16	22	104	
177.3	5	**LEAN CLAY WITH SAND (CL)** very stiff, moist, dark brown to bown, fine to medium sand, trace fine gravel, low plasticity	CL	21	14	113	
	10	hard		20	14	117	
169.5		**SANDY LEAN CLAY (CL)** very stiff, moist, brown, fine sand, low plasticity	CL	16	11	103	55
	15			15			
165.5		Bottom of Borinng at 16½ feet					



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

Northing: 1,945,431
Easting: 6,121,039

LA CORP.GDT 2/17/05 MV' FLL

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EXPLORATORY BORING: EB-9

Sheet 1 of 3

DRILL RIG: MOBILE B-61	PROJECT NO: 259-5E
BORING TYPE: 8 INCH HOLLOW-STEM AUGER	PROJECT: VALLCO
LOGGED BY: BM	LOCATION: CUPERTINO, CA
START DATE: 8-4-04 FINISH DATE: 8-4-04	COMPLETION DEPTH: 84.5 FT.

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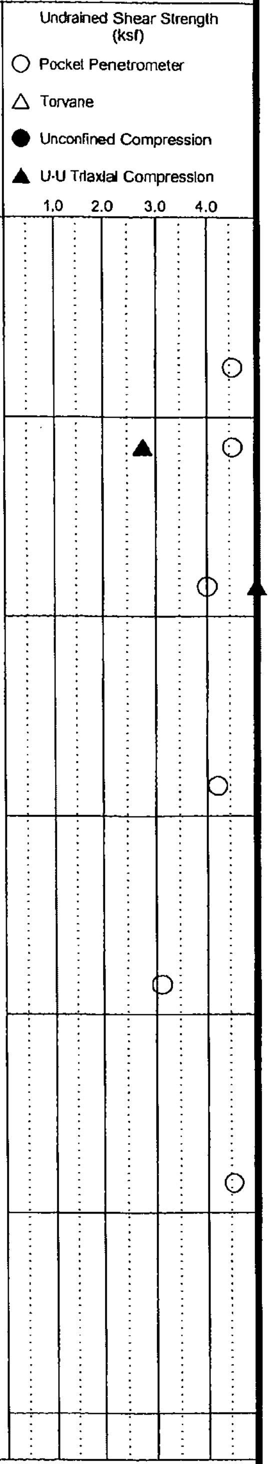
SURFACE ELEVATION: 177 FT. (+/-)

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
177.0	0	3 inches asphalt concrete over 4 inches aggregate base					
176.7							
176.4		**LEAN CLAY WITH SAND (CL)** hard, moist, brown, fine to medium sand, some fine gravel, low to moderate plasticity	CL	41	12	101	
				51	14	111	
172.0	5	**LEAN CLAY (CL)** hard, moist, brown, some fine sand, trace fine gravel, low plasticity	CL	52	19	109	
				36	19	99	
	10						
				32	21	102	
	15	sandier					
		very stiff		39	17	105	
	20						
				34	15	115	
	25						
150.0		**CLAYEY SAND WITH GRAVEL (SC)** medium dense, moist, brown, fine to medium sand, some fine gravel	SC	36	10		
147.0	30						



Continued Next Page

GROUND WATER OBSERVATIONS:

⊻: FREE GROUND WATER MEASURED DURING DRILLING AT 68.0 FEET

LA CORP.GDT 2/17/05 MV* FLL

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-9 Cont'd

Sheet 2 of 3

DRILL RIG: MOBILE B-61
BORING TYPE: 8 INCH HOLLOW-STEM AUGER
LOGGED BY: BM
START DATE: 8-4-04 FINISH DATE: 8-4-04

PROJECT NO: 259-5E
PROJECT: VALLCO
LOCATION: CUPERTINO, CA
COMPLETION DEPTH: 84.5 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
147.0	30	**CLAYEY SAND WITH GRAVEL (SC)** medium dense, moist, brown, fine to medium sand, some fine gravel	SC						
145.0		**POORLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC)** dense, moist, brown, medium to coarse sand, some fine sand, fine to coarse gravel	SP-SC	42	⊠	4		9	
	35								
139.0		**CLAYEY SAND WITH GRAVEL (SC)** dense to very dense, moist, brown, fine to coarse sand, fine gravel, some coarse gravel	SC	75	⊠	5			
	40								
				39	⊠	7			
	45								
				62	⊠	7		14	
	50								
				36	⊠	8			
	55								
118.0			CL	18	⊠	22			○
117.0	60								

Continued Next Page

GROUND WATER OBSERVATIONS:
▽: FREE GROUND WATER MEASURED DURING DRILLING AT 68.0 FEET

LA CORP.GDT 2/17/05 MV' FLL

EXPLORATORY BORING: EB-9 Cont'd

Sheet 3 of 3

DRILL RIG: MOBILE B-61
BORING TYPE: 8 INCH HOLLOW-STEM AUGER
LOGGED BY: BM
START DATE: 8-4-04 FINISH DATE: 8-4-04

PROJECT NO: 259-5E
PROJECT: VALLCO
LOCATION: CUPERTINO, CA
COMPLETION DEPTH: 84.5 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
117.0	60	**LEAN CLAY (CL)** hard, moist, brown, some fine sand, low plasticity	CL						
116.0		**CLAYEY SAND WITH GRAVEL (SC)** very dense, moist, brown, fine to coarse sand, fine gravel	SC						
				54	☒	11		16	
	65								
	▽								
				27	☒	25			○
107.5	70	**LEAN CLAY (CL)** very stiff to hard, moist, brown, some fine sand, low plasticity	CL						
				50	■	17	116		○
102.3	75	**CLAYEY SAND WITH GRAVEL (SC)** dense to very dense, moist, brown, fine to coarse sand, fine to coarse gravel	SC						
				50/6"	■	8	125		
	80								
				50/6"	☒				
92.5	85	Bottom of Boring at 84½							
	90								

GROUND WATER OBSERVATIONS:
▽: FREE GROUND WATER MEASURED DURING DRILLING AT 68.0 FEET

LA CORP.GDT 2/17/05 MV* FLL

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-10

Sheet 1 of 1

DRILL RIG: MOBILE B-61
BORING TYPE: 8 INCH HOLLOW-STEM AUGER
LOGGED BY: BM
START DATE: 8-4-04 FINISH DATE: 8-4-04

PROJECT NO: 259-5E
PROJECT: VALLCO
LOCATION: CUPERTINO, CA
COMPLETION DEPTH: 20.0 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION: 189 FT. (+/-)	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
189.0 188.8 188.6	0	1½ inches asphalt concrete over 3 inches aggregate base						
		CLAYEY SAND WITH GRAVEL (SC) loose, moist, brown, fine to medium sand, fine gravel		8	14	98		
				6	9	100	23	
	5	medium dense	SC	15				
				17				○
179.5	10	**LEAN CLAY WITH SAND (CL)** hard, moist, brown, fine sand, trace fine gravel, low plasticity						
				73	16	113		○
	15		CL					
				51	11	113		○
169.0	20	Bottom of Boring at 20 feet						
	25							
	30							

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 2/11/05 MV* FLL

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EXPLORATORY BORING: EB-1

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-17-99 FINISH DATE: 5-17-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 30.0 FT.

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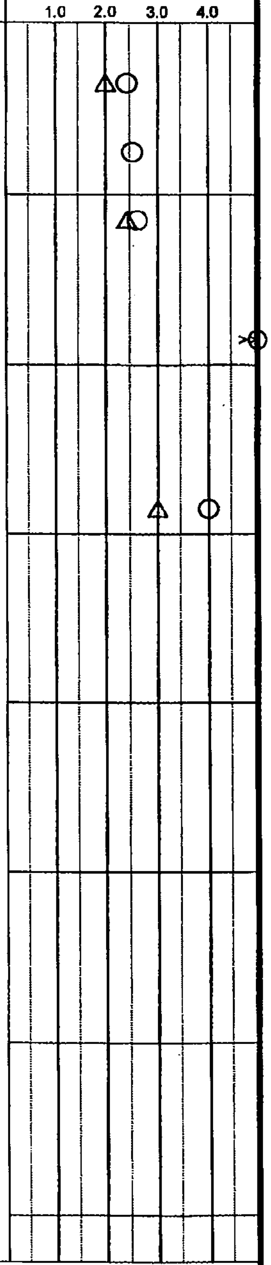
MATERIAL DESCRIPTION AND REMARKS

SURFACE ELEVATION: 179.0 FT. (+/-)

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
179.0	0								
178.7			3 inches asphaltic concrete over 10 inches aggregate base						
177.9			SILTY CLAY (CL) very stiff, moist, brown, trace subrounded gravel to 3/4 inch, mottled gray, trace rootlets	CL	27	☒	23	106	
					22	☒	26	98	
	5		trace fine to medium sand		31	☒	24	102	
	10				44	☒	15	113	
167.0			SILTY SAND (SM) medium dense, moist, fine to coarse grained, occasional fine to medium subrounded gravel Estimated angle of interior friction: 37°-42°	SM	41	☒	11		
164.0	15		SILTY CLAY (CL) very stiff, moist, brown, low plasticity	CL	18	☒	21		
	20								
155.5			SILTY SAND (SM) very dense, moist, fine to medium grained, some coarse sand to fine sand, occasional subrounded sandstone fragments to 3/4 inch Estimated angle of internal friction: >42°	SM	50/4"	☒	4		
152.5			SILTY CLAY (CL) very stiff, moist, orange-brown, low plasticity	CL	22	☒	21		
149.0	30		Bottom of Boring at 30 feet						
	35								

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

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EXPLORATORY BORING: EB-2

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-17-99 FINISH DATE: 5-17-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 29.5 FT.

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MATERIAL DESCRIPTION AND REMARKS

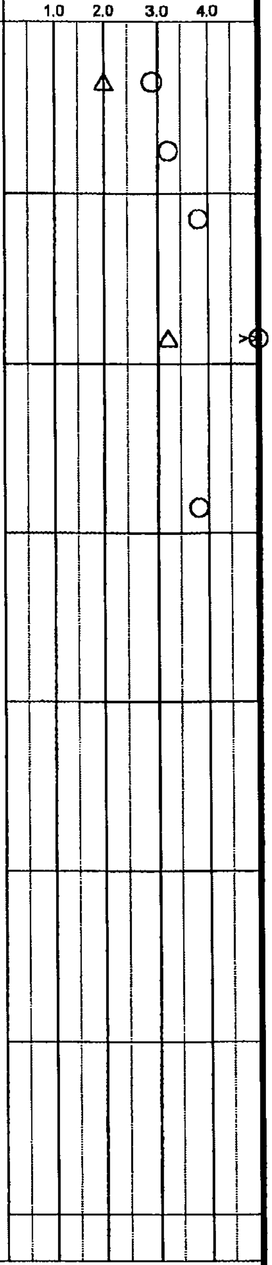
SURFACE ELEVATION: 180.0 FT. (+/-)

ELEVATION (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE
180.0 179.7	3 inches asphaltic concrete over 10 inches aggregate base	
178.9	SILTY CLAY (CL) very stiff to hard, moist, brown, low to moderate plasticity, trace rootlets, mottled black	CL
164.5	SILTY SAND (SM) medium dense, moist, orange brown, with some gravel, occasional subrounded to subangular sandstone fragments up to 3/4 inch Estimated angle of internal friction: 33°-38°	SM
157.0	GRAVELLY SAND (SP-SM) dense, moist, brown, some silt, trace clayey sand seams, gravel to 1 1/2 inch Estimated angle of internal friction: >42° very dense	SP-SM
150.5	Bottom of Boring at 29 1/2 feet	

PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
22	21	107	
35	23	106	
24	19	115	
60	19	113	
52	21	105	
14	6		
48	3		7
50/6"	4		

Undrained Shear Strength (ksf)

○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

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EXPLORATORY BORING: EB-3

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-17-99 FINISH DATE: 5-17-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 29.5 FT.

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Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression (scale 1.0 2.0 3.0 4.0)

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
173.5	0	SURFACE ELEVATION: 173.5 FT. (+/-)							
173.2		3 inches asphaltic concrete over 10 inches aggregate base							
172.4		SANDY CLAY (CL) hard, moist, orange brown, subrounded gravel, low plasticity, occasional thin clayey sand lense	CL	53	■	11	115		>○
				48	■	10	114	17	>○
	5			33	■	11	109		>○
	10			42	☒	7			
161.0		SILTY CLAY (CL) hard, moist, orange brown, trace to some fine sand, low plasticity	CL	30	☒	19			
	15								
156.5		CLAYEY SAND (SC) dense, moist, orange-brown, fine to coarse grained, trace silt, occasional subangular gravel	SC	53	■	10	125		○
	20								
151.5		SILTY SAND (SM) very dense, moist, gray brown, fine to coarse grained, occasional subrounded to subangular gravel to 1 1/4 inch	SM	54	☒	8			
148.5	25	Estimated angle of internal friction: >40° Bottom of Boring at 25 feet							
	30								
	35								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

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EXPLORATORY BORING: EB-4

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-17-99 FINISH DATE: 5-17-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 35.0 FT.

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Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
173.0	0		SURFACE ELEVATION: 173.0 FT. (+/-)							
172.7 171.9			3 inches asphaltic concrete over 10 inches aggregate base							
		▨	SANDY CLAY (CL) very stiff to stiff, moist, orange brown, fine sand, some silt, trace subangular gravel, low plasticity	CL	24	☒	19		53	
					27	☒	27			
	5		increase fine sand		13	☒	25			
165.5			SILTY SAND (SM) dense, moist, brown, subrounded gravel to 1 inch, trace to some clay Estimated angle of internal friction: 37°-44°	SM	43	☒	8			
	10									
	15				50/5"	⧓	6			△ ○
	20				31	☒	5		10	
	25				46	☒	7			
	30				43	☒	5			
140.0		▨	SILTY CLAY (CL) very stiff, moist, orange-brown, some fine sand, low plasticity	CL	28	⧓	21	105		○△
138.0	35		Bottom of Boring at 35 feet							

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

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EXPLORATORY BORING: EB-5

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-17-99 FINISH DATE: 5-17-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 24.5 FT.

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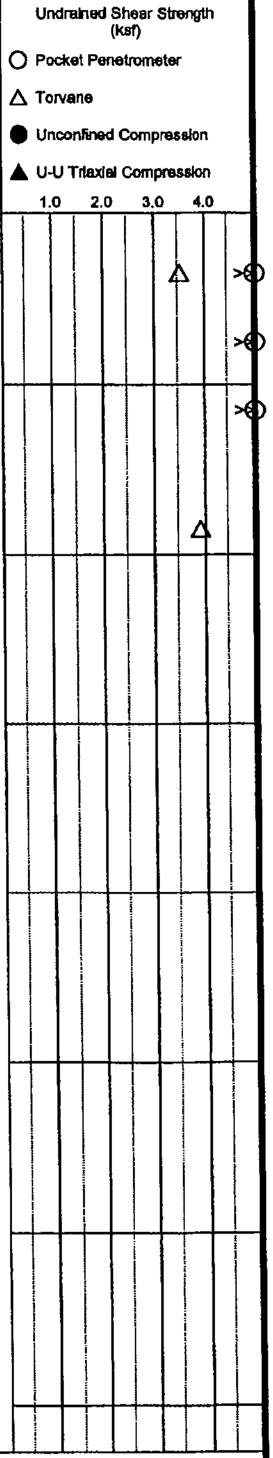
SURFACE ELEVATION: 173.0 FT. (+/-)

ELEVATION (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE
173.0	3 inches asphaltic concrete over 5 inches aggregate base	
172.7		
172.2	SILTY CLAY (CL) very stiff to hard, moist, brown, trace subrounded gravel to 1/2 inch, trace sand, occasional competely weathered sandstone fragments and fine sandy pocket	CL
165.5	SILTY SAND (SM) dense, moist, orange-brown, uniform fine grained, trace clay Estimated angle of internal friction: >40°	SM
161.5	SILTY SAND (SM) dense, moist, fine to coarse grained, some subrounded to angular fractured gravel to 1 1/4 inch, some iron oxide coatings on fractures, occasional clayey sand to sandy clay seam Estimated angle of internal friction: 38°- >42° very dense	SM
148.5	Bottom of Boring at 24 1/2 feet	

PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
39	21	108	
52	19	111	
51	19	108	
49	12		
32	9		12
50/6"	5		
50/5"	7		



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV*

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Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-6

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-18-99 FINISH DATE: 5-18-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 26.5 FT.

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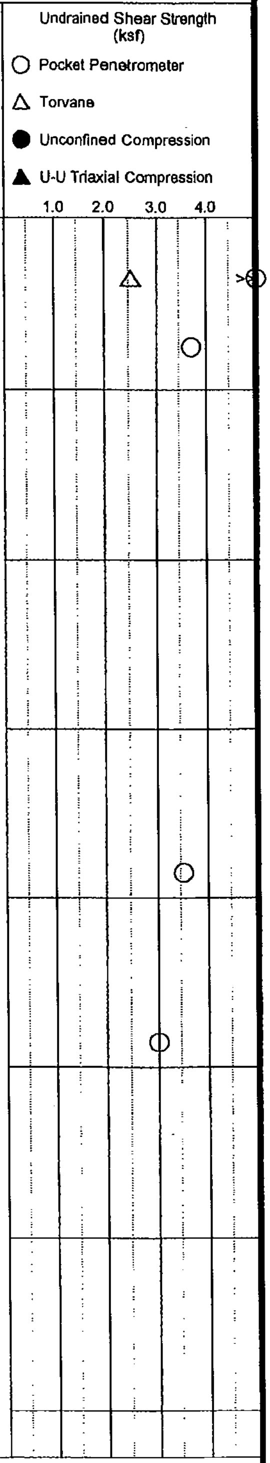
SURFACE ELEVATION: 173.5 FT. (+/-)

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
173.5	0							
173.2		3 inches asphaltic concrete over 5 inches aggregate base						
172.7		SILTY CLAY (CL) very stiff to hard, moist, orange brown, trace subrounded gravel, some fine sand, occasional completely weathered sandstone fragments and fine sand, pockets up to 1/2 inch	CL	35	⧗	17	116	
				34	☒	16		
	5			48	⧗	19	113	
167.5		SILTY SAND (SM) dense, moist, orange brown, uniform fine grained , trace clay	SM					
165.0		SILTY SAND (SM) very dense, moist, orange brown, some gravel to 3/4 inch, some clay and sandy clay seams Estimated angle of internal friction: >42°	SM	53	☒	7		14
	10							
				78	☒	9		
	15							
156.0		SILTY CLAY (CL) very stiff, moist, orange-brown, mottled black, trace fine sand, low plasticity, becomes dense	CL	35	☒	20		
	20							
152.0		SILTY SAND (SM) medium dense, moist, orange-brown, uniform fine grained, trace fine gravel, low plasticity, trace fine gravel Estimated angle of internal friction: 33°-39°	SM	25	⧗	16		
148.5	25	SILTY CLAY (CL) very stiff, moist, orange brown, trace fine sand, low plasticity	CL	24	☒	23		
147.0		Bottom of Boring at 26 1/2 feet						
	30							
	35							



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

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EXPLORATORY BORING: EB-7

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-18-99 FINISH DATE: 5-18-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 25.0 FT.

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Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression; scale 1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
174.5			SURFACE ELEVATION: 174.5 FT. (+/-)							
174.2	0		3 inches asphaltic concrete over 5 inches aggregate base							
173.7			SILTY CLAY (CL) hard, moist, brown to orange-brown, occasional completely weathered, sandstone fragments, trace coarse sand and fine subrounded gravel, low plasticity, trace rootlets	CL	19		19	108		△ >○
					31		24	105	84	○
	5		increase in fine sand		63		16	119		△ >○
166.5	10		CLAYEY SAND (SC) dense, moist, orange-brown, subangular to subrounded gravel to 1 inch Estimated angle of internal friction: 37°-42°	SC	39		8			
			increase in clay content		30		11		17	
160.0	15		SILTY SAND (SM) dense, moist, orange-brown, fine uniform grained	SM						
158.5	20		SILTY CLAY (CL) hard to very stiff, moist, orange brown, low plasticity, occasional thin fine grained silty sand lense	CL	56		21	109		>○
			very stiff		29		20			○
149.5	25		Bottom of Boring at 25 feet							
	30									
	35									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

EXPLORATORY BORING: EB-8

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-18-99 FINISH DATE: 5-18-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 30.0 FT.

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Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
173.5	0	SURFACE ELEVATION: 173.5 FT. (+/-)							
173.2 172.7		3 inches asphaltic concrete over 5 inches aggregate base							
		SANDY CLAY (CL) very stiff, moist, orange brown, with some silt, fine sand	CL	41		15	112		>○
				42		18	112	61	△○
	5			37		19	111		△ >○
				48		14	121		△
163.5	10	SILTY SAND (SM) very dense, moist, orange brown, subangular gravel to 1 inch, trace clay, fine to coarse grained sand increase sand Estimated angle of internal friction: >40°	SM	51		5			
	15								
157.0		SILTY CLAY (CL) hard, moist, orange brown, low plasticity	CL						
155.0		SILTY SAND (SM) very dense, moist, yellowish to olive brown, fine to coarse grained, some subangular to subrounded gravel up to 1 1/2 inch increase gravel Estimated angle of internal friction: >40°	SM	50/6"		14			>○
	20								
150.5		SILTY CLAY (CL) very stiff, moist, brown, low plasticity, trace coarse sand, fine gravel, some fine to medium sand increase gravel, increase medium to fine sand	CL	27		18			
	25								
144.5		CLAYEY SAND with gravel (SC) dense, moist, orange brown to brown, subrounded gravel to 1 1/4 inch	SC	38		7			
143.5	30	Bottom of Boring at 30 feet							
	35								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV*

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-9

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-18-99 FINISH DATE: 5-18-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 25.0 FT.

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Undrained Shear Strength (ksf)
- ○ Pocket Penetrometer
- △ Torvane
- ● Unconfined Compression
- ▲ U-U Triaxial Compression

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) 1.0 2.0 3.0 4.0
173.5	0	SURFACE ELEVATION: 173.5 FT. (+/-)							
173.2 172.7		3 inches asphaltic concrete over 6 inches aggregate base							
		SANDY CLAY (CL) hard, moist, brown to orange brown, fine sand, trace fine gravels, low plasticity	CL	62	■	14		68	>○
				34	☒	15			>○
	5			56	■	15	112		△ >○
	10			57	■	14	114		>○
162.0		GRAVELLY SAND (SP) medium dense, moist, brown Estimated angle of internal friction: 38°-43°	SP	42	■	9			○
158.0	15	SANDY CLAY (CL) very stiff, moist, orange brown, low plasticity, trace fine gravel	CL	30	☒	20			
155.0	20	CLAYEY SAND (SC) very dense, moist, brown, fine grained sand, trace clay Estimated angle of internal friction: 33°-38°	SC	61	■				○
		medium dense		28	☒	14			
148.5	25	Bottom of Boring at 25 feet							
	30								
	35								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

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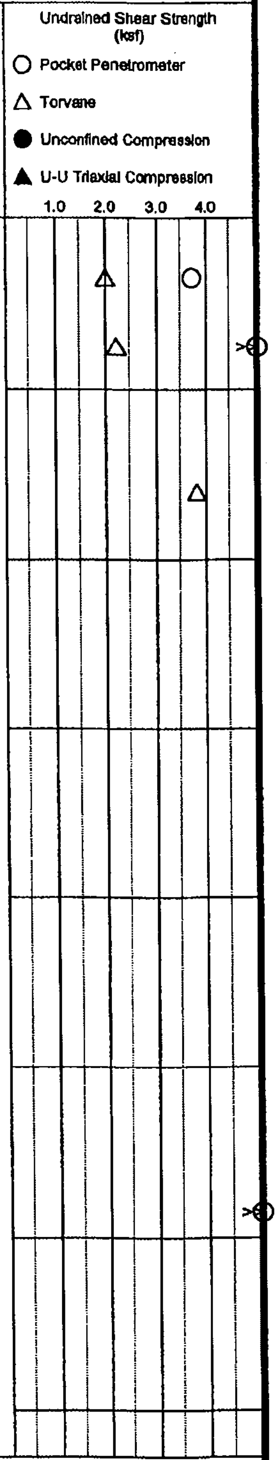
EXPLORATORY BORING: EB-10

Sheet 1 of 2

DRILL RIG: MOBILE B-40	PROJECT NO: 259-5D
BORING TYPE: 8-INCH HOLLOW STEM	PROJECT: VALLCO EXPANSION
LOGGED BY: LML	LOCATION: CUPERTINO, CALIFORNIA
START DATE: 5-18-99 FINISH DATE: 5-18-99	COMPLETION DEPTH: 50.0 FT.

SURFACE ELEVATION: 180.5 FT. (+/-)

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
180.5	0						
180.1		4 inches asphaltic concrete over 8 inches aggregate base					
179.5		SILTY CLAY (CL) very stiff to hard, moist, dark brown, trace fine sand, trace gravel, rootlets, low plasticity	CL	42	13	107	
				30	12	106	
	5			38	15	108	
		increase gravel, alternating clayey sand lenses		50/5"	7	117	
	10			50/5"	4		
167.5		CLAYEY SAND (SC) very dense, moist, with some gravel, occasional completely weathered sandstone fragments and fine silty sand pockets Estimated angle of internal friction: >40°	SC	84	4		
	15						
	20			63	6		18
	25	dense		68	5		
153.5		SILTY CLAY WITH SAND (CL) very stiff, moist, orange brown, trace fine gravel, low plasticity	CL	30	19	119	
	30						
146.5			SP	50/6"	5		
145.5	35						



Continued Next Page

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

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LA-10

EXPLORATORY BORING: EB-10 Cont'd

Sheet 2 of 2

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-18-99 FINISH DATE: 5-18-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 50.0 FT.

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ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf) ○ Pocket Penetrometer △ Torvane ● Unconfined Compression ▲ U-U Triaxial Compression 1.0 2.0 3.0 4.0
145.5	35		GRAVELLY SAND (SP) very dense, moist, orange-brown, subangular gravel to 1 inch Estimated angle of internal friction: >42°							
					50/5"	☒	3			
	40			SP						
					64	☒	4			
	45									
131.8			SILTY CLAY (CL) very stiff	CL	25	☒	23		91	
130.5	50		Bottom of Boring at 50 feet							
	55									
	60									
	65									
	70									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

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Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-11

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-19-99 FINISH DATE: 5-19-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 30.0 FT.

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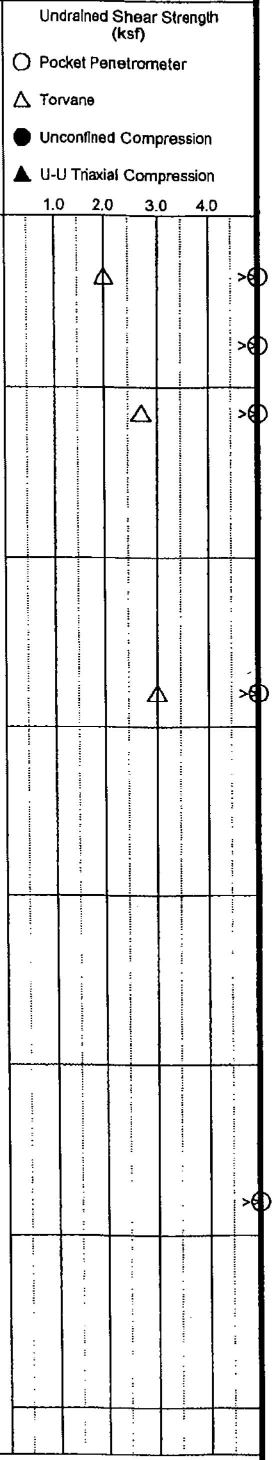
ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
180.5	0	SURFACE ELEVATION: 180.5 FT. (+/-)					
180.2		3 inches asphaltic concrete over 9 inches aggregate base					
179.5		SILTY CLAY (CL) very stiff to hard, moist, brown to orange brown, trace fine sand, some medium to fine gravel, low plasticity	CL	41	12	118	
				36	16		
	5			53			
				50/5"	15 10	97	
	10						
		Clayey Sand Lense					
167.0		SANDY CLAY (CL) hard, moist, orange brown, some fine sand, low plasticity	CL	50/6"	11	108	
	15						
				34	9		
	20						
157.0		GRAVELLY SAND (SC) medium dense, dry, orange brown, with some clay, subrounded gravel to 3/4 inch Estimated angle of internal friction: 35°-41°	SC	26	4		
	25						
152.0		SILTY CLAY (CL) hard, moist, orange brown, some fine to medium sand		50/6"	19		
150.5	30	Bottom of Boring at 30 feet					
	35						



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA_CORP.GDT 7/1/99 MV

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EXPLORATORY BORING: EB-12

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-19-99 FINISH DATE: 5-19-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 30.0 FT.

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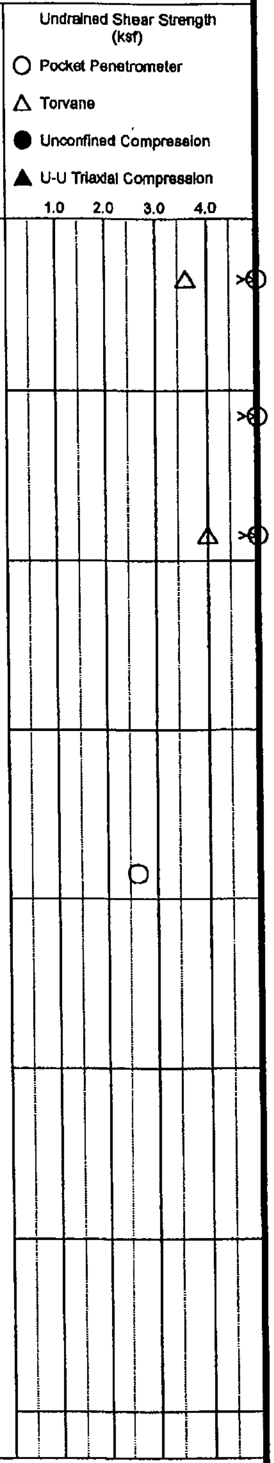
ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
173.0	0	SURFACE ELEVATION: 173.0 FT. (+/-)					
172.7		3 inches asphaltic concrete over 5 inches aggregate base					
172.2		SILTY CLAY (CL) hard to stiff, dry to moist, orange brown, trace fine to medium sand, low plasticity, rootlets	CL	54	18	115	
		increase sand		45	17		
	5			58	16	113	
		sand lense					
				41	17	98	
	10						
				15	12		
	15						
156.5		SILTY SAND (SM) medium dense, moist, orange brown, fine uniformly graded sand, trace clay Estimated angel of internal friction: 33°-39°	SM	25	10		35
	20	increase clay					
				29	8		
148.5	25	GRAVELLY SAND (SC) medium dense, dry to moist, brown, with some clay, subangular gravel to 3/4 inch	SC				
145.0		GRAVELLY SAND (SP) very dense, dry, brown, gravel to 1 inch, trace clay Estimated angle of internal friction: >42°	SP	70	5		
143.0	30	Bottom of Boring at 30 feet					
	35						



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

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EXPLORATORY BORING: EB-13

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-19-99 FINISH DATE: 5-19-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 30.0 FT.

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Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression; scale 1.0, 2.0, 3.0, 4.0

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
172.5	0	SURFACE ELEVATION: 172.5 FT. (+/-)							
172.2 171.7		3 inches asphaltic concrete over 5 inches aggregate base							
		SANDY CLAY (CL) hard, moist, orange brown, fine to coarse grained, some silt, occasional gravel, thin sandy lense at 2 feet	CL	60		12	120	25	>○
				50/6"		8	82		
168.5		SILTY CLAY (CL)	CL						
167.0	5	GRAVELLY SAND (SC) dense to very dense, brown, subangular gravel to 3/4 inch, with trace to some clay	SC	33		7			>○
		decreasing clay Estimated angle of internal friction: 38°- >42°		62		5			
	10	increase sand							
	15			92		6			
154.5		SILTY CLAY (CL) very stiff, moist, brown, low plasticity, trace fine sand	CL	46		19			>○
	20								
	25			49		16	113		
				45		15	118		
142.5	30	Bottom of Boring at 30 feet							
	35								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

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EXPLORATORY BORING: EB-14

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM
LOGGED BY: LML
START DATE: 5-19-99 FINISH DATE: 5-19-99

PROJECT NO: 259-5D
PROJECT: VALLCO EXPANSION
LOCATION: CUPERTINO, CALIFORNIA
COMPLETION DEPTH: 30.0 FT.

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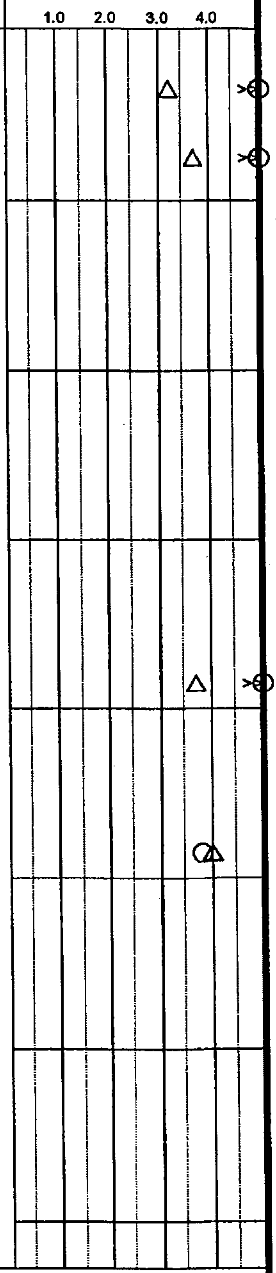
ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
172.5	0	SURFACE ELEVATION: 172.5 FT. (+/-)						
172.2		3 inches asphaltic concrete over 5 inches aggregate base						
171.7		SANDY CLAY (CL) hard, moist, orange brown, fine sand, some silt, trace coarse gravel	CL	42	■	14	123	
		increase sand and gravel		42	■	11	108	55
167.5	5	CLAYEY SAND (SC) medium dense, dry, brown, with some fine gravel Estimated angle of internal friction: 36°-40°	SC	32	☒	10		
				42	☒	28		
	10	decrease clay		34	☒	7		
159.5		SANDY GRAVEL (GC) dense, dry to moist, brown, trace to some clay	GC	43	☒	8		
	15							
155.5		SILTY CLAY (CL) hard, moist, brown, some fine sand, trace gravel, low plasticity	CL	66	■	22	107	89
	20							
				55	■	22	105	
148.0	25	SANDY CLAY (CL) hard, moist, orange brown, low plasticity	CL					
				50/6"	■	14		
143.0	30	SANDY GRAVEL (GC) very dense, moist, brown, subangular gravel to 1 inch, trace to some clay	GC					
142.5		Bottom of Boring at 30 feet						
	35							

Undrained Shear Strength (ksf)

○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression



GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 7/1/99 MV

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DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 190' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/4/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
3" Asphaltic Concrete over 6" Baserock				1						
CLAY, silty with trace of sand and gravel	brown	stiff	CL		x					13
				2						
				3	x				21	28
				4						
					x					13
				5						
				6						
(grading more sandy and gravelly)		very stiff		7						
				8						
				9						
					x				15	24
Bottom of Boring = 10 Feet				10						
				11						
				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	1

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	188' (approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/4/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
3" Asphaltic Concrete over 6" Baserock										
				1						
CLAY, sandy, gravelly	brown	stiff	CL		x				13	10
				2						
	gray-brown	very stiff		3	x					17
				4						
					x				17	17
				5						
				6						
				7						
				8						
				9						
					x					20
				10						
Bottom of Boring = 10 Feet										
				11						
				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	2

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 187' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/4/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, silty	brown	stiff	CL							
				1	x					15
		very stiff		2	x				17	16
				3						
(trace of coarse sand and gravel)				4	x					18
GRAVEL, sandy, silty	brown	medium dense	GM	5						
				6						
SAND, gravelly, silty	yellow-brown	loose	SM	7						
				8						
				9	x				10	7
Bottom of Boring = 10 Feet				10						
				11						
Note: The stratification lines represent the approximate boundary between soil types and the transitions may be gradual.				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	3

EB-3

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	184' (Approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/4/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty	brown	very stiff	CL							
				1	x				7	18
(trace of gravel)				2	x					24
SAND, gravelly, clayey	brown	medium dense	SC	3						
				4	x				11	13
				5						
(grading more gravelly)			GC	6						
				7						
				8	x				7	29
				9						
Bottom of Boring = 9 Feet										
				10						
Note: The stratification line represents the approximate boundary between soil types and the transition may be gradual.				11						
				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	4

EB-4

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	183' (Approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/4/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
GRAVEL, clayey with some cobbles	brown	medium dense	GC							
				1	x					37
(grading less clayey, more silty)			GM	2						
					x				4	28
		dense to very dense		3						
				4						
					x					66
				5						
				6						
SAND, gravelly, clayey	brown	medium dense	SC	7						
				8						
				9						
					x				7	19
				10						
Bottom of Boring = 10 Feet										
				11						
Note: The stratification line represents the approximate boundary between soil types and the transition may be gradual.				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	5

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	173' (Approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/5/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty	dark brown	stiff	CL							
				1	x				20	14
Liquid Limit = 44% Plasticity Index = 22% Passing #200 Sieve = 76%				2	x				22	9
				3						
	brown			4	x				17	9
				5						
				6						
				7						
Note: The stratification line represents the approximate boundary between soil types and the transition may be gradual.				8						
				9						
				10	x					12
				11						
				12						
				13						
SAND, gravelly, clayey to GRAVEL, sandy, clayey	gray-brown	medium dense	SC-GC	14	x				8	19
				15						
				16						
				17						
		dense		18						
(grading less gravelly, more silty)			SM	19	x				7	40
Bottom of Boring = 20 Feet				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	9

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 179' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/5/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty	brown	stiff	CL							
				1	x					14
(grading sandy)										
				2						
					x				12	11
				3						
				4						
					x					7
				5						
				6						
GRAVEL, sandy with clay binder	brown	dense	GC	7						
				8						
				9						
					x				5	49
				10						
				11						
CLAY, silty	brown	stiff	CL							
				12						
				13						
				14						
					x				16	16
				15						
				16						
		very stiff		17						
				18						
				19	x					
SAND, silty, fine grained	light brown	medium dense	SM		x					20
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 2	10

DRILL RIG: Continuous Flight Auger
SURFACE ELEVATION 179' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/5/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
SAND, silty, fine grained (Continued)	light brown	medium dense	SM	21						
SAND, gravelly, silty	gray-brown	very dense	SM	22						
				23						
				24	x				5	58
				25						
				26						
				27						
				28						
				29	x					55
				30						

Bottom of Boring = 30 Feet

Note: The stratification lines represent the approximate boundary between soil types and the transitions may be gradual.

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	2 OF 2	10

EB-10

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	181' (Approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/6/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty	brown	stiff	CL	1	x					13
Dry Density = 105 pcf Unconfined Compressive Strength = 4,400 psf		very stiff to hard		2						
				3					19	34
				4						
				5						
				6						
				7						
GRAVEL, sandy, clayey	gray- brown	dense	GC	8						
Dry Density = 116 pcf				9					10	40
				10						
				11						
CLAY, silty	brown	very stiff to hard	CL	12						
				13						
Dry Density = 101 pcf Unconfined Compressive Strength = 5,300 psf				14					23	41
				15						
				16						
				17						
				18						
				19	x					34
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 3	11

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 181' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/6/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, silty	brown	very stiff	CL							
				21						
				22						
				23						
				24				☒		
					x			☒		29
				25						
				26						
				27						
				28						
				29			◫			
					x		◫		22	17
				30						
				31						
				32						
				33						
SAND, silty, fine to medium grained	brown	medium dense	SM	34				☒		24
CLAY, silty	brown	very stiff	CL	35						
				36						
(occasional lenses of silty sand)				37						
				38						
				39			◫			
					x		◫		19	17
				40						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	2 OF 3	11

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 181' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/6/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty (Continued)	brown	very stiff	CL	41 42 43 44	x					26
Bottom of Boring = 45 Feet Note: The stratification lines represent the approximate boundary between soil types and the transitions may be gradual.				45						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	3 OF 3	11

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 180' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/6/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, gravelly	dark brown	very stiff	CL	1	x		▮			22
				2			▮			
				3	x		▮		15	33
				4				▮	11	21
				5				▮		
				6						
				7						
GRAVEL, sandy, silty	brown	dense	GM	8						
				9	x		▮		8	39
				10			▮			
				11						
CLAY, silty	brown	hard	CL	12						
				13						
				14	x		▮			35
				15			▮			
				16						
Dry Density = 106 pcf Unconfined Compressive Strength = 3,800 psf				17						
				18						
(grading very silty)			CL-ML	19	x			▮	21	43
				20				▮		

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 2	12

DRILL RIG Continuous Flight Auger

SURFACE ELEVATION 180' (Approx.)

LOGGED BY R.R.

DEPTH TO GROUNDWATER Not Established

BORING DIAMETER 6 Inches

DATE DRILLED 6/6/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty to SILT, clayey (Continued)	brown	hard	CL-ML							
				21						
				22						
				23						
Dry Density = 98 pcf Unconfined Compressive Strength = 1,800 psf				24					26	45
				25						
				26						
		very stiff		27						
				28						
				29	x					30
Bottom of Boring = 30 Feet				30						
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	2 OF 2	12

DRILL RIG 'Continuous Flight Auger

SURFACE ELEVATION 183' (Approx.)

LOGGED BY R.R.

DEPTH TO GROUNDWATER Not Established

BORING DIAMETER 6 Inches

DATE DRILLED 6/6/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty with occasional lenses of very fine grained sand	brown	firm	CL							
				1						
				2	x				25	7
		stiff		3						
				4						
				5						
				6						
				7						
Dry Density = 109 pcf Unconfined Compressive Strength = 3,800 psf				8						
		very stiff to hard		9					19	40
				10						
				11						
				12						
				13						
Dry Density = 101 pcf Unconfined Compressive Strength = 4,200 psf				14					24	68
				15						
				16						
		very stiff		17						
				18						
				19						
				20	x					28

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 2	13

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	183' (Approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/6/74

DESCRIPTION AND CLASSIFICATION

DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty (Continued)	brown	very stiff	CL							
				21						
				22						
		hard		23						
				24						
					x					49
				25						
				26						
		very stiff		27						
				28						
				29						
					x				20	31
				30						
Bottom of Boring = 30 Feet										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	2 OF 2	13

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 184' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/6/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, silty with trace of coarse sand	brown	stiff	CL							
				1						
				2						
				3			▯			
				4	x		▯		21	10
				5						
				6						
		very stiff to hard		7						
Dry Density = 107 pcf Unconfined Compressive Strength = 2,700 psf				8						
				9				⧄		
				10				⧄	19	53
				11						
SAND, gravelly with some clay binder	brown	dense to very dense	SC	12						
				13						
Dry Density = 118 pcf				14				⧄	15	68
				15						
				16						
CLAY, silty to SILT, clayey	brown	very stiff	CL-ML	17						
				18						
				19			▯			
				20	x		▯		18	27

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 2	14

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 184' (Approx.)	LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 6/6/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty to SILT, clayey (Continued)	brown	very stiff	CL-ML	21						
				22						
				23						
(grading less silty)				24						
			CL		x					32
				25						
				26						
CLAY, sandy	brown	hard	CL	27						
				28						
				29						
					x				17	41
Bottom of Boring = 30 Feet				30						
Note: The stratification lines represent the approximate boundary between soil types and the transitions may be gradual.										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	2 OF 2	14

EB-14

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 186' (Approx.)	LOGGED BY A.K.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty, trace of fine sand	dark brown	very stiff	CL							
				1						
				2						
				3						
				4				▨	19	21
				5						
				6						
CLAY, silty, sandy, gravelly	brown	hard	CL	7						
				8						
Dry Density = 109 pcf Unconfined Compressive Strength = 3,500 psf				9				▨	22	39
				10						
				11						
				12						
CLAY, silty	tan	hard	CL-CH	13						
Dry Density = 107 pcf Unconfined Compressive Strength = 5,100 psf				14				▨	20	57
				15						
(grading siltier with depth)		very stiff	CL	16						
				17						
				18						
				19	x		▨		21	28
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 2	15

DRILL RIG Continuous Flight Auger

DEPTH TO GROUNDWATER Not Established

SURFACE ELEVATION 186' (Approx.)

BORING DIAMETER 6 Inches

LOGGED BY A.K.

DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT
CLAY, very silty (Continued)	tan	very stiff	CL							
				21						
				22						
		hard		23						
(grading sandy and gravelly with depth)				24	x					48
				25						
				26						
				27						
(rock blocked end of split spoon sampler)				28						
				29	x					99
Bottom of Boring = 29.5 Feet				30						

Note: The stratification lines represent the approximate boundary between soil types and the transitions may be gradual.

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	2 OF 2	15

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 186' (Approx.)	LOGGED BY A.K.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, silty, trace of fine sand	dark brown	very stiff	CL	1						
				2						
				3				▨		
Dry Density = 104 pcf Unconfined Compressive Strength = 6,400 psf				4				▨	20	24
				5						
				6						
CLAY, silty, sandy (well graded) gravelly (fine)	brown	hard	CL	7						
				8				▨		
Dry Density = 115 pcf Unconfined Compressive Strength = 4,500 psf				9				▨	15	91
				10	170					
				11						
				12						
CLAY, silty	tan	hard	CL	13				▨		
				14				▨		91
				15						
(grading siltier with depth)		very stiff		16						
				17						
				18			▨			
				19	x		▨		22	23
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 2	16

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 186' (Approx.)
LOGGED BY A.K.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, very silty (Continued)	tan	very stiff	CL	21						
(grading with fine sand with depth)				22						
		hard		23						
				24	x					37
				25						
(grading less sandy with depth)				26						
				27						
				28						
				29	x				17	53
Bottom of Boring = 29.5 Feet				30						
Note: The stratification lines represent the approximate boundary between soil types and the transitions may be gradual.										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	2 OF 2	16

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 185' (Approx.)
LOGGED BY A.K.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty, trace of fine sand	dark brown	very stiff	CL							
				1						
				2						
				3				▨		
				4				▨	20	18
				5						
				6						
CLAY, silty, sandy (well)	brown	hard	CL	7						
SAND (well), gravelly (fine and medium), clayey	brown	dense	SC-SW	8				▨		
				9				▨	9	38
				10						
				11						
GRAVEL, sandy	brown	dense	GW	12						
				13			▨			
SAND, clayey, gravelly	brown	dense	SC-SW	14	x		▨			39
				15						
				16						
		very dense		17						
				18			▨			
				19	x		▨		8	50/7"
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 2	17

EB-17

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 185' (Approx.)
LOGGED BY A.K.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SAND, clayey, gravelly (Continued)	brown	very dense	SC-SW							
				21						
				22						
				23						
				24	x					83
				25						
				26						
				27						
				28						
				29	x				6	84
Bottom of Boring = 29.5 Feet				30						

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-9	June 1974	2 OF 2	17

Continuous Flight Auger

DEPTH TO GROUNDWATER Not Established

SURFACE ELEVATION 184' (Approx.)

BORING DIAMETER 6 Inches

LOGGED BY A.K.

DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION

DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SAND, gravelly	brown	dense	SW							
				1						
				2						
				3				▨		
				4				▨		43
				5						
				6						
		medium dense		7						
				8				▨		
				9				▨	9	20
				10						
				11						
CLAY, silty	brown	hard	CL-CH	12						
				13				▨		
				14				▨		50
(grading siltier with depth)				15						
		very stiff	CL	16						
				17						
				18	▨					
				19 ×	▨				19	18
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 2	18

DRILL RIG Continuous Flight Auger | SURFACE ELEVATION 184' (Approx.) | LOGGED BY A.K.

DEPTH TO GROUNDWATER Not Established | BORING DIAMETER 6 Inches | DATE DRILLED 6/7/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty (Continued)	brown	very stiff	CL	21						
				22						
(grading with some fine sand)		hard		23						
				24	x				21	41
				25						
				26						
				27						
				28						
				29	x					34
Bottom of Boring = 29.5 Feet Note: The stratification line represents the approximate boundary between soil types and the transition may be gradual.				30						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	2 OF 2	18

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 180' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, silty	brown	firm	CL		x					6
				1						
				2						
		stiff			x					9
				3						
Dry Density = 102 pcf Unconfined Compressive Strength = 1700 psf				4					20	15
				5						
				6						
				7						
CLAY, gravelly to GRAVEL clayey	brown	very stiff to medium dense	CL-GC	8						
				9						
					x					22
				10						
CLAY, silty	brown	hard	CL	11						
				12						
Dry Density = 113 pcf Unconfined Compressive Strength = 7200 psf				13						
				14					11	78/10"
GRAVEL, clayey	brown	very dense	GC	15						
				16						
				17						
(grading silty and sandy)			GM	18						
				19	x					65
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 2	20

EB-20

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 180' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
GRAVEL, sandy, silty (Continued)	brown	very dense	GM							
				21						
				22						
				23						
				24	x				6	57
				25						
				26						
SAND, clayey	brown	dense	SC	27						
				28						
				29	x				15	40
				30						
Bottom of Boring = 30 Feet										
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO. 259-5
DATE June 1974
SHEET NO. 2 OF 2
BORING NO. 20

EB-20

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	180' (Approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty with occasional gravel	brown	stiff	CL	1	x					10
Dry Density = 104 pcf Unconfined Compressive Strength = 4300 psf				2 3					21	28
				4						
		very stiff		5 6 7						
SAND, gravelly, clayey	brown	very dense	SC	8 9	x				8	50/6"
				10 11 12						
CLAY, silty	brown	hard	CL	13 14	x					52
				15 16 17						
SAND, gravelly, clayey	brown	very dense	SC	18						
Dry Density = 109 pcf				19 20					7	53/6"

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 3	21

EB-21

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 180' (Approx.)	LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SAND, gravelly, clayey (Continued)	brown	very dense	SC	21 22						
SAND, silty, very fine grained	brown	dense	SM	23 24	×		▯			36
				25						
CLAY, silty	brown	hard	CL	26 27						
Dry Density = 106 pcf Unconfined Compressive Strength = 3100 psf				28 29				⧄	16	57
				30 31 32 33						
(occasional gravel)				34 35				⧄		91
SAND, gravelly with some clay binder	brown	very dense	SC	36 37 38						
				39	×		▯		7	50/6"
				40						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	2 OF 3	21

EB-21

DRILL RIG 'Continuous Flight Auger
SURFACE ELEVATION 180' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SAND, gravelly with some clay binder (Continued)	brown	very dense	SC	41 42 43						
(grading more gravelly)			SC-GC	44	x				5	50/6"
Bottom of Boring = 44.5 Feet				45						
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	3 OF 3	21

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	178' (Approx.)	LOGGED BY	R.R.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SAND, gravelly, clayey	brown	loose	SC		x		▯		13	7
Liquid Limit = 29% Plasticity Index = 12% Passing No. 200 Sieve = 42%				1 2	x		▯			9
		medium dense		3						
Dry Density = 127 pcf Unconfined Compressive Strength = 1,200 psf				4 5 6				◸	17	19
GRAVEL, sandy, clayey	brown	medium dense	GC	7 8						
		dense		9 10 11	x		▯		8	30
SAND, clayey with some gravel	brown	dense	SC	12 13						
				14 15 16	x		▯			40
(grading more gravelly)		very dense		17 18						
				19 20	x		▯		8	66

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 2	22

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 178' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SAND, gravelly, clayey (Continued)	brown	very dense	SC	21						
CLAY, silty with silty sand lenses	brown	very stiff	CL	22						
				23						
				24	x				24	26
Bottom of Boring = 25 Feet				25						

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	2 OF 2	22

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 181' (Approx.)	LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty with trace of coarse grained sand	dark brown	stiff	CL		x					14
				1						
		very stiff		2	x				24	27
				3						
				4						
					x					18
Bottom of Boring = 5 Feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 1	23

EB-23

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 180' (Approx.)	LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty with trace of coarse grained sand	dark brown	firm	CL		x		▯		18	8
				1			▯			
Liquid Limit = 37% Plasticity Index = 18% Passing No. 200 Sieve = 64%		stiff		2			▯			
					x		▯			10
				3						
Dry Density = 104 pcf Unconfined Compressive Strength = 2300 psf		very stiff		4				⧄	18	22
				5						
				6						
		hard		7						
				8						
(grading more sandy)	brown			9				⧄	16	57
Dry Density = 115 pcf Unconfined Compressive Strength = 6800 psf				10						
				11						
				12						
				13						
		very stiff		14			▯			
					x		▯			26
				15						
				16						
(grading less sandy)				17						
				18						
				19	x		▯			23
				20			▯			

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 3	24

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 180' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, silty with trace of coarse grained sand (Continued)	brown	very stiff	CL	21						
SAND, gravelly, clayey	brown	medium	SC	22						
				23						
				24	x					21
				25						
		dense to very dense		26						
				27						
				28						
				29	x					88/9"
				30						
GRAVEL, sandy, silty	gray-brown	very dense	GM	31						
				32						
				33						
				34	x				6	54/6"
				35						
SILT, clayey to CLAY silty	brown	very stiff	ML-CL	36						
				37						
				38						
				39	x					28
				40						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	2 OF 3	24

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 180' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION

DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SILT, clayey to CLAY silty (Continued)	brown	very stiff	ML-CL	41 42						
(grading more clayey with occasional lenses of fine grained sand)				43 44						
			CL		x				24	18
Bottom of Boring = 45 Feet				45						
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	3 OF 3	24

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 176' (Approx.)	LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION

DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty	dark brown	firm	CL		x		▯			6
				1			▯			
				2	x		▯			16
				3			▯			
				4				▨		17
				5				▨		
				6						
SAND, gravelly, clayey	brown	dense to very dense	SC	7						
				8						
				9			▯			
				10	x		▯		7	50
				11						
CLAY, silty with occasional lenses of silty sand	brown	very stiff	CL	12						
				13						
				14	x		▯			25
				15			▯			
				16						
				17						
				18						
				19			▯			
				20	x		▯		24	20

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	1 OF 2	25

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION 176' (Approx.)
LOGGED BY R.R.
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 6/10/74

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Modified Calif.	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty with occasional lenses of silty sand (Continued)	brown	very stiff	CL							
				21						
				22						
				23						
				24	x				19	23
				25						
Bottom of Boring = 25 Feet Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.										

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June 1974	2 OF 2	25

DRILL RIG Continuous Flight Auger
SURFACE ELEVATION ---
LOGGED BY J. [illegible]
DEPTH TO GROUNDWATER Not Established
BORING DIAMETER 6 Inches
DATE DRILLED 9/15/72

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
SAND, clayey and silty with charcoal (Burn Pile Area)	black-brown	loose	SM-SC		x				15	5
CLAY, sandy and silty	brown	firm	CL	2	x				30	3
				4						
(grading with more sand)	light brown	stiff		6						
		very stiff		8	x				19	25
				10						
SAND, clayey and silty	light brown	medium dense	SM-SC	12	x				19	30
				14						
				16	x				20	23
				18						
SILT, very sandy to SAND, silty, fine grained	light brown	medium dense	ML-SM	20						
				22	x				19	30
Bottom of Boring = 23.5 Feet				24						
Note: The stratifications lines represent the approximate boundary between soil types and the transition may be gradual.				26						
				28						
				30						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	A

EB-A

DRILL RIG Continuous Flight Auger

SURFACE ELEVATION ----

LOGGED BY J.C.P.

DEPTH TO GROUNDWATER Not Established

BORING DIAMETER 6 Inches

DATE DRILLED 9/15/72

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	Calif. Sampler	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty and sandy	dark	firm	CL		x			▯	19	13
(Dry Density = 95 & 97 pcf)				2	x			▯	21	9
(grading with more sand)	brown			4	x		▯		19	6
	dark brown	stiff		6						
				8						
GRAVEL and SAND, silty and clayey	brown	medium dense	GM-GC	10	x		▯			22
				12						
(grading with sand lenses)		dense		14						
				16	x		▯			41
SAND, silty	brown	dense	SM	18						
GRAVEL, sandy and silty	brown	dense	GM	20	x		▯			45
				22						
				24						
SILT, sandy	brown	medium dense	ML	26	x		▯		8	14
Bottom of Boring = 26.5 Feet				28						
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.				30						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER

Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	B

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION ---	LOGGED BY J.C.P.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 9/15/72

DESCRIPTION AND CLASSIFICATION										
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
CLAY, silty and sandy	dark brown	firm	CL		x				14	8
				2	x				16	6
				4						
SAND, silty, fine grained	light brown	loose	SM							
CLAY, sandy and silty	light brown	firm	CL	6	x				10	9
				8						
(grading with more sand)		stiff		10						
		very stiff			x				20	25
				12						
				14						
SAND, silty and clayey	brown	medium dense	SM-SC	16	x				17	28
(grading with very silty lenses)				18						
SAND, silty with lenses of SILT, sandy	light brown	medium dense	SM-ML	20	x				19	30
				22						
				24						
				26	x				15	17
Bottom of Boring = 26.5 Feet				28						
				30						

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	C

EB-C

DRILL RIG Continuous Flight Auger | SURFACE ELEVATION --- | LOGGED BY J.C.P.

DEPTH TO GROUNDWATER Not Established | BORING DIAMETER 6 Inches | DATE DRILLED 9/15/72

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
SAND, silty and clayey with fine gravel (Dry Density = 112 pcf)	brown	medium dense	SM-SC	2	x			◸	16	
CLAY, silty and sandy	brown	firm	CL	4	x		■		24	4
	dark brown	stiff to very stiff		6 8	x		■		24	20
GRAVEL, sandy	brown	medium dense	GP	10						
CLAY, sandy and silty with some gravel	brown	very stiff	CL		x		■		10	14
				12 14	x		■		18	22
SAND, clayey and silty	brown	dense	SM-SC	16						
GRAVEL, sandy with some silt	brown	dense	GM	18 20	x		■			33
(grading with little silt and less sand)		very dense		22 24 26	x		■			40/6"
SILT, very sandy with some clay	brown	dense	ML	28 30	x				21	35
GRAVEL, sandy	brown	dense	GP	32 34						
SAND, silty and clayey with some gravel (grading with more gravel)	brown	dense to very dense	SM	36 38 40	x		■		12	51

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 2	D

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION ----	LOGGED BY J.C.P.
DEPTH TO GROUNDWATER Not Established	BORING DIAMETER 6 Inches	DATE DRILLED 9/15/72

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
GRAVEL, sandy with some cobbles	brown	dense to very dense	GP	42 44 46						
Bottom of Boring = 47 Feet Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.				48 50						

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EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	2 OF 2	D

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	---	LOGGED BY	J.C.P.
DEPTH TO GROUNDWATER	Not Established	BORING DIAMETER	6 Inches	DATE DRILLED	9/15/72

DESCRIPTION AND CLASSIFICATION				DEPTH (feet)	JARS	SACKS	SPLIT SPOON	SHELBY TUBE	MOISTURE CONTENT %	PENETRATION RESISTANCE BLOWS/FT.
DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE							
CLAY, silty and sandy with some organic matter near surface	light brown	firm to stiff	CL		x				19	9
				2	x				17	8
(Dry Density = 108 pcf)					x				18	
(grading more clay with some fine gravel)	dark brown	very stiff		4						
				6	x				22	17
				8						
GRAVEL, sandy with some silt	brown	dense	GM-GP							
				10						
					x					40
				12						
(grading with more sand)				14						
				16	x					43
				18						
				20						
SILT, sandy to SAND, silty	brown	medium dense	ML-SM		x				19	28
				22						
				24						
SAND, silty	brown	medium dense	SM							
				26	x				23	16
Bottom of Boring = 26.5 Feet				28						
				30						

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOWNEY·KALDVEER ASSOCIATES

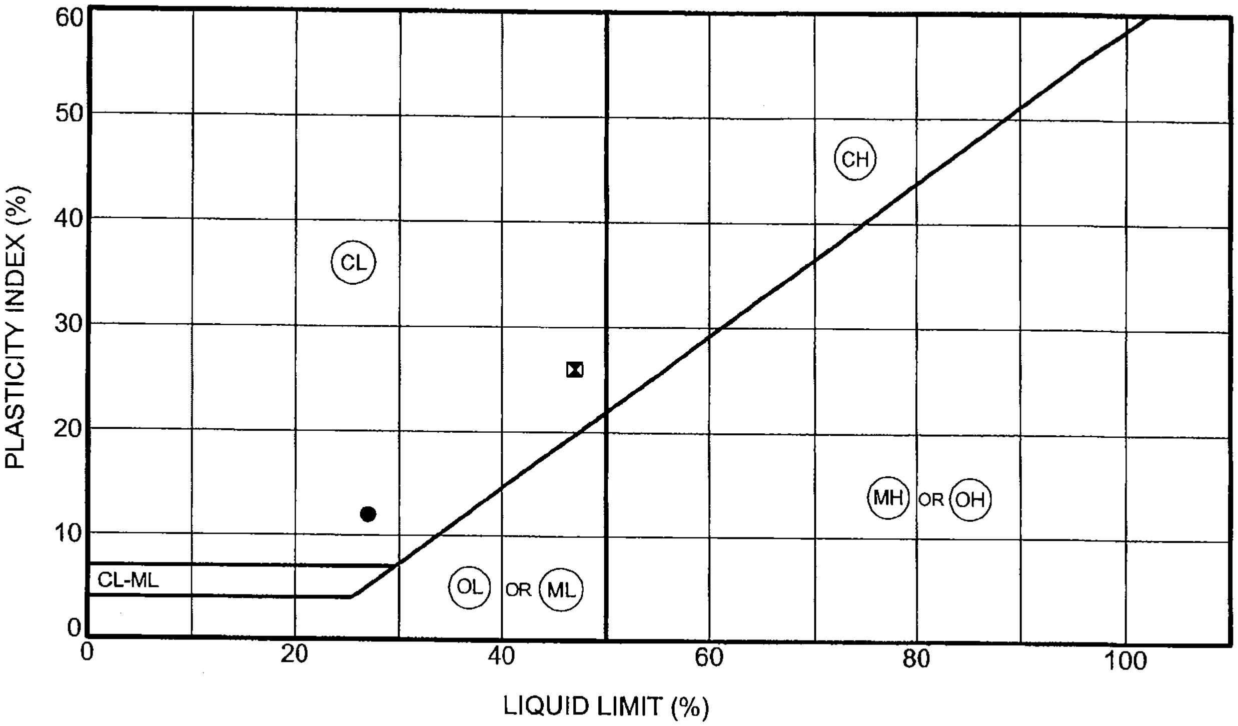
Foundation/Soil/Geological Engineers

EXPLORATORY BORING LOG

VALLCO PARK REGIONAL SHOPPING CENTER
Cupertino, California

PROJECT NO.	DATE	SHEET NO.	BORING NO.
259-5	June, 1974	1 OF 1	E

EB-E



Symbol	Boring No.	Depth (ft.)	Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing No. 200 Sieve	Unified Soil Classification Description
●	**EB-1** LB-1	1.5	13	27	15	12		**LEAN CLAY (CL)**
☒	**EB-4** LB-4	1.5	18	47	21	26		**LEAN CLAY WITH SAND (CL)**

LA CORP.GDT 8/20/04 MV* FLL

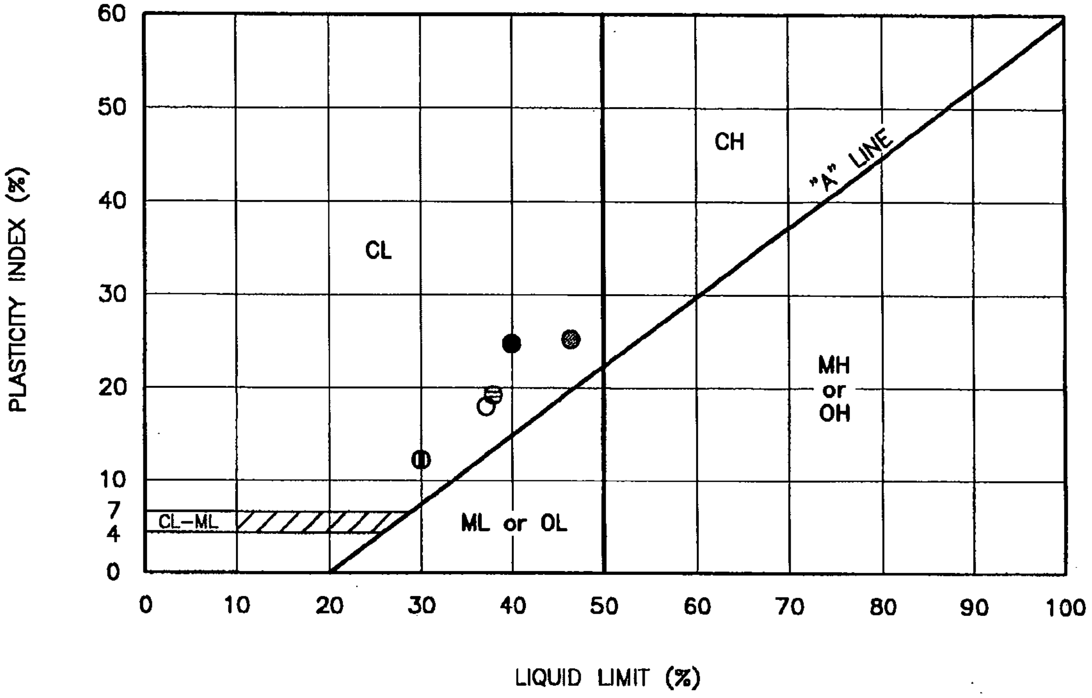
LOWNEY ASSOCIATES
Environmental/Geotechnical/Engineering Services

PLASTICITY CHART AND DATA

Project: VALLCO
Location: CUPERTINO, CA
Project No.: 259-5E

2004 Geotechnical Investigation

FIGURE B-1



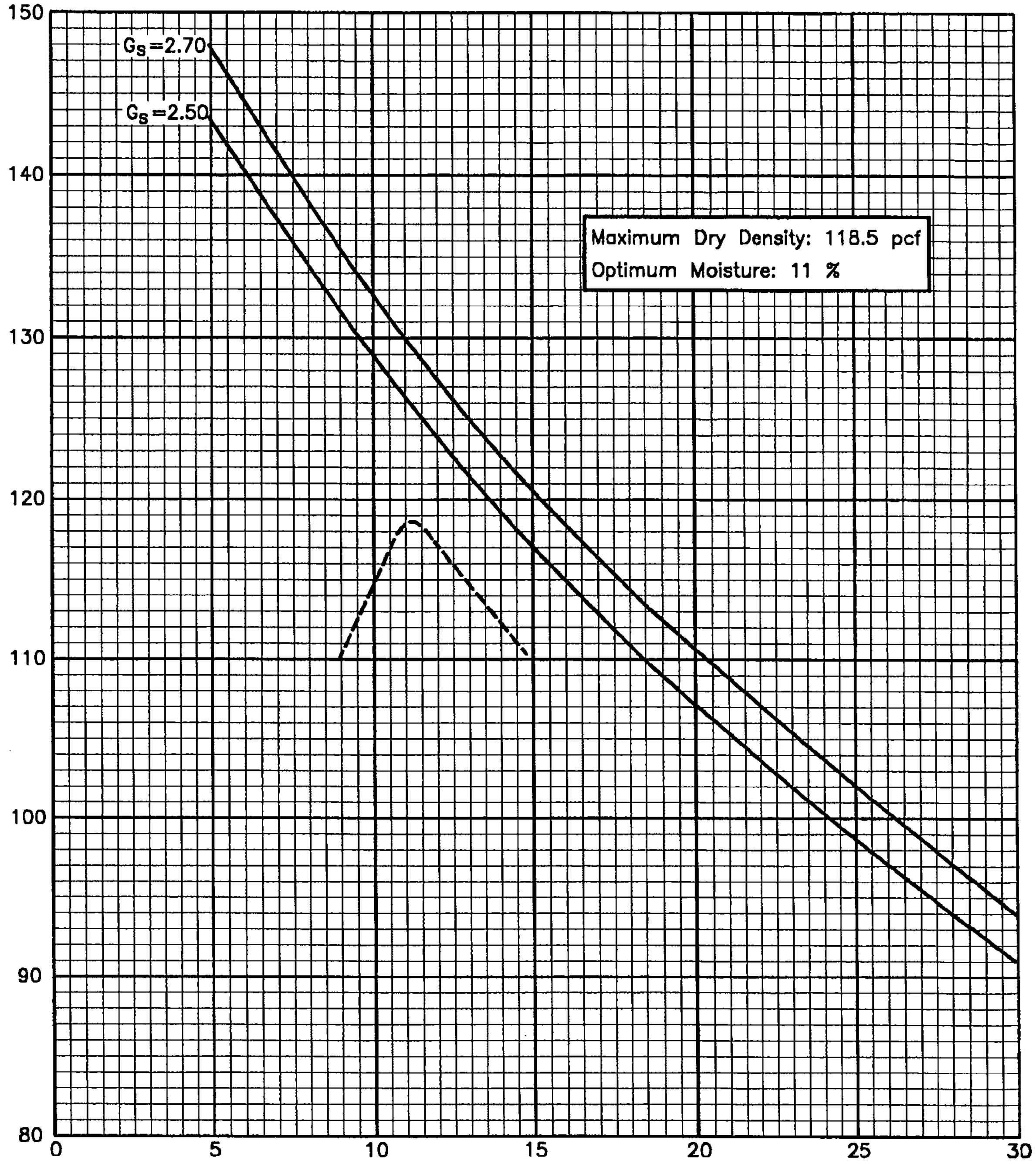
KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	NATURAL WATER CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	LIQUIDITY INDEX	UNIFIED SOIL CLASSIFICATION SYMBOL
●	EB-4 LA-4	2.0	19	40	24	53	--	CL
⊖	EB-9 LA-9	1.5	14	38	19	68	--	CL
○	B-24 EB-24	0.5	18	37	18	64	--	CL
⦶	EB-E	0-1.5	19	30	12	62	--	CL
◍	EB-E	5.0-6.5	22	46	25	77	--	CL

PLASTICITY CHART AND DATA

1999 Geotechnical Investigation

LOWNEY ASSOCIATES
Environmental/Geotechnical/Engineering Services

FIGURE B-1
259-50



LA-1, LA-2, LA-10, and LA-11

Sample Description: Bulk composite sample from boring EB-1, EB-2,
EB-10, and EB-11 at depth of 0.5 to 5 feet.
Dark brown silty clay (CL)

6/99*CB

COMPACTION CURVE

VALLCO EXPANSION
Cupertino, California

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

1999 Geotechnical Investigation

FIGURE B-2

259-5D

APPENDIX B - LABORATORY INVESTIGATION

The laboratory testing program was directed toward a quantitative and qualitative evaluation of the physical and mechanical properties of the soils underlying the site.

The natural water content was determined on 83 samples of the materials recovered from the borings; these water contents are recorded on the boring logs at the appropriate sample depths.

Atterberg Limits determinations were performed on three samples of the surface soils at the site to determine the range of water content over which these materials exhibit plasticity. The Atterberg Limits are used to classify the soil in accordance with the Unified Soil Classification System and to indicate the soil's expansion potential. The results of these tests, as well as the results of three tests performed during the previous investigation, are presented on Figure B-1 and on the logs of borings at the appropriate sample depths.

The percent passing the No. 200 sieve was determined on three samples of the surface soils to aid in the classification of these soils; the results of these tests, as well as the results of three tests performed during the previous investigation are presented on Figure B-1 and on the boring logs at the appropriate sample depths.

Dry density determinations were performed on 21 samples of the subsurface soils to evaluate their physical properties. The results of these tests as well as the result of three tests performed during the previous investigation are presented on the boring logs at the appropriate sample depths.

Unconfined compression tests were performed on 18 undisturbed samples of the clayey subsurface soils to evaluate the undrained shear strengths of these materials. The unconfined tests were performed on samples having a diameter of 2.8 inches and a height-to-diameter ratio of at least 2. Failure was taken as the peak normal stress. The results of these tests are presented on the boring logs at the appropriate sample depths.

Resistance "R" value tests were performed on two representative samples of the surface soils at the site to provide data for pavement design. The tests indicated that the expansion pressure controls the design of pavement sections with the "R" values by expansion equal to 4, 12 and 23 for traffic indices of 3.5, 4.5 and 6.0, respectively.

RESULTS OF "R" VALUE TESTS

Sample No.	Description of Material	Water Content (%)	Dry Density (pcf)	Exudation Pressure (psi)	"R" Value	Expansion Pressure (psf)
S-1	CLAY, silty	13	120	160	15	110
		12	122	270	24	140
		11	124	520	46	240
S-2	SAND, gravelly, silty and clayey	15	117	190	21	70
		13	118	410	32	80
		13	121	530	36	190

APPENDIX B

LOGS OF TEST BORINGS

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-1

PAGE 1 OF 5

Boring location: See Site Plan, Figure 2
Date started: 9/7/16
Date finished: 9/8/16
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Automatic
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)
Logged by: D. Wagstaffe

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value^1	LITHOLOGY	MATERIAL DESCRIPTION — Ground Surface Elevation: 194.2 feet^2	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
						4 inches asphalt concrete (AC)						
1						3 inches aggregate base (AB)						
2	HA	☒				CLAY with GRAVEL (CH) brown to dark brown, moist, fine subangular gravel, trace fine sand, trace organics R-Value Test, see Figure D-14						
6	S&H	■	4 7 11	13		decrease in gravel content, hard	PP		6,500		20.5	108
11	S&H	■	7 14 17	22		yellow-brown, very stiff LL = 59, PI = 39, see Figure D-1 Triaxial Test, see Figure D-2 Particle Size Analysis, see Figure D-12	TxUU	600	4,750		20.0	111
13					CH							
16	S&H	■	4 7 10	12		stiff					16.5	116
21	S&H	■	3 7 7	10		grades silty	PP		3,500			
26	S&H	■	14 14 17	22	CL	SANDY CLAY with GRAVEL (CL) brown to yellow-brown, very stiff, moist, fine sand LL = 31, PI = 16, see Figure D-1 Consolidation Test, see Figure D-9					13.4 17.7	112
29					SC	CLAYEY SAND with GRAVEL (SC) brown, medium dense, moist, fine- to medium-grained sand,						
30												

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Project No.: 770633101
Figure: B-1a

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-1

DEPTH (feet)	SAMPLES Sampler Type	Sample	Blows/ 6"	SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	S&H	■	11 15 20	25	SC	CLAYEY SAND with GRAVEL (SC) (continued) some fine subrounded gravel Triaxial test, see Figure D-3 Particle Size Analysis, see Figure D-12	TxUU	3,700	2,040	22	12.0	127
32												
33					GC	CLAYEY GRAVEL (GC) brown, very dense, moist, fine subangular gravel, medium to coarse sand						
34												
35	SPT	◩	35 50/ 6"	55/ 6"								
36					SP	SAND with CLAY (SP) yellow, very dense, moist, medium to coarse-grained						
37												
38					SC	CLAYEY SAND with GRAVEL (SC) brown, very dense, moist, medium to coarse-grained, fine subangular gravel						
39												
40												
41	SPT	◩	16 35 42	85		Particle Size Analysis, see Figure D-12 yellow and red mottling, fine-grained sand, weakly cemented				17.1	10.1	
42												
43												
44												
45												
46	SPT	◩	20 37 50	96								
47												
48						∇ (09/08/16, 6:20 a.m.)						
49												
50												
51	S&H	■	14 12 32	31		dense, medium-grained sand, fine subrounded to subangular gravel					10.7	
52					CL	SANDY CLAY with GRAVEL (CL) yellow-brown, very stiff to hard, wet, fine- to coarse sand, fine subrounded to subangular gravel						
53												
54					SC	CLAYEY SAND with GRAVEL (SC) brown, very dense, wet, fine to medium-grained, fine subangular gravel						
55												
56	SPT	◩	22 32 50	90								
57												
58												
59					CL	CLAY (CL) brown, hard, wet, trace fine subangular gravel						
60												

TEST GEOTECH LOG 770633101.GPJ TR.GDT 10/25/16

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Project No.: 770633101

Figure: B-1b

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-1

	SAMPLES						LABORATORY TEST DATA					
DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
	SPT	◪	9 25 30	61	CL	CLAY (CL) (continued)					20.6	
61												
62												
63					GC	CLAYEY GRAVEL with SAND (GC) brown, medium dense, wet, fine to coarse subrounded and subangular, fine to coarse sand						
64												
65												
66	S&H	⊙	4 11 15	18								
67												
68	SPT	◪	10 42 30	79	ML	SILT (ML) red, hard, wet						
69					GC	CLAYEY GRAVEL with SAND (GC) brown, medium dense, wet, fine to coarse subrounded and subangular, fine to coarse sand						
70												
71	SPT	⊙	4 7 8	17								
72												
73												
74					CL	SANDY CLAY (CL) brown, hard, wet, fine sand						
75												
76	S&H	■	4 19 50/ 3.5"	48/ 9.5"		Triaxial test, see Figure D-4	TxUU	9,100	640		18.0	112
77					SC	CLAYEY SAND (SC) brown, very dense, wet, fine to medium-grained					11.2	
78					SC	CLAYEY SAND with GRAVEL (SC) brown, very dense, wet, medium-grained, subangular gravel						
79												
80	SPT	◪	27 50/ 6"	55/ 6"								
81												
82												
83					CL	SANDY CLAY (CL) brown, very stiff, wet, fine to medium sand, trace fine subangular gravel						
84												
85												
86	SPT	◪	8 12 12	26	CL	CLAY (CL) brown, very stiff, wet, trace fine sand					19.4	
87												
88												
89					SC							
90												

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Project No.: 770633101

Figure: B-1c

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-1

PAGE 4 OF 5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
91	SPT		30 50/ 6"	55/ 6"	SC	CLAYEY SAND (SC) brown, very dense, wet, fine to medium-grained, some fine subangular gravel				19.0	10.3	
92												
93												
94												
95						dense, fine-grained						
96	S&H		22 22 24	32							20.0	
97					CL	SANDY CLAY (CL) brown, hard, wet, fine sand						
98					SC	CLAYEY SAND with GRAVEL (SC) brown, medium dense, wet, fine to coarse-grained, fine subangular gravel						
99												
100												
101	SPT		8 10 10	22							18.4	
102												
103												
104												
105					CL	CLAY (CL) brown, hard, moist, trace fine sand						
106	S&H		10 22 32	38		grades sandy with increase sand content	PP		6,000		19.3	111
107												
108					SC	CLAYEY SAND with GRAVEL (SC) brown, very dense, wet, fine to coarse-grained, fine subangular gravel						
109												
110	SPT		32 50/ 2.5"	55/ 2.5"						17.1	13.0	
111												
112												
113												
114												
115					CL	SANDY CLAY (CL) brown, hard, wet, fine sand						
116	SPT		10 10 17	30								
117												
118												
119												
120					SC							

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PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-1

PAGE 5 OF 5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
	SPT	◪	50/ 6"	55/ 6"		CLAYEY SAND with GRAVEL (SC) brown, very dense, wet, fine to coarse-grained, fine subangular gravel, weak to moderate cementation				19.0	9.9	
121												
122												
123												
124												
125					SC							
126												
127												
128												
129												
130	S&H	■	15 33 50/ 5.5"	58/ 11.5"	CL	CLAY with SAND (CL) brown, hard, wet, fine sand						
131											14.6	122
132						CLAYEY SAND (SC) brown to orange-brown, very dense, wet, fine to coarse-grained						
133												
134												
135					SC							
136												
137												
138												
139												
140	SPT	◪	27 50/ 6"	55/ 6"	SC	CLAYEY SAND with GRAVEL (SC) orange-brown, very dense, wet, fine to coarse-grained, fine subangular to angular gravel						
141												
142												
143												
144												
145												
146												
147												
148												
149												
150												

Boring terminated at a depth of 141 feet below ground surface.
Boring backfilled with cement grout.
Groundwater encountered at 48 feet below ground surface on 09/08/16 at 6:20 a.m.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.1, respectively to account for sampler type and hammer energy.
[2] Elevations based on NAVD 88 Datum.

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Project No.: 770633101
Figure: B-1e

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-2

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2
Date started: 9/6/16
Date finished: 9/6/16
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Automatic
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)
Logged by: D. Wagstaffe

Ground Surface Elevation: 197.6 feet[2]

	SAMPLES					MATERIAL DESCRIPTION	LABORATORY TEST DATA					
DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	Ground Surface Elevation: 197.6 feet[2]	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						3 inches asphalt concrete (AC)						
1						4 inches aggregate base (AB)						
2	HA				CL	CLAY (CL) brown, moist, trace fine sand grades sandy						
3												
4						with fine subangular gravel						
5			9			CLAY with GRAVEL (CL) dark brown, very stiff, moist, fine subangular gravel, some fine sand						
6	S&H		12 20	22			PP		8,000		16.0	121
7					CL							
8												
9						CLAY (CL) brown, very stiff, moist, some fine to coarse sand, fine subrounded gravel						
10			10									
11	S&H		17 22	27							15.1	118
12					CL							
13												
14												
15			7			increased gravel content CLAY with SAND (CL) dark brown, very stiff, moist, fine to medium sand Triaxial test, see Figure D-5						
16	S&H		14 20	24			TxUU	1,900	4,580		18.6	113
17						6-inch thick gravel layer						
18					CL							
19												
20			10									
21	S&H		14 23	26		CLAY with SAND (CL) gray, very stiff, moist, fine sand, with trace coarse sand, with wood debris					17.8	116
22												
23					CL							
24						6-inch thick gravel layer						
25			8			CLAY with SAND (CL) dark brown, very stiff, moist, fine sand, trace fine subangular gravel					20.1	110
26	S&H GRAB		14 20	24								
27					CL	increased gravel content						
28												
29					SC							
30												

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Project No.: 770633101
Figure: B-2a

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-2

DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	SPT	◩	11 27 23	55		CLAYEY SAND with GRAVEL (SC) brown, very dense, moist						
32					SC							
33						increased gravel content						
34												
35												
36	SPT	◩	5 10 14	26		SANDY CLAY (CL) yellow-brown, very stiff, moist, fine sand					20.1	
37					CL							
38												
39												
40						SANDY CLAY (CL) brown, hard, moist, fine sand						
41	S&H	■	10 24 27	36		Consolidation Test, see Figure D-10					17.2	111
42					CL							
43												
44												
45						increased gravel content						
46	SPT	◩	10 9 8	19	SM	SILTY SAND (SM) yellow-brown, medium dense, moist, fine-grained, trace fine subrounded gravel				25.0	24.2	
47						Particle Size Analysis, see Figure D-12						
48	SPT	◩	6 12 22	37	CL	CLAY (CL) brown, hard, moist, some sand, and gravel					20.4	
49												
50	S&H	■	27 50/ 4.5"	35/ 4.5"		CLAYEY GRAVEL with SAND (GC) brown, very dense, moist, fine subrounded, fine sand					9.8	
51												
52					GC							
53												
54												
55						CLAYEY SAND with GRAVEL (SC) brown, very dense, moist, fine to coarse-grained, fine to coarse subangular to angular gravel						
56	SPT	◩	31 37 50/ 3.5"	96/ 9.5"	SC	Particle Size Analysis, see Figure D-12				16.7	9.8	
57												
58												
59					SC	CLAYEY SAND with GRAVEL (SC) yellow-brown, very dense, moist, medium to coarse-grained, fine subangular gravel						
60												

LANGAN

Project No.: 770633101

Figure: B-2b

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-2

PAGE 3 OF 4

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
	SPT		27 50/ 6"	55/ 6"		CLAYEY SAND with GRAVEL (SC) (continued)					11.2	
61												
62												
63												
64												
65												
66	SPT		14 18 35	58		fine to medium-grained, fine to coarse gravel, less clay						
67					SC							
68												
69												
70	SPT		17 50/ 6"	55/ 6"		increased clay content, weak cementation, wet				16.7	10.5	
71												
72												
73												
74												
75						SANDY CLAY (CL) brown, hard, wet, fine to coarse sand, trace fine subrounded to subangular gravel						
76	SPT		10 17 25	46	CL						13.7	
77												
78						CLAYEY GRAVEL with SAND (GC) yellow-brown, very dense, wet, coarse and subangular, fine to coarse sand						
79												
80												
81	SPT		25 32 32	70								
82												
83												
84					GC							
85	SPT		32 50/ 6"	55/ 6"		LL = 29, PI = 15, see Figure D-1					12.2	
86												
87												
88												
89												
90												

LANGAN

Project No.: 770633101
Figure: B-2c

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-2

	SAMPLES						LABORATORY TEST DATA					
DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
91	SPT		35 34 38	79	GC	CLAYEY GRAVEL with SAND (GC) (continued) red and orange oxidation staining						
92												
93						CLAYEY SAND (SC) yellow-brown, dense, wet, fine to medium-grained						
94					SC							
95												
96	S&H		15 29 24	37							16.7	
97	GRAB				CL	with coarse subrounded gravel SANDY CLAY (CL) yellow-brown, hard, wet, fine to coarse sand					16.4	
98												
99						CLAY (CL) brown, very stiff, wet, with silt						
100												
101	S&H		11 22 24	32		Triaxial test, see Figure D-6 fine gravel	TxUU	12,100	2,090		24.3 23.1	103.5 105
102												
103												
104												
105												
106												
107												
108												
109												
110												
111												
112												
113												
114												
115												
116												
117												
118												
119												
120												

Boring terminated at a depth of 101.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscured by drilling method.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.1, respectively to account for sampler type and hammer energy.
[2] Elevations based on NAVD 88 Datum.

LANGAN

Project No.: 770633101
Figure: B-2d

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-3

PAGE 1 OF 2

Boring location: See Site Plan, Figure 2
Logged by: D. Wagstaffe
Date started: 9/14/16
Date finished: 9/14/16
Drilling method: Hollow Stem Auger (B-61)
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Downhole Safety
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)

DEPTH (feet)	SAMPLES Sampler Type	 Sample	 Blows/ 6"	 SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: 196.1 feet[2]	LABORATORY TEST DATA Type of Strength Test	 Confining Pressure Lbs/Sq Ft	 Shear Strength Lbs/Sq Ft	 Fines %	 Natural Moisture Content, %	 Dry Density Lbs/Cu Ft
		☒				3 inches asphalt concrete (AC) CLAY with SAND and GRAVEL (CL) brown, moist, fine sand, fine subangular gravel						
1												
2	HA				CL							
3												
4												
5						CLAY (CL) brown, hard, moist, trace medium sand						
6	S&H	■	21 30 49	47			PP		>4,500			
7												
8					CL							
9	S&H	■	30 29 23	31		abundant fine sand						
10							PP		>4,500			
11												
12						SANDY CLAY (CL) brown, hard, moist, fine sand						
13												
14	S&H	■	26 30 37	40								
15							PP		>4,500			
16												
17												
18												
19	SPT	◪	12 13 14	27		very stiff						
20												
21					CL							
22												
23												
24	S&H	■	22 16 20	22			PP		>4,500			
25												
26												
27												
28												
29	SPT	◪	17 18 19	37		hard						
30												

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Project No.: 770633101
Figure: B-3a

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-3

PAGE 2 OF 2

DEPTH (feet)	SAMPLES Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						SANDY CLAY (CL) (continued)						
31												
32					CL							
33												
34	S&H	■	20 30 40	42		with fine sand						
35					SP	SAND (SP) yellow-brown, dense, moist, medium-grained sand, trace clay						
36					CL	SANDY CLAY (CL) brown, hard, moist, fine sand						
37												
38						SAND with GRAVEL (SW) yellow-brown, very dense, moist, fine to coarse-grained, fine to coarse subangular gravel, trace clay						
39	SPT	◩	20 26 26	52								
40												
41												
42					SW							
43												
44	SPT	◩	28 18 26	44		dense						
45												
46												
47						SANDY CLAY (CL) yellow-brown, stiff, moist, fine sand, with silt						
48					CL							
49	S&H	■	14 12 12	14			PP		3,500			
50												
51												
52												
53												
54												
55												
56												
57												
58												
59												
60												

Boring terminated at a depth of 50 feet below ground surface.
Boring backfilled with cement grout.
Groundwater not encountered during drilling
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.6 and 1.0, respectively to account for sampler type and hammer energy.

[2] Elevations based on NAVD 88 Datum.

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-4

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2

Logged by: D. Wagstaffe

Date started: 9/13/16

Date finished: 9/14/16

Drilling method: Hollow Stem Auger (B-56 and B-61)

Hammer weight/drop: 140 lbs./30 inches

Hammer type: Downhole Safety

Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)

DEPTH (feet)	SAMPLES Sampler Type	SAMPLES Blows/ 6"	SAMPLES SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: 182.4 feet[2]	LABORATORY TEST DATA Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
					3 inches asphalt concrete (AC)						
1					CLAY with SAND and GRAVEL (CL) brown, moist, fine to medium sand, fine subangular gravel R-Value Test, see Figure D-15						
2	HA			CL							
3											
4											
5					CLAY (CL) gray-brown, medium stiff to stiff, moist, trace fine sand						
6	S&H	3 4 7	7		LL = 44, PI = 25, see Figure D-1	PP		1,000			
7											
8				CL							
9	S&H	6 14 20	20		stiff, trace medium-grained sand						
10						PP		1,750			
11											
12					SANDY CLAY (CL) brown, hard, moist, fine sand						
13				CL							
14	S&H	8 26 30	34							8.7	
15					CLAYEY SAND with GRAVEL (SC) brown, dense, moist, fine to coarse-grained, fine subangular gravel						
16				SC							
17											
18				SP-SC	SAND with CLAY and GRAVEL (SP-SC) brown, medium dense, moist, fine- to coarse-grained, fine subangular gravel						
19	SPT	20 10 9	19		Particle Size Analysis, see Figure D-13				11.5	7.7	
20					CLAY (CL) brown, very stiff, moist, trace fine sand						
21											
22				CL							
23											
24	S&H	6 10 20	18								
25					CLAYEY SAND (SC) yellow-brown, medium dense, moist, fine-grained sand, trace coarse sand, trace fine subrounded gravel	PP		3,500			
26				SC							
27					CLAY (CL) brown, moist, trace fine sand						
28				CL							
29	S&H	7 7 12	11	SC	CLAYEY SAND (SC) yellow-brown, medium dense, moist, fine-grained,						
30				ML		PP		2,500			

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-4

PAGE 2 OF 4

	SAMPLES						LABORATORY TEST DATA					
DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						trace coarse sand						
31					ML	SILT (ML) yellow-brown, very stiff, moist, with clay						
32						CLAY with SAND (CL) brown, hard, moist, fine sand						
33												
34	S&H	■	10 24 34	35								
35							PP		4,500			
36												
37												
38					CL							
39	S&H	■	10 24 40	38		trace coarse sand						
40						Triaxial test, see Figure D-7	TxUU	2,300	21,510		21.4	104
41												
42												
43						with fine sand						
44	S&H	■	22 50/ 5"	30/ 5"		GRAVEL with SILT and SAND (GP-GM) brown, dense, moist, subangular to subrounded gravel, fine to medium sand				5.9	5.6	
45					GP-GM	Particle Size Analysis, see Figure D-13						
46						SAND with SILT and GRAVEL (SP-SM) yellow-brown, very dense, moist fine to coarse-grained, trace subangular gravel, weakly cemented						
47												
48												
49	SPT	◩	50/ 6"	50/ 6"		Particle Size Analysis, see Figure D-13				9.7	4.3	
50					SP-SM							
51												
52						cuttings have a cobble						
53												
54	S&H	■	22 24 30	32		SANDY CLAY (CL) brown with gray-brown mottling, hard, moist, fine to medium sand						
55							PP		3,000			
56												
57					CL							
58												
59	S&H	■	8 16 32	29		brown, with fine subrounded gravel						
60							PP		4,500			

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Project No.: 770633101

Figure: B-4b

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-4

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
						SANDY CLAY (CL) (continued)						
61					CL							
62												
63						CLAYEY SAND with GRAVEL (SC) yellow-brown, very dense, moist, fine to medium-grained, fine subangular gravel						
64	SPT	◪	40 50/ 5"	50/ 5"								
65												
66						interbedded sand and clay layers						
67												
68					SC							
69	S&H	■	40 50/ 6"	30/ 6"								
70												
71												
72												
73						CLAY (CL) brown, hard, moist, trace fine sand						
74	S&H	■	12 25 38	38								
75						Consolidation Test, see Figure D-11	PP		4,500		20.7	105
76					CL							
77												
78												
79	S&H	■	12 25 50/ 5"	30/ 11"		SANDY CLAY (CL) yellow-brown, very stiff, moist, fine sand	PP		3,000			
80												
81												
82												
83												
84	S&H	■	5 10 26	22	CL							
85						Triaxial test, see Figure D-8	TxUU	10,100	1,220		21.8	105
86												
87												
88												
89	S&H	■	12 50/ 2"	30/ 2"	SC	CLAYEY SAND with GRAVEL (SC) brown, very dense, moist, fine- to						
90												

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-4

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
91						CLAYEY SAND with GRAVEL (SC) (continued) medium-grained, fine subangular gravel						
92					CL	SANDY CLAY (CL) yellow-brown, hard, moist, fine sand, trace fine subrounded gravel						
93												
94	S&H	■	21 40 50/ 1"	54/ 7"			PP		4,500			
95					CL	GRAVELLY CLAY with SAND (CL) yellow-brown, hard, moist, fine subangular gravel, fine sand ∇ (09/14/16, 10:40 a.m.)						
96												
97					SM	SILTY SAND (SM) yellow-brown, dense, wet, fine-grained						
98												
99	S&H	■	28 40 41	49	CL	SANDY CLAY (CL) yellow-brown, hard, wet, fine sand, with medium sand						
100					SC	CLAYEY SAND with GRAVEL (SC) yellow-brown, dense, wet, fine to coarse-grained, fine subrounded to subangular gravel						
101												
102												
103												
104												
105												
106												
107												
108												
109												
110												
111												
112												
113												
114												
115												
116												
117												
118												
119												
120												

Boring terminated at a depth of 101.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater encoutnerd at 96 feet on 09/14/16 at 10:40 a.m.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.6 and 1.0, respectively to account for sampler type and hammer energy.

[2] Elevations based on NAVD 88 Datum.

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Project No.: 770633101

Figure: B-4d

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-5

PAGE 1 OF 2

Boring location: See Site Plan, Figure 2
Date started: 9/14/16
Date finished: 9/14/16
Drilling method: Hollow Stem Auger
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Downhole Safety
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)
Logged by: D. Wagstaffe

Ground Surface Elevation: 179.8 feet[2]

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0		☒				4 inches asphalt concrete (AC)						
1						CLAY (CL) brown, moist						
2	HA											
3					CL							
4						with fine subangular gravel						
5						SANDY CLAY (CL)						
6	S&H	■	14 18 23	25		brown, very stiff, moist, fine sand					10.2	109
7												
8												
9	S&H	■	18 28 38	40		yellow-brown, hard, decreased sand content						
10							PP		>4,500			
11												
12												
13												
14	S&H	■	30 21 31	31	CL							
15						with medium to coarse sand and fine subangular gravel	PP		>4,500			
16												
17												
18												
19	S&H	■	15 20 30	30		with silt						
20							PP		>4,500			
21												
22												
23						SANDY SILT (ML) light brown, stiff to very stiff, moist, fine sand Particle Size Analysis, see Figure D-13						
24	SPT	◩	10 8 7	15	ML					54.0	8.9	
25												
26						CLAY (CL)						
27	SPT	◩	8 10 13	23		yellow-brown, very stiff, moist, with silt						
28			12		CL							
29	S&H	■	20 50/ 4"	42/ 10"		hard, decrease silt	PP		4,500			
30												

Project No.: 770633101
Figure: B-5a

PROJECT: **THE HILLS AT VALLCO**
Cupertino, California

Log of Boring B-5

PAGE 2 OF 2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
31					CL	CLAY (CL) (continued)						
32												
33					CL	SANDY CLAY (CL) yellow-brown, hard, moist, fine sand						
34	S&H	■	14 26 44	42								
35					SW-SC	SAND with CLAY (SW-SC) yellow-brown, dense, moist, fine- to coarse-grained						
36												
37					SW-SC	SAND wIth CLAY and GRAVEL (SW-SC) yellow-brown, dense, moist, fine to coarse-grained, fine subangular gravel						
38												
39	SPT	◩	24 24 20	44								
40						CLAY (CL) yellow-brown, hard, moist, trace fine sand						
41												
42												
43												
44	S&H	■	18 19 24	26		hard, with silt, decrease sand content						
45					CL		PP		4,500			
46												
47												
48												
49	S&H	■	14 18 24	25		very stiff						
50							PP		3,000			
51												
52												
53												
54												
55												
56												
57												
58												
59												
60												

Boring terminated at a depth of 50 feet below ground surface.
Boring backfilled with cement grout.
Groundwater not encountered during drilling.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.6 and 1.0, respectively to account for sampler type and hammer energy.

[2] Elevations based on NAVD 88 Datum.

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Project No.: 770633101

Figure: B-5b

TEST GEOTECH LOG 770633101.GPJ TR.GDT 10/25/16

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size	**Gravels** (More than half of coarse fraction > no. 4 sieve size)	**GW**	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	**SW**	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	**Silts and Clays** LL = < 50	**ML**	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	**MH**	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		**PT**	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	**Range of Grain Sizes**	
	U.S. Standard Sieve Size	**Grain Size in Millimeters**
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel coarse fine	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
Sand coarse medium fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.075 4.76 to 2.00 2.00 to 0.420 0.420 to 0.075
Silt and Clay	Below No. 200	Below 0.075

▽	Unstabilized groundwater level
▼	Stabilized groundwater level

SAMPLE DESIGNATIONS/SYMBOLS

⊟	Sample taken with Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter. Darkened area indicates soil recovered
◩	Classification sample taken with Standard Penetration Test sampler
◨	Undisturbed sample taken with thin-walled tube
⊠	Disturbed sample
⊙	Sampling attempted with no recovery
◫	Core sample
◙	Analytical laboratory sample
▥	Sample taken with Direct Push or Drive sampler

SAMPLER TYPE

C	Core barrel
CA	California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter
D&M	Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube
O	Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube
PT	Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube
S&H	Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter
SPT	Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter
ST	Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

THE HILLS AT VALLCO
Cupertino, California

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CLASSIFICATION CHART

Date 09/19/16 | Project No. 770633101 | Figure B-6

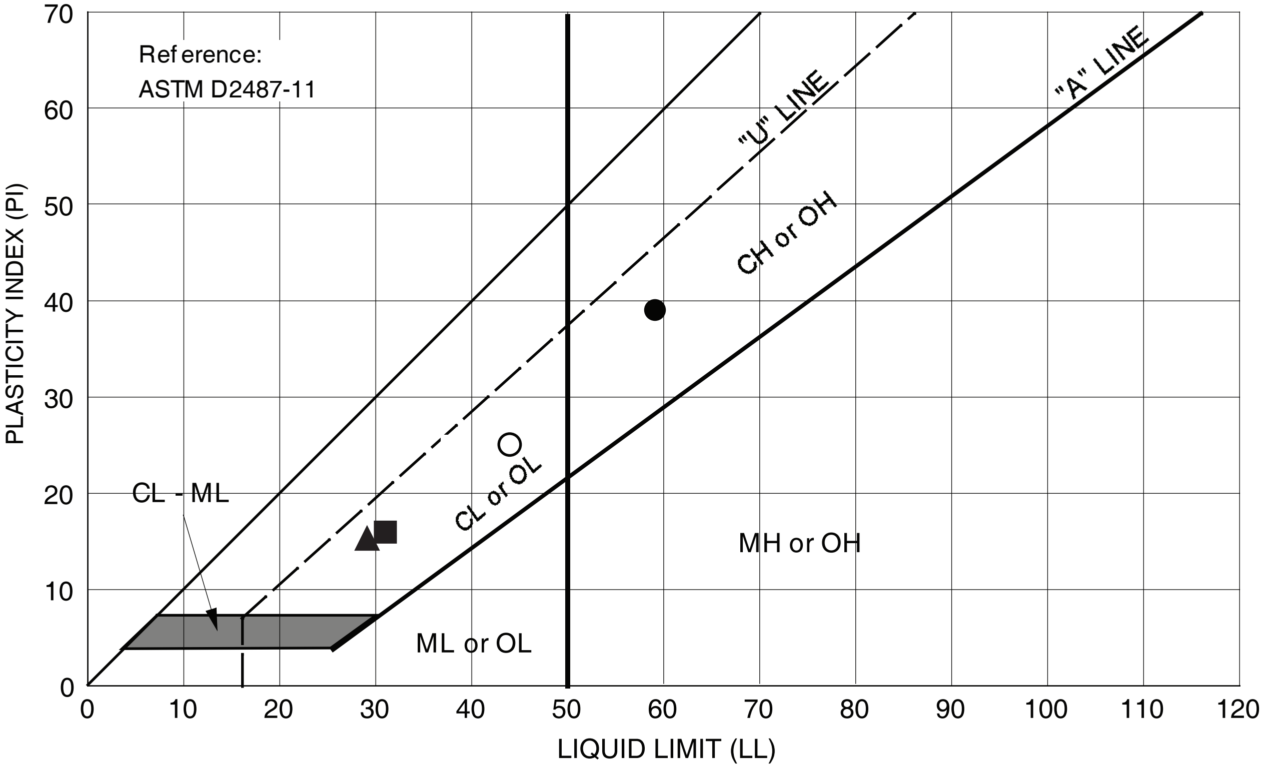
APPENDIX C

DOWNHOLE SUSPENSION LOGGING

(To be included at a later date)

APPENDIX D

LABORATORY DATA



Symbol	Source	Description and Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
●	B-1 at 11 feet	CLAY with GRAVEL (CH), brown to dark brown	20.0	59	39	--
■	B-1 at 25.5 feet	SANDY CLAY with GRAVEL (CL), brown to yellow-brown	13.4	31	16	--
▲	B-2 at 85 feet	CLAYEY GRAVEL with SAND (GC), yellow-brown	12.2	29	15	--
○	B-4 at 6 feet	CLAY (CL), gray-brown	--	44	25	--

THE HILLS AT VALLCO
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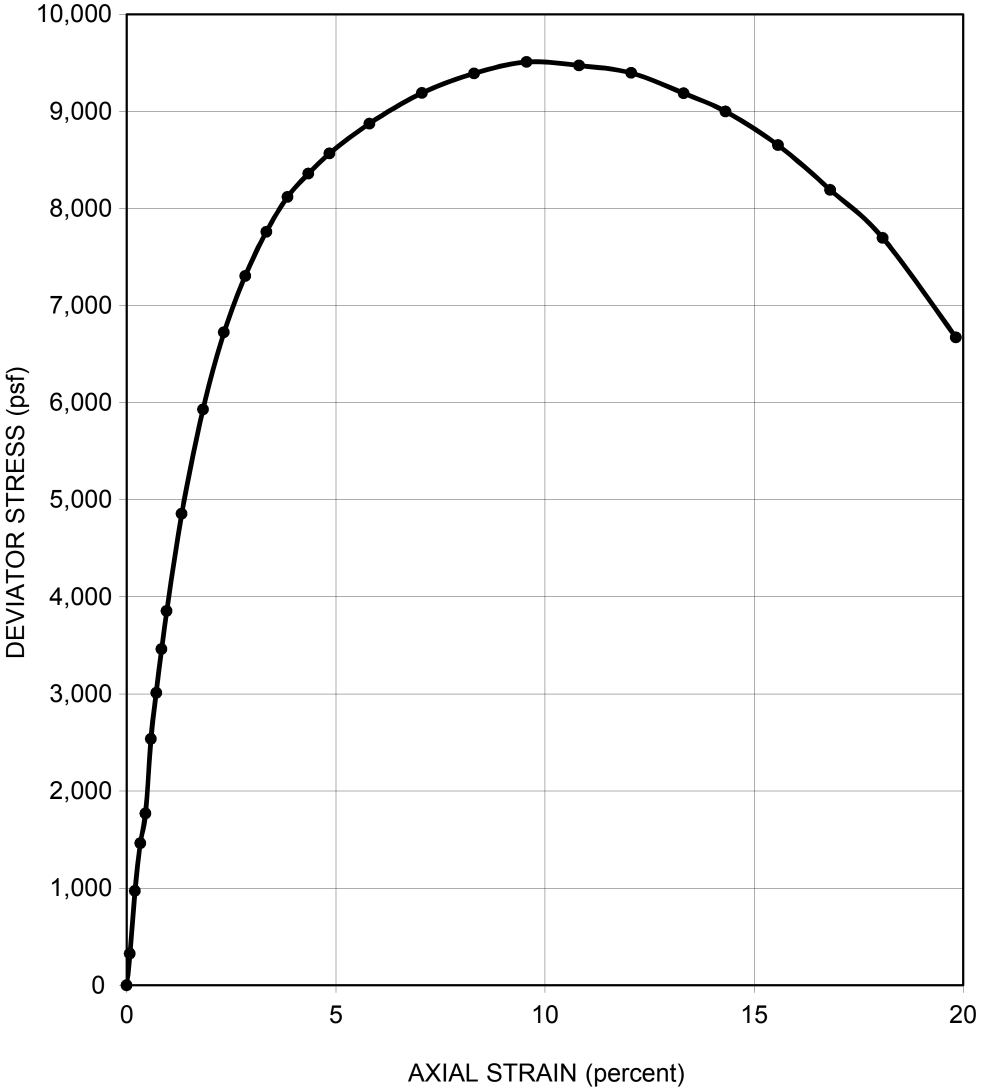
PLASTICITY CHART

Date 10/12/16 | Project No. 770633101 | Figure D-1



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SAMPLER TYPE	Sprague & Henwood			SHEAR STRENGTH	4,750	psf
DIAMETER (in.)	2.39	HEIGHT (in.)	5.72	STRAIN AT FAILURE	9.6	%
MOISTURE CONTENT		20.0	%	CONFINING PRESSURE	600	psf
DRY DENSITY		111	pcf	STRAIN RATE	0.75	% / min
DESCRIPTION	CLAY with GRAVEL (CH), yellow-brown			SOURCE	B-1 at 10.5 feet	

THE HILLS AT VALLCO
Cupertino, California

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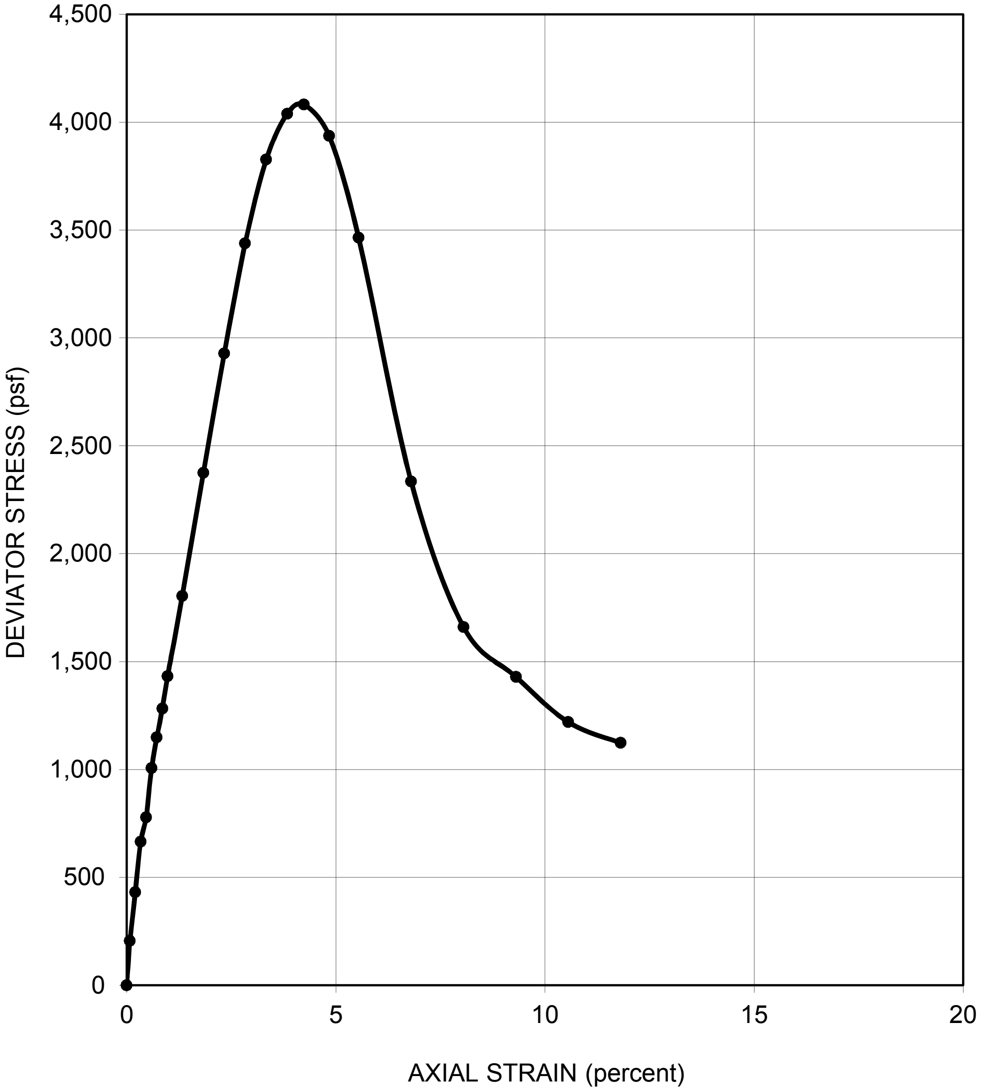
UNCONSOLIDATED-UNDRAINED
TRIAXIAL COMPRESSION TEST

Date 10/13/16 | Project No. 770633101 | Figure D-2



DRAFT

SAMPLER TYPE	Sprague & Henwood			SHEAR STRENGTH	2,040	psf
DIAMETER (in.)	2.40	HEIGHT (in.) 5.7		STRAIN AT FAILURE	4.2	%
MOISTURE CONTENT		12.0	%	CONFINING PRESSURE	3,700	psf
DRY DENSITY		127	pcf	STRAIN RATE	0.50	% / min
DESCRIPTION	CLAYEY SAND (SC), brown			SOURCE	B-1 at 31 feet	

THE HILLS AT VALLCO
Cupertino, California

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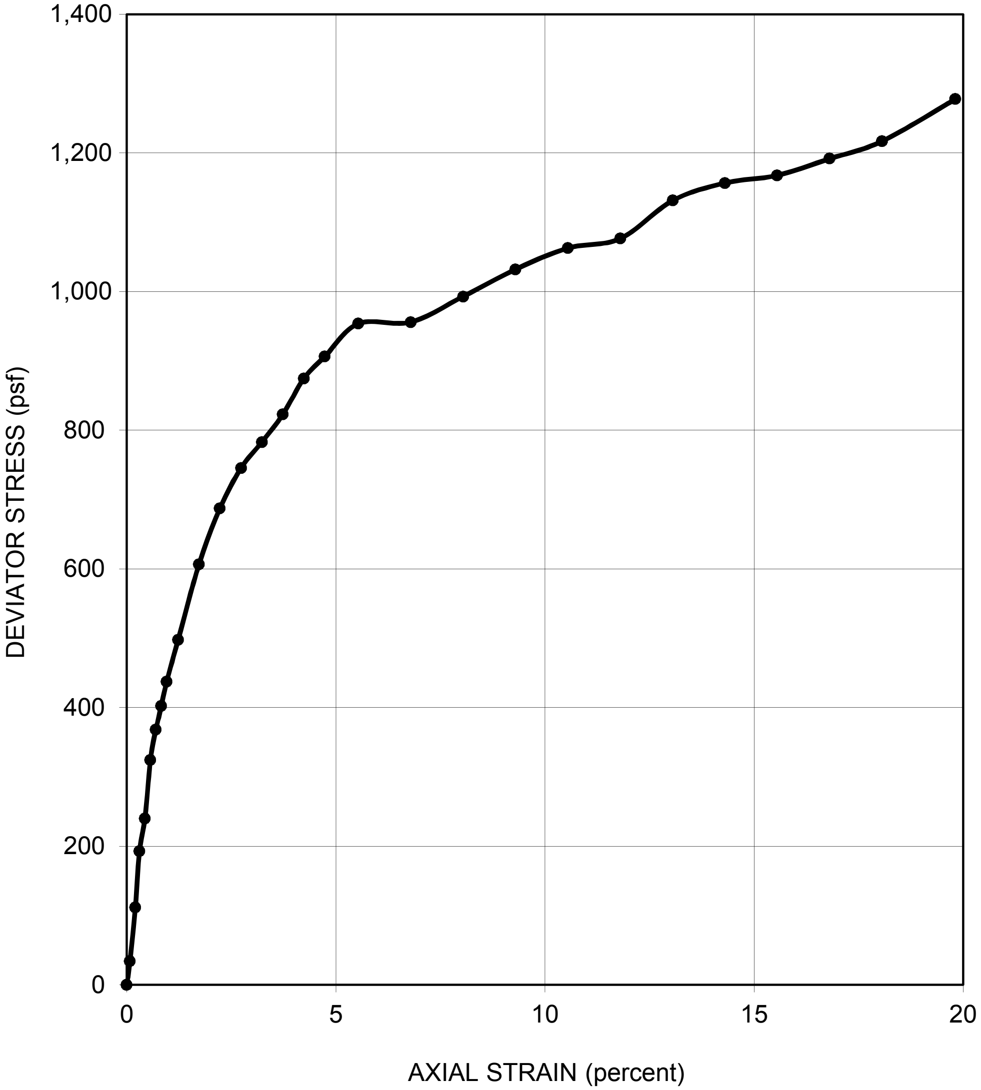
UNCONSOLIDATED-UNDRAINED
TRIAXIAL COMPRESSION TEST

Date 10/13/16 | Project No. 770633101 | Figure D-3



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SAMPLER TYPE	Sprague & Henwood		SHEAR STRENGTH	640	psf
DIAMETER (in.) 2.40	HEIGHT (in.) 5.52		STRAIN AT FAILURE	19.8	%
MOISTURE CONTENT	18.0	%	CONFINING PRESSURE	9,100	psf
DRY DENSITY	112	pcf	STRAIN RATE	0.50	% / min
DESCRIPTION	SANDY CLAY (CL), brown			SOURCE	B-1 at 75.5 feet

THE HILLS AT VALLCO
Cupertino, California

UNCONSOLIDATED-UNDRAINED
TRIAXIAL COMPRESSION TEST

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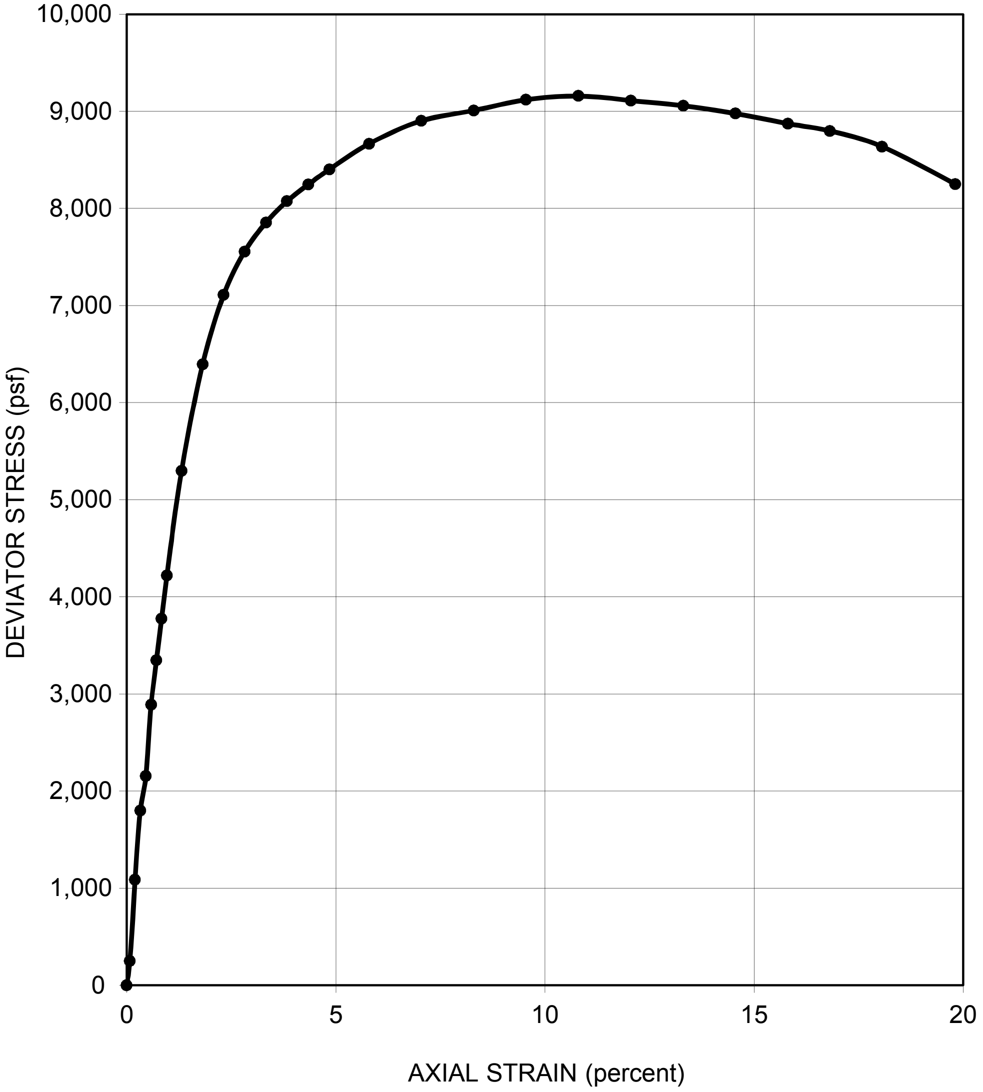
Date 10/13/16 | Project No. 770633101 | Figure D-4



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SAMPLER TYPE	Sprague & Henwood			SHEAR STRENGTH	4,580	psf
DIAMETER (in.)	2.40	HEIGHT (in.)	5.61	STRAIN AT FAILURE	10.8	%
MOISTURE CONTENT		18.6	%	CONFINING PRESSURE	1,900	psf
DRY DENSITY		113	pcf	STRAIN RATE	0.75	% / min
DESCRIPTION	CLAY with SAND (CL), dark brown			SOURCE	B-2 at 16 feet	

THE HILLS AT VALLCO
Cupertino, California

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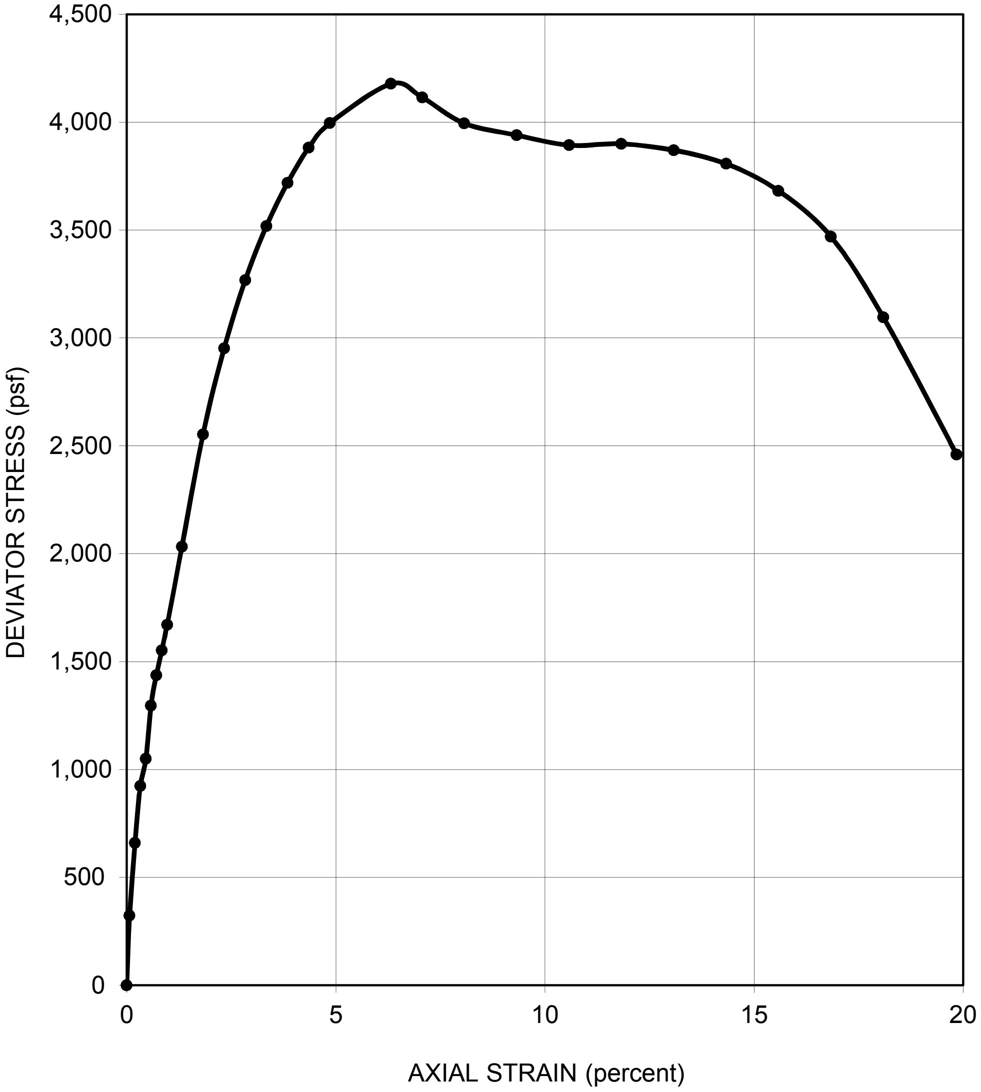
UNCONSOLIDATED-UNDRAINED
TRIAXIAL COMPRESSION TEST

Date 10/13/16 | Project No. 770633101 | Figure D-5



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SAMPLER TYPE	Sprague & Henwood		SHEAR STRENGTH	2,090	psf
DIAMETER (in.) 2.40	HEIGHT (in.) 5.72		STRAIN AT FAILURE	6.3	%
MOISTURE CONTENT	23.1	%	CONFINING PRESSURE	12,100	psf
DRY DENSITY	105	pcf	STRAIN RATE	0.75	% / min
DESCRIPTION	CLAY (CL), brown		SOURCE	B-2 at 100.5 feet	

THE HILLS AT VALLCO
Cupertino, California

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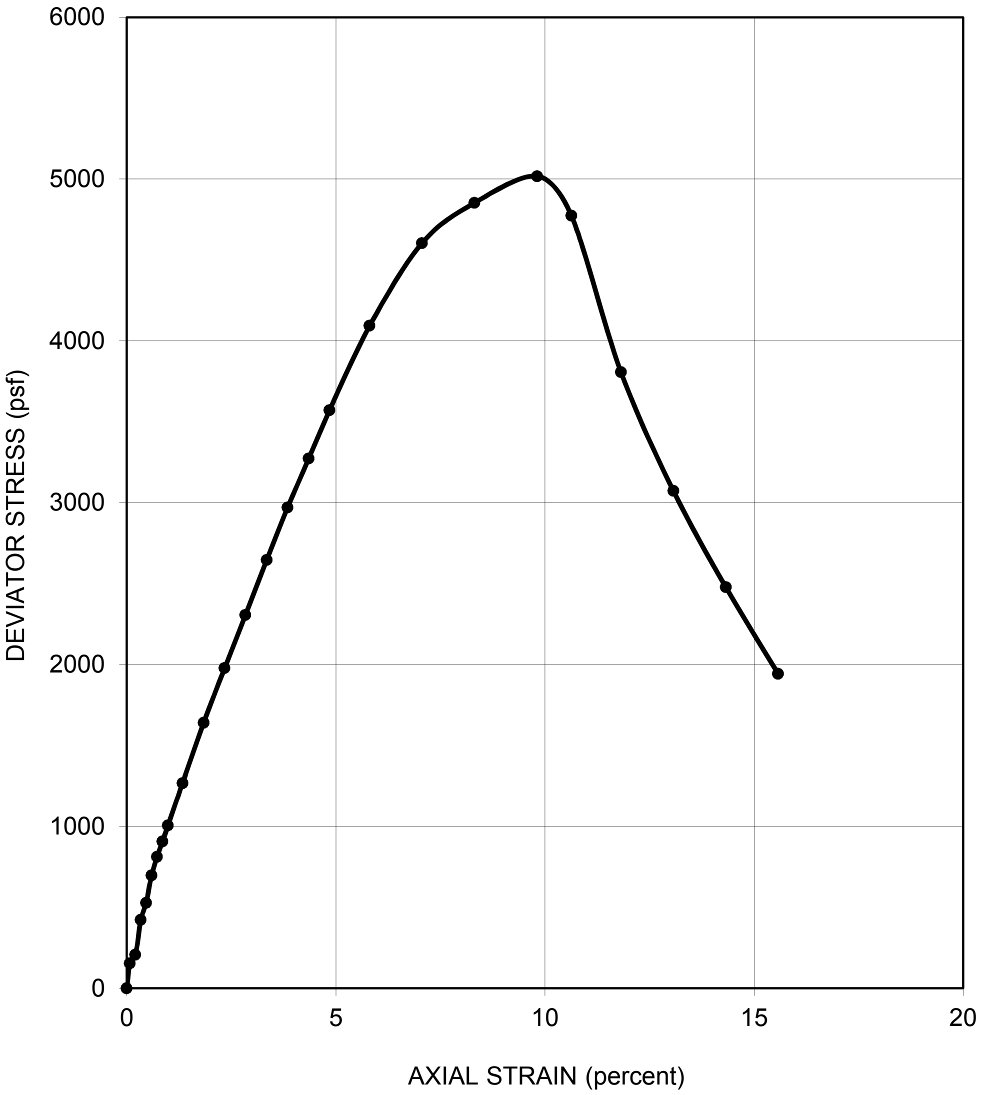
UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Date 10/13/16 | Project No. 770633101 | Figure D-6



DRAFT

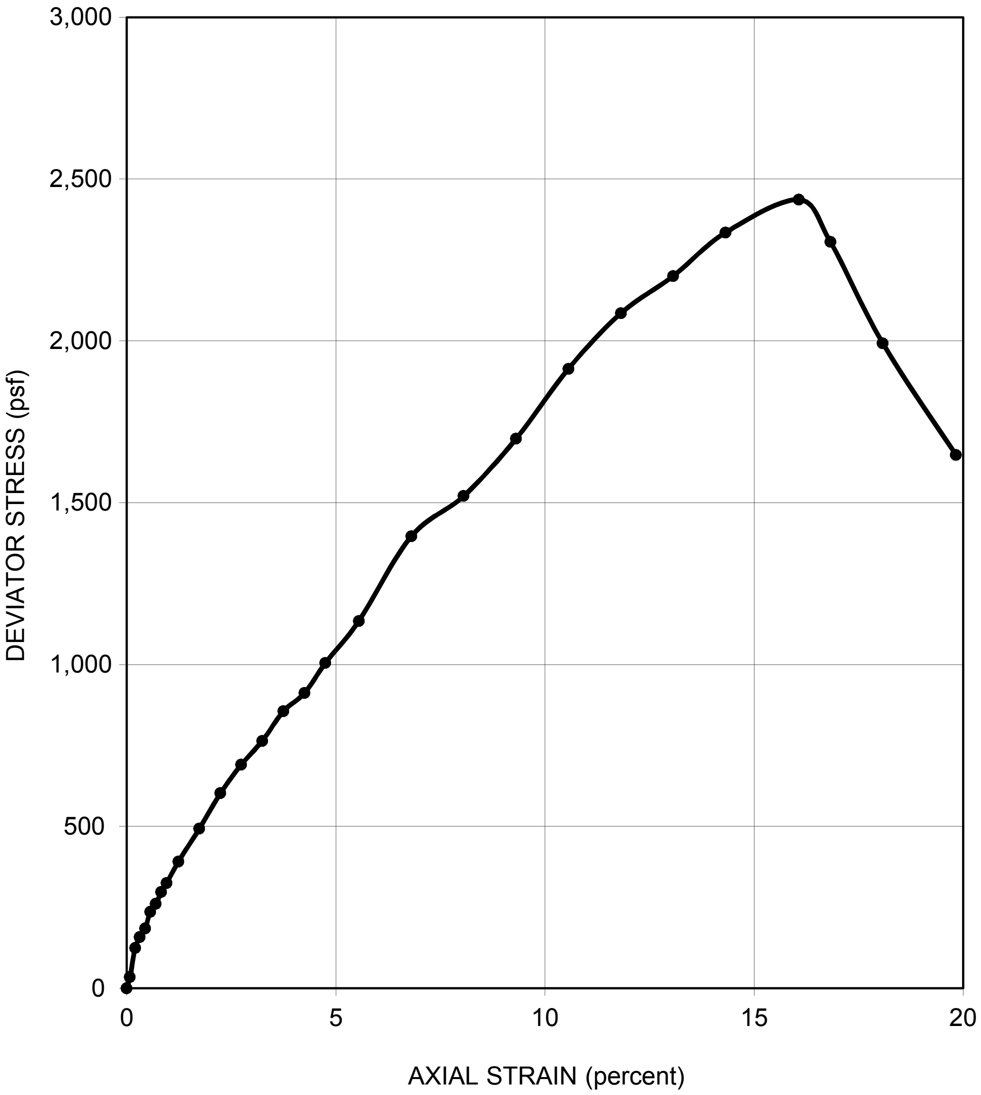
SAMPLER TYPE	Sprague & Henwood		SHEAR STRENGTH	2,510	psf
DIAMETER (in.)	2.42	HEIGHT (in.) 5.41	STRAIN AT FAILURE	9.8	%
MOISTURE CONTENT	21.4	%	CONFINING PRESSURE	2,300	psf
DRY DENSITY	104	pcf	STRAIN RATE	0.50	% / min
DESCRIPTION	CLAY with SAND (CL), brown		SOURCE	B-4 at 39.5 feet	

THE HILLS AT VALLCO
Cupertino, California

LANGAN

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Date 10/13/16 | Project No. 770633101 | Figure D-7



DRAFT

SAMPLER TYPE	Sprague & Henwood			SHEAR STRENGTH	1,220	psf
DIAMETER (in.) 2.40	HEIGHT (in.) 5.42			STRAIN AT FAILURE	16.1	%
MOISTURE CONTENT		21.8	%	CONFINING PRESSURE	10,100	psf
DRY DENSITY		105	pcf	STRAIN RATE	0.50	% / min
DESCRIPTION	SANDY CLAY (CL), yellow-brown				SOURCE	B-4 at 84.5 feet

THE HILLS AT VALLCO
Cupertino, California

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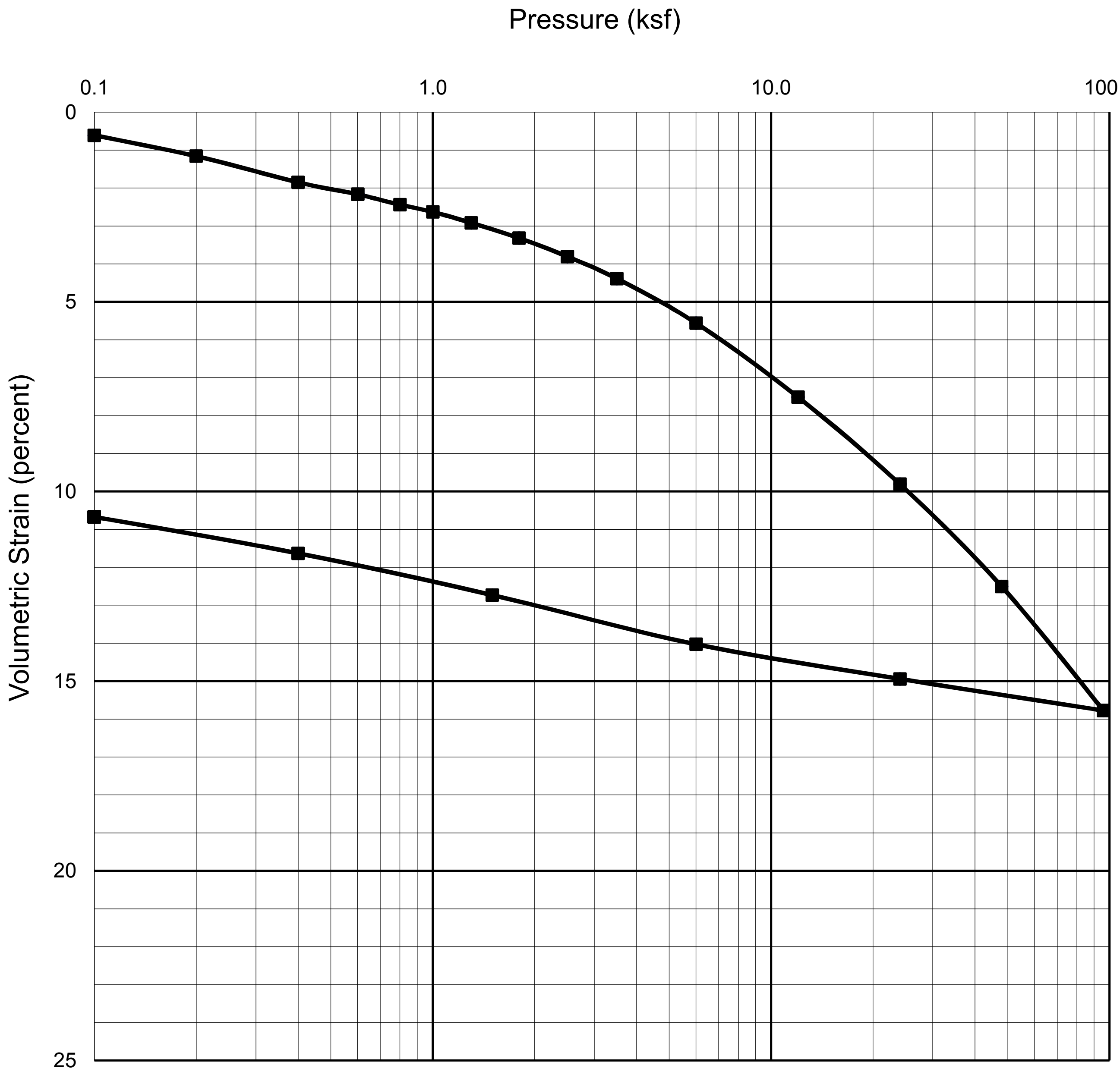
UNCONSOLIDATED-UNDRAINED
TRIAXIAL COMPRESSION TEST

Date 10/13/16 | Project No. 770633101 | Figure D-8



DRAFT

Sampler Type: Sprague & Henwood				Condition	Before Test			After Test	
Diameter (in) 2.42	Height (in) 1.00			Water Content	w_o	17.7 %		w_f	12.6 %
Overburden Pressure, p_o	3,120	psf		Void Ratio	e_o	0.50		e_f	0.34
Preconsol. Pressure, p_c	8,000	psf		Saturation	S_o	95 %		S_f	100 %
Compression Ratio, $C_{\varepsilon c}$	0.10			Dry Density	γ_d	112 pcf		γ_d	126 pcf
LL - -	PL - -			PI - -		G_s	2.70	(assumed)	
Classification	SANDY CLAY with GRAVEL (CL), yellow-brown					Source	B-1 at 26 feet		

THE HILLS AT VALLCO
Cupertino, California

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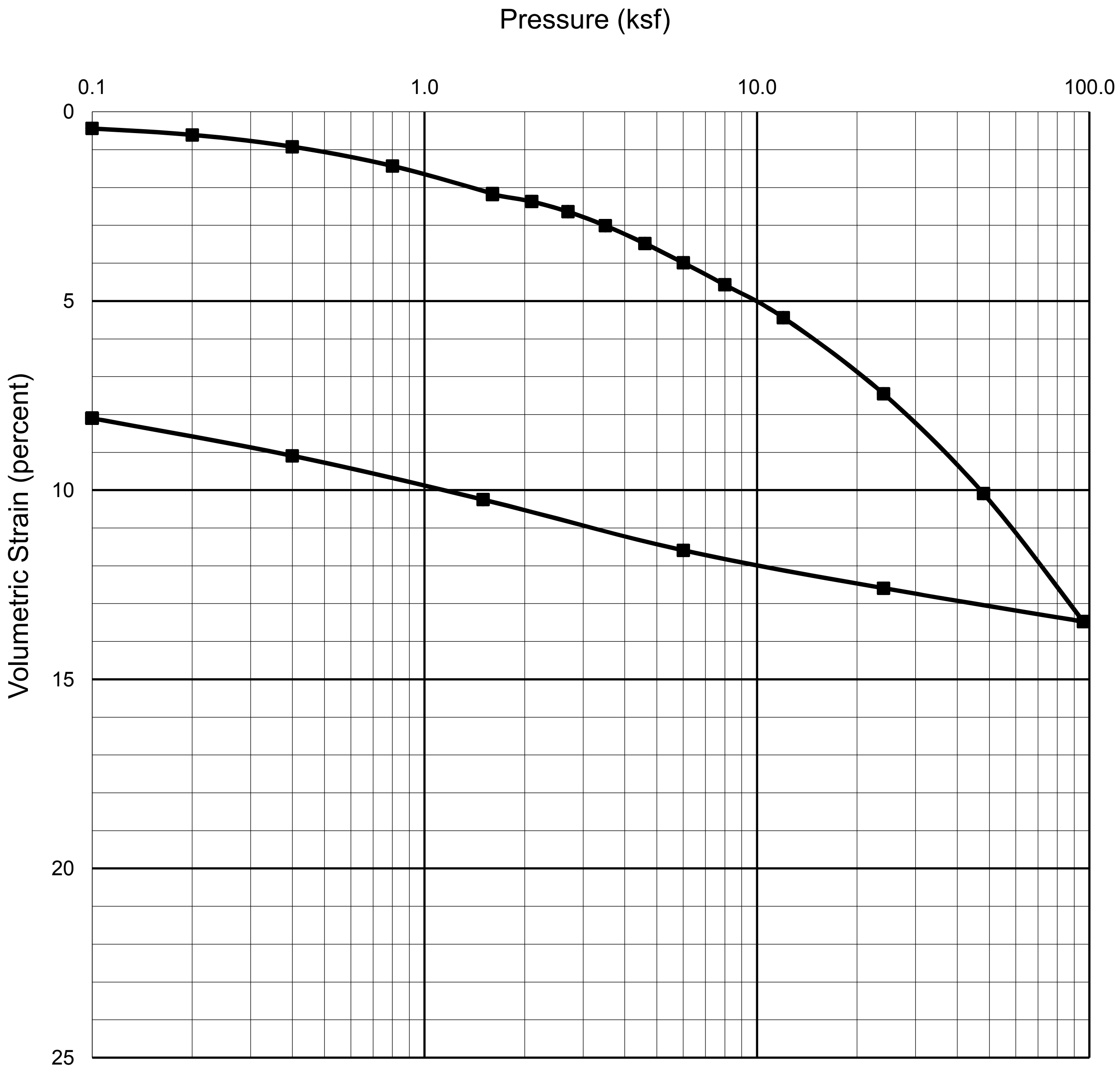
CONSOLIDATION TEST REPORT

Date 10/12/16 | Project No. 770633101 | Figure D-9



DRAFT

Sampler Type: Sprague & Henwood		Condition		Before Test		After Test	
Diameter (in) 2.42	Height (in) 1.00	Water Content	w_o	17.2 %	w_f	14.7 %	
Overburden Pressure, p_o	4,920 psf	Void Ratio	e_o	0.52	e_f	0.40	
Preconsol. Pressure, p_c	10,700 psf	Saturation	S_o	89 %	S_f	100 %	
Compression Ratio, $C_{\varepsilon c}$	0.10	Dry Density	γ_d	111 pcf	γ_d	121 pcf	
LL - -	PL - -	PI - -		G_s	2.70	(assumed)	
Classification	SANDY CLAY (CL), brown			Source	B-2 at 41 feet		

THE HILLS AT VALLCO
Cupertino, California

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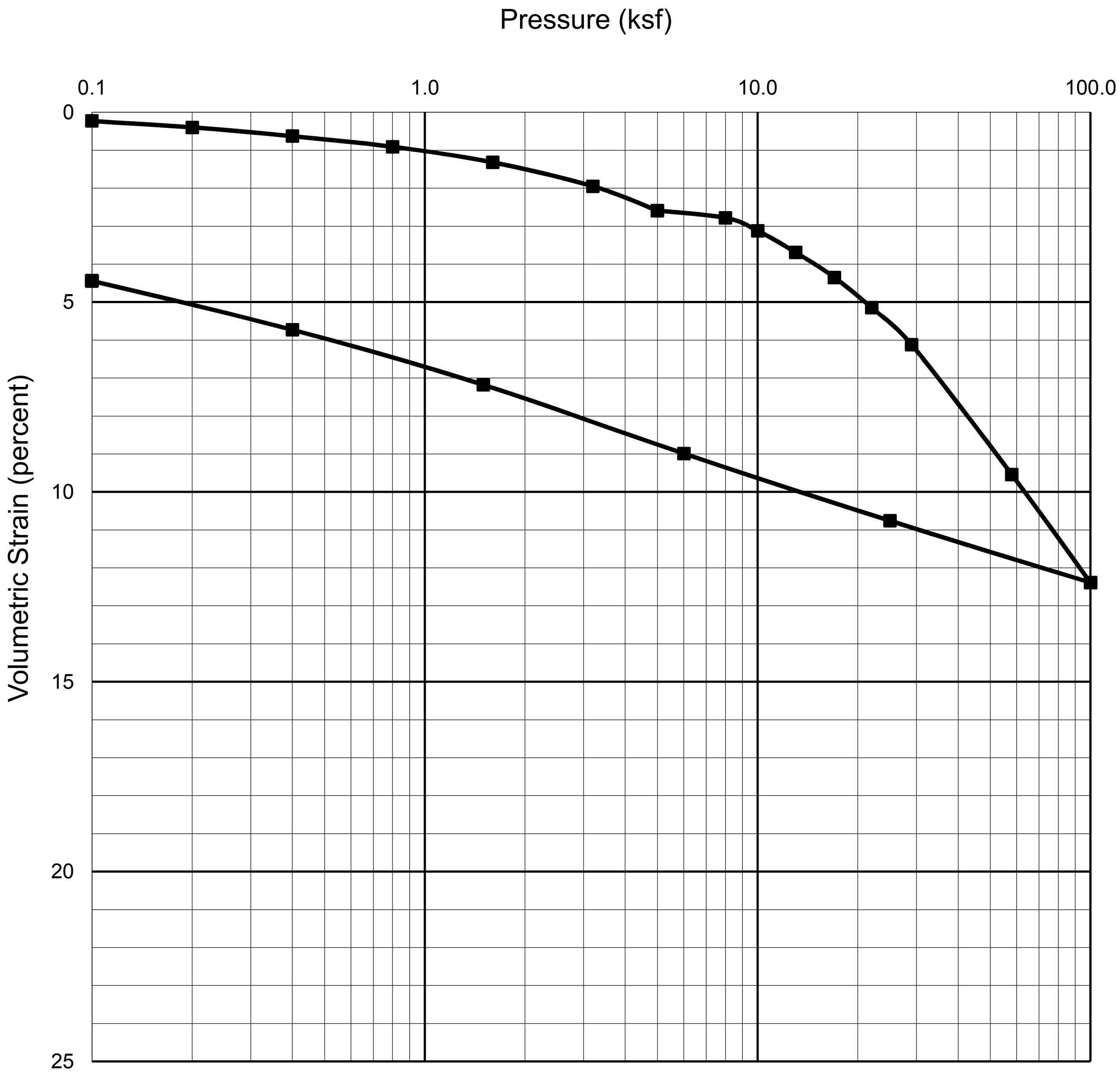
CONSOLIDATION TEST REPORT

Date 10/12/16 | Project No. 770633101 | Figure D-10



Sampler Type: Sprague & Henwood				Condition		Before Test		After Test
Diameter (in)	2.42	Height (in)	1.00	Water Content	w_o	20.7 %	w_f	19.6 %
Overburden Pressure, p_o	8,940 psf			Void Ratio	e_o	0.60	e_f	0.53
Preconsol. Pressure, p_c	18,500 psf			Saturation	S_o	93 %	S_f	100 %
Compression Ratio, $C_{\varepsilon c}$	0.12			Dry Density	γ_d	105 pcf	γ_d	110 pcf
LL	- -	PL	- -	PI	- -	G_s	2.70	(assumed)
Classification	CLAY (CL), brown					Source		B-4 at 74.5 feet

THE HILLS AT VALLCO
Cupertino, California

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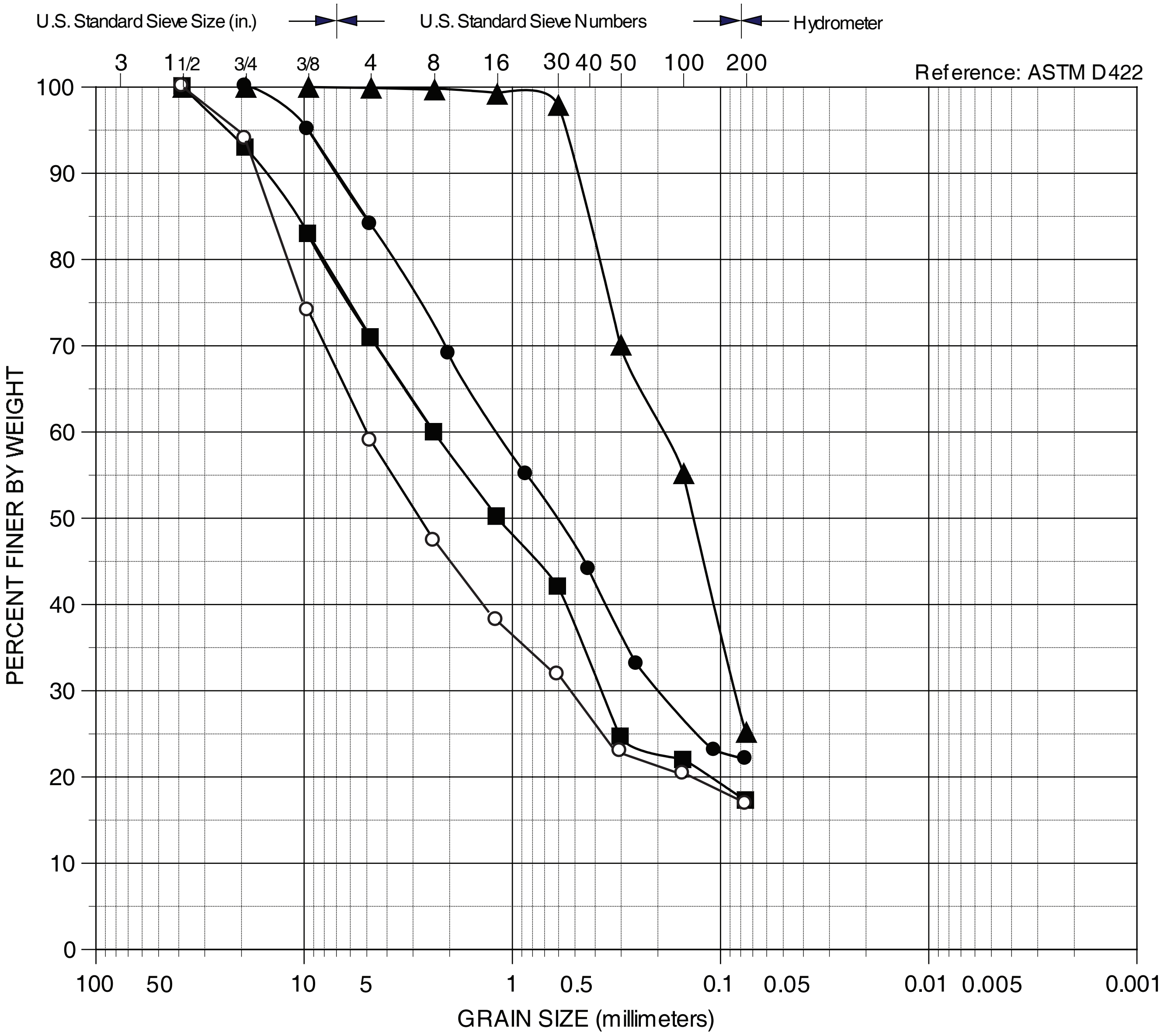
CONSOLIDATION TEST REPORT

Date 10/12/16 | Project No. 770633101 | Figure D-11



% Gravel		%Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Symbol	Sample Source	Classification
●	B-1 at 31 feet	CLAYEY SAND with GRAVEL (SC), brown
■	B-1 at 40.5 feet	CLAYEY SAND with GRAVEL (SC), brown
▲	B-2 at 45 feet	SILTY SAND (SM), yellow-brown
○	B-2 at 55 feet	CLAYEY SAND with GRAVEL (SC), brown

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THE HILLS AT VALLCO
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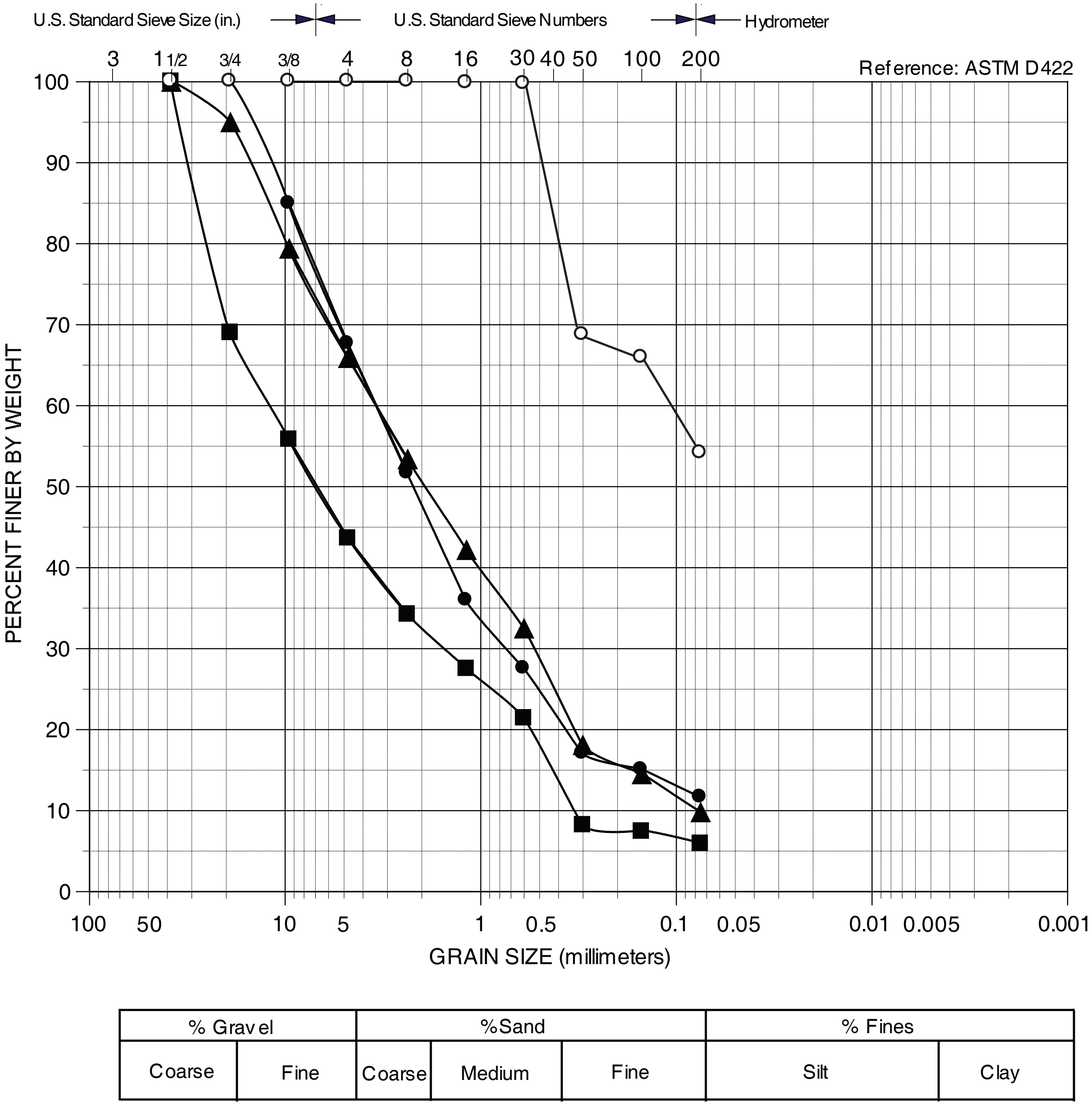
PARTICLE SIZE ANALYSIS

Date 10/12/16 | Project No. 770633101 | Figure D-12



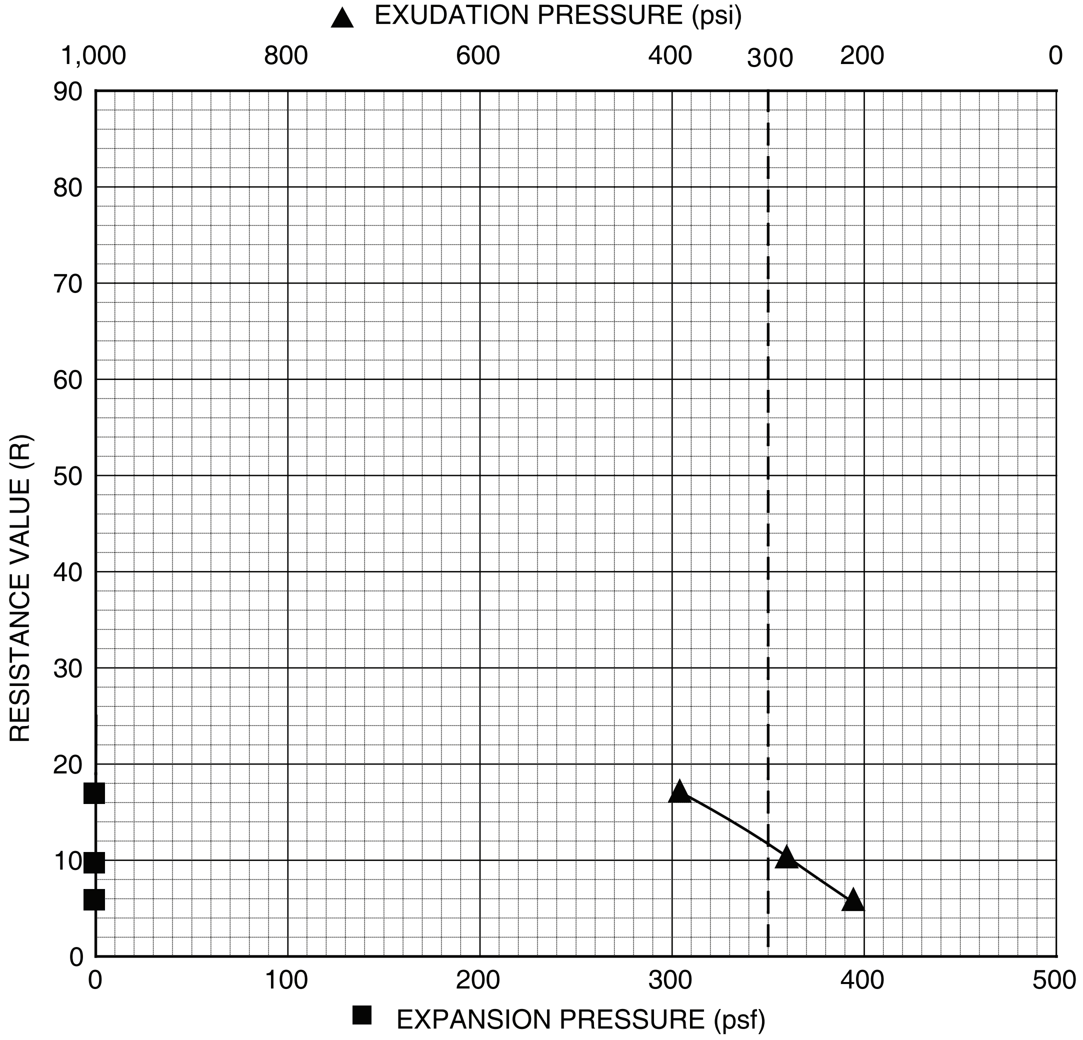
Symbol	Sample Source	Classification
●	B-4 at 18.5 feet	SAND with CLAY and GRAVEL (SW-SC), brown
■	B-4 at 44 feet	GRAVEL with SILT and SAND (GP-GM), brown
▲	B-4 at 48.5 feet	GRAVEL with SILT and SAND (GP-GM), brown
○	B-5 at 23.5 feet	SANDY SILT (ML), light brown

THE HILLS AT VALLCO
Cupertino, California

PARTICLE SIZE ANALYSIS

LANGAN

Date 10/12/16 | Project No. 770633101 | Figure D-13



Specimen ID:	A	B	C	D
Water Content (%)	15.3	14.0	13.2	--
Dry Density (pcf)	115.4	119.8	121.2	--
Exudation Pressure (psi)	205	281	390	--
Expansion Pressure (psf)	0.00	0.00	0.00	--
Resistance Value (R)	6	10	17	--

Sample Source	Sample Description	Sand Equivalent	Expansion Pressure	R value
B-1 at 0 to 5 feet	CLAY with GRAVEL (CH), brown to dark brown	--	--	12

THE HILLS AT VALLCO
Cupertino, California

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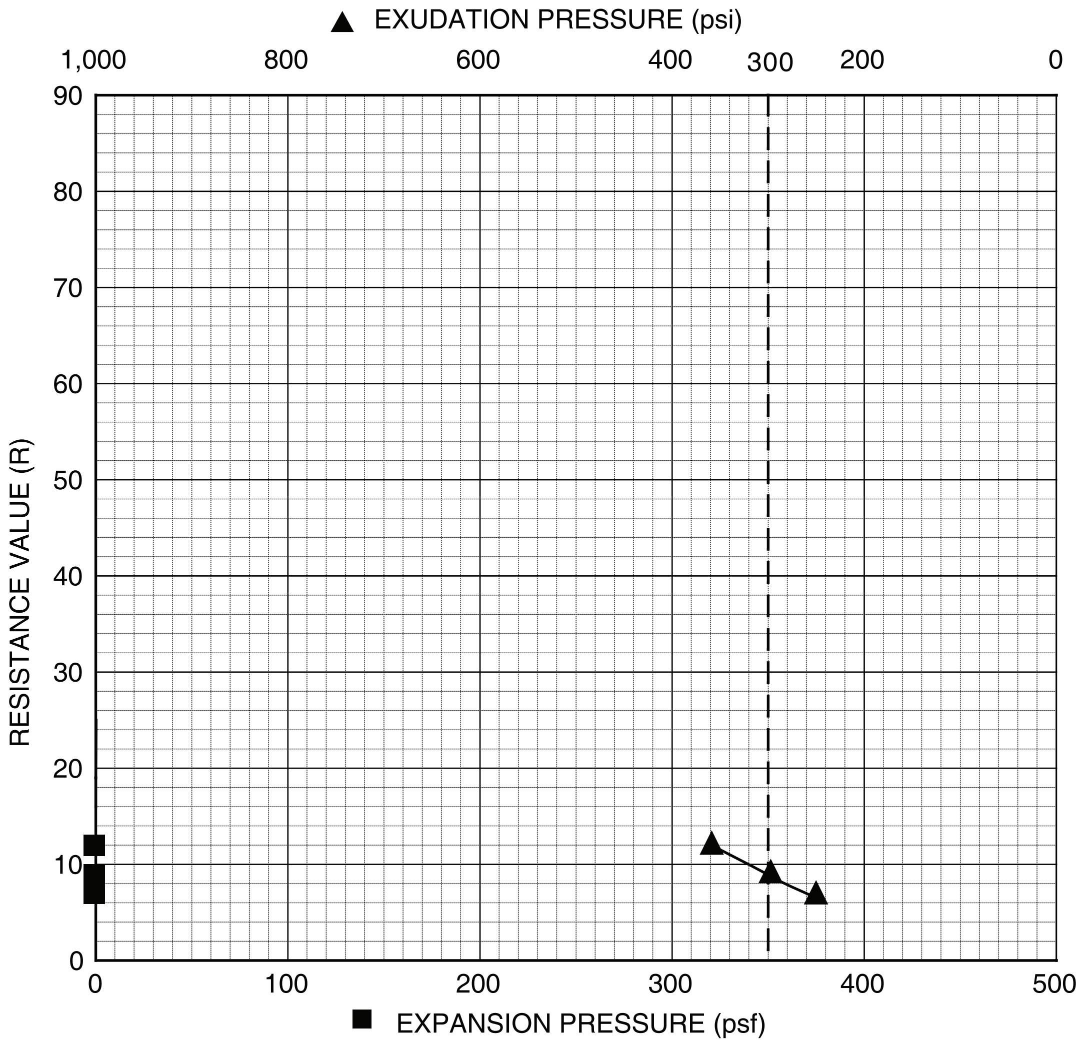
RESISTANCE VALUE TEST DATA

Date 10/12/16 | Project No. 770633101 | Figure D-14



Specimen ID:	A	B	C	D
Water Content (%)	17.8	16.9	16.0	--
Dry Density (pcf)	108.4	113.1	113.9	--
Exudation Pressure (psi)	251	295	361	--
Expansion Pressure (psf)	0.00	0.00	0.00	--
Resistance Value (R)	7	9	12	--

Sample Source	Sample Description	Sand Equivalent	Expansion Pressure	R value
B-4 at 0 to 5 feet	CLAY with SAND and GRAVEL (CL), brown	--	--	9

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THE HILLS AT VALLCO
Cupertino, California

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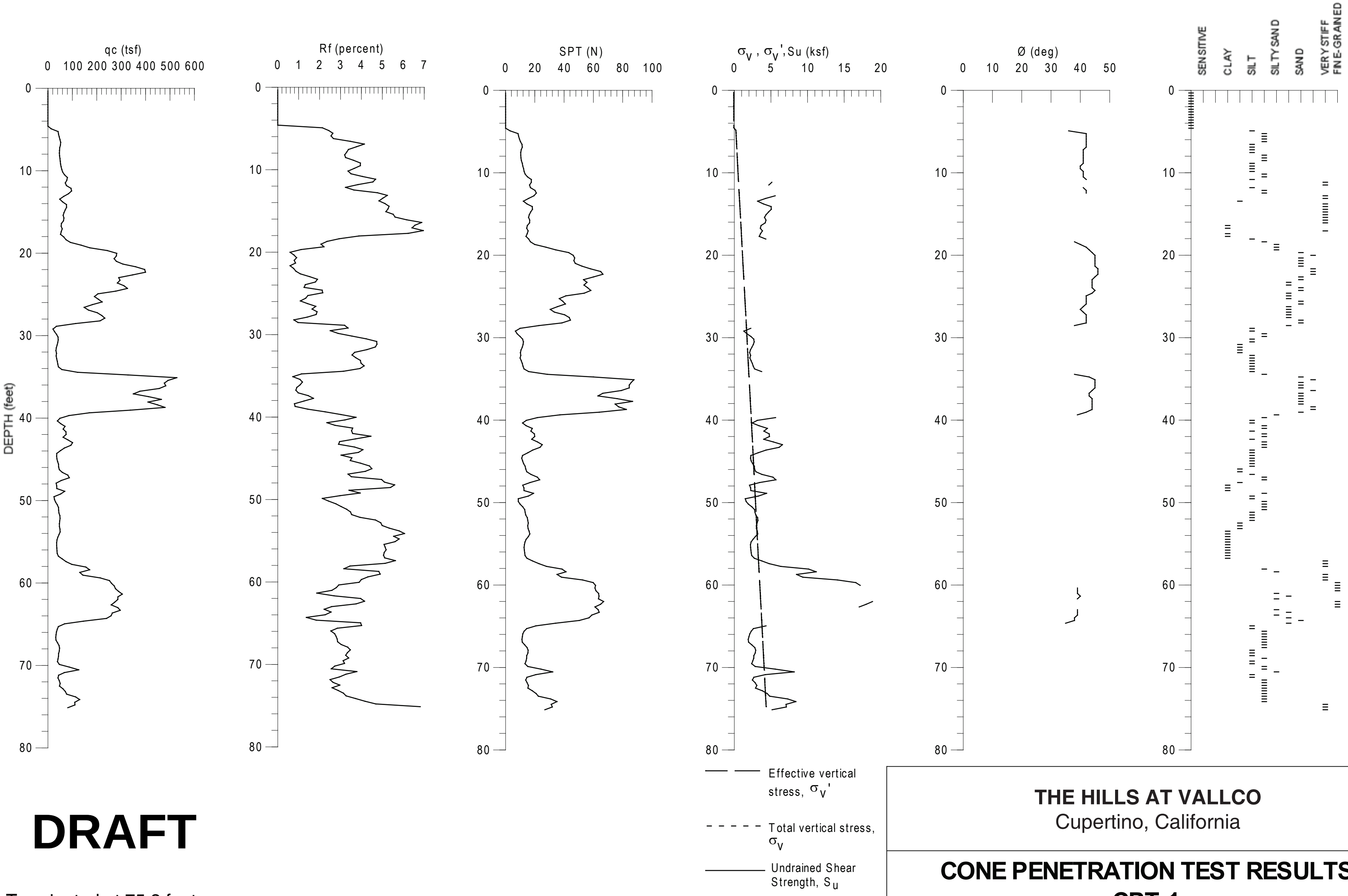
RESISTANCE VALUE TEST DATA

Date 10/12/16 | Project No. 770633101 | Figure D-15

APPENDIX E

CONE PENETRATION TESTS



DRAFT

Terminated at 75.3 feet.
Groundwater assumed at 80 feet.
Date performed 09/29/16.
Ground surface elevation: 195.4 feet, NAVD 88 Datum.

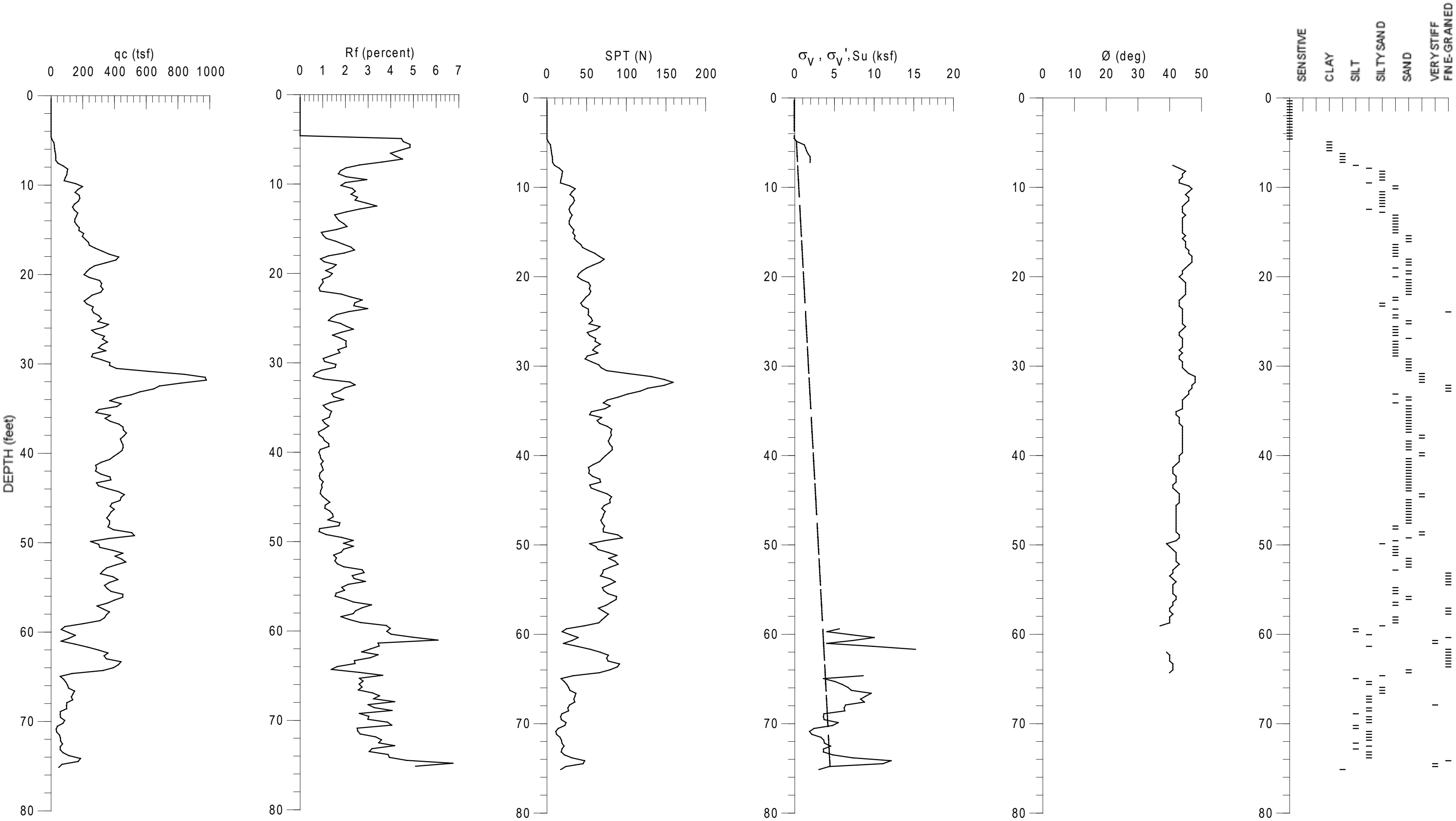
THE HILLS AT VALLCO

Cupertino, California

CONE PENETRATION TEST RESULTS
CPT-1

Date 10/17/16	Project No. 770633101	Figure E-1

LANGAN



DRAFT

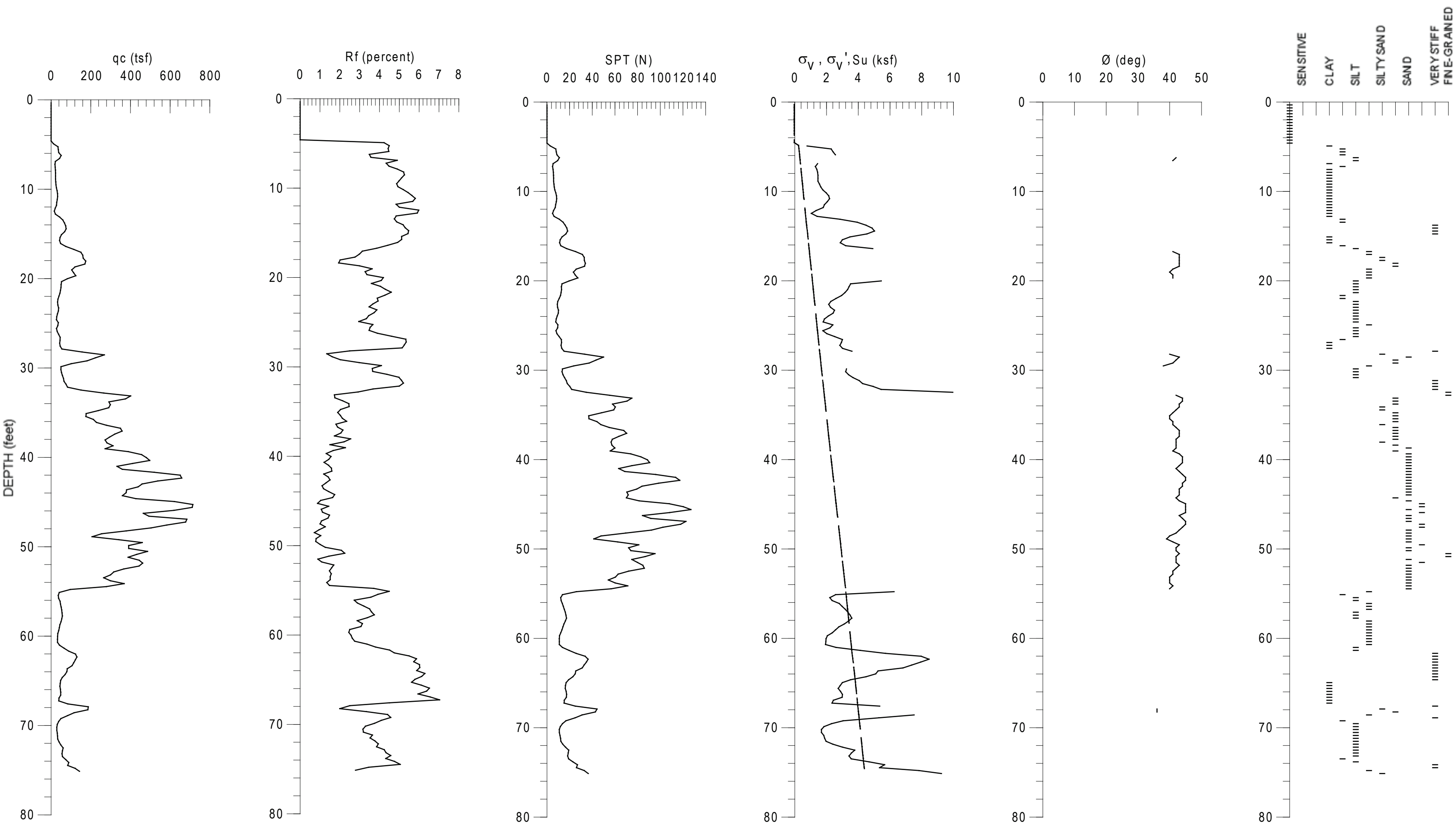
Terminated at 75.3 feet.
Groundwater assumed at 80 feet.
Date performed 09/29/16.
Ground surface elevation: 194.2 feet, NAVD 88 Datum.

THE HILLS AT VALLCO
Cupertino, California

CONE PENETRATION TEST RESULTS
CPT-2

Date 10/17/16	Project No. 770633101	Figure E-2

LANGAN



DRAFT

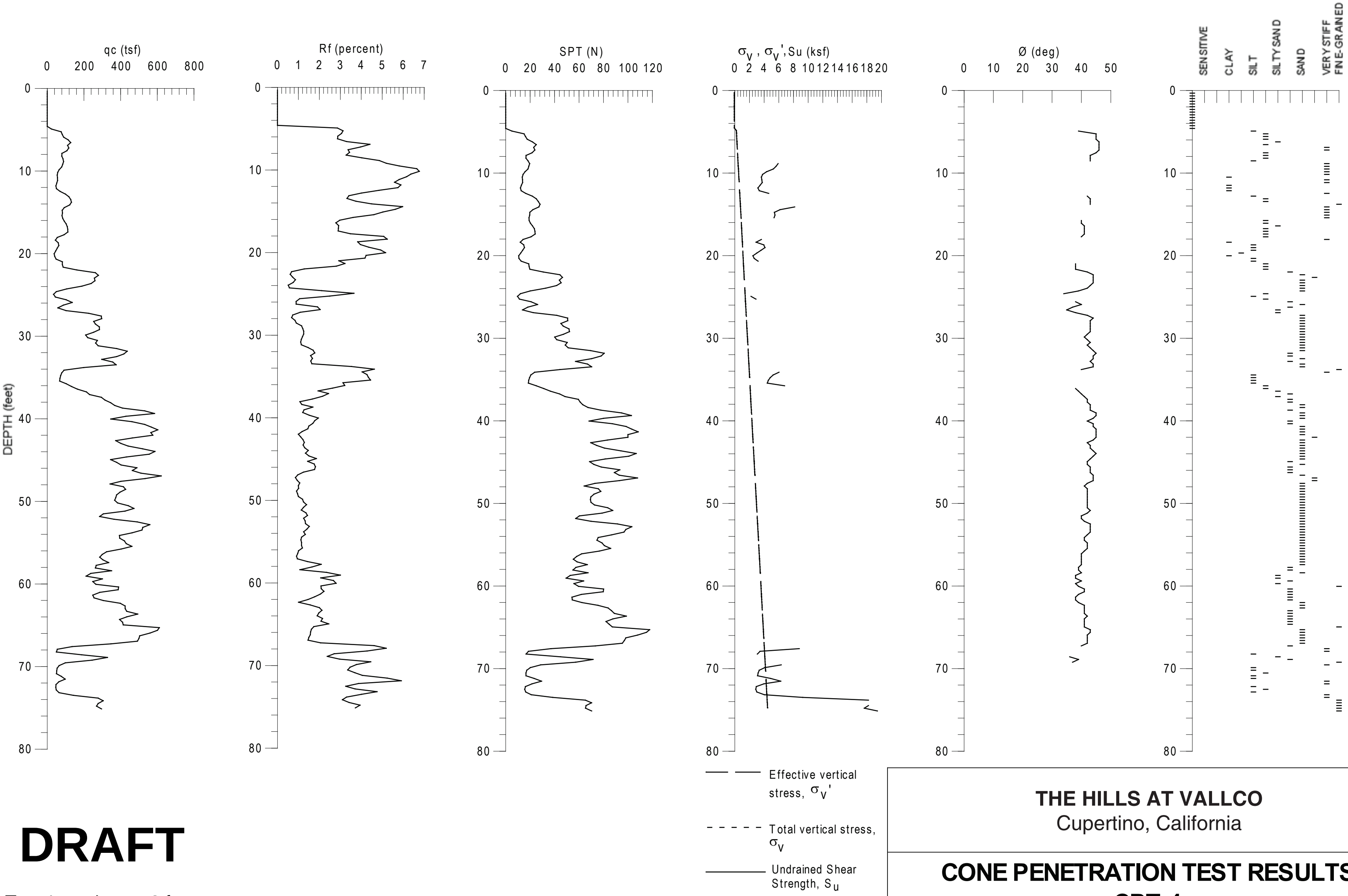
Terminated at 75.5 feet.
Groundwater assumed at 80 feet.
Date performed 09/29/16.
Ground surface elevation: 194.0 feet, NAVD 88 Datum.

THE HILLS AT VALLCO
Cupertino, California

CONE PENETRATION TEST RESULTS
CPT-3

Date 10/17/16 | Project No. 770633101 | Figure E-3

LANGAN



DRAFT

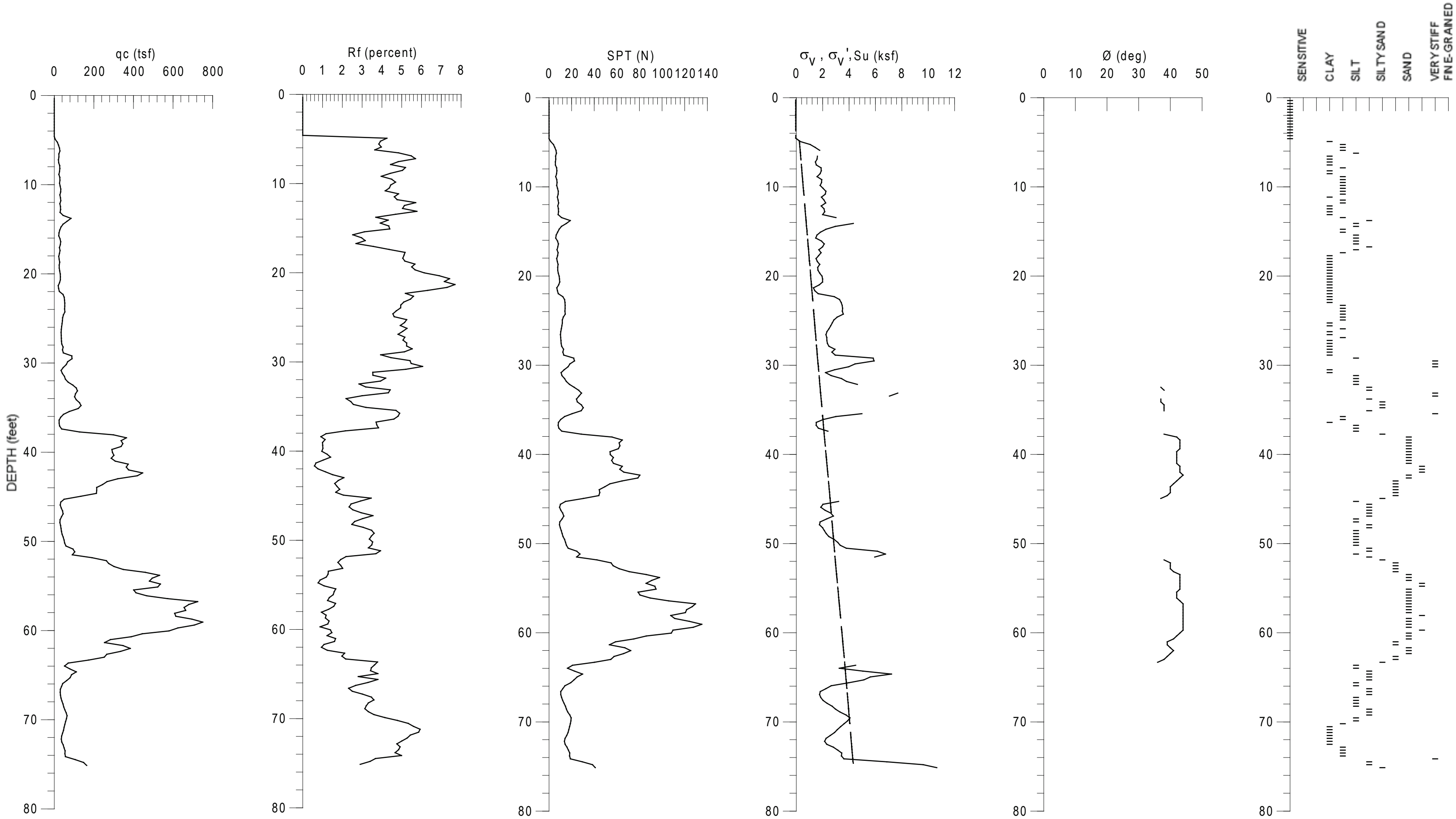
Terminated at 75.3 feet.
Groundwater assumed at 80 feet.
Date performed 09/29/16.
Ground surface elevation: 176.4 feet, NAVD 88 Datum.

THE HILLS AT VALLCO
Cupertino, California

CONE PENETRATION TEST RESULTS
CPT-4

Date 10/17/16	Project No. 770633101	Figure E-4

LANGAN



DRAFT

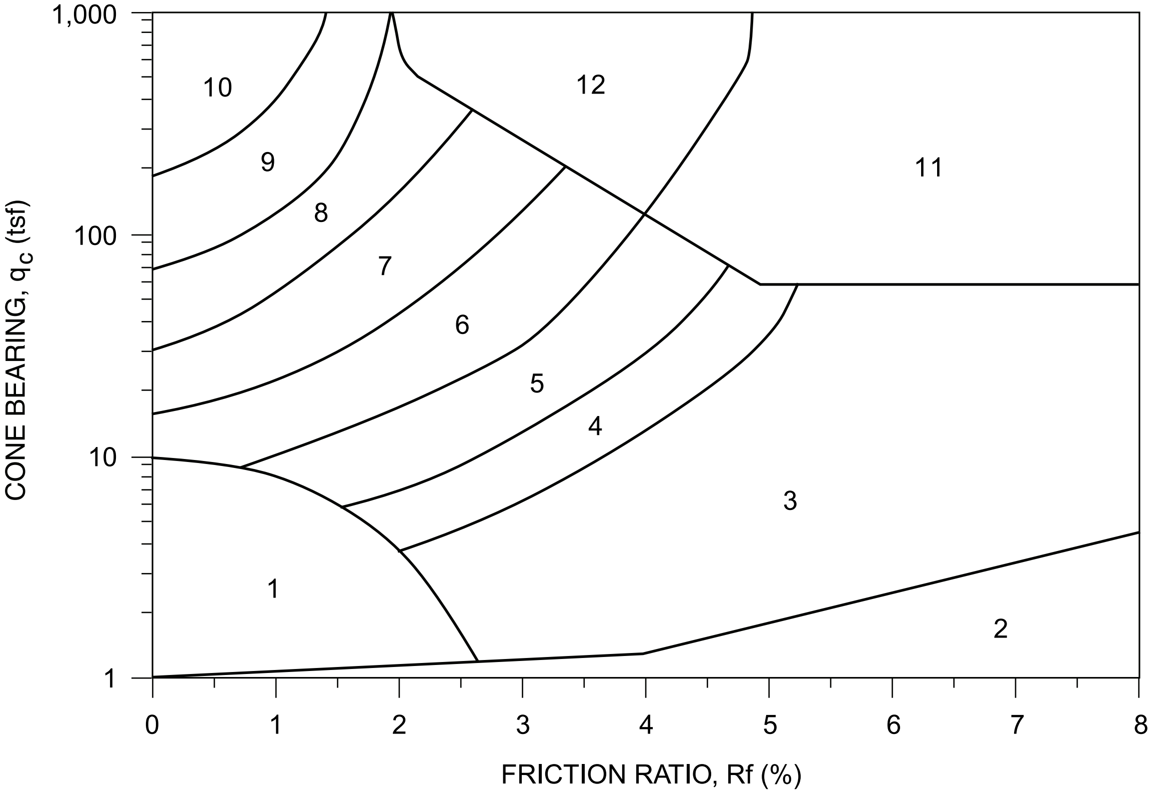
Terminated at 75.5 feet.
Groundwater assumed at 80 feet.
Date performed 09/30/16.
Ground surface elevation: 189.2 feet, NAVD 88 Datum.

THE HILLS AT VALLCO
Cupertino, California

CONE PENETRATION TEST RESULTS
CPT-5

Date 10/17/16 | Project No. 770633101 | Figure E-5

LANGAN



ZONE	q_c/N[1]	Su Factor (Nk)[2]	SOIL BEHAVIOR TYPE[1]
1	2	15 (10 for $q_c \leq 9$ tsf)	Sensitive Fine-Grained
2	1	15 (10 for $q_c \leq 9$ tsf)	Organic Material
3	1	15 (10 for $q_c \leq 9$ tsf)	CLAY
4	1.5	15	SILTY CLAY to CLAY
5	2	15	CLAYEY SILT to SILTY CLAY
6	2.5	15	SANDY SILT to CLAYEY SILT
7	3	---	SILTY SAND to SANDY SILT
8	4	---	SAND to SILTY SAND
9	5	---	SAND
10	6	---	GRAVELLY SAND to SAND
11	1	15	Very Stiff Fine-Grained (*)
12	2	---	SAND to CLAYEY SAND (*)

(*) Overconsolidated or Cemented
q_c = Tip Bearing
f_s = Sleeve Friction
$Rf = f_s/q_c x 100$ = Friction Ratio

Note: Testing performed in accordance with ASTM D3441.

References: 1. Robertson, 1986, Olsen, 1988.
2. Bonaparte & Mitchell, 1979 (young Bay Mud $q_c \leq 9$).
Estimated from local experience (fine-grained soils $q_c > 9$).

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THE HILLS AT VALLCO
Cupertino, California

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CLASSIFICATION CHART FOR CONE PENETRATION TESTS

Date 10/17/16	Project No. 770633101	Figure E-6

APPENDIX F

SOIL CORROSIVITY EVALUATION AND RECOMMENDATIONS FOR CORROSION CONTROL

California State Certified Laboratory No. 2153

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

28 September, 2016

Job No. 1609167
Cust. No. 12242

Mr. Wilson Wong
Langan Treadwell Rollo
4030 Moorpark Avenue, Suite 210
San Jose, CA 95117

Subject: Project No.: 770633101.700.340
Project Name: Hills at Vallco
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Wong:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on September 21, 2016. Based on the analytical results, a brief evaluation is enclosed for your consideration.

Based upon the resistivity measurements, samples 001 & 003 are classified as "corrosive" and sample 002 is classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations range from none detected to 32 mg/kg. Because the chloride ion concentrations are less than 300 mg/kg, they are determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentrations range from none detected to 210 mg/kg and are determined to be sufficient to potentially be detrimental to reinforced concrete structures and cement mortar-coated steel at these locations. Therefore, concrete that comes into contact with this soil should use sulfate resistant cement such as Type II, with a maximum water-to-cement ratio of 0.55.

The pH of the soils range from 7.56 to 7.95, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials are 350-mV which is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please *call JDH Corrosion Consultants, Inc. at (925) 927-6630.*

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: Langan Treadwell Rollo
Client's Project No.: 770633101.700.340
Client's Project Name: Hills at Vallco
Date Sampled: 14-Sep-16
Date Received: 21-Sep-16
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 28-Sep-2016

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1609167-001	B-3 @ 18.5'	350	7.56	-	1,200	-	32	210
1609167-002	B-4 @ 63.5'	350	7.77	-	3,900	-	N.D.	N.D.
1609167-003	B-5 @ 26'	350	7.95	-	1,700	-	21	21

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	27-Sep-2016	27-Sep-2016	-	27-Sep-2016	-	27-Sep-2016	27-Sep-2016

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

<u>Quality Control Summary</u> - All laboratory quality control parameters were found to be within established limits

Chain of Custody

1100 Willow Pass Court
Concord, CA 94520-1006
925 462 2771
Fax: 925 462 2775

CERCO analytical

Page 1 of 1

Job No.	CU#		Client Project I.D.	Schedule		Date Sampled	Date Due
1609167	12242		Hills at Vallco, 770633101	Analyte		9/14/16	

Full Name Wilson Wong

Phone 415-955-5251 X

Fax

Cell ☒

Company and/or Mailing Address
Langan Treadwell Rollo, 4030 Moorpark Ave, #210, San Jose, CA 95117

Sample Source
Hollow stem auger borings

									ANALYSIS								ASTM					
Lab No.	Sample I.D.	Date	Time	Matrix	Contain.	Size	Preserv.	Qty.	Redox Potential	pH	Sulfate	Chloride	Resistivity-100% Saturated			Brief Evaluation						
001	B-3 @ 18.5'	9/14/16	17:18	Soil	Bag			1	X	X	X	X	X			X						
002	B-4 @ 63.5'	9/14/16	8:28	Soil	Bag			1	x	x	x	x	x			x						
003	B-5 @ 26'	9/14/16	15:07	Soil	Bag			1	x	x	x	x	x			x						

Phase 700.340

GSO

MATRIX
DW - Drinking Water
GW - Ground Water
SW - Surface Water
WW - Waste Water
Water
SL - Sludge
S - Soil
Product

ABBREVIATIONS
HB - Hosebib
PV - Petcock Valve
PT - Pressure Tank
PH - Pump House
RR - Restroom
GL - Glass
PL - Plastic
ST - Sterile

SAMPLE RECEIPT
Total No. of Containers
Rec'd Good Cond/Cold
Conforms to Record
Temp. a t Lab -°C
Sampler

	Date	Time
Relinquished By:	9/20/16	9:10am
Received By:	9/21/16	10:00
Relinquished By:		
Received By:		
Relinquished By:		
Received By:		

Comments:

THERE IS AN ADDITIONAL CHARGE FOR EXTRUDING SOIL FROM METAL TUBES

Email Address: wwong@langan.com

APPENDIX G

SITE-SPECIFIC GROUND MOTIONS

APPENDIX G

SITE-SPECIFIC RESPONSE SPECTRA

This appendix presents the details of our estimation of the level of ground shaking at the site during future earthquakes. To develop site-specific response spectra in accordance with 2016 California Building Code (CBC) criteria, and by reference ASCE 7-10, we performed probabilistic seismic hazard analysis (PSHA) and deterministic seismic hazard analysis to develop smooth, site-specific horizontal rock spectra for two levels of shaking, namely:

- Risk Targeted Maximum Considered Earthquake (MCE_R), which corresponds to the lesser of two percent probability of exceedance in 50 years (2,475-year return period) or 84th percentile of the controlling deterministic event both considering the maximum direction as described in ASCE 7-10.
- Design Earthquake (DE) which corresponds to 2/3 of the MCE_R.

F1.0 PROBABILISTIC SEISMIC HAZARD ANALYSIS

Because the location, recurrence interval, and magnitude of future earthquakes are uncertain, we performed a PSHA, which systematically accounts for these uncertainties. The results of a PSHA define a uniform hazard for a site in terms of a probability that a particular level of shaking will be exceeded during the given life of the structure.

To perform a PSHA, information regarding the seismicity, location, and geometry of each source, along with empirical relationships that describe the rate of attenuation of strong ground motion with increasing distance from the source, are needed. The assumptions necessary to perform the PSHA are that:

- the geology and seismic tectonic history of the region are sufficiently known, such that the rate of occurrence of earthquakes can be modeled by historic or geologic data
- the level of ground motion at a particular site can be expressed by an attenuation relationship that is primarily dependent upon earthquake magnitude and distance from the source of the earthquake
- the earthquake occurrence can be modeled as a Poisson process with a constant mean occurrence rate.

As part of the development of the site-specific spectra, we performed a PSHA to develop a site-specific response spectrum for 2 percent probability of exceedance in 50 years. The spectrum for this hazard level was developed using the computer code EZFRISK 8.00 (Risk

Engineering 2015). The approach used in EZFRISK is based on the probabilistic seismic hazard model developed by Cornell (1968) and McGuire (1976). Our analysis modeled the faults in the Bay Area as linear sources, and earthquake activities were assigned to the faults based on historical and geologic data. The levels of shaking were estimated using Next Generation Attenuation West 2 (NGA – West2) relationships that are primarily dependent upon the magnitude of the earthquake and the distance from the site to the fault.

F1.1 Probabilistic Model

In probabilistic models, the occurrence of earthquake epicenters on a given fault is assumed to be uniformly distributed along the fault. This model considers ground motions arising from the portion of the fault rupture closest to the site rather than from the epicenter. Fault rupture lengths were modeled using fault rupture length-magnitude relationships given by Wells and Coppersmith (1994).

The probability of exceedance, $P_e(Z)$, at a given ground-motion, Z, at the site within a specified time period, T, is given as:

$$P_e(Z) = 1 - e^{-V(z)T}$$

where V(z) is the mean annual rate of exceedance of ground motion level Z. V(z) can be calculated using the total-probability theorem.

$$V(z) = \sum_i v_i \iint P[Z > z \mid m, r] f_{M_i}(m) f_{R_i|M_i}(r;m)\,dr\,dm$$

where:

v_i = the annual rate of earthquakes with magnitudes greater than a threshold M_{oi} in source i

P [Z > z | m,r] = probability that an earthquake of magnitude m at distance r produces ground motion amplitude Z higher than z

f_{Mi} (m) and $f_{Ri|Mi}$ (r;m) = probability density functions for magnitude and distance

Z represents peak ground acceleration, or spectral acceleration values for a given frequency of vibration. The peak accelerations are assumed to be log-normally distributed about the mean with a standard error that is dependent upon the magnitude and attenuation relationship used.

F1.2 Source Modeling and Characterization

The segmentation of faults, mean characteristic magnitudes, and recurrence rates were modeled using the data presented in the WGCEP (2008) and Cao et al. (2003) reports. We also included the combination of fault segments and their associated magnitudes and recurrence rates as described in the WGCEP (2008) in our seismic hazard model. Table G-1 presents the distance and direction from the site to the fault, mean characteristic magnitude, mean slip rate, and fault length for individual fault segments. We used the California fault database identified as “USGS 2014 Lower 48 v0.1” in EZFRISK 8.00. Each segment is characterized with multiple magnitudes, occurrence or slip rates and weights. This approach takes into account the epistemic uncertainty associated with the various seismic sources in our model.

TABLE G-1
Source Zone Parameters

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude	Mean Slip Rate (mm/yr)	Approx. Fault Length (km)
Monte Vista-Shannon	4.8	Southwest	6.50	0.4	45
N. San Andreas; SAN+SAP	10.6	Southwest	7.73	22	274
N. San Andreas; SAN+SAP+SAS	10.6	Southwest	7.87	21	336
N. San Andreas; SAO+SAN+SAP	10.6	Southwest	7.95	22	410
N. San Andreas; SAO+SAN+SAP+SAS	10.6	Southwest	8.05	22	472
N. San Andreas; SAP	10.6	Southwest	7.23	17	85
N. San Andreas; SAP+SAS	10.6	Southwest	7.48	17	147
N. San Andreas; SAS	17	South	7.12	17	62
Hayward-Rodgers Creek; HN+HS	20	Northeast	7.00	9	87
Hayward-Rodgers Creek; HS	20	Northeast	6.78	9	52
Hayward-Rodgers Creek; RC+HN+HS	20	Northeast	7.33	9	150
Calaveras; CC	22	Northeast	6.39	15	59
Calaveras; CC+CS	22	Northeast	6.50	15	78
Calaveras; CN	22	Northeast	6.87	6	45
Calaveras; CN+CC	22	Northeast	7.00	11	104
Calaveras; CN+CC+CS	22	Northeast	7.03	12	123
Zayante-Vergeles	27	South	7.00	0.1	58
San Gregorio Connected	33	West	7.50	5.5	176
Greenville Connected	46	East	7.00	2	50
Monterey Bay-Tularcitos	46	South	7.30	0.5	83
Mount Diablo Thrust	48	Northeast	6.70	2	25
Hayward-Rodgers Creek; HN	58	North	6.60	9	35
Hayward-Rodgers Creek; RC+HN	58	North	7.19	9	97
Calaveras; CS	61	Southeast	5.83	15	19
Great Valley 7	63	Northeast	6.90	1.5	45
Green Valley Connected	64	North	6.80	4.7	56
Ortigalita	65	East	7.10	1	70

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude	Mean Slip Rate (mm/yr)	Approx. Fault Length (km)
N. San Andreas; SAN	71	Northwest	7.51	24	189
N. San Andreas; SAO+SAN	71	Northwest	8.00	24	326
Quien Sabe	73	Southeast	6.60	1	23
SAF - creeping segment	75	Southeast	6.70	34	125
Rinconada	76	Southeast	7.50	1	191
Great Valley 8	77	East	6.80	1.5	41
Great Valley 5, Pittsburg Kirby Hills	78	North	6.70	1	32
Hayward-Rodgers Creek; RC	92	Northwest	7.07	9	62
Great Valley 9	94	East	6.80	1.5	39
West Napa	95	North	6.70	1	30
Point Reyes	100	Northwest	6.90	0.3	47

F1.3 Attenuation Relationships

As part of our field exploration we performed down hole suspension logging to estimate the shear wave velocity of the soil beneath the proposed basement. On the basis of the shear wave velocity measurements, we estimate an average shear wave velocity of the upper 30 meters (100 ft), V_{S30}, of approximately 1,600 feet per second (490 meters per second) as such, the site is classified as a very dense profile, site class C.

Pacific Earthquake Engineering Research Center (PEER) embarked on a project to enhance the Next Generation Attenuation for the Western United States, the NGA-West 2 project. We used the relationships by Abrahamson et al. (2014), Boore et al. (2014), Campbell and Bozorgnia (2014) and Chiou and Youngs (2014). These attenuation relationships include the average shear wave velocity in the upper 100 feet. Furthermore, these relationships were developed using the same database and each relationship is considered equally credible. Therefore, the average of the relationships was used to develop the recommended spectra.

The NGA-West 2 relationships were developed for the orientation-independent geometric mean of the data. Geometric mean is defined as the square root of the product of the two recorded components.

F2.0 PSHA RESULTS

Figures G-1 presents results of the PSHA for 2 percent probability of exceedance in 50 years, 2,475 return period, using the four relationships discussed above. The average of these relationships is also presented.

ASCE 7-10 specifies the development of MCE_R site-specific response spectra in the maximum direction. Shahi and Baker (2014) provide scaling factors that modify the geometric mean spectra to provide spectral values for the maximum response (maximum direction). We used the scaling factors presented in Table 1 of Shahi and Baker (2014) ratios $Sa_{RotD100}/Sa_{RotD50}$ to modify the average of the PSHA results. The maximum direction spectrum is also shown on Figure G-1.

Figure G-2 presents the deaggregation plots of the PSHA results for the 2 percent probability of exceedance in 50 years hazard level. From the examination of these results, it can be seen that the Monte Vista Shannon and San Andreas faults dominate the hazard at the project site at different periods of interest.

F3.0 DETERMINISTIC ANALYSIS

We performed a deterministic analysis to develop the MCE_R spectrum at the site. In a deterministic analysis, a given magnitude earthquake occurring at a certain distance from the source is considered as input into an appropriate ground motion attenuation relationship. On the basis of the deaggregation results we developed deterministic spectra for both scenarios earthquakes:

- a moment magnitude 6.5 earthquake on the Monte Vista Shannon fault occurring 4.8 km from the site
- a moment magnitude 8.0 earthquake on the San Andreas fault occurring 10.6 km from the site.

The deterministic MCE spectrum was defined as an envelope of both scenario earthquakes. This is consistent with the deaggregation results discussed in Section F2.0.

The same attenuation relationships as discussed in Section F1.3 were used in our deterministic analysis. Figures G-3 and G-4 presents the 84th percentile deterministic results for the San Andreas and Monte Vista scenarios, respectively. The average of the four relationships is also presented on those figures. Similarly to the PSHA results, we developed the 84th percentile deterministic spectrum in the maximum direction using the Shahi and Baker (2014) ratios. Figure G-5 presents the average of the 84th percentile deterministic results in the maximum direction for both scenarios as well as the recommended envelop of both scenarios.

F5.0 RECOMMENDED SPECTRA

The MCE_R as defined in ASCE 7-10 is the lesser of the maximum direction PSHA spectrum having a two percent probability of exceedance in 50 years (2,475-year return period) or the maximum direction 84th percentile deterministic spectrum of the governing earthquake scenario and the DE spectrum is defined as 2/3 times the MCE_R spectrum. Furthermore, the MCE_R spectrum is defined as risk targeted response spectrum which corresponds to a targeted collapse probability of one percent in 50 years. According to USGS website the risk coefficients for the PSHA spectra for short and long periods are, 0.93 and 0.91, respectively. We used these risk coefficients to develop the Risk-Targeted PSHA response spectrum.

Furthermore, we followed the procedures outlined in Chapter 21 of ASCE 7-10 to develop the site-specific spectra for MCE_R and DE. Chapter 21 of ASCE 7-10 requires the following checks:

- the deterministic spectrum used to develop the MCE_R shall not fall below the Deterministic Lower Limit spectrum as shown on Figure 21.2-1 of ASCE 7-10;
- the DE spectrum shall not fall below 80 percent of general design spectrum (Section 21.3 of Chapter 21 ASCE 7-10).

Figure G-6 and Table G-2 present a comparison of the site-specific spectra for the PSHA 2,475 year return period (max. dir.), the 84th percentile deterministic (max. dir.), and the Deterministic Lower Limit spectra for Site Class C per ASCE 7-10. We included the risk coefficients as discussed above in the Risk-Targeted PSHA spectrum. The deterministic 84th percentile spectrum is greater than the Deterministic Lower Limit spectrum; hence the MCE_R is defined as the lower of the 84th percentile deterministic and the PSHA 2,475-year return spectra. The recommended MCE_R spectrum is presented on Figure G-4 and in Table G-2.

TABLE G-2
Comparison of Site-specific and Code Spectra for Development of MCE_R Spectrum per ASCE 7-10
S_a (g) for 5 percent damping

Period (seconds)	Risk Targeted PSHA – 2,475-Year Return Period – Maximum Direction	Deterministic 84th percentile – Maximum Direction	ASCE 7-10 Deterministic Lower Limit Site Class C	Recommended MCE_R
0.01	0.905	0.817	0.600	0.817
0.10	1.825	1.607	1.500	1.607
0.20	2.353	2.027	1.500	2.027
0.30	2.300	1.964	1.500	1.964

Period (seconds)	Risk Targeted PSHA – 2,475-Year Return Period – Maximum Direction	Deterministic 84th percentile – Maximum Direction	ASCE 7-10 Deterministic Lower Limit Site Class C	Recommended MCE_R
0.40	2.097	1.774	1.500	1.774
0.50	1.900	1.620	1.500	1.620
0.60	1.683	1.450	1.300	1.450
0.75	1.453	1.254	1.040	1.254
1.00	1.126	1.005	0.780	1.005
1.50	0.755	0.708	0.520	0.708
2.00	0.564	0.542	0.390	0.542
3.00	0.382	0.387	0.260	0.387
4.00	0.288	0.305	0.195	0.288
5.00	0.231	0.245	0.156	0.231
6.00	0.178	0.194	0.130	0.178
7.00	0.148	0.160	0.111	0.148
8.00	0.125	0.132	0.098	0.125

Table G-3 presents the development of recommended DE spectrum following the procedures outlined in Chapter 21 of ASCE 7-10. The DE is defined as 2/3 of the MCE_R per ASCE 7-10; however, the recommended DE may not be below 80 percent of the general spectrum at any period (ASCE 7-10 Section 21.3). Figure G-6 and Table G-3 presents a comparison of 2/3 of the MCE_R spectrum and 80 percent of the general spectrum for Site Class C. As shown in Table G-3 and Figure G-6, 80 percent of the general spectrum is lower than 2/3 of the MCE_R spectrum. Therefore, we recommend that 2/3 of the MCE_R spectrum be used to develop the DE spectrum. The recommended DE spectrum is shown on Figure G-6.

TABLE G-3
Comparison of Site-specific and Code Spectra for Development of DE Spectrum per ASCE 7-10
S_a (g) for 5 percent damping

Period (seconds)	Recommended MCE_R	2/3 times MCE_R	80% of General Design Spectrum	Recommended DE
0.01	0.817	0.545	0.320	0.545
0.10	1.607	1.071	0.855	1.071
0.20	2.027	1.351	0.855	1.351
0.30	1.964	1.309	0.855	1.309
0.40	1.774	1.182	0.855	1.182
0.50	1.620	1.080	0.855	1.080
0.60	1.450	0.966	0.740	0.966
0.75	1.254	0.836	0.592	0.836

Period (seconds)	Recommended MCE_R	2/3 times MCE_R	80% of General Design Spectrum	Recommended DE
1.00	1.005	0.670	0.444	0.670
1.50	0.708	0.472	0.296	0.472
2.00	0.542	0.361	0.222	0.361
3.00	0.387	0.258	0.148	0.254
4.00	0.288	0.196	0.111	0.192
5.00	0.231	0.157	0.089	0.154
6.00	0.178	0.121	0.074	0.119
7.00	0.148	0.100	0.063	0.098
8.00	0.125	0.085	0.056	0.083

The recommended MCE_R and DE spectra in the maximum direction are presented on Figure G-7 along with a comparison of the general spectrum for site class C and digitized values of the recommended spectra are presented in Table G-4 for a damping ratio of 5 percent.

TABLE G-4

Recommended SpectraS_a (g) for 5 percent damping

Period (seconds)	Recommended MCE_R	Recommended DE
0.01	0.817	0.545
0.10	1.607	1.071
0.20	2.027	1.351
0.30	1.964	1.309
0.40	1.774	1.182
0.50	1.620	1.080
0.60	1.450	0.966
0.75	1.254	0.836
1.00	1.005	0.670
1.50	0.708	0.472
2.00	0.542	0.361
3.00	0.387	0.254
4.00	0.288	0.192
5.00	0.231	0.154
6.00	0.178	0.119
7.00	0.148	0.098
8.00	0.125	0.083

Because site-specific procedure was used to determine the recommended MCE_R and DE response spectra, the corresponding values of S_{MS}, S_{M1}, S_{DS} and S_{D1} per Section 21.4 of ASCE 7-10 should be used as shown in Table G-5.

TABLE G-5
Design Spectral Acceleration Value

Parameter	Spectral Acceleration Value (g's)
S_{MS}	2.027
S_{M1}	1.084*
S_{DS}	1.351
S_{D1}	0.722*

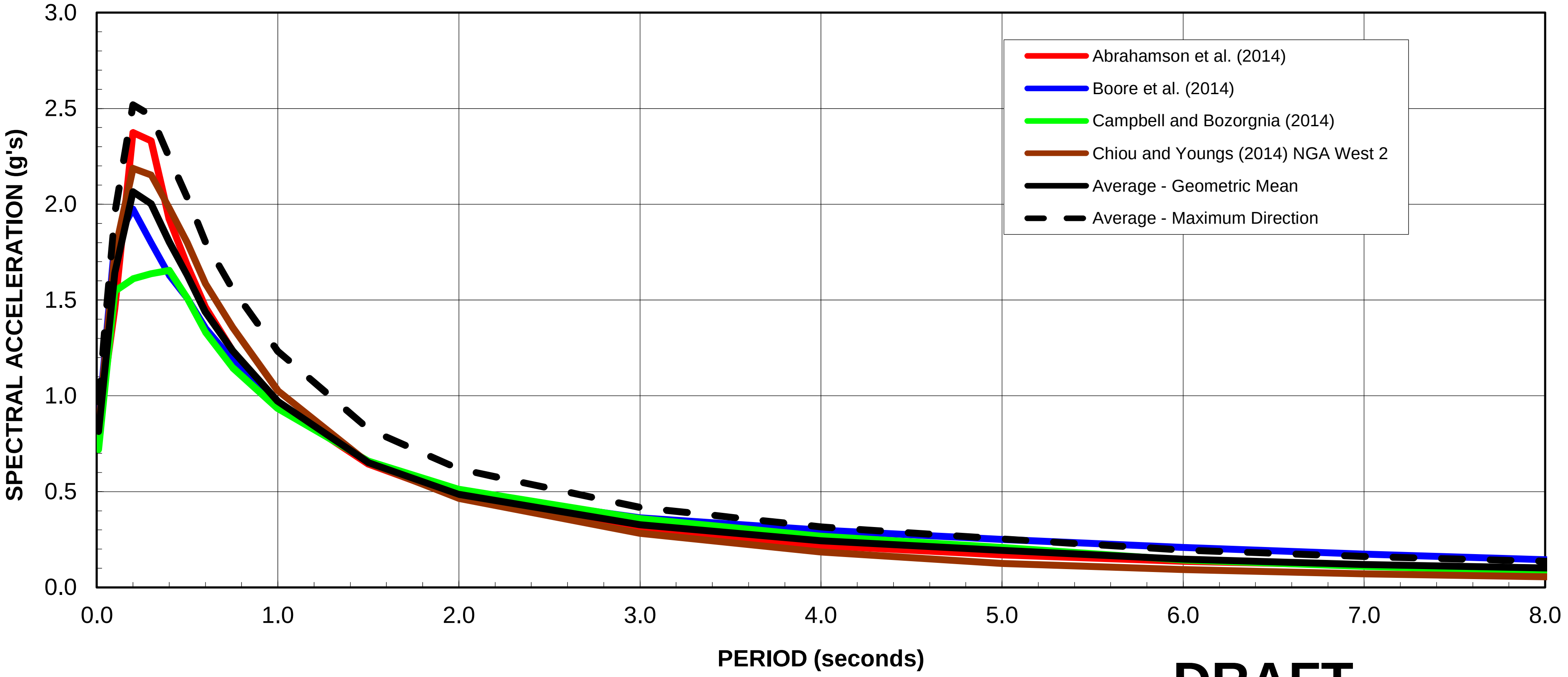
* S_{M1} and S_{D1} are based on the site-specific response spectra and are governed by the spectral acceleration at a period of two seconds.

G4.0 MATCHED TIME SERIES

(To be included at a later date)

REFERENCES

Shahi, S. K. and Baker J. W. (2014). “NGA-West 2 Models for Ground Motion Directionality.” *Earthquake Spectra*. Volume 30. No. 3. Pages 1285-1300.



DRAFT

Damping Ratio = 5%

Notes: (1) Estimated V_{S30} = 490 m/s

(2) Maximum direction factors from Shahi and Baker (2014)

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RESULTS OF PSHA, 2 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS

Date 10/07/14	Project No. 770633101	Figure G-1

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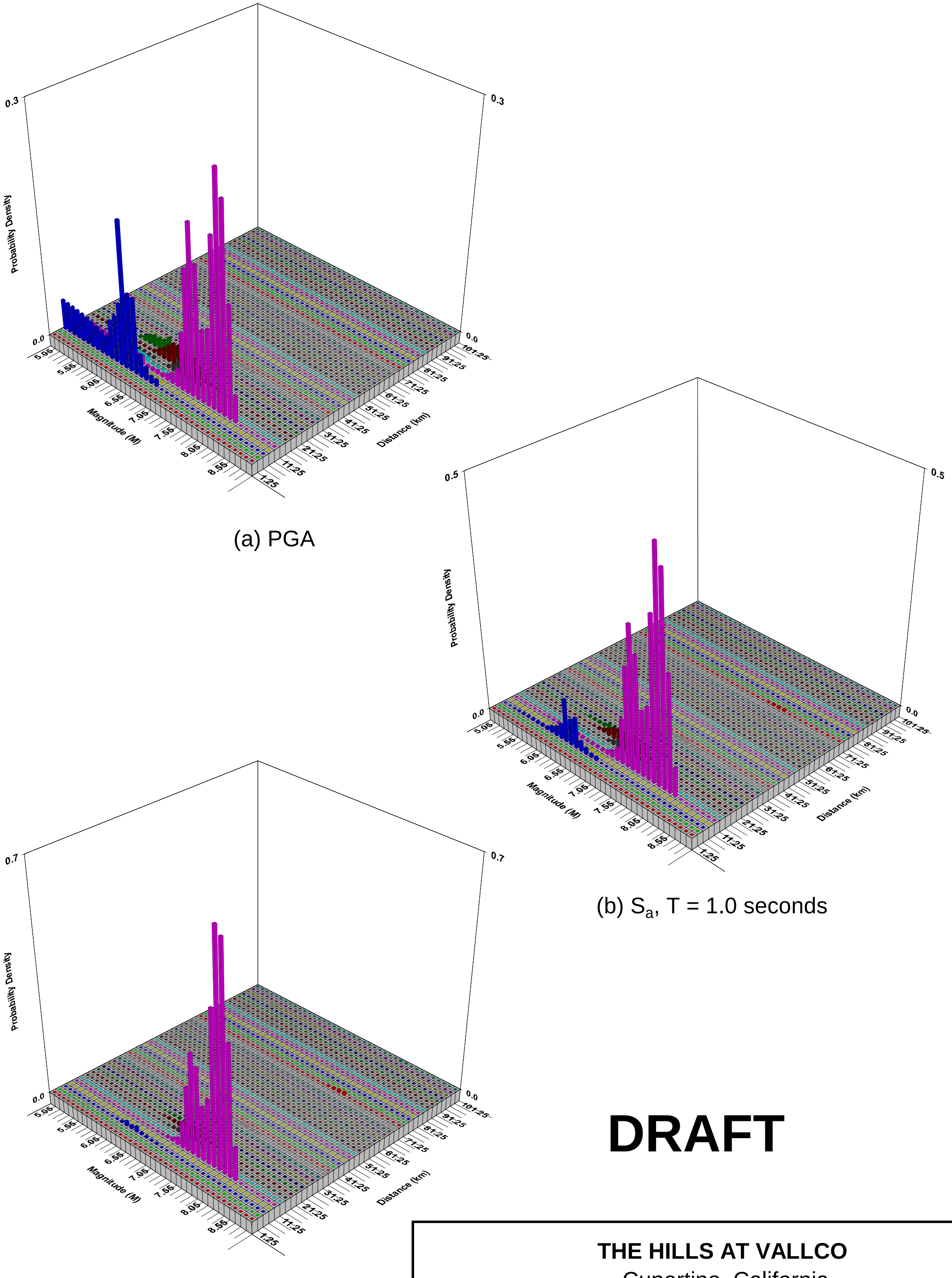

(a) PGA

(b) S_a, T = 1.0 seconds

(c) S_a, T = 4.0 seconds

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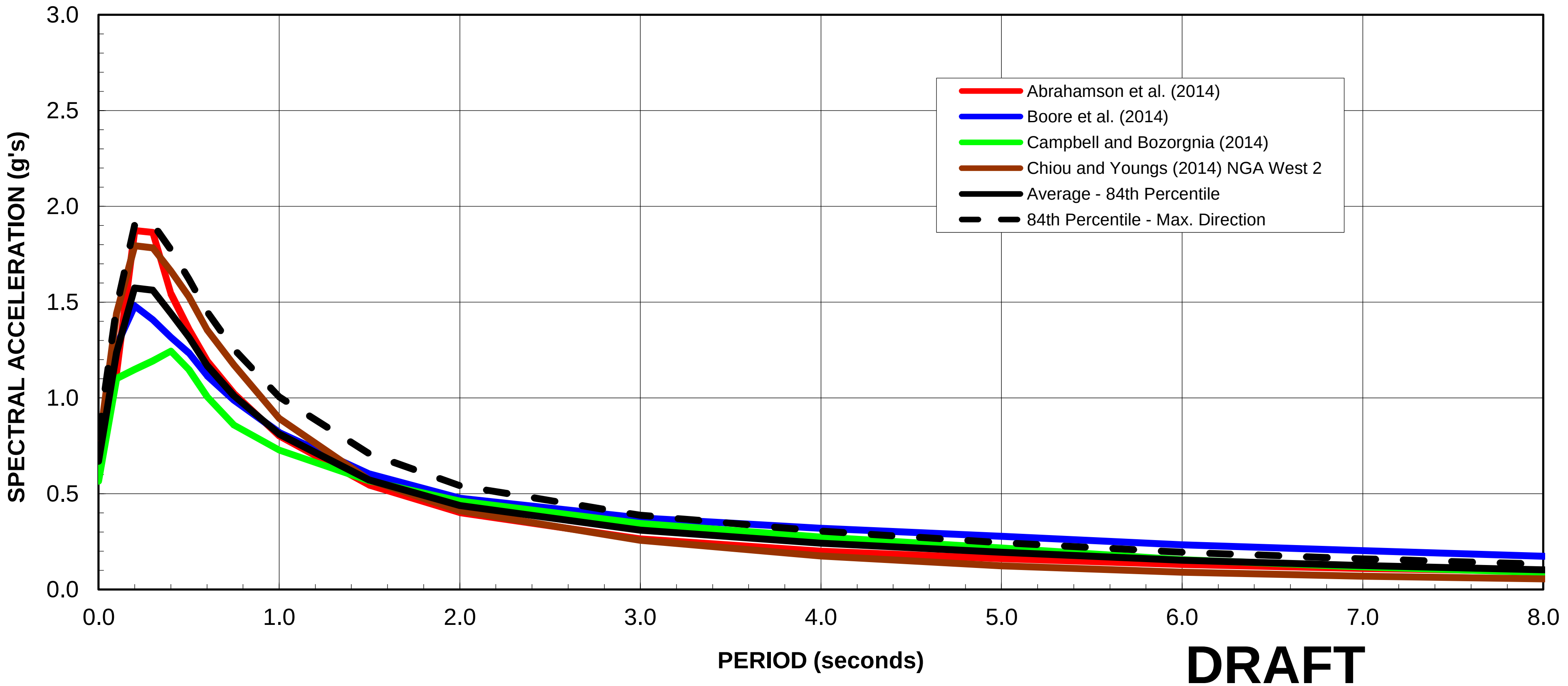
2% PROBABILITY OF EXCEEDANCE IN 50 YEARS FOR - MAGNITUDE DISTANCE DEAGGREGATION PLOTS

Date 10/07/14	Project No. 770633101	Figure G-2



DRAFT

Damping Ratio = 5%

Notes: (1) Estimated V_{S30} = 490 m/s

(2) Deterministic results correspond to a Moment Magnitude 8.05 occuring on the San Andreas fault about 10.6 km from the site.

(3) Maximum direction factors from Shahi and Baker (2014)

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RESULTS OF 84th PERCENTILE DETERMINISTIC ANALYSIS FOR SAN ANDREAS FAULT

Date 10/07/14	Project No. 770633101	Figure G-3

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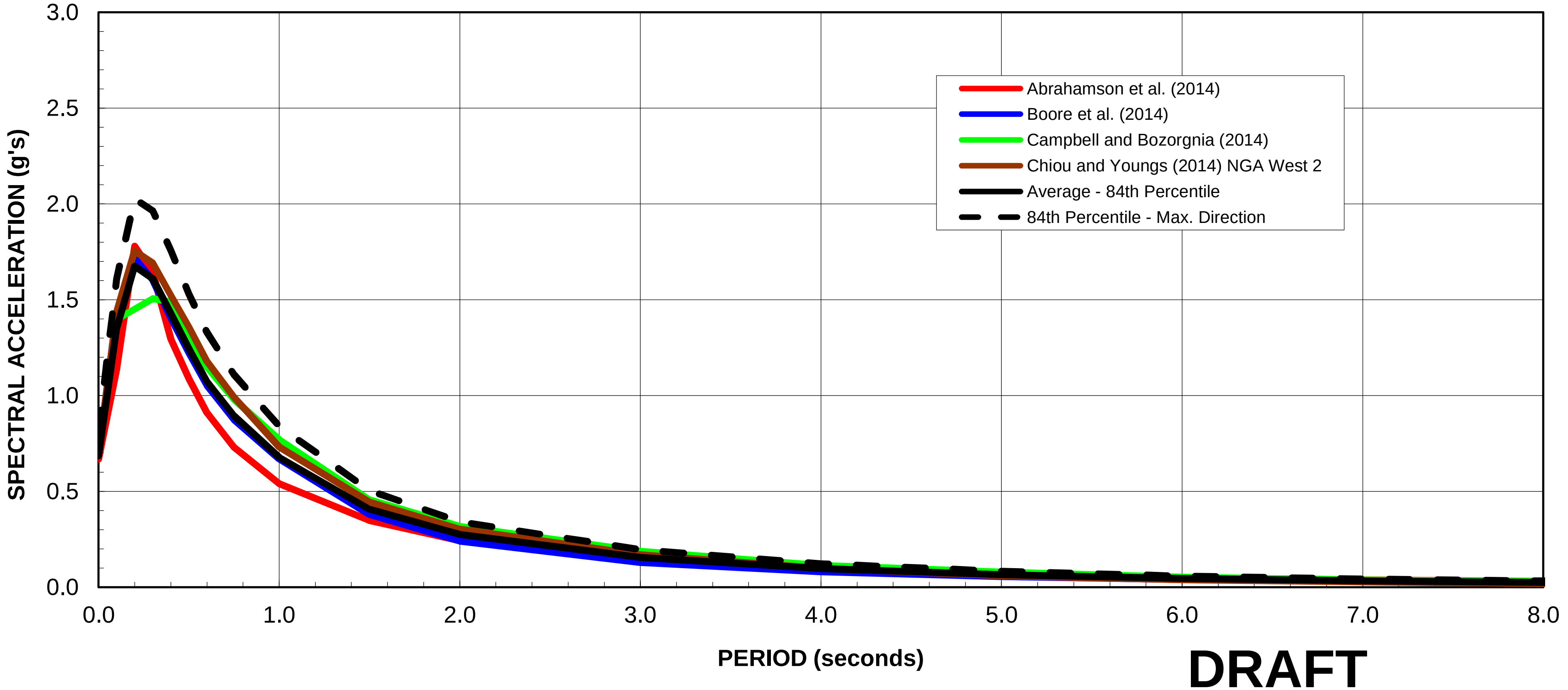

DRAFT

Damping Ratio = 5%

Notes: (1) Estimated V_{S30} = 490 m/s

(2) Deterministic results correspond to a Moment Magnitude 6.5 occuring on the Monte Andreas fault about 4.8 km from the site.

(3) Maximum direction factors from Shahi and Baker (2014)

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RESULTS OF 84th PERCENTILE DETERMINISTIC ANALYSIS FOR MONTE VISTA SHANNON FAULT

Date 10/07/14	Project No. 770633101	Figure G-4

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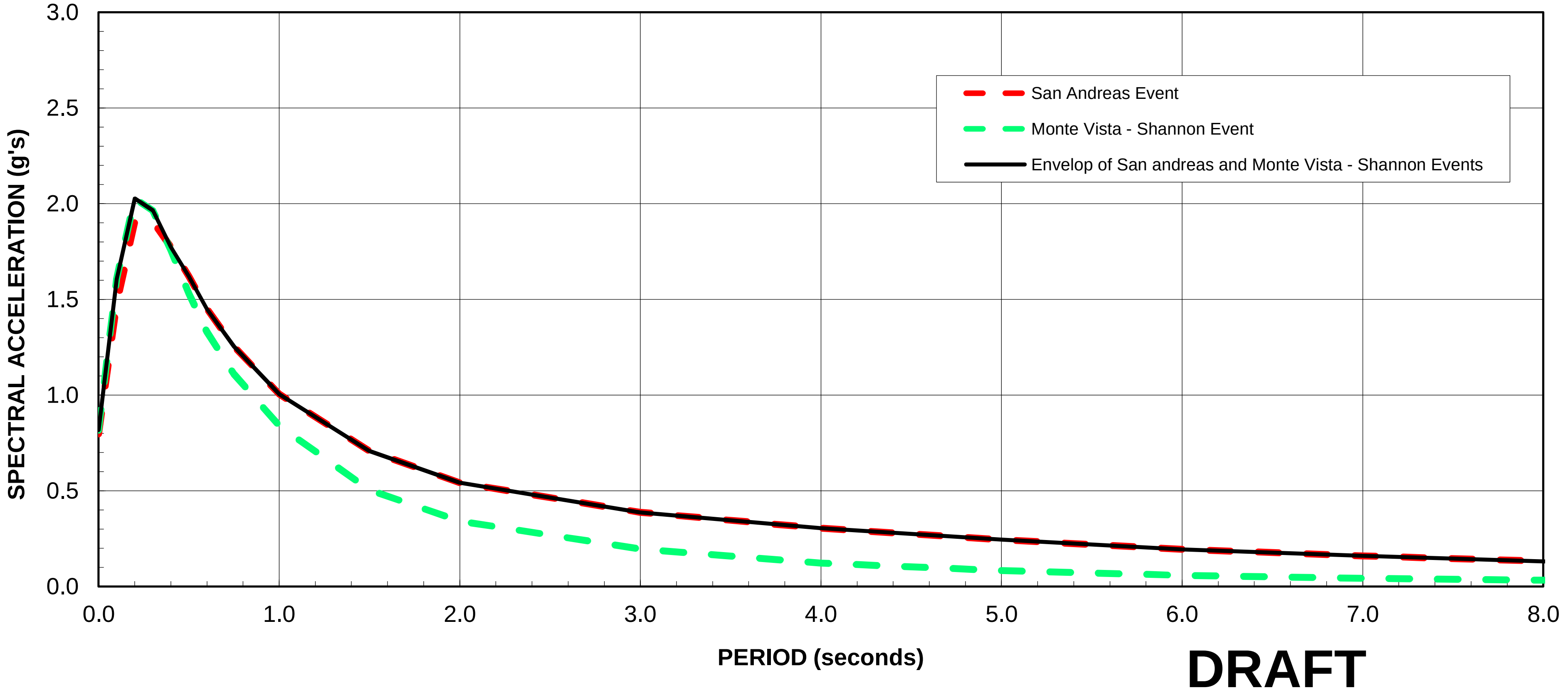

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Damping Ratio = 5%

Notes: (1) Estimated V_{S30} = 465 m/s

(2) Deterministic results corresponds to the San Andreas event (M_W = 8.05 and D = 10.6 km) and the Monte Vista-Shannon event ((M_W = 6.5 and D = 4.8 km).

(3) Maximum direction factors from Shahi and Baker (2014)

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COMPARISON OF 84th PERCENTILE DETERMINISTIC SPECTRA FOR SAN ANDREAS AND MONTE VISTA SHANNON FAULTS

Date 10/07/14	Project No. 770633101	Figure G-5

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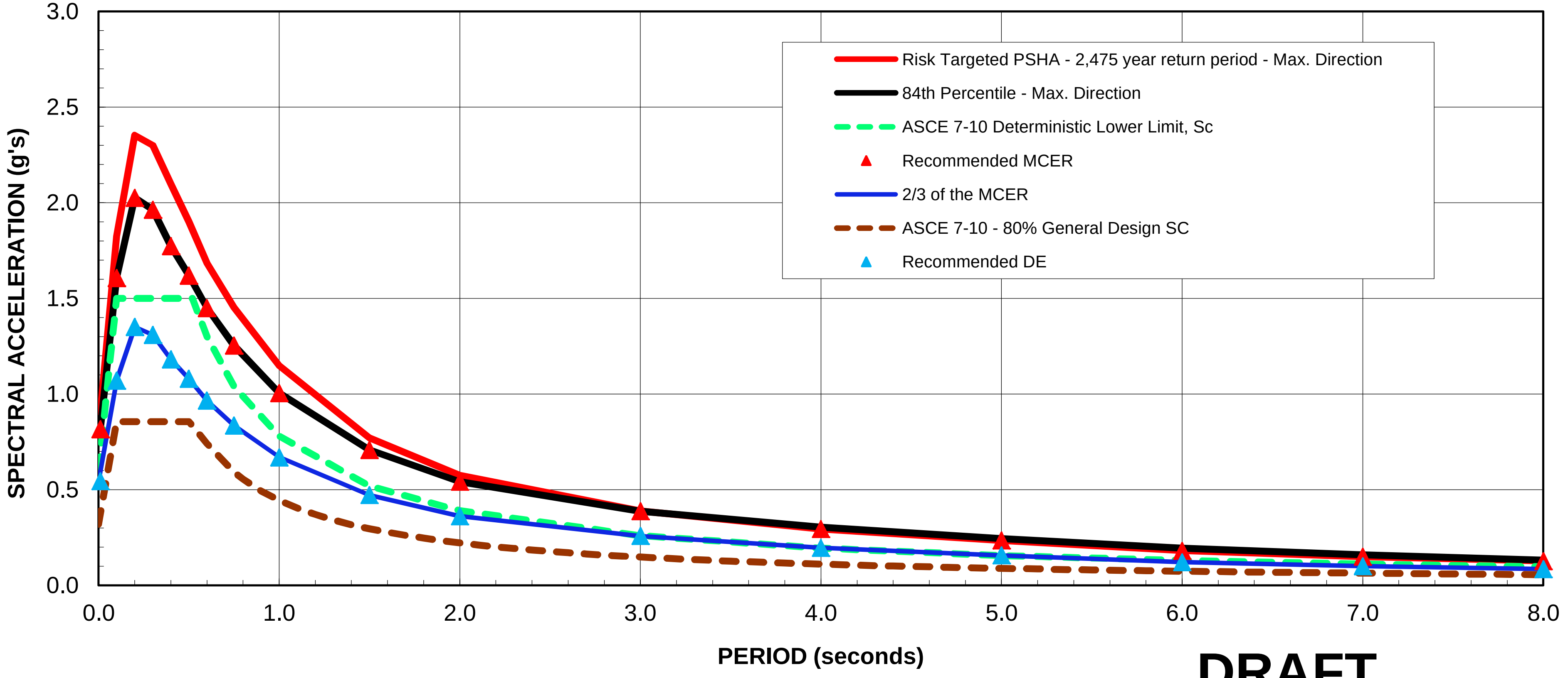

DRAFT

Damping Ratio = 5%

Notes: (1) Estimated V_{S30} = 465 m/s

(2) Deterministic results corresponds to an envelop of the San Andreas event (M_W = 8.05 and D = 10.6 km) and the Monte Vista-Shannon event (M_W = 6.5 and D = 4.8 km).

(3) Maximum direction factors from Shahi and Baker (2014)

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COMPARISON OF DETERMINISTIC, PROBABILISTIC AND CODE SPECTRA

Date 10/07/14	Project No. 770633101	Figure G-6

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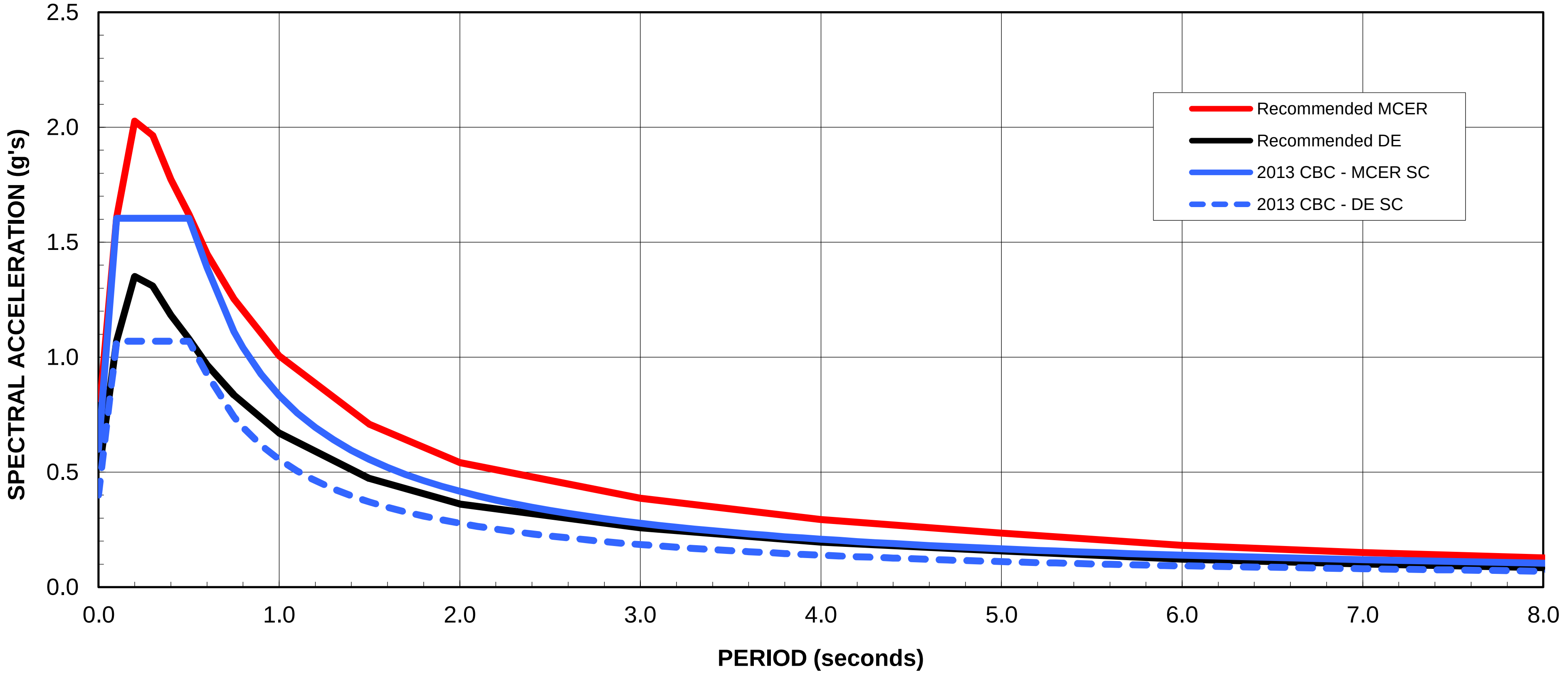

Damping Ratio = 5%

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COMPARISON OF RECOMMENDED MCE$_R$ AND DE SPECTRA WITH CODE

Date 10/07/14	Project No. 770633101	Figure G-7

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