REPORT TO

CASTILLEJA SCHOOL
PALO ALTO, CALIFORNIA

FOR

PROPOSED IMPROVEMENTS

CASTILLEJA SCHOOL
1310 BRYANT STREET
PALO ALTO, CALIFORNIA

GEOTECHNICAL INVESTIGATION

JANUARY 2017

PREPARED BY

SILICON VALLEY SOIL ENGINEERING
2391 ZANKER ROAD, SUITE 350
SAN JOSE, CALIFORNIA

SILICON VALLEY SOIL ENGINEERING
GEOTECHNICAL CONSULTANTS

File No. SV1598
January 9, 2017

Castilleja School
1310 Bryant Street
Palo Alto, CA 94301

Attention: Ms. Mandy Brown, Finance & Operation Analyst

Subject: Proposed Improvements
Castilleja School
APN 142-12-031, 033, & 034
1310 Bryant Street
Palo Alto, California
GEOTECHNICAL INVESTIGATION

Dear Ms. Brown:

Pursuant to your request, we are pleased to present herein geotechnical investigation for the proposed improvements. The subject site is the Castilleja School located at 1310 Bryant Street in Palo Alto, California.

Our findings indicate that the site is suitable for the improvements provided the recommendations contained in this report are carefully followed. Field reconnaissance, drilling, sampling, and laboratory testing of the surface and subsurface material evaluated the suitability of the site. The following report details our investigation, outlines our findings, and presents our conclusions based on those findings.

If you have any questions or require additional information, please feel free to contact our office at your convenience.

Very truly yours,

SILICON VALLEY SOIL ENGINEERING

Sean Deivert
Project Manager

Vien Vo, P.E.

REGISTERED PROFESSIONAL ENGINEER
VIEN M. VO
C 32296
EXP. 12/31/18
CIVIL
STATE OF CALIFORNIA

SV1598.GI/Copies: 4 to Castilleja School

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INTRODUCTION

Per your authorization, Silicon Valley Soil Engineering (SVSE) conducted a geotechnical investigation. The purpose of this geotechnical investigation was to determine the nature of the surface and subsurface soil conditions at the project site through field investigations and laboratory testing. This report presents an explanation of our investigative procedures, results of the testing program, our conclusions, and our recommendations for earthwork and foundation design to adapt the proposed improvements to the existing soil conditions.

SITE LOCATION AND DESCRIPTION

The subject site is located at 1310 Bryant Street including 1235 and 1263 Emerson Street in Palo Alto, California (Figure 1). Bryant Street bound the subject site to the north, Kellogg Avenue to the east, Emerson Street and existing residence to the south, and Embarcadero Road to the west. At the time of this investigation, the subject site is an irregular shaped land, relatively flat occupied by Castilleja Campus surrounded by landscaped areas. According to the preliminary architectural site plan (master plan), the improvements will consist of different phases. The improvements would include the demolition of some of the existing structures and construction of multiple building structures with basements, below grade swimming pool, and below grade and ground surface parking/driveways with associated improvements. The approximate location of the existing structures, proposed improvements, and our borings are shown on the Site Plan (Figure 2).

PREVIOUS FIELD INVESTIGATIONS

In 1999, United Soil Engineering, Inc. (USE) performed a geotechnical investigation and pavement design for the administration building renovations. Two exploratory borings were drilled at the project site to the depths ranging from 20 to 30 feet below the existing ground surface elevation. The results of the investigation were presented in a report, File No. 4855-S1 dated December 29, 1999.

In 2005, USE performed a geotechnical investigation and pavement design for the proposed Physical Arts Building. Two exploratory borings were drilled to the depths ranging from 35.0 feet to 51.5 feet below the existing ground surface elevation. The results of the investigation were presented in a report; File No. 4865A-S1 dated October 18, 2005. The subsurface soil data obtained from the above-mentioned reports was reviewed and used for the preparation of this report.

CURRENT FIELD INVESTIGATION

After considering the nature of the proposed improvements and reviewing available data on the area, our geotechnical engineer conducted a field investigation at the subject site. It included a site reconnaissance to detect any unusual surface features, and the drilling of three SPT (Standard Penetration Test) exploratory test borings per ASTM D1586 and six Cone Penetration Tests (CPTs) per ASTM D5778 to determine the subsurface soil characteristics. The approximate location of the SPT borings and CPTs is shown on Figure 2 - Site Plan. The SPT borings (B-2, B-5, and B-7) were drilled to the depth of 35 feet below the existing ground surface elevation (bgs) and the CPTs (B-1, B-3, B-4, B-6, B-8, and B-9) were advanced to the depths of 35 feet and 65 feet bgs. The SPT borings were drilled with a truck mounted drill rig using 8-inch diameter hollow stem augers.

The soils encountered were logged continuously in the field during the drilling operation. Relatively undisturbed soil samples were obtained by hammering a 2.0-inch outside diameter (O.D.) split-tube sampler for a Standard Penetration Test (SPT), ASTM Standard D1586, into the ground at various depths. A 140-pound hammer with a free fall of 30 inches was used to drive the sampler 18 inches into the ground. Blow counts were recorded on each 6-inch increment of the sampled interval. The blows required to advance the sampler the last 12 inches of the 18 inch sampled interval were recorded on the boring logs as penetration resistance. The CPT procedure explanation is included in the Appendix. After the completion of the drilling operation, the exploratory SPT borings and CPTs were backfilled from the bottom of the borehole to the surface with neat cement in accordance to the rules and regulations of the Santa Clara Valley Water District. A copy of the drilling permit is enclosed at the end of the report.

In addition, one disturbed bulk sample of the near-surface soil was collected for laboratory analyses. The Exploratory Boring Log, a graphic representation of the encountered soil profile which also shows the depths at which the relatively undisturbed soil samples were obtained, can be found in the Appendix at the end of this report.

LABORATORY INVESTIGATION

A laboratory-testing program was performed to determine the physical and engineering properties of the soils underlying the site.

1. Moisture content and dry density tests were performed on the relatively undisturbed soil samples in order to determine soil consistency and the moisture variation throughout the explored soil profile (Table I).

2. The strength parameters of the foundation soils were determined from direct shear tests that were performed on selected relatively undisturbed soil samples at the depths of 5 feet and 10 feet (Table I).

3. Atterberg Limits tests were performed on the sub-surface soil to assist in the classification of these soils and to obtain an evaluation of their expansion and shrinkage potential and liquefaction analysis (Figure 4).

4. Laboratory compaction tests were performed on the near-surface material per the ASTM D1557-12 test procedure (Figure 5).

5. One R-Value test was performed on a near surface soil sample for pavement section design recommendations (Figure 6).

6. Corrosivity tests were performed on soil samples obtained at the depth of 2.5 feet, 9.5 feet, and 19.5 feet for addressing the issue of corrosive potential of the subsurface soil with respect to underground utilities and structure concrete (Appendix).

The results of the laboratory-testing program are presented in the Tables, Figures and Appendices at the end of this report.

SOIL CONDITIONS

In Boring B-2 (35.0 feet boring), from the surface to a depth of 13 feet, a brown, damp, very stiff silty clay layer was encountered. A color change of reddish brown was noted at a depth of 10 feet. From the depths of 13 feet to the end of the boring at 35 feet, the soil became reddish brown, moist, dense sandy gravel. The gravel was 1.5 inches in maximum diameter, sub-angular, and well graded. Similar soil profiles were encountered in Boring B-5 and Boring B-7. However, in Boring B-5, the sandy gravel layer was encountered from the depths of 16 feet to 30 feet. In Boring B-7, the sandy gravel layer was encountered from the depths of 16 feet to 26 feet.

In CPT B-1, from the surface to a depth of 14 feet, the CPT sounding interpreted the soil behavior type (SBT) as very dense/stiff sandy silt to silty clay. From the depths of 14 feet to 23 feet, the SBT is silty sand to sand. From the depths of 23 feet to the end of the sounding at 65 feet, the SBT is stiff silty clay. Similar SBT profiles were encountered in other CPTs. When compare to SPT borings profiles we concluded that the CPTs profiles from the surface to the depth of 35 feet are relatively consistent with the SPT borings profiles.

Groundwater was encountered in all borings to the depths of 29 feet to 31 feet and stabilized at after drilling completion at the depths of 28 feet to 30 feet. It should be noted that the groundwater level would fluctuate as a result of seasonal changes and hydrogeological variations such as groundwater pumping and/or recharging. A graphic description of the explored soil profiles is presented in the Exploratory Boring Log contained in the Appendix. CPT logs contained in the Appendix.

GENERAL GEOLOGY

The site lies in the San Francisco Bay Region, which is part of the Coast Range province. The regional structure is dominated by the northwest trending Santa Cruz Mountains to the southwest and the Diablo Range across the bay to the northeast.

The site lies on the east flank of the Santa Cruz Mountains on a thin layer of Holocene alluvial deposits overlying the Merced formation, Lower Pleistocene and Upper Pliocene marine deposits. The Santa Cruz Mountains consists of two entirely different, incompatible core complexes, lying side by side and separated from each other by large faults. These two core complexes are Early Cretaceous Granitic intrusions, and an Upper Jurassic to Lower Cretaceous eugosynclinal assemblage - the Franciscan formation. These core complexes are blanketed by thick layers of Eocene to Pleistocene marine deposits. Some Miocene volcanic intrusions are also present in the Santa Cruz Mountains southwest of the subject site. The core complex of the Diablo Range to the northeast of the subject site is comprised of Franciscan formation, predominantly covered with Upper Cretaceous and Lower to Middle Pliocene marine deposits.

The Quaternary history of the region is recorded by sedimentary marine strata alternating with non-marine strata. The changes of the depositional environment are related to the fluctuation of sea level corresponding to the glacial and interglacial periods. Late Quaternary deposits fill the center of the San Francisco

Bay Region and most of the strata are of continental origin characterized as alluvial and fluvial materials.

Folds, thrust faults, steep reverse faults, and strike-slip faults developed as a consequence of Cenozoic deformations that occur very often within the province and are continuing today.

The closest major active faults are the San Andreas, Hayward, and San Gregorio faults with main traces respectively mapped to lie approximately 5.2 miles southwest, 13.7 miles northeast, and 15.6 miles southwest, respectively.

LIQUEFACTION ANALYSIS:

A. GROUNDWATER

Groundwater was initially encountered in Boring B-2, Boring B-5, and Boring B-7 at the depths of 29 feet to 31 feet and rose to a static levels ranging of 28 feet to 30 feet at the end of the drilling operation. Groundwater was encountered in CPT B-1, CPT B-6, and CPT B-9 at the depth of 31 feet below existing ground surface elevation. Based on the State guidelines and CGS Seismic Hazard Zone Report 111 [*Seismic Hazard Evaluation of the Palo Alto 7.5-Minute Quadrangle, San Mateo and Santa Clara Counties, California. 2006 (Released April 18, 2006).* Department Of Conservation. Division of Mines and Geology], the highest expected groundwater level is approximately 23 feet below ground elevation. Therefore, the 23 feet depth of the groundwater table will be used for the liquefaction analysis.

B. SUSPECTED LIQUEFIABLE SOIL LAYERS

A computer program named LiquefyPro Version 5.8n (CivilTech Corporation) was used in the liquefaction analysis for CPT B-1, CPT B-6, and CPT B-9. These CPTs are selected for the liquefaction analysis because of the 65-foot depth. This program is based on the most recent publications of NCEER Workshop and procedure outline in SP117 Implementation. The program was used to identify liquefiable soil layers in CPT B-1, CPT B-6, and CPT B-9. The following-mentioned list are potential liquefiable soil layers identified by LiquefyPro and shown in Figure 7 through Figure 9.

CPT B-1: No liquefiable soil layer was found

CPT B-6: Sand layer at depth of 23 feet to 30 feet and (7 feet in thickness)

CPT B-9: Sand layers at depths of 23 feet to 24 feet and 39 feet to 41 feet (3 feet in cumulative thickness)

C. PEAK GROUND ACCELERATION

The ground motion caused by earthquakes is generally characterizes in terms of ground surface displacement, velocity, and acceleration. For this liquefaction study, the measure of the cyclic ground motion is represented by the maximum horizontal acceleration at the ground surface, a_{max}. The maximum horizontal acceleration at ground surface is also called the peak horizontal ground acceleration. The value of peak ground acceleration is usually based on prior earthquake and faults studies because it is not possible to predict earthquakes. Based on the State guidelines and CGS Seismic Hazard Zone Report 111 [*Seismic Hazard Evaluation of the Palo Alto 7.5-Minute Quadrangle, San Mateo and Santa Clara Counties, California*. 2006 *(Released April 18, 2006)*. Department of Conservation. Division of Mines and Geology], the peak ground acceleration value of 0.62g is used for the liquefaction analysis.

D. LIQUEFACTION ANALYSIS

The evaluation procedure is a semi-empirical method for a moment magnitude Mw7.9 earthquake, a peak ground acceleration of 0.62g, and highest expected groundwater table of 23 feet. A computer program named LiquefyPro Version 5.8n (CivilTech Corporation) was used in the liquefaction analysis for CPT B-1, CPT B-6, and CPT B-9. This program is based on the most recent publications of NCEER Workshop and procedure outline in SP117 Implementation. Based on our analysis, it is our opinion that the liquefaction of the liquefiable soil layers at this site is low. In addition, based on our analysis using Modified Robertson and Ishihara & Yosemine, we estimated maximum total settlements from liquefaction at CPT B-1 = 0.18 inch, CPT B-6 = 1.66 inches, and CPT B-9 = 0.42 inch. The maximum differential settlements at CPT B-1 = 0.12 inch, CPT B-6 = 1.098 inches, and CPT B-9 = 0.278 inch.

The results of the analysis including the liquefaction-induced settlements are enclosed at the end of this report.

E. LIQUEFACTION-INDUCED GROUND DAMAGE

In addition to the ground surface settlements, there could be also liquefaction-induced ground damage that causes settlement of structures. The ground damage may include sand boils and/or surface fissures. To evaluate liquefaction-induced ground damage, we use Figure 10. These figures were reproduced from *Kramer 1996, which was originally developed by Ishihara 1985.* In plotting the coordinates of the suspected liquefiable soil layers of CPT B-1, CPT B-6, and CPT B-9 in Figure 10, the thickness of surface non-liquefiable soil layer (H_1) and the cumulative thickness of the liquefiable soil layers (H_2) were entered with a maximum peak acceleration of $a_{max} = 0.62g$. The following is the determination of H_1 and H_2 in CPT B-1, CPT B-6, and CPT B-9.

<u>CPT B-1:</u> $H_1 = 7.7$ meters (23 feet); $H_2 = 0$ meter

<u>CPT B-6:</u> $H_1 = 7.7$ meters (23 feet); $H_2 = 2.33$ meters (7 feet)

<u>CPT B-9:</u> $H_1 = 7.7$ meters (23 feet); $H_2 = 1$ meter (3 feet)

Based on the plotted coordinates of the suspected liquefiable soil layers of CPT B-1, CPT B-6, and CPT B-9 using the above data, we concluded that there is a minimal potential for liquefaction-induced ground surface damage to occur at the site.

F. CONCLUSIONS

The followings are the conclusions of this study.

- The liquefaction-induced total maximum settlements at the site is 1.66 inches. The conventional foundation system should tolerate this magnitude.
- The liquefaction-induced maximum differential settlements at the site is 1.098 inches. The conventional foundation system should tolerate this magnitude.
- The potential of liquefaction-induced ground surface damage at the majority of the site is minimal.

INUNDATION POTENTIAL

The subject site is located at 1310 Bryant Street in Palo Alto, California. According to the Limerinos and others, 1973 report, the site is not located in an area that has potential for inundation as the result of a 100-year flood (Limerinos; 1973).

CONCLUSIONS

1. The site covered by this investigation is suitable for the proposed improvements provided the recommendations set forth in this report are carefully followed.

2. Based on the laboratory testing results, the native surface soil at the project site has been found to have a moderately high expansion potential when subjected to fluctuations in moisture. Therefore, we recommend that the building pad at grade should be underlain by a minimum of 12 inches non-expansive fill layer. During the construction of the building pad, any moderately high expansive native soil should not be used as non-expansive engineered fill material.

3. We recommend that above grade buildings be supported on conventional spread foundation.

4. We recommend that the entire basement foundation system should be a concrete mat slab. The native subgrade soil at bottom elevation of the basement mat slab has been found to have a low expansion potential.

5. The imported non-expansive fill soils, if any, should be free of organic material and hazardous substances. All imported fill material to be used for engineered fill should be environmentally tested prior to be used at the site.

6. The basement slab and retaining walls should be waterproofed.

7. Basement retaining walls should be designed without subdrain system per City of Palo Alto guidelines.

8. The exterior grade of the structure should be graded to permit proper drainage and diversion of water away from the building structure.

9. A reference to our report should be stated in the grading and foundation plans (this includes the *Geotechnical Investigation* report File No. and date).

10. On the basis of the engineering reconnaissance and exploratory borings, it is our opinion that trenches that will be excavated to depths less than 5 feet below the existing ground surface will not need shoring. However, for trenches and excavation that will be excavated greater than 5 feet in depth, shoring will be required.

11. Specific recommendations are presented in the remainder of this report.

12. All earthwork and grading shall be observed and inspected by a representative from Silicon Valley Soil Engineering (SVSE). These operations are not limited to testing and inspection during grading.

RECOMMENDATIONS:

GRADING

1. The placement of fill and control of any grading operations at the site should be performed in accordance with the recommendations of this report. These recommendations set forth the minimum standards to satisfy other requirements of this report.

2. All existing surface and subsurface structures that will not be incorporated in the final improvements shall be removed from the project site prior to any grading operations. These objects should be accurately located on the grading plans to assist the field engineer in establishing proper control over their removal. All utility lines in the new building pad area should be relocated or removed prior to any excavation/grading at the site.

3. All organic surface material and debris should be stripped prior to any other grading operations, and transported away from all areas that are to receive structures or structural fills. Soil containing organic material may be stockpiled for later use in landscaping areas only.

4. After removing all the subsurface structures or existing pavement section and after stripping the organic material from the soil, the improved area should be scarified by machine to a depth of 12 inches and thoroughly cleaned of vegetation and other deleterious matter.

5. After stripping, scarifying and cleaning operations, subgrade soil should be compacted to not less than 90% relative maximum density using ASTM D1557-12 procedure over the entire building/basement pad, 5 feet beyond the building pad as permitted, moisture conditioned to 3% over optimum moisture, and 3 feet beyond of the edge of the parking/driveway area.

6. All engineered fill or imported soil should be placed in uniform horizontal lifts of not more than 8 inches in un-compacted thickness, and compacted to not less than 90% relative maximum density. The baserock, however, should be compacted to not less than 95% relative maximum density. Before compaction begins, the subgrade and/or fill material shall be brought to a water content that will permit proper compaction by either; 1) aerating the material if it is too wet, or 2) spraying the material with water if it is too dry. Each lift shall be thoroughly mixed before compaction to assure a uniform distribution of water content.

7. When fill material includes rocks, nesting of rocks will not be allowed and all voids must be carefully filled by proper compaction. Rocks larger than 4 inches in diameter should not be used for the final 2 feet of building pad.

8. Unstable (yielding) subgrade should be aerated or moisture conditioned as necessary. Yielding isolated area in the subgrade can be stabilized with an excavation of the subgrade to the depth of 12 to 18 inches, lined with stabilization fabric membrane (Mirafi 500X or equivalent) and backfilled with aggregate base.

9. Silicon Valley Soil Engineering (SVSE), should be notified at least two days prior to commencement of any grading operations so that our office may coordinate the work in the field with the contractor. All imported borrow must be approved by SVSE before being brought to the site. Import soil must have a plasticity index no greater than 15, an R-Value greater than 25, and environmentally clean.

10. All grading work shall be observed and approved by a representative from SVSE. The geotechnical engineer shall prepare a final report upon completion of the grading operations.

WATER WELLS

11. Any water wells and/or monitoring wells on the site which are to be abandoned, shall be capped according to the requirements of the Santa Clara Valley Water District. The final elevation of the top of the well casing must be a minimum of 3 feet below the adjacent grade prior to any grading operation.

FOUNDATION DESIGN CRITERIA (ABOVE GRADE)

12. The proposed above grade buildings should be supported on conventional spread foundation.

13. Conventional continuous perimeter and isolated interior spread foundation should be founded at a minimum depth of 24 inches below the pad finished subgrade elevation. For these conditions, the allowable bearing capacity is 2,500 psf for both perimeter and interior spread footings.

14. The above bearing values are for dead plus live loads and may be increased by one-third for short term seismic and wind loads. The design of the structures and the foundations shall meet local building code requirements.

15. The project structural engineer responsible for the foundation design shall determine the final design of the foundations and reinforcing required. We recommend that the foundation plans be reviewed by our office prior to submitting to the appropriate local agency and/or to construction.

FOUNDATION DESIGN CRITERIA (BELOW GRADE)

16. The entire basement foundation system should be a concrete mat slab.

17. The mat slab foundation should have a minimum thickness of 12 inches. A value of 250 pci as the soil modulus of subgrade of reaction and contact pressure of 2,000 psf can be used in the design of the mat foundation. The weight of the mat slab can be neglected for bearing pressures.

18. The above bearing values are for dead plus live loads and may be increased by one-third for short term seismic and wind loads. The design of the structures and the foundations should meet local building code requirements.

19. The anticipated total settlement is 1.0 inch and the differential settlement is 0.75 inch over a 200 feet span respectively for the basement with mat slab foundation.

20. The mat foundation should be underlain by 6 inches of 3/4-inch clean crushed rock (recycled material not acceptable) and waterproofed with Bitumen Waterproof Membrane or Paraseal LG or equivalent. Waterproof consultant should provide proper recommendations.

21. The bottom soil subgrade of the basement should be compacted to at least 90% relative maximum density.

2016 CBC SEISMIC VALUES

22. Chapter 16 of the 2016 California Building Code (CBC) outlines the procedure for seismic design. The site categorization and site coefficients are shown in the following table.

Classification/Coefficient	Design Value
Site Class (ASCE 7-10, Table 20.3-1; 2016 CBC, Section 1613A.3.2)	D
Risk Category	I,II,III
Site Latitude	37.439075° N.
Site Longitude	122.151342° W.
0.2-second Mapped Spectra Acceleration[1], S_S (Section 1613A.3.1)*	1.514g
1-second Mapped Spectra Acceleration[1], S_1 (Section 1613A.3.1)*	0.694g
Short-Period Site Coefficient, F_a Table 1613A.3.3(1)*	1.0
Long-Period Site Coefficient, F_V Table 1613A.3.3(2)*	1.5
0.2-second Period, Maximum considered Earthquake Spectral Response Acceleration, S_{MS} ($S_{MS} = F_aS_S$: Section 1613A.3.3)*	1.514g
1-second Period, Maximum Considered Earthquake Spectral Response Acceleration, S_{M1} ($S_{M1} = F_VS_1$: Section 1613A.3.3)*	1.041g
0.2-second Period, Designed Spectra Acceleration, S_{DS} ($S_{DS} = 2/3S_{MS}$: Section 1613A.3.4)*	1.009g
1-second Period, Designed Spectra Acceleration, S_{D1} ($S_{D1} = 2/3S_{M1}$: Section 1613A.3.4)*	0.694g

[1] For Site Class B, 5 percent damped.
*2016 CBC

BASEMENT RETAINING WALLS

23. The basement retaining walls should be design for seismic loading condition. The pseudo-static method by Seed and Whitman can be used (PE = $(3/8)(0.45a_{max}/g)(H^2)W_t$ (where a_{max} = 0.62g; H = height of the retaining wall; W_t = total unit weight of retained soil, for this site W_t = 120 pcf). This pseudo-static pressure is inverted triangularly-distributed with the top value of 377 psf and 0 psf at the bottom. This pseudo-static pressure should be added to the active pressure for seismic loading condition.

24. The basement retaining wall should be designed for active lateral earth pressure (static and seismic) and a surcharge value of 200 psf (vertically uniformed distributed down to 10 feet) as shown in Figure 11. Surcharge value includes adjacent buildings and vehicular traffic loads.

25. A friction coefficient of 0.3 should be used for retaining wall design. This value may be increased by 1/3 for short-term seismic loads.

26. The basement walls should be waterproofed with Bitumen Waterproof Membrane or Paraseal LG or equivalent.

27. Subdrain system is not allowed. Therefore, the above-mentioned values assume an un-drained condition.

28. We recommend a thorough review by our office of all designs pertaining to facilities retaining a soil mass.

SITE RETAINING WALLS

29. Any facilities that will retain a soil mass above grade or near surface grade should be designed for a lateral earth pressure (active) equivalent to 55 pounds equivalent fluid pressure, plus surcharge loads. If the retaining walls are restrained from free movement at both ends, the walls should be designed for the earth pressure resulting from 65 pounds equivalent fluid pressure.

30. In designing for allowable resistive lateral earth pressure (passive), a value of 250 pounds equivalent fluid pressure may be used with the resultant acting at the third point. The top foot of native soil should be neglected for computation of passive resistance.

31. A friction coefficient of 0.3 should be used for retaining wall design. This value may be increased by 1/3 for short-term seismic loads.

32. The fore-mentioned values for above grade or near surface grade assume a drained condition and a moisture content compatible with those encountered during our investigation.

33. Drainage should be provided behind the retaining wall. The drainage system should consist of perforated (subdrain) pipe placed at the base of the retaining wall and surrounded by ¾ inch drain rock wrapped in a filter fabric. The drain rock wrapped in fabric should be at least 12 inches wide and extend from the base of the wall to within 1.5 feet of the ground surface. The upper 1.5 feet of backfill should consist of compacted native soil. The retaining wall drainage system should be sloped to an appropriate discharge facility.

34. As an alternative to the drain rock and fabric, Miradrain 2000 or approved equivalent drain mat may be used behind the retaining wall. The drain mat should extend from the base of the wall to the ground surface. A perforated pipe (subdrain system) should be placed at the base of the wall in direct contact with the drain mat. The pipe should be sloped to an appropriate discharge facility.

35. We recommend a thorough review by our office of all designs pertaining to facilities retaining a soil mass.

CONCRETE SLAB-ON-GRADE CONSTRUCTION (ABOVE GRADE)

36. Based on the laboratory testing results of the near-surface soil, the native surface soil at the project site has been found to have a moderately high expansion potential when subjected to fluctuations in moisture. Therefore, concrete slab, if any near surface grade should be underlain by a minimum of 12 inches non-expansive fill layer. This layer should be compacted to at least 90% relative maximum density. The non-expansive fill is not included in the rock section.

37. Concrete slab-on-grade should be underlain by a minimum of 6 inches of Class II Baserock or ¾ inch clean crushed rock (recycled asphalt concrete not acceptable). The baserock should be compacted to not less than 95% relative maximum density and 90% for the subgrade.

38. Use of a vapor barrier membrane (Stego 15 mil) under the concrete slab is required if a floor covering would be applied. The membrane should be placed between the rock and the concrete slab. The vapor barrier membrane should be overlapped, taped at seams and/or mastic applied for protrusions.

39. Prior to placing the vapor membrane and/or pouring concrete, the slab grade should be moistened with water to reduce the swell potential, if deemed necessary, by the field engineer at the time of construction.

SWIMMING POOL

40. Swimming pool retaining walls should be designed for a lateral earth pressure (active) equivalent to 65 pounds equivalent fluid pressure for horizontal backfill which should be added surcharge loads. The structural engineer should discuss the surcharge loads with the geotechnical engineer prior to designing the swimming pool retaining walls.

41. In designing for allowable resistive lateral earth pressure (passive) of 250 pounds equivalent fluid pressure may be used with the resultant acting at the third point.

42. Concrete slab for the swimming pool bottom should be underlain by a minimum of 6 inch of 3/4-inch clean crushed rock.

43. The swimming pool structure should be constructed with a hydrostatic relief value.

EXCAVATION

44. No difficulties due to soil conditions are anticipated in excavating the on-site material. Conventional earth moving equipment will be adequate for this project.

45. Any vertical cuts deeper than 5 feet must be properly shored. The minimum cut slope for excavation to the desired elevation is one horizontal to one vertical (1:1). The cut slope should be increased to 2:1 if the excavation is conducted during the rainy season or when the soil is highly saturated with water.

SHORING SUPPORT FOR THE BASEMENT EXCAVATION

46. The basement excavation should be shored. The basement will be excavated to the approximate depth of 13 feet to 15 feet below existing ground surface. Therefore, the excavation should be supported with steel soldier "H" beams and a 3 x 12 and/or 4 x 12 wood lagging. Prior to any excavation, the soldier beams should be placed in pre-drilled minimum 24-inch diameter holes to a minimum depth of 30 feet below existing ground elevation. The holes should be filled with concrete to one foot below the bottom of the excavation and concrete slurry (2 sack cement) for the remaining void to existing ground elevation. Groundwater more likely will be encountered and should be displaced properly in the pier holes by the concrete via tremmie pipe. Thereafter, excavation can begin. As the excavation operation proceeds, the wood lagging should be placed between the soldier beams. The soldier beams should be placed a maximum distance of 6 feet apart. There should be no voids between the soil wall excavation and wood lagging. However, if a void occurs, the void should be filled with sand slurry or pressure grouted. Proper attention should be considered during the construction. Introduction of any heavy equipment on the top of the vertical cut may damage the shoring. The

lateral soil pressure acting on the shoring system including surcharge of the adjacent building and adjacent street vehicle loading is shown in Figure 12. The passive pressure of 250 pounds equivalent fluid pressure can be used for short-term shoring purposes. The shoring should be designed by the structural engineer or shoring design engineer and our office should review the shoring plan for approval.

DEWATERING

47. The bottom subgrade of the underground basement structure will be approximately 13 feet to 15 feet below ground surface elevation. The groundwater table at the time of our investigation was encountered to the depths of 28 feet to 30 feet. Based on the State guidelines and CGS Seismic Hazard Zone Report 111 [*Seismic Hazard Evaluation of the Palo Alto 7.5-Minute Quadrangle, San Mateo and Santa Clara Counties, California. 2006 (Released April 18, 2006)*. Department Of Conservation. Division of Mines and Geology], the highest expected groundwater level is approximately 23 feet below ground elevation. The bottom of the basement excavation will be 13 feet to 15 feet below existing ground surface. Therefore, in our opinion, dewatering is not expected during the basement excavation.

DRAINAGE

48. It is considered essential that positive surface drainage be provided during construction and be maintained throughout the life of the structures.

49. The final exterior grade adjacent to the structures should be such that the surface drainage will flow away from the structures. Rainwater discharge at downspouts should be directed onto pavement sections, splash blocks, or other acceptable facilities, which will prevent water from collecting in the soil adjacent to the foundations.

50. Basement garage drain sump pump, if any, should be installed and piped to proper drainage facility.

51. Utility lines that cross under or through slab, footings, or walls should be completely sealed or waterproofed as necessary, to prevent moisture intrusion into the areas under the slab, footings and/or basement area.

52. Consideration should be given to collection and diversion of roof runoff and the elimination of planted areas or other surfaces which could retain water in areas adjoining the building. The grade adjacent to the foundation should be sloped away from the structure at a minimum of 2 percent.

53. If the subgrade in the landscaping area is moderately to highly expansive, proper drainage should be provided in the landscaping area adjacent to the building foundation. A drip irrigation system is preferable. If the sprinkler system is located adjacent to the building perimeter or concrete walkway, a moisture cut-off barrier should be provided.

54. Based on laboratory test results of the near surface soil at the subject site, the infiltration rate is approximately 0.5 inch per hour ($K_{SAT} = 3.5 \times 10^{-4}$ cm/sec). This rate can be used in the design of the bio-retention system for on-site storm drainage.

ABANDONMENT OF THE EXISTING UTILITY LINES

55. All existing and abandoned utility lines located within the new building pad and basement area must be removed.

56. All abandoned utility lines within 2 feet from existing ground surface should be removed.

57. Removing the utility lines would require proper backfill and re-compaction of the excavation. Abandoning utility lines in-place would require to cap the abandoned portion of the pipe and all exposed pipe ends with concrete and the removal of any surface clean-outs, manhole or drain inlet structures.

ON-SITE UTILITY TRENCHING

58. All on-site utility trenches must be backfilled with native on-site material or import fill and compacted to at least 90% relative maximum. Backfill should be placed in 8 to 12 inch lifts and compacted. Jetting of trench backfill is not recommended. An engineer from our firm should be notified at least 48 hours before the start of any utility trench backfilling operations.

59. If utility trench excavation is to encounter groundwater, our office should be notified for dewatering recommendations.

PAVEMENT DESIGN

60. Due to the uniformity of the near-surface soil at the site, one R-Value Test was performed on a representative bulk sample. The result of the R-Value test is enclosed in this report. The following alternate sections are based on our laboratory resistance R-Value test of near-surface soil samples and traffic indices (T.I.) of 4.5 for parking stalls and 5.5 for parking area and driveway (travel way). Alternate asphalt pavement section designs, which satisfy the State of California Standard Design Criteria, and above traffic indices, are presented in Table II. Concrete and paver pavement section designs are presented in Table III and IV. Due to the moderately high expansion potential of the surface native soil, minor cracks in the pavement should be expected.

CORROSIVITY ANALYSIS

61. Three soil samples collected on December 21, 2016 at the depths of 2.5 feet, 9.5 feet, and 19.5 feet below existing grade were submitted to Cooper Testing Lab. The sample was tested for Resistivity (100% Saturation), Conductivity, Chloride, Sulfate, pH, and Redox potential.

- The soil resistivity measurement for the near surface soil is 3,045, which can be classified as "highly corrosive". Therefore, all buried iron, steel, cast iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the nature of the structure. In addition, all buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

- The chloride ion concentrations for the site soil are 2, 3 mg/kg and less than 2 mg/kg. Because the chloride concentrations are less than 100 mg/kg, it is determined to be insufficient to attack steel embedded in a concrete mortar coating.

- The sulfate ion concentrations for the site soil are 27, 68, and 100 mg/kg. Therefore, the sulfate ion concentration in the soil is determined to be moderate to damage reinforced concrete structures and cement mortar-coated steel at the site.

- The type of cement for construction: Evaluation of soluble sulfate content of soil samples considered representative of the predominate material types on-site suggests that Type V cement is a requirement for use in construction.

- The soil pH for the near surface soil is 5.9, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

- The soil redox potential for the near surface soil is 472 mV, which is indicative of potentially "non-corrosive" soil resulting from anaerobic soil conditions.

A corrosivity consultant should be consulted if necessary such as for the cathodic protection design. The results of the corrosivity laboratory tests results are shown in the Appendix.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations presented herein are based on the soil conditions revealed by our test boring(s) and evaluated for the proposed construction planned at the present time. If any unusual soil conditions are encountered during the construction, or if the proposed construction will differ from that planned at the present time, Silicon Valley Soil Engineering (SVSE) should be notified for supplemental recommendations.

2. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the necessary steps are taken to see that the contractor carries out the recommendations of this report in the field.

3. The findings of this report are valid, as of the present time. However, the passing of time will change the conditions of the existing property due to natural processes, works of man, from legislation or the broadening of knowledge. Therefore, this report is subjected to review and should not be relied upon after a period of three years.

4. The conclusions and recommendations presented in this report are professional opinions derived from current standards of geotechnical practice and no warranty is intended, expressed, or implied, is made or should be inferred.

5. The area of the boring(s) is/are very small compared to the site area. As a result, buried structures such as septic tanks, storage tanks, abandoned utilities, or etc. may not be revealed in the boring(s) during our field investigation. Therefore, if buried structures are encountered during grading or construction, our office should be notified immediately for proper disposal recommendations.

6. Standard maintenance should be expected after the initial construction has been completed. Should ownership of this property change hands, the prospective owner should be informed of this report and recommendations so as not to change the grading or block drainage facilities of this subject site.

7. This report has been prepared solely for the purpose of geotechnical investigation and does not include investigations for toxic contamination studies of soil or groundwater of any type. If there are any environmental concerns, our firm can provide additional studies.

8. Any work related to grading and/or foundation operations during construction performed without direct observation from SVSE personnel will invalidate the recommendations of this report and, furthermore, if we are not retained for observation services during construction, SVSE will cease to be the Geotechnical Engineer of Record for this subject site.

REFERENCES

Borcherdt R.D., Gibbs J. F., Lajoie K.R., 1977 - Maps showing maximum earthquake intensity predicted in the southern San Francisco Bay Region, California, for large earthquakes on the San Andreas and Hayward faults. U.S.G.S. MF-709.

Helley E.J., Brabb, E.E., 1971 - Geologic map of Late Cenozoic deposits, Santa Clara County, California, U.S.G.S. MFS No. 335, Basic Data Contribution No. 27.

Limerinos J.T., Lee K.W., Lugo P.E., 1973 - Flood Prone Areas in the San Francisco Bay Region, California U.S.G.S. Open file report.

Rogers T.H., and Williams J.W., 1974 - Potential seismic hazards in Santa Clara County, California Special Report, No. 107, California Division of Mines and Geology.

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

USGS (2006). CGS Seismic Hazard Zone Report 111 [*Seismic Hazard Evaluation of the Palo Alto 7.5-Minute Quadrangle, Santa Clara, Alameda, San Mateo Counties, California. 2006 (Released April 18, 2006)*. Department Of Conservation. Division of Mines and Geology].

USGS (December 01, 2016), U.S. Seismic Design Maps http://earthquake.usgs.gov/designmaps/us/application.php

2016 (CBC) California Building Code, Title 24, Part 2.

TABLES

TABLE I

SUMMARY OF LABORATORY TESTS

Sample No.	Depth Ft.	In-Place Conditions: Moisture Content % Dry Wt.	In-Place Conditions: Dry Density p.c.f.	Direct Shear Testing: Unit Cohesion k.s.f.	Direct Shear Testing: Angle of Internal Friction Degrees		
2-1	3	20.0	106.6				
2-2	5	16.0	110.1	0.9	10		
2-3	10	14.0	124.2				
2-4	15	8.1	117.5	1.0	12		
2-5	20	9.5	104.8				
2-6	25	11.6	92.2				
2-7	30	11.8	125.3				
2-8	35	12.1	129.1				
5-1	3	15.8	116.4				
5-2	5	23.4	102.2				
5-3	10	20.9	108.0				
5-4	15	19.5	100.2				
5-5	20	6.8	103.1				
5-6	25	5.5	120.0				
5-7	30	6.2	121.4				
5-8	35	20.1	110.8				

TABLE I (CONTINUED)

SUMMARY OF LABORATORY TESTS

Sample No.	Depth Ft.	In-Place Conditions: Moisture Content % Dry Wt.	In-Place Conditions: Dry Density p.c.f.	Direct Shear Testing: Unit Cohesion k.s.f.	Direct Shear Testing: Angle of Internal Friction Degrees		
7-1	3	19.3	109.8				
7-2	5	28.2	103.5				
7-3	10	20.2	112.6				
7-4	15	16.9	112.2				
7-5	20	9.9	104.7				
7-6	25	9.1	112.4				
7-7	30	33.6	87.7				
7-8	35	31.9	93.4				

TABLE II

PROPOSED ASPHALT PAVEMENT SECTIONS

Location: Proposed Improvements
Castilleja School
1310 Bryant Street
Palo Alto, California

	PARKING STALLS			DRIVEWAY		
Design R-Value	6.0			6.0		
Traffic Index	4.5			5.5		
Gravel Equivalent	17.0			20.0		
Recommended Alternate Pavement Sections:	1A	1B	1C	2A	2B	2C
Asphalt Concrete	3.0"	3.5"	4.0"	3.0"	3.5"	4.0"
Class II Baserock (R=78 min.) compacted to at least 95% relative maximum density	9.0"	8.0"	7.0"	11.0"	10.0"	9.0"
Native soil scarified & compacted to at least 90% relative maximum density	12.0"	12.0"	12.0"	12.0"	12.0"	12.0"

TABLE III

PROPOSED CONCRETE PAVEMENT SECTIONS

Location: Proposed Improvements
Castilleja School
1310 Bryant Street
Palo Alto, California

	DRIVEWAY*	PEDESTRIAN SIDEWALK/PATIO**
Recommended Concrete Pavement Sections:		
P.C. Concrete	6.0"	4.0"
Class II Baserock (R=78 min.) compacted to at least 95% relative maximum density	8.0"	6.0"
Subgrade soil scarified and compacted to at least 90% relative maximum density	12.0"	12.0"

* Including trash enclosures, stress pads, and valley gutters. Driveway concrete slabs should be reinforced with No. 4 rebar at 18 inch maximum spacing on-center, both ways or recommended by Structural Engineer. Maximum control joints at 10' by 10' or as recommended by Structural Engineer. Vertical curbs should be keyed at least 3 inches into pavement subgrade.

** Patio concrete slab areas should be reinforced with No. 3 rebar at 18 inch maximum spacing on-center, both ways or recommended by Structure Engineer.

TABLE IV

PROPOSED PAVER PAVEMENT SECTIONS

Location: Proposed Improvements
Castilleja School
1310 Bryant Street
Palo Alto, California

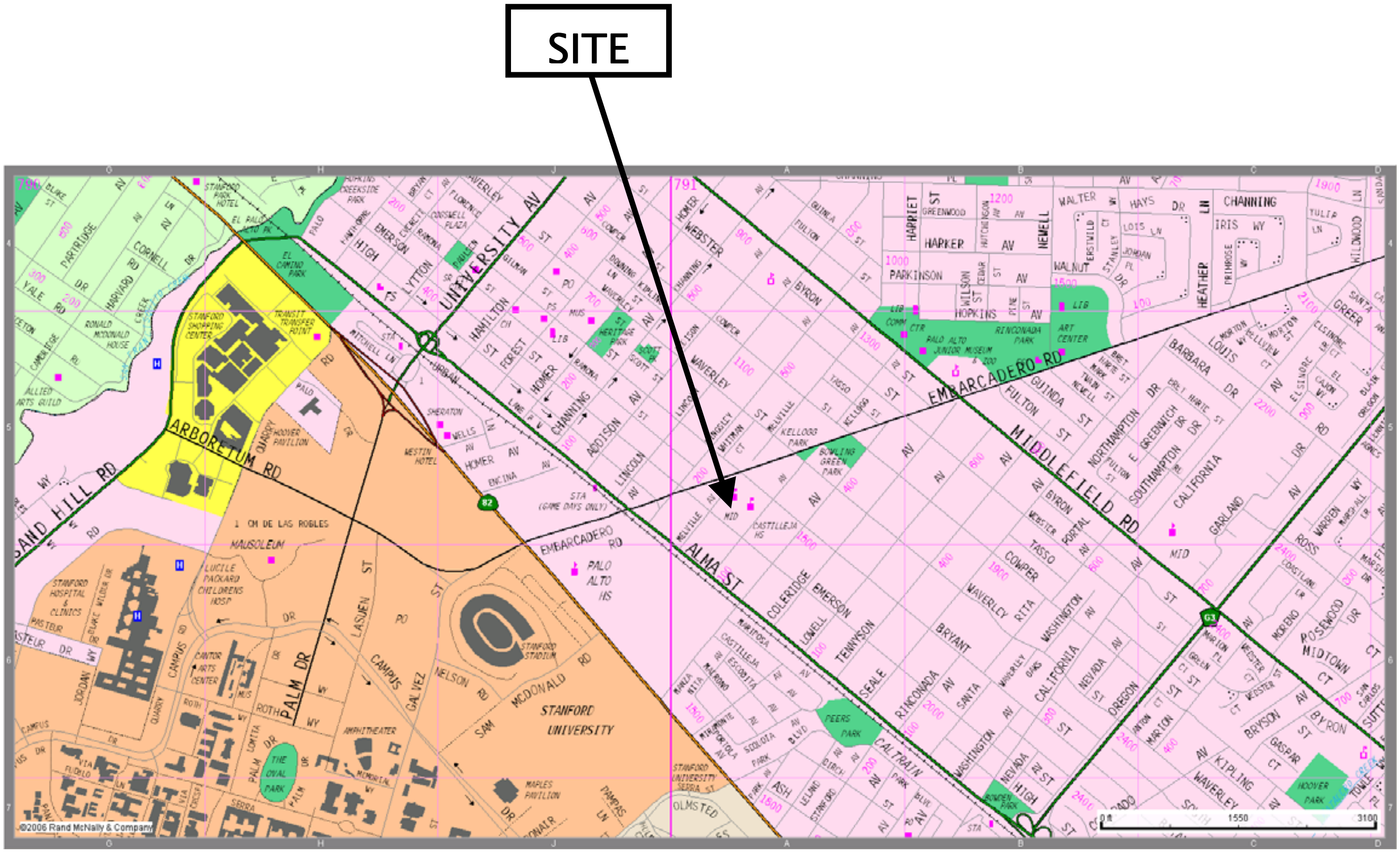
	DRIVEWAY/PARKING AREA**			
Recommended Paver Pavement Sections:	1A*	1B*	2A	2B
Vehicular Rated Pavers	Min. 3.25" ± Permeable Paver Parking Stalls	Min. 3.25" ± Permeable Paver Driveway	Min. 3.25" ± Non-Permeable Paver Parking Stalls	Min. 3.25" ± Non-Permeable Paver Driveway
ASTM No. 8 Bedding Course & Paver Filler	2.0"	2.0"	2.0"	2.0"
3/4" Clean Crushed Rock or ASTM No. 57 Drain Stone or Class II Permeable Baserock compacted to 95% relative maximum density	12.0"	16.0"	---	---
Class II Baserock (R=78 min.) compacted to at least 95% relative maximum density	---	---	12.0"	16.0"
Native soil scarified & compacted to at least 90% relative max. density	12.0"	12.0"	12.0"	12.0"

* The subgrade should be lined with a geotextile membrane Mirafi 500X, geogrid or equivalent. The membrane should be place and overlapped properly for drainage. The subgrade should be sloped at a minimum of 2% towards the subdrain system.

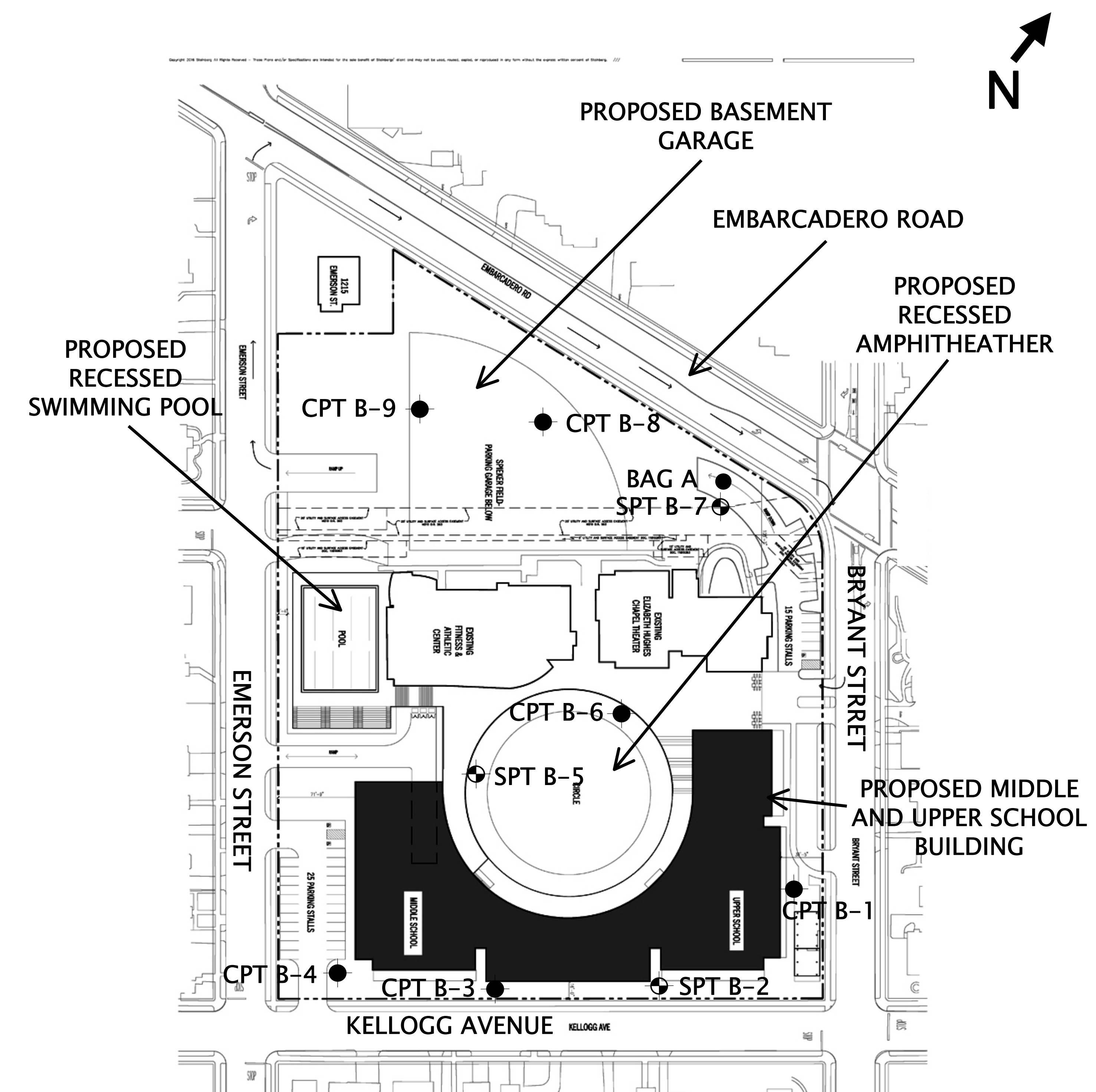
* The subdrain system should consist of a 4-inch diameter perforated pipe surrounded by ¾ inch drain rock wrapped in a filter fabric. The drain rock wrapped in fabric should be at least 12 inches wide and 12 inches below the finished subgrade elevation. The drainage system should be sloped to a discharge facility.

** The pavers should be bordered with a concrete curb/band. Typically, minor maintenance would be required during the life of the pavers.

FIGURES



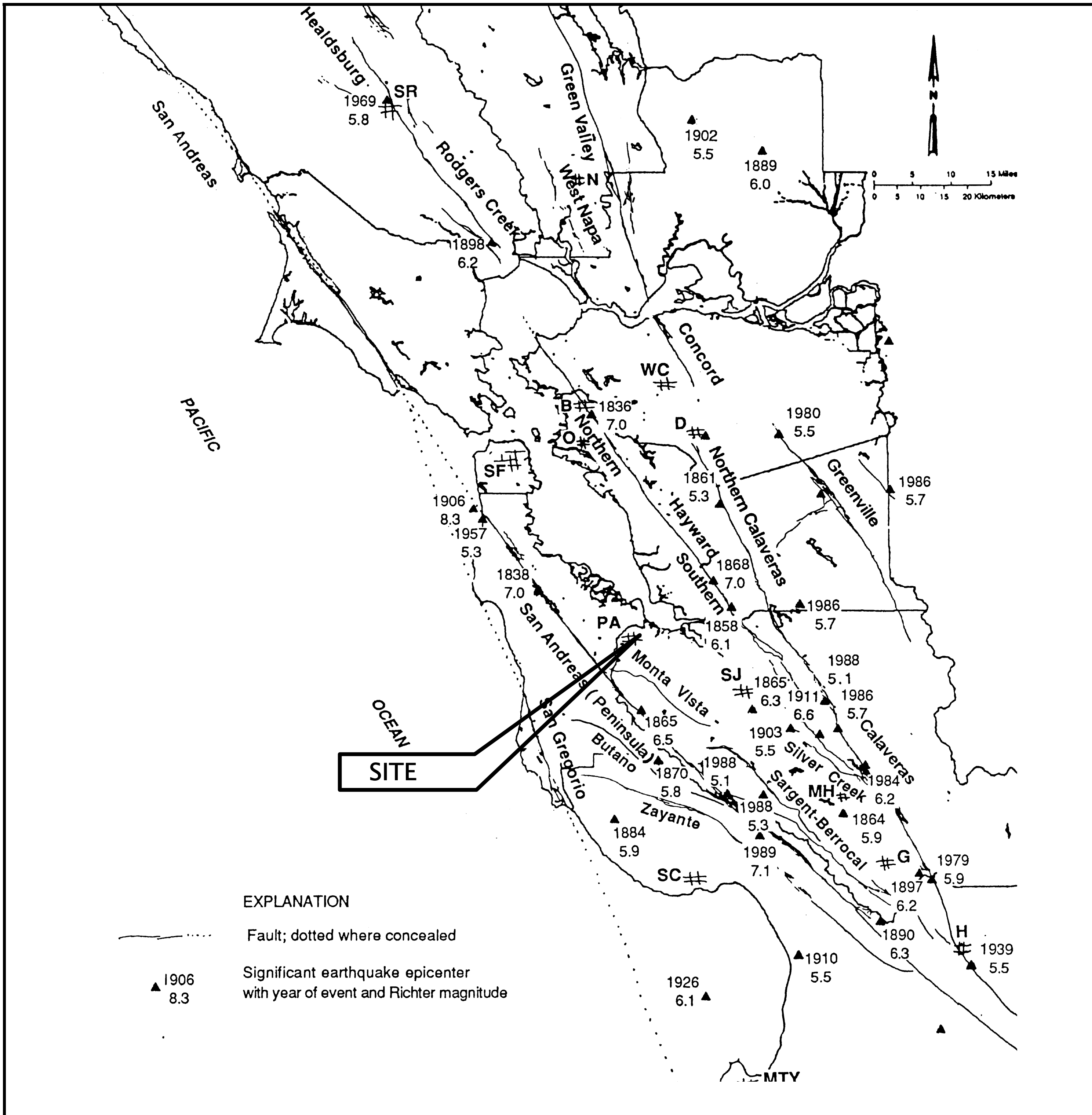
Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**VICINITY MAP** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No.: SV1598	FIGURE
		Drawn by: V.V.	1
		Scale: NOT TO SCALE	January 2017



DENOTES APPROXIMATE CPT SOUNDING LOCATION

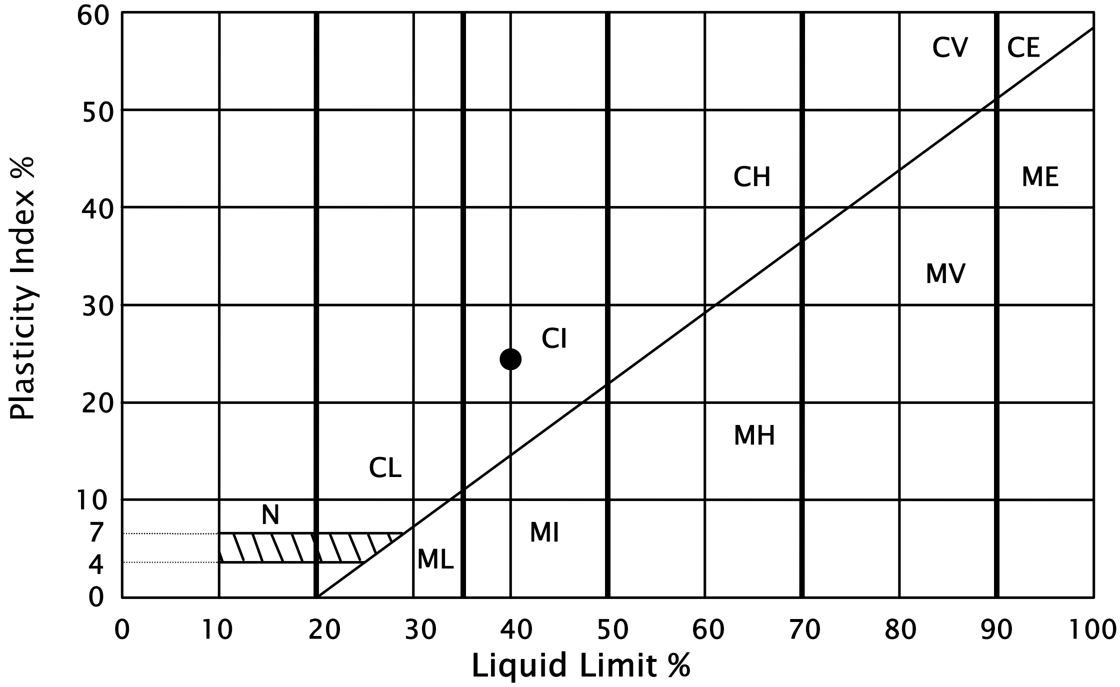
NOTE: DENOTES APPROXIMATE EXPLORATORY BORING LOCATION
DENOTES APPROXIMATE SPT EXPLORATORY BAG SAMPLE LOCATION

Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**SITE PLAN** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No.: SV1598 Drawn by: V.V. Scale: NOT TO SCALE	FIGURE 2 January 2017



Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**FAULT LOCATION MAP** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No.: SV1598 Drawn by: V.V. Scale: NOT TO SCALE	FIGURE 3 January 2017

PLASTICITY CHART

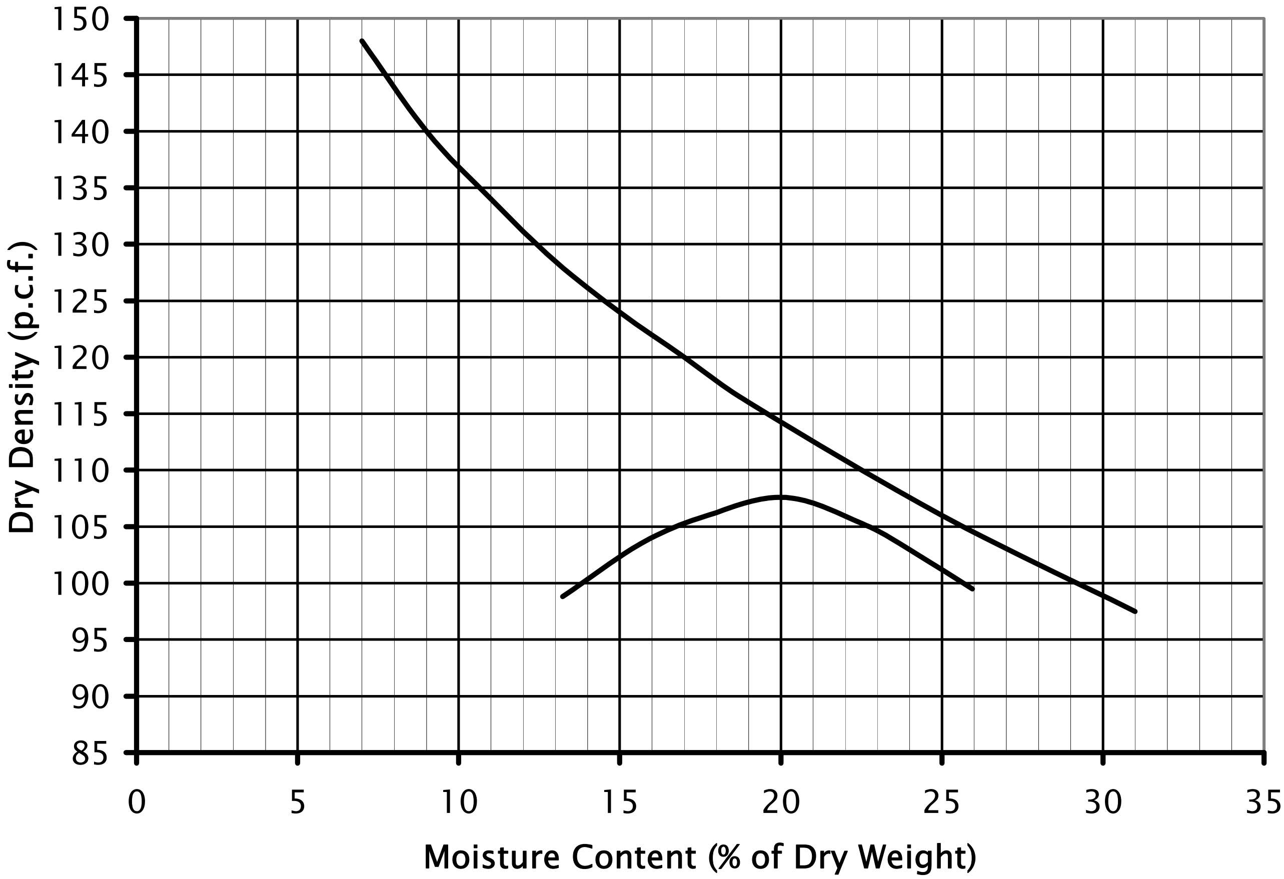


PLASTICITY DATA

Key Symbol	Hole No.	Depth ft.	Liquid Limit %	Plasticity Index %	Unified Soil Classification Symbol *
●	BAG A	0-1	40	25	CI

*Soil type classification Based on British suggested revisions to Unified Soil Classification System

Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**PLASTICITY INDEX** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No.: SV1598	FIGURE
		Drawn by: V.V.	4
		Scale: NOT TO SCALE	January 2017



SAMPLE: A

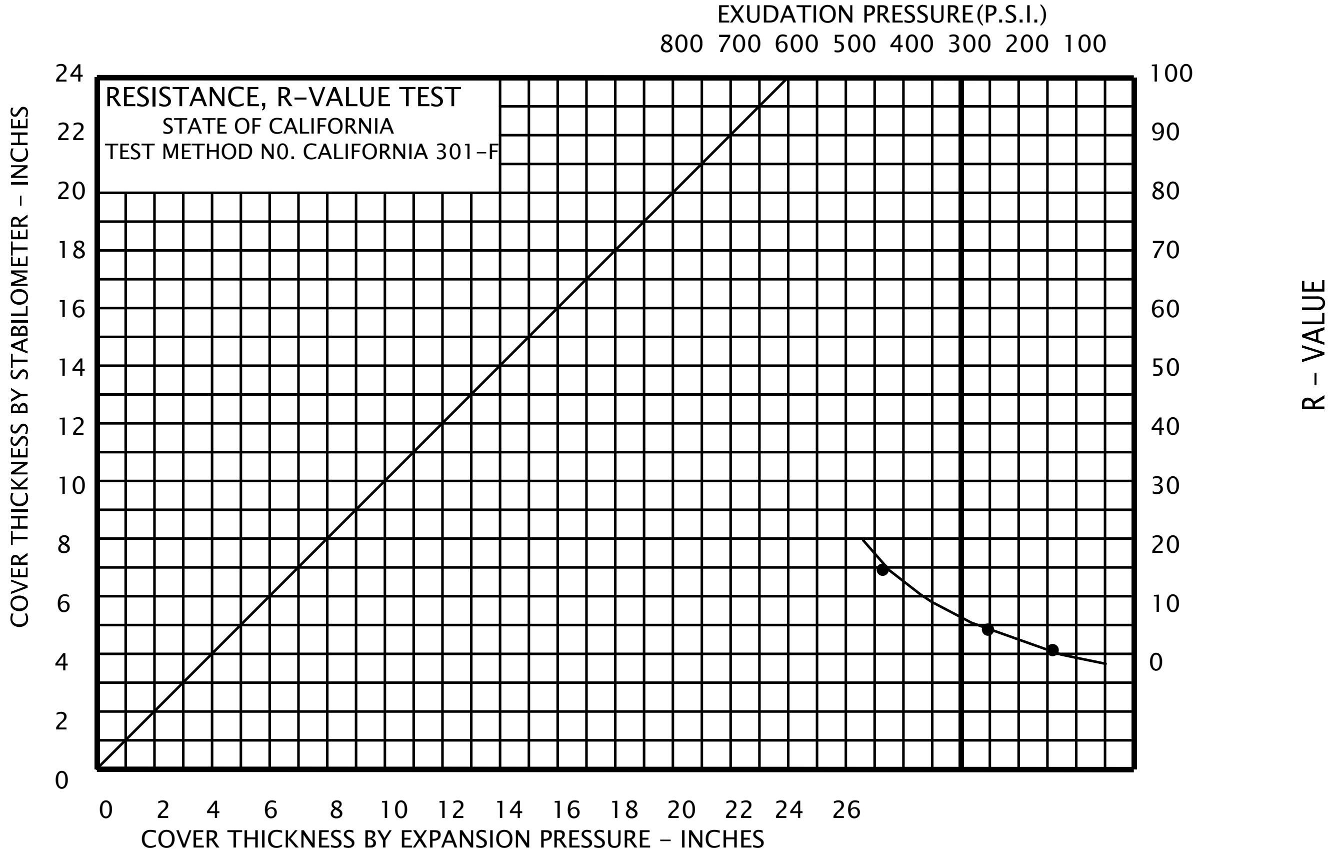
DESCRIPTION: Dark Olive Brown Gravelly Silty CLAY

LABORATORY TEST PROCEDURE: ASTM D1557-12

MAXIMUM DRY DENSITY: 108.0 p.c.f.

OPTIMUM MOISTURE CONTENT: 20.0 %

Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**COMPACTION TEST A** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No. SV1598	FIGURE
		Drawn by: V.V.	5
		Scale: NOT TO SCALE	January 2017



SAMPLE: A
DESCRIPTION: Dark Olive Brown Gravelly Silty CLAY

SPECIMEN	A	B	C
EXUDATION PRESSURE (P.S.I.)	149.0	251.0	449.0
EXPANSION DIAL (.0001")	9.0	14.0	20.0
EXPANSION PRESSURE (P.S.F.)	45.0	76.0	94.0
RESISTANCE VALUE, "R"	1.0	4.0	15.0
% MOISTURE AT TEST	20.7	18.0	17.6
DRY DENSITY AT TEST (P.C.F.)	106.7	108.5	111.2
R-VALUE AT 300 P.S.I. EXUDATION PRESSURE	= (6)		

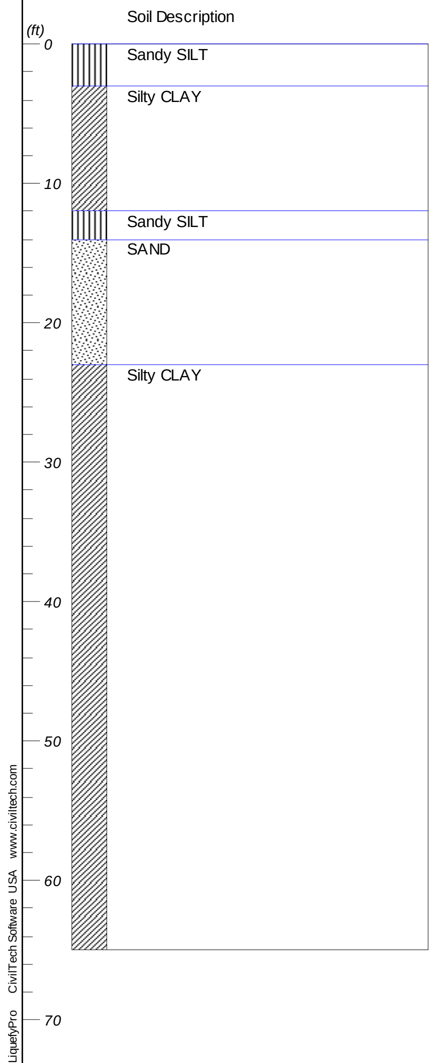
Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95054 (408) 988-2990	**R-VALUE TEST** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No. SV1598 Drawn by: V.V. Scale: NOT TO SCALE	FIGURE 6 January 2017

LIQUEFACTION ANALYSIS

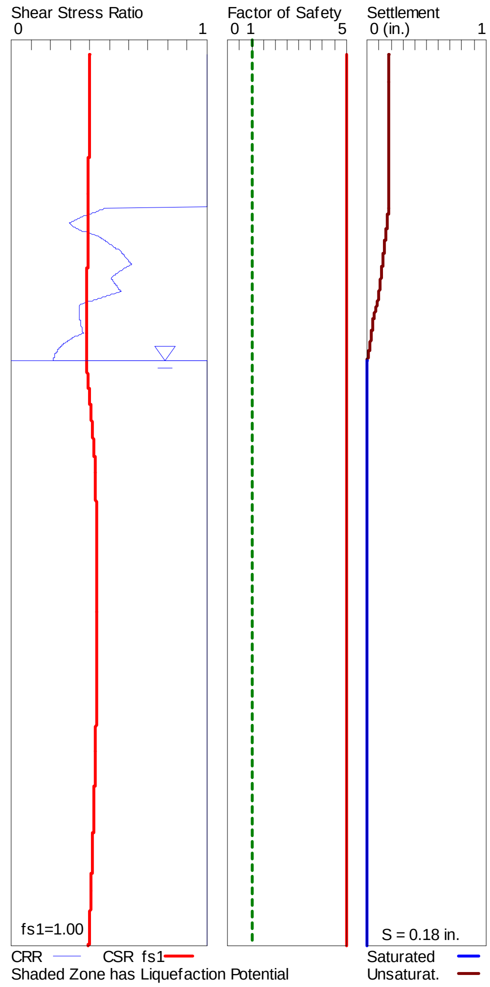
Castilleja School - Proposed Improvements

Hole No.=B-1 Water Depth=23 ft Surface Elev.=100

Magnitude=7.9
Acceleration=0.62g



Raw qc	fc	Unit Weight	Fines %
66.07	0.566	121	15
91.15	2.190	118	15
123.5	3.017	118	15
86.70	4.198	131	NoLq
62.23	3.880	131	NoLq
64.11	4.026	131	NoLq
87.10	5.345	131	NoLq
87.44	5.807	131	NoLq
100.4	6.151	131	NoLq
113.1	4.805	131	NoLq
93.6	3.363	115	NoLq
95.56	2.645	115	NoLq
83.96	1.724	118	50
145.5	1.293	124	15
159.0	1.749	124	15
178.8	1.632	124	15
158.2	1.935	121	15
160.0	2.446	121	15
149.6	1.3	124	15
150.8	1.421	124	15
145.3	1.916	121	15
110.8	1.726	121	15
84.07	1.733	118	50
42.20	1.489	115	NoLq
59.91	2.104	115	NoLq
27.41	0.71	115	NoLq
24.51	0.819	115	NoLq
21.20	0.637	115	NoLq
52.44	2.272	115	NoLq
51.01	1.247	115	NoLq
17.80	0.630	115	NoLq
18.60	0.596	115	NoLq
43.50	1.845	115	NoLq
26.68	0.907	115	NoLq
32.68	1.368	115	NoLq
19.50	0.712	115	NoLq
19.92	0.638	115	NoLq
17.85	0.530	115	NoLq
19.40	0.540	115	NoLq
31.39	1.107	115	NoLq
26.79	0.727	115	NoLq
16.44	0.343	115	NoLq
24.34	0.693	115	NoLq
18.71	0.535	115	NoLq
17.38	0.440	115	NoLq
18.55	0.421	115	NoLq
34.42	1.024	115	NoLq
42.50	1.576	115	NoLq
50.34	1.572	115	NoLq
24.66	0.646	115	NoLq
27.15	0.828	115	NoLq
25.59	0.77	115	NoLq
10.64	0.335	115	NoLq
24.65	0.759	115	NoLq
20.39	0.391	115	NoLq
26.33	0.716	115	NoLq
17.76	0.465	115	NoLq
18.51	0.433	115	NoLq
20.43	0.472	115	NoLq
23.99	0.756	115	NoLq
19.81	0.619	115	NoLq
22.77	0.8	115	NoLq
36.14	1.349	115	NoLq
39.24	1.746	115	NoLq
28.46	1.313	115	NoLq



CivilTech Corporation **1310 Bryant Street, Palo Alto, CA** **Plate A-1**

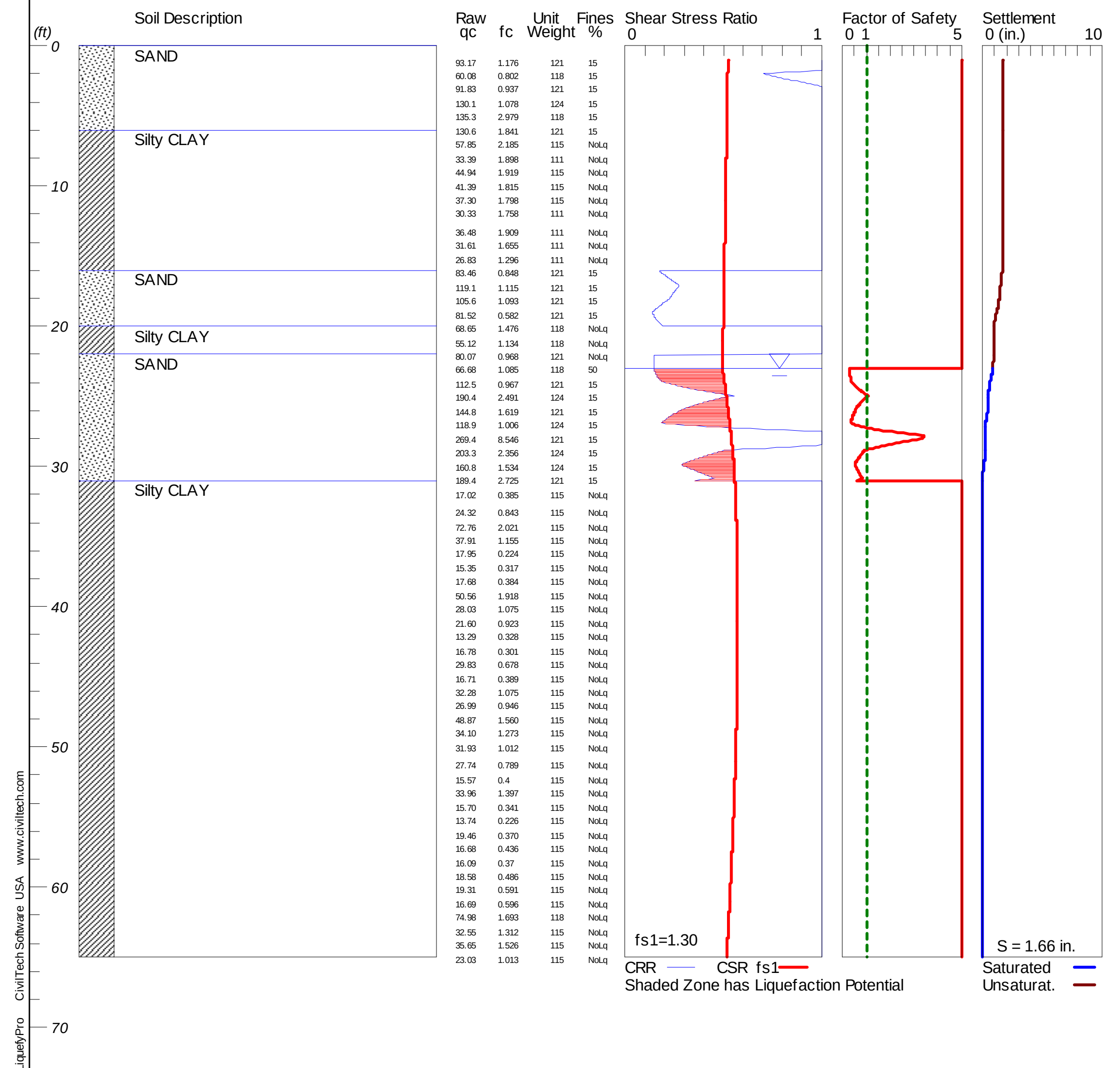
Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	LIQUEFACTION ANALYSIS CPT B-1 Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No. SV1598 Drawn by: V.V. Scale: NOT TO SCALE	FIGURE 7 January 2017

LIQUEFACTION ANALYSIS

Castilleja School - Proposed Improvements

Hole No.=B-6 Water Depth=23 ft Surface Elev.=100

Magnitude=7.9
Acceleration=0.62g



Raw qc	fc	Unit Weight	Fines %
93.17	1.176	121	15
60.08	0.802	118	15
91.83	0.937	121	15
130.1	1.078	124	15
135.3	2.979	118	15
130.6	1.841	121	15
57.85	2.185	115	NoLq
33.39	1.898	111	NoLq
44.94	1.919	115	NoLq
41.39	1.815	115	NoLq
37.30	1.798	115	NoLq
30.33	1.758	111	NoLq
36.48	1.909	111	NoLq
31.61	1.655	111	NoLq
26.83	1.296	111	NoLq
83.46	0.848	121	15
119.1	1.115	121	15
105.6	1.093	121	15
81.52	0.582	121	15
68.65	1.476	118	NoLq
55.12	1.134	118	NoLq
80.07	0.968	121	NoLq
66.68	1.085	118	50
112.5	0.967	121	15
190.4	2.491	124	15
144.8	1.619	121	15
118.9	1.006	124	15
269.4	8.546	121	15
203.3	2.356	124	15
160.8	1.534	124	15
189.4	2.725	121	15
17.02	0.385	115	NoLq
24.32	0.843	115	NoLq
72.76	2.021	115	NoLq
37.91	1.155	115	NoLq
17.95	0.224	115	NoLq
15.35	0.317	115	NoLq
17.68	0.384	115	NoLq
50.56	1.918	115	NoLq
28.03	1.075	115	NoLq
21.60	0.923	115	NoLq
13.29	0.328	115	NoLq
16.78	0.301	115	NoLq
29.83	0.678	115	NoLq
16.71	0.389	115	NoLq
32.28	1.075	115	NoLq
26.99	0.946	115	NoLq
48.87	1.560	115	NoLq
34.10	1.273	115	NoLq
31.93	1.012	115	NoLq
27.74	0.789	115	NoLq
15.57	0.4	115	NoLq
33.96	1.397	115	NoLq
15.70	0.341	115	NoLq
13.74	0.226	115	NoLq
19.46	0.370	115	NoLq
16.68	0.436	115	NoLq
16.09	0.37	115	NoLq
18.58	0.486	115	NoLq
19.31	0.591	115	NoLq
16.69	0.596	115	NoLq
74.98	1.693	118	NoLq
32.55	1.312	115	NoLq
35.65	1.526	115	NoLq
23.03	1.013	115	NoLq

CivilTech Corporation **1310 Bryant Street, Palo Alto, CA** **Plate A-1**

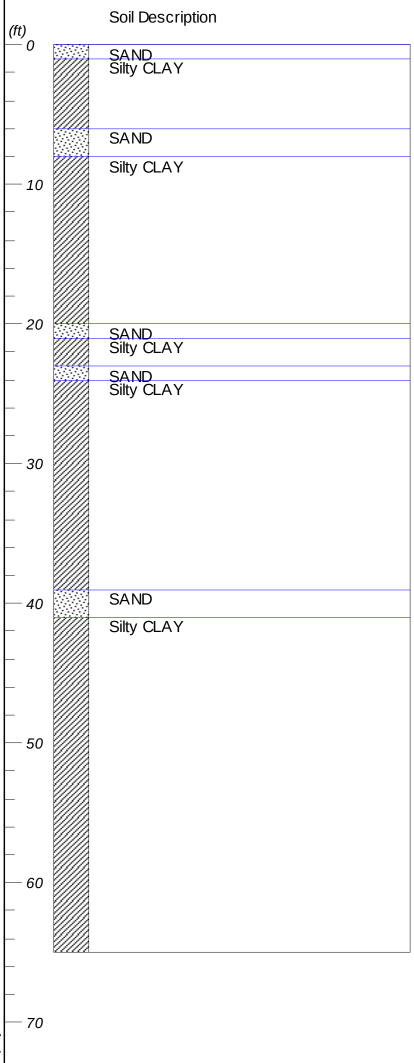
Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	LIQUEFACTION ANALYSIS CPT B-6 Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No. SV1598	FIGURE
		Drawn by: V.V.	8
		Scale: NOT TO SCALE	January 2017

LIQUEFACTION ANALYSIS

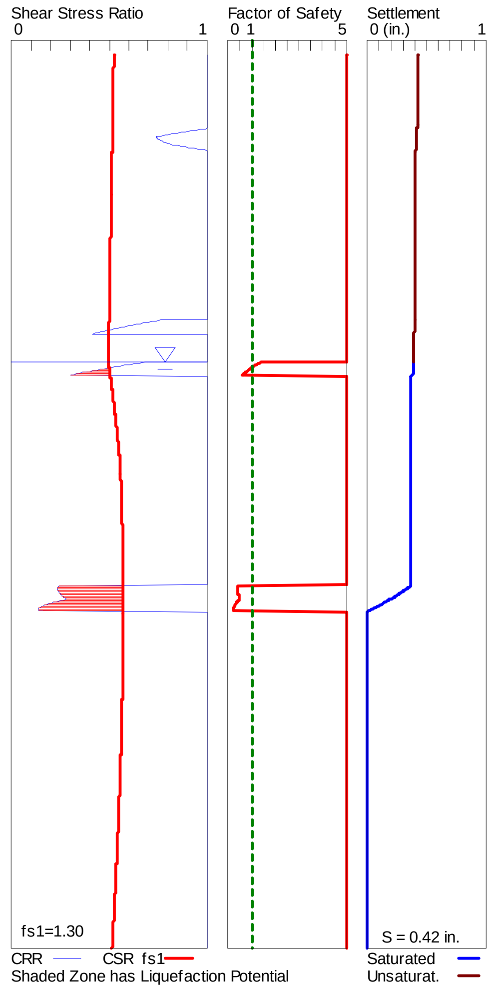
Castilleja School - Proposed Improvements

Hole No.=B-9 Water Depth=23 ft Surface Elev.=100

Magnitude=7.9
Acceleration=0.62g



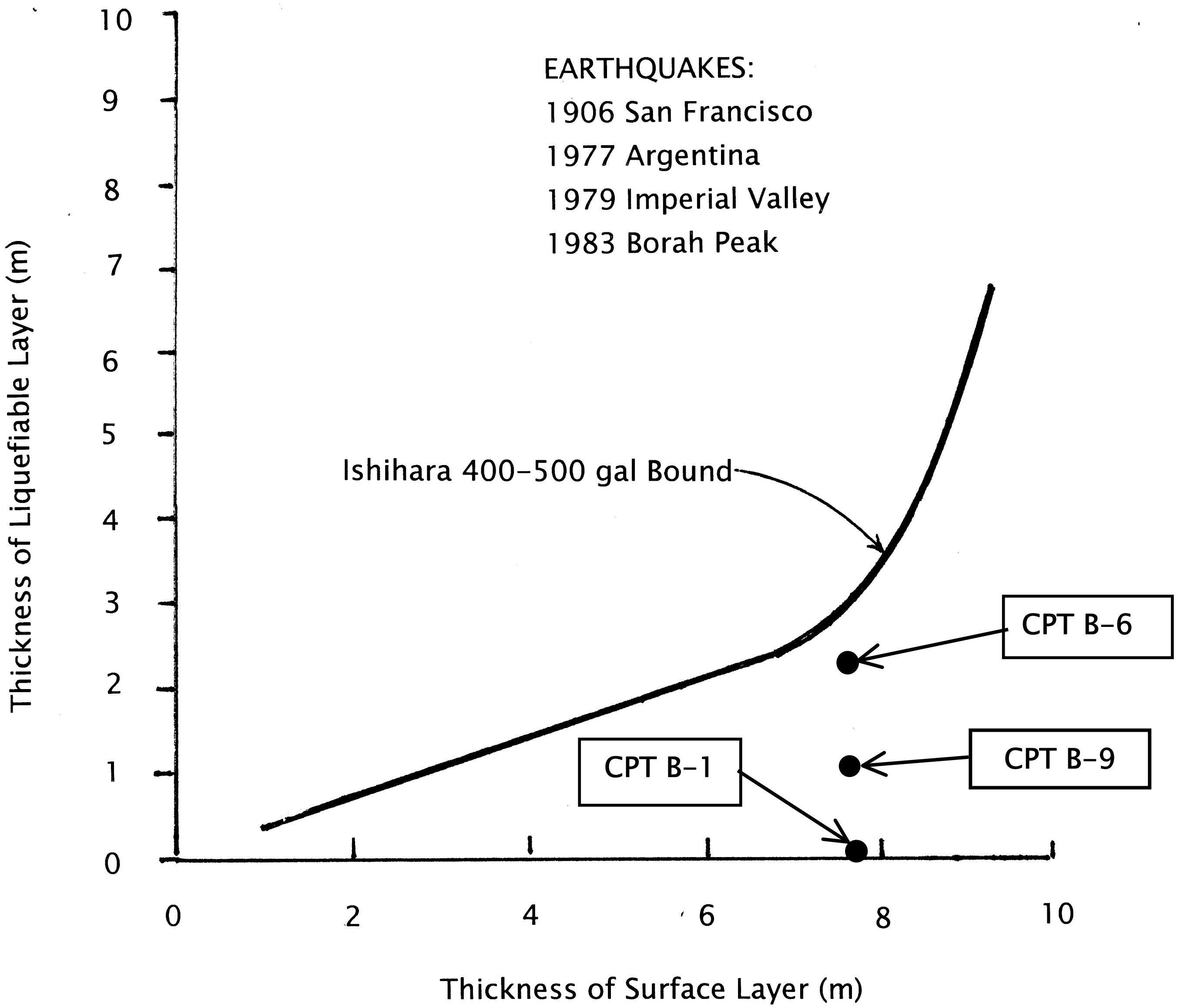
Raw qc	fc	Unit Weight	Fines %
198.3	3.667	121	15
107.5	3.428	115	NoLq
125.7	3.852	115	NoLq
61.69	3.721	131	NoLq
94.00	3.148	115	NoLq
130.5	1.914	121	NoLq
112.8	1.625	121	15
88.11	3.317	115	101
84.19	3.887	131	NoLq
70.82	3.533	131	NoLq
76.47	4.181	131	NoLq
56.57	3.118	131	NoLq
51.92	2.864	111	NoLq
60.65	3.674	131	NoLq
66.47	3.005	115	NoLq
96.51	3.661	115	NoLq
124.6	5.806	131	NoLq
167.5	8.057	131	NoLq
175.7	4.369	118	NoLq
142.5	4.393	115	101
134.8	2.548	121	15
108.9	3.434	115	NoLq
190.6	3.462	121	NoLq
127.1	2.202	121	15
16.86	0.599	115	NoLq
16.76	0.301	115	NoLq
16.32	0.302	115	NoLq
17.77	0.24	115	NoLq
31.14	0.802	115	NoLq
18.89	0.696	115	NoLq
25.66	0.968	115	NoLq
16.00	0.389	115	NoLq
22.52	0.771	115	NoLq
17.78	0.557	115	NoLq
16.78	0.507	115	NoLq
9.813	0.208	115	NoLq
12.95	0.277	115	NoLq
23.60	0.75	115	NoLq
107.9	2.449	118	15
181.7	1.669	124	15
26.33	1.097	115	NoLq
19.27	0.331	115	NoLq
19.02	0.401	115	NoLq
75.24	2.199	115	NoLq
30.84	1.144	115	NoLq
49.25	1.238	115	NoLq
60.00	1.72	115	NoLq
46.90	1.852	115	NoLq
83.87	1.964	118	NoLq
26.05	0.472	115	NoLq
27.98	0.773	115	NoLq
17.30	0.571	115	NoLq
41.82	1.816	115	NoLq
19.97	0.591	115	NoLq
35.26	0.928	115	NoLq
36.52	1.254	115	NoLq
29.31	1.223	115	NoLq
20.64	0.650	115	NoLq
17.65	0.427	115	NoLq
18.50	0.464	115	NoLq
27.95	0.718	115	NoLq
43.72	1.584	115	NoLq
29.30	1.024	115	NoLq
26.86	0.931	115	NoLq
25.89	0.841	115	NoLq



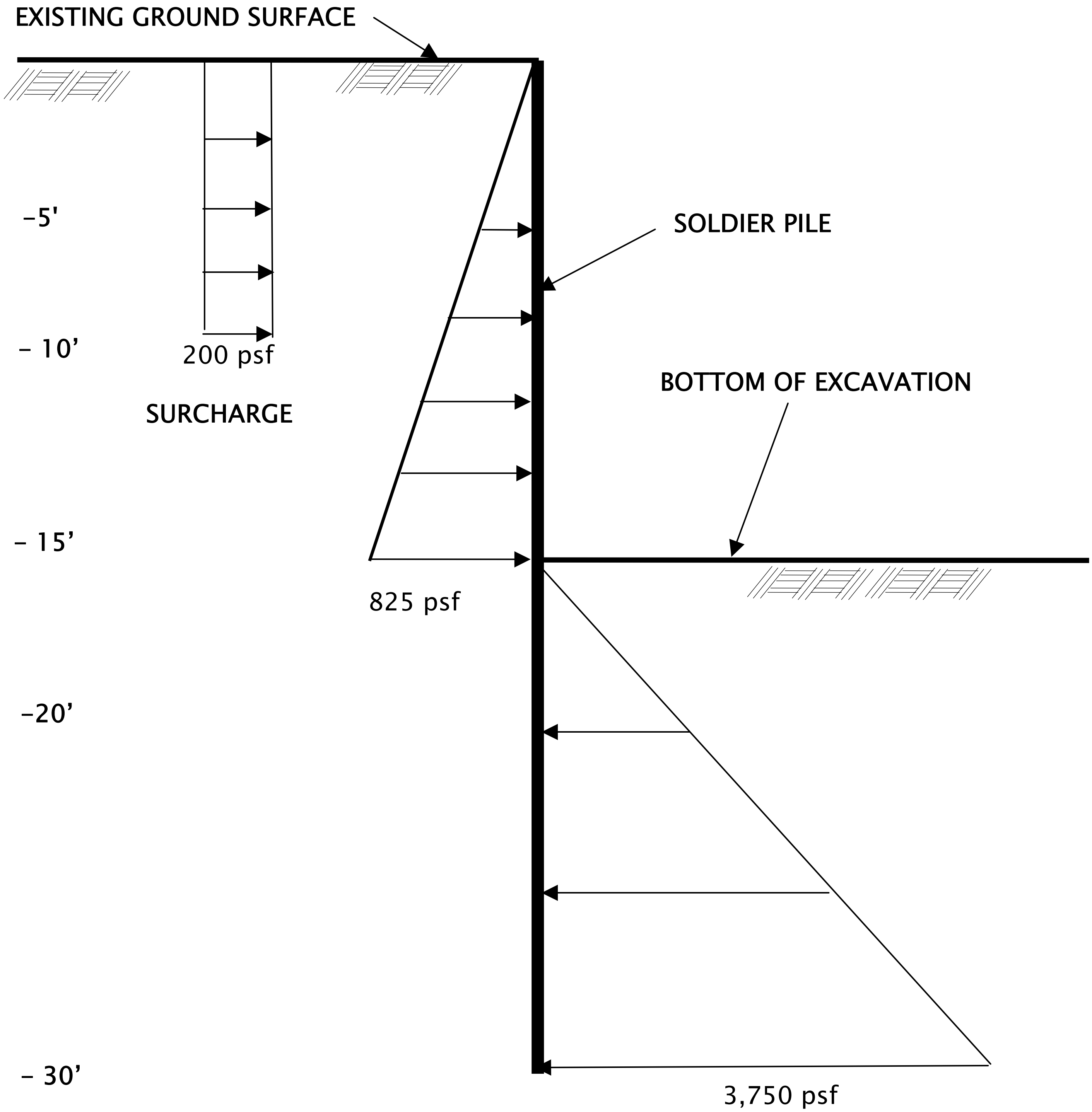
CivilTech Corporation **1310 Bryant Street, Palo Alto, CA** **Plate A-1**

Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	LIQUEFACTION ANALYSIS CPT B-9 Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No. SV1598 Drawn by: V.V. Scale: NOT TO SCALE	FIGURE 9 January 2017

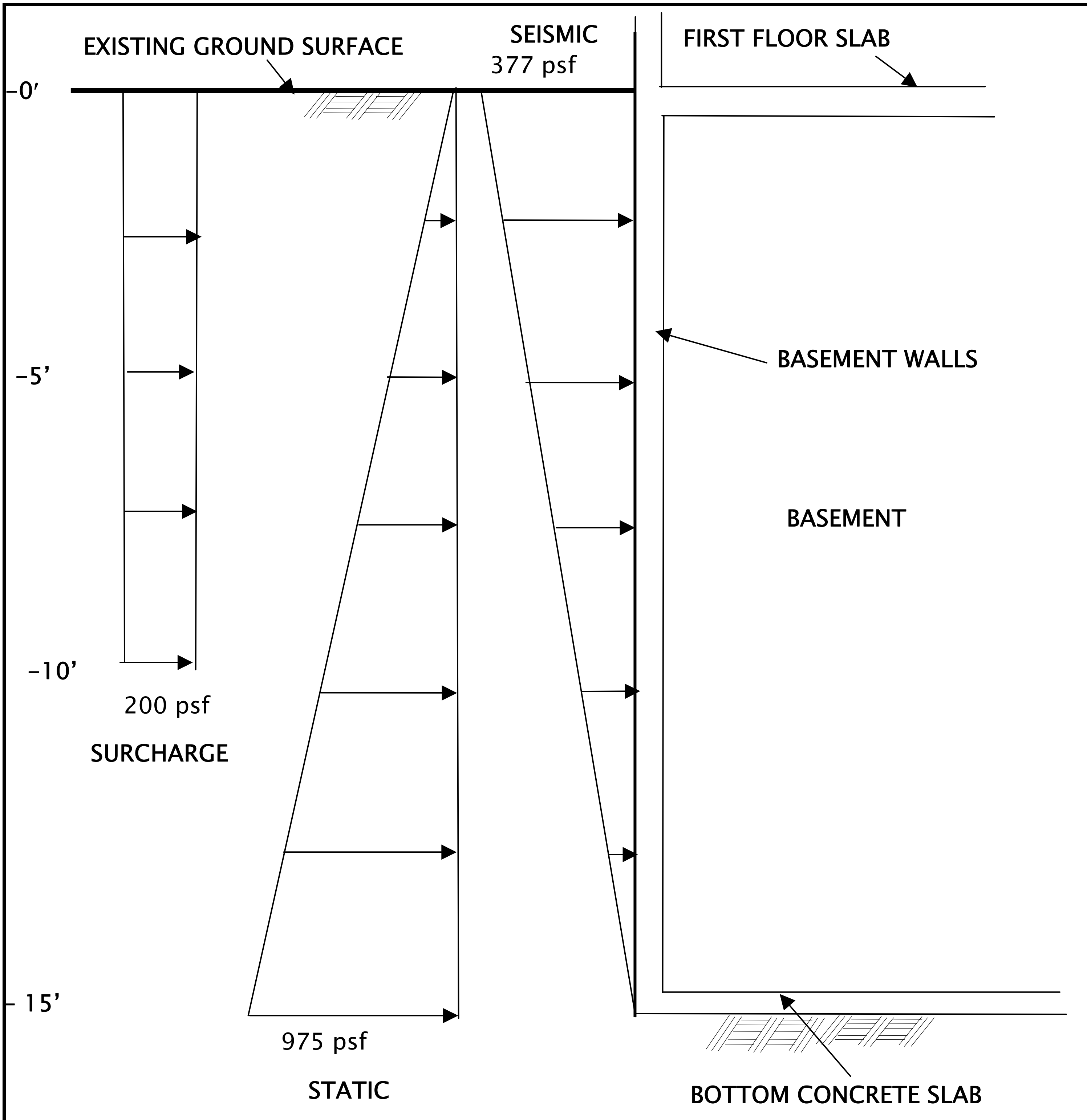
Magnitude Range: 5.9 to 8.0 M_w
Acceleration Range: 0.56 to 0.78g



Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**LIQUEFACTION-INDUCED GROUND DAMAGE** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No. SV1598	FIGURE
		Drawn by: V.V.	10
		Scale: NOT TO SCALE	January 2017



Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**LATERAL SOIL PRESSURES** **SOLDIER PILE & WOOD LAGGING** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No.: SV1598 Drawn by: V.V. Scale: NOT TO SCALE	FIGURE 11 January 2017



Silicon Valley Soil Engineering 2391 Zanker Road, #350 San Jose, CA 95131 (408) 324-1400	**LATERAL SOIL PRESSURES** **BASEMENT WALLS** Proposed Improvements Castilleja School 1310 Bryant Street Palo Alto, California	File No.: SV1598	FIGURE
		Drawn by: V.V.	12
		Scale: NOT TO SCALE	January 2017

APPENDICES

GENERAL COMPARISON BETWEEN EARTHQUAKE MAGNITUDE AND THE EARTHQUAKE EFFECTS DUE TO GROUND SHAKING

Earthquake Category	Richter Magnitude	Modified Mercalli Intensity Scale* (After Housner, 1970)	Damage to Structure
		I – Detected only by sensitive instruments.	
	2.0	II – Felt by few persons at rest, especially on upper floors; delicate suspended objects may swing.	
	3.0	III – Felt noticeably indoors, but not always recognized as an earthquake; standing cars rock slightly, vibration like passing truck.	No Damage
Minor		IV – Felt indoors by many, outdoors by a few; at night some awaken; dishes, windows, doors disturbed; cars rock noticeably.	
	4.0	V – Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects.	Architectural Damage
		VI – Felt by all; many are frightened and run outdoors; falling plaster and chimneys; damage small.	
5.3	5.0	VII – Everybody runs outdoors. Damage to building varies, depending on quality of construction; noticed by drivers of cars.	
Moderate	6.0	VIII – Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of cars disturbed.	
6.9		IX – Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked, underground pipes broken; serious damage to reservoirs and embankments.	Structural Damage
Major	7.0	X – Most masonry and frame structures destroyed; ground cracked; rail bent slightly; landslides.	
7.7		XI – Few structures remain standing; bridges destroyed; fissures in ground; pipes broken; landslides; rails bent.	
Great	8.0	XII – Damage total; waves seen on ground surface; lines of sight and level distorted; objects thrown into the air; large rock masses displaced.	Near Total Destruction

*Intensity is a subject measure of the effect of the ground shaking, and is not engineering measure of the ground acceleration.

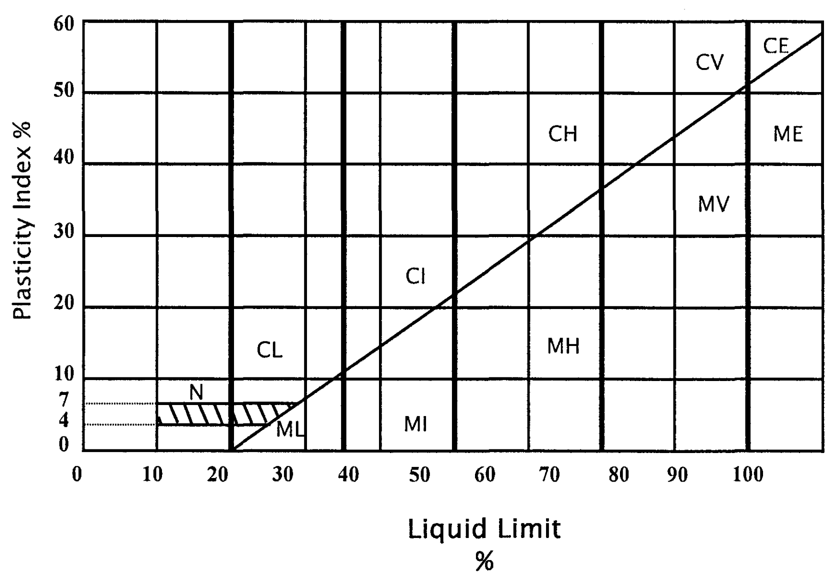
METHOD OF SOIL CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOL		TYPICAL NAMES
COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size)	GW		Well graded gravel or gravel-sand mixtures, little or no fines
		GP		Poorly graded gravel or gravel-sand moistures, little or no fines
		GM		Silty gravels, gravel-sand-silt mixtures
		GC		Clayey Gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction < no. 4 sieve size	SW		Well graded sands or gravelly sands, no fines
		SP		Poorly graded sands or gravelly sands, no fines
		SM		Silty sands, sand-silt mixtures
		SC		Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sand, rock, flour, silty or clayey fine sand or clayey silt/slight plasticity
		CL		Inorganic clay of low to medium plasticity, gravelly clayes, sandy clay, silty clay, lean clays
		OL		Organic siltys and organic silty clay of low plasticity
	SILTS & CLAYS LL > 50	MH		Inorganic silts, micaceous or diatocaceous fine sandy, or silty soils, elastic silt
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOIL		PT		Peat and other highly organic soils

CLASSIFICATION CHART - UNIFIED SOIL CLASSIFICATION SYSTEM

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
GRAVELS 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 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT AND CLAY	Below No. 200	Below 0.074

PLASTICITY INDEX CHART



Project: Proposed Improvements Castilleja School Project Location: 1310 Bryant Street Palo Alto, California Project Number: SV1598	**Silicon Valley Soil Engineering** **2391 Zanker Road, Suite 350** **San Jose, CA 95131** **(408) 324-1400**	Key to Log of Boring **Sheet 1 of 1**

Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Direct Shear Test - Cohesion in ksf	Direct Shear Test - Internal Friction Angle in degrees	Liquid Limit - LL, %	Plasticity Index - PI, %
1	2	3	4	5	6	7	8	9	10	11	12	13

COLUMN DESCRIPTIONS

1 Depth (feet): Depth in feet below the ground surface.
2 Sample Type: Type of soil sample collected at the depth interval shown.
3 Sample Number: Sample identification number.
4 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
5 Material Type: Type of material encountered.
6 Graphic Log: Graphic depiction of the subsurface material encountered.
7 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
8 Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
9 Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
10 Direct Shear Test - Cohesion in ksf: Cohesion is the y-axis intercept of the failure envelope tangent to the Mohr circles.
11 Direct Shear Test - Internal Friction Angle in degrees: The internal friction angle (Phi) is the angle inclination of the failure envelope.
12 Liquid Limit - LL, %: Liquid Limit, expressed as a water content.
13 Plasticity Index - PI, %: Plasticity Index, expressed as a water content.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Asphaltic Concrete (AC)
Lean-Fat CLAY, CLAY w/SAND, SANDY CLAY (CL-CH)
SILTY CLAY (CL-ML)
Agrregate Base (AB)
Well graded GRAVEL (GW)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
—?— Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: Proposed Improvements Castilleja School **Project Location:** 1310 Bryant Street Palo Alto, California **Project Number:** SV1598	**Silicon Valley Soil Engineering** **2391 Zanker Road, Suite 350** **San Jose, CA 95131** **(408) 324-1400**	# Log of Boring B-2 **Sheet 1 of 2**

Date(s) Drilled **12/21/16**	Logged By **V.V.**	Checked By
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8-inch**	Total Depth of Borehole **35.0 feet**
Drill Rig Type		Approximate Surface Elevation **feet**
Groundwater Level and Date Measured **31 feet (12/21/16)**	Sampling Method(s) **SPT**	Hammer Data **140 lbs**
Borehole Backfill **Grout**	Location	

Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Direct Shear Test - Cohesion in ksf	Direct Shear Test - Internal Friction Angle in degrees	Liquid Limit - LL, %	Plasticity Index - PI, %
0				CL		Brown Silty CLAY Damp, very stiff						
		2-1	32				20.0	106.6				
		2-2	35				16.0	110.1	0.9	10		
5												
		2-3	55+				14.0	124.2				
10						Color changed to reddish brown						
				GW		Reddish Brown Sandy GRAVEL Moist, dense GRAVEL: 1.5 inhces maximum diameter Sub-angular, well graded						
		2-4	55+				8.1	117.5	1.0	12		
15												
		2-5	32				9.5	104.8				
20												
		2-6	27				11.6	92.2				
25												
		2-7	54				11.8	125.3				
30						Stabilized after drilling completion						

Project: Proposed Improvements Castilleja School Project Location: 1310 Bryant Street Palo Alto, California Project Number: SV1598	Silicon Valley Soil Engineering 2391 Zanker Road, Suite 350 San Jose, CA 95131 (408) 324-1400	Log of Boring B-2 Sheet 2 of 2

Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Direct Shear Test - Cohesion in ksf	Direct Shear Test - Internal Friction Angle in degrees	Liquid Limit - LL, %	Plasticity Index - PI, %
30				GW		Stabilized after drilling completion ▼ Reddish Brown Sandy GRAVEL First encountered ▽ Moist, dense GRAVEL: 1.5 inhces maximum diameter Sub-angular, well graded						
		2-8	49				12.1	129.1				
35						Boring terminated at 35.0 feet						
40												
45												
50												
55												
60												
65												

Project: Proposed Improvements Castilleja School **Project Location:** 1310 Bryant Street Palo Alto, California **Project Number:** SV1598	**Silicon Valley Soil Engineering** **2391 Zanker Road, Suite 350** **San Jose, CA 95131** **(408) 324-1400**	Log of Boring B-5 **Sheet 1 of 2**

Date(s) Drilled **12/21/16**	Logged By **V.V.**	Checked By
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8-inch**	Total Depth of Borehole **35.0 feet**
		Approximate Surface Elevation **feet**
Groundwater Level and Date Measured **28 feet (12/21/16)**	Sampling Method(s) **SPT**	Hammer Data **140 lbs**
Borehole Backfill **Grout**	Location	

Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Direct Shear Test - Cohesion in ksf	Direct Shear Test - Internal Friction Angle in degrees	Liquid Limit - LL, %	Plasticity Index - PI, %
0				Asphalt		2.0 inches of Asphalt Concrete (AC)						
				CL-CH		4.0 inches of Aggregate Base (AB)						
						Dark Gray Gravelly Silty CLAY Moist, stiff						
		5-1	15				15.8	116.4				
		5-2	35				23.4	102.2				
5												
						Color changed to reddish brown						
		5-3	32				20.9	108.0				
10												
		5-4	27				19.5	100.2				
15												
16				GW		Reddish Brown Sandy GRAVEL Moist, medium dense GRAVEL: 1.5 inches maximum diameter Sub-angular, well graded						
		5-5	28				6.8	103.1				
20												
		5-6	44				5.5	120.0				
25												
						Became dense						
						Stabilized after drilling completion						
		5-7	51				6.2	121.4				
						First encountered						
30												

Project: Proposed Improvements Castilleja School **Project Location:** 1310 Bryant Street Palo Alto, California **Project Number:** SV1598	**Silicon Valley Soil Engineering** **2391 Zanker Road, Suite 350** **San Jose, CA 95131** **(408) 324-1400**	Log of Boring B-5 **Sheet 2 of 2**

Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Direct Shear Test - Cohesion in ksf	Direct Shear Test - Internal Friction Angle in degrees	Liquid Limit - LL, %	Plasticity Index - PI, %
30				CL-ML		Light Olive Brown Clayey SILT Moist, hard First encountered ∇						
		5-8	48				20.1	110.8				
35						Boring terminated at 35.0 feet						
40												
45												
50												
55												
60												
65												

Project: Proposed Improvements Castilleja School **Project Location:** 1310 Bryant Street Palo Alto, California **Project Number:** SV1598	**Silicon Valley Soil Engineering** **2391 Zanker Road, Suite 350** **San Jose, CA 95131** **(408) 324-1400**	Log of Boring B-7 **Sheet 1 of 2**

Date(s) Drilled **12/21/16**	Logged By **V.V.**	Checked By
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8-inch**	Total Depth of Borehole **35.0 feet**
		Approximate Surface Elevation **feet**
Groundwater Level and Date Measured **28 feet (12/21/16)**	Sampling Method(s) **SPT**	Hammer Data **140 lbs**
Borehole Backfill **Grout**	Location	

Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Direct Shear Test - Cohesion in ksf	Direct Shear Test - Internal Friction Angle in degrees	Liquid Limit - LL, %	Plasticity Index - PI, %
0 – 0.21				Asphalt		2.5 inches of Asphalt Concrete (AC)						
0.21 – 0.54						4.0 inches of Aggregate Base (AB)						
0.54				CL-CH		Dark Olive Brown Gravelly Silty CLAY Moist, stiff						
		7-1	21				19.3	109.8				
		7-2	26				28.2	103.5				
5												
						Color changed to reddish brown						
		7-3	27				20.2	112.6				
10												
		7-4	38				16.9	112.2				
15												
16				SW		Reddish Brown Gravelly SAND Moist, medium dense SAND: Medium grained, well graded						
18				GW		Reddish Brown Sandy GRAVEL Moist, medium dense GRAVEL: 1.5 inches maximum diameter Sub-angular, well graded						
		7-5	20				9.9	104.7				
20												
		7-6	39				9.1	112.4				
25												
26				CL		Reddish Brown Silty CLAY Moist, stiff						
						Stabilized after drilling completion ▼						
						First encountered ▽						
		7-7	21				33.6	87.7				
30												

Project: Proposed Improvements Castilleja School **Project Location:** 1310 Bryant Street Palo Alto, California **Project Number:** SV1598	**Silicon Valley Soil Engineering** **2391 Zanker Road, Suite 350** **San Jose, CA 95131** **(408) 324-1400**	Log of Boring B-7 **Sheet 2 of 2**

Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Direct Shear Test - Cohesion in ksf	Direct Shear Test - Internal Friction Angle in degrees	Liquid Limit - LL, %	Plasticity Index - PI, %
30				CL		Reddish Brown Silty CLAY Moist, stiff						
		7-8	20			Color changed to bluish gray	31.9	93.4				
35						Boring terminated at 35.0 feet						
40												
45												
50												
55												
60												
65												

GREGG

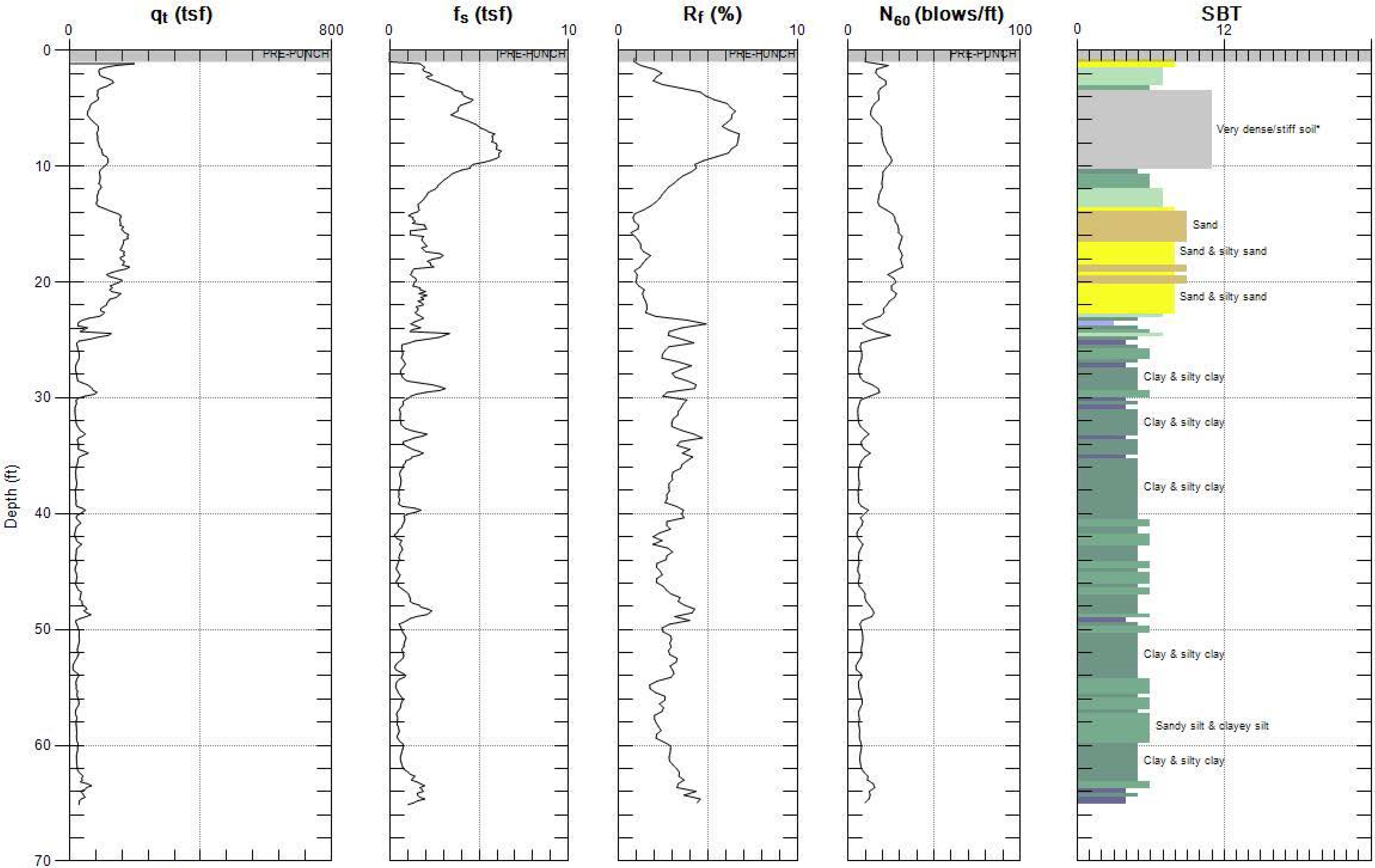
SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL

Engineer: V.VO

Sounding: B-1

Date: 12/21/16 08:55



Max. Depth: 65.125 (ft)
Avg. Interval: 0.328 (ft)

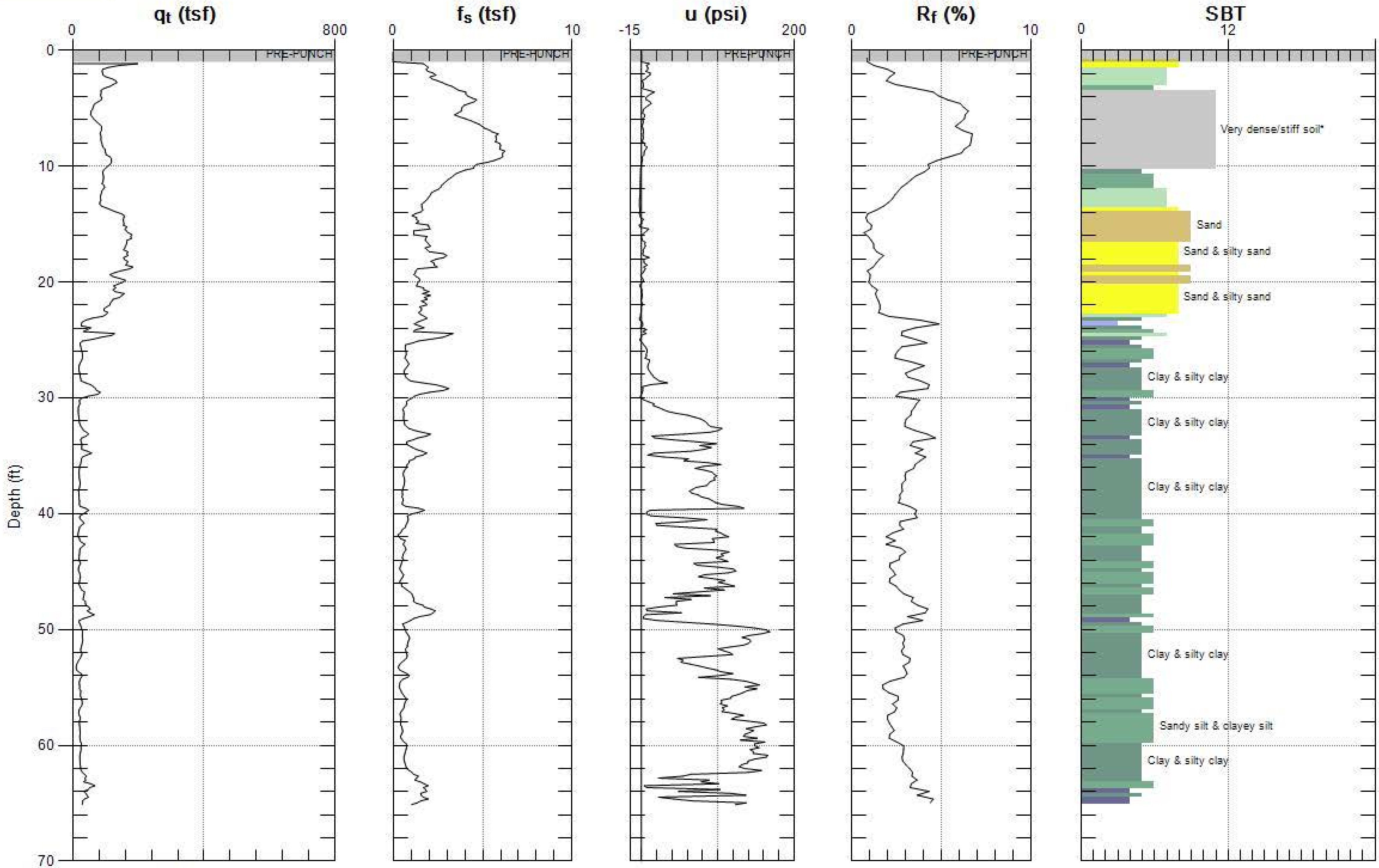
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL
Sounding: B-1

Engineer: V.VO
Date: 12/21/16 08:55



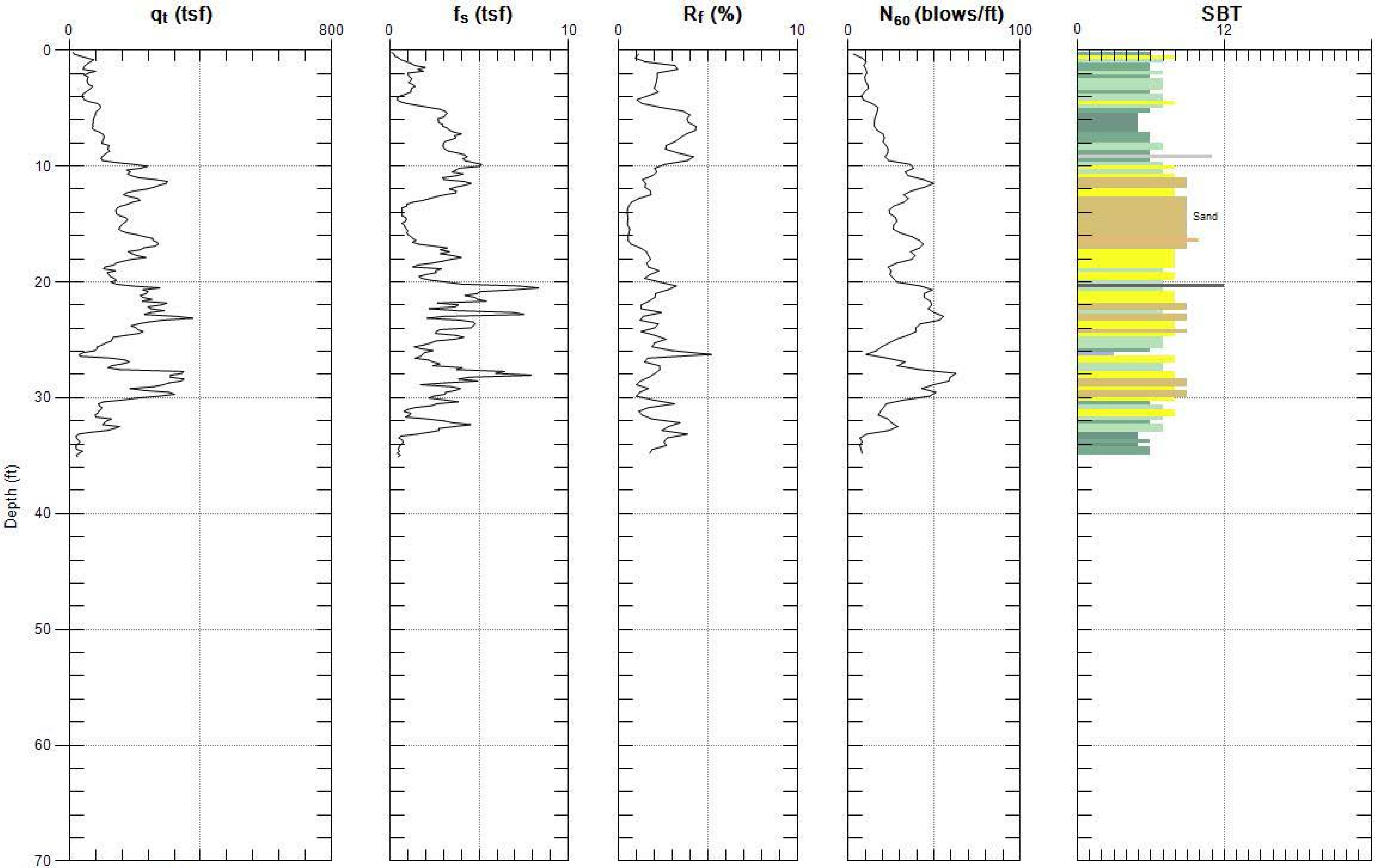
Max. Depth: 65.125 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL | Engineer: V.VO
Sounding: B-3 | Date: 12/21/16 10:15



Max. Depth: 35.105 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

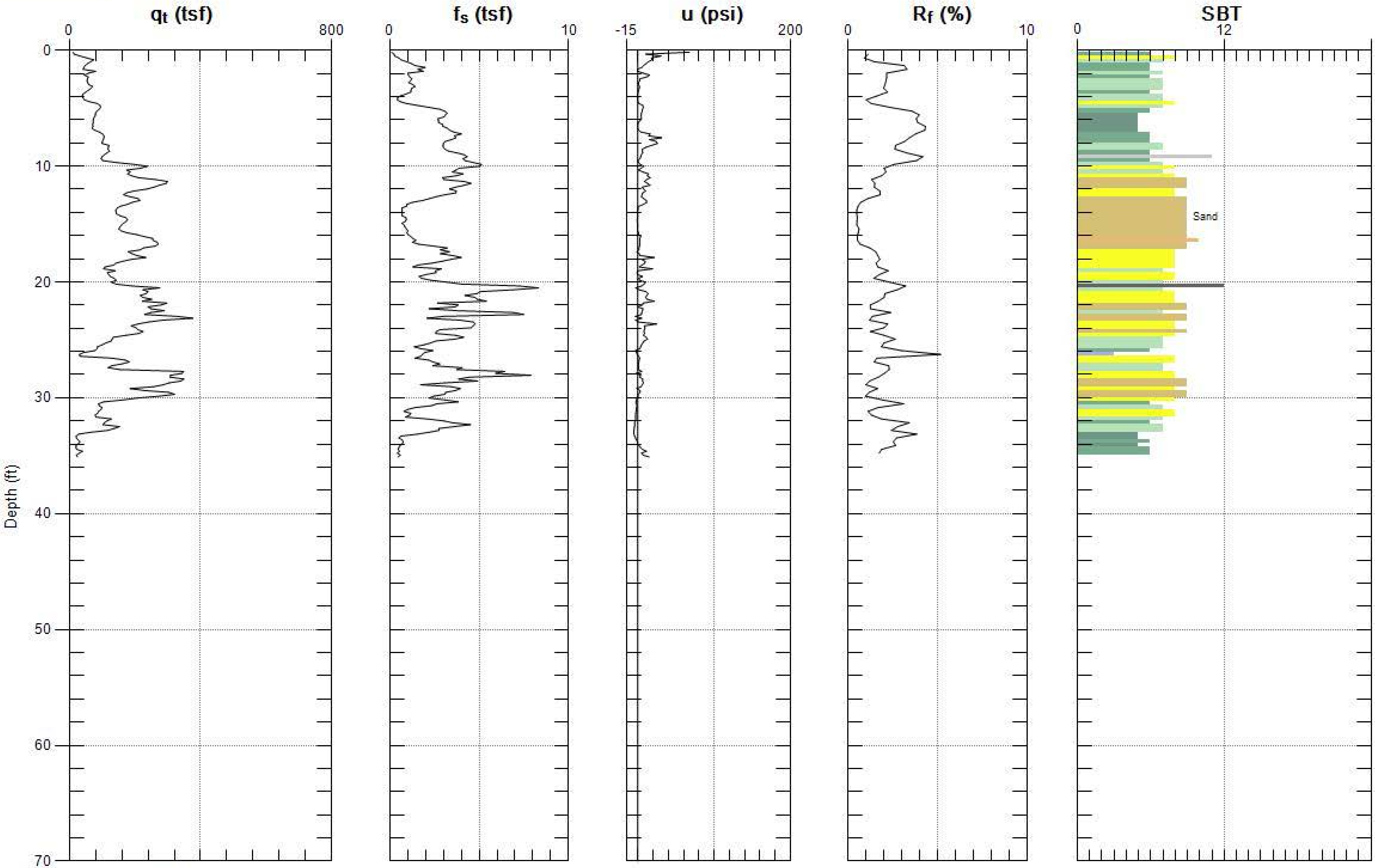
SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL

Sounding: B-3

Engineer: V.VO

Date: 12/21/16 10:15

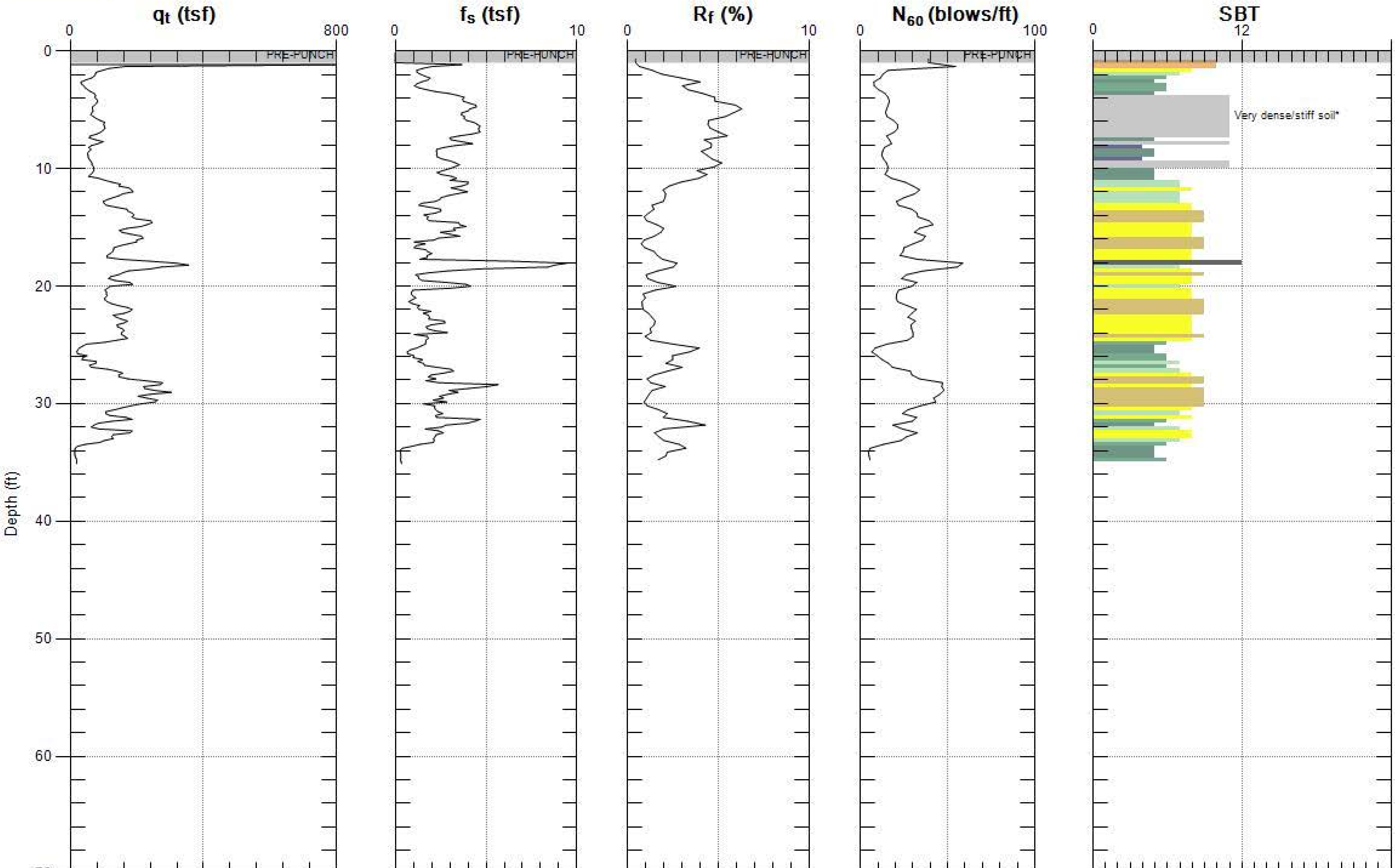


Max. Depth: 35.105 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL
Sounding: B-4
Engineer: V.VO
Date: 12/21/16 11:07



Max. Depth: 35.105 (ft)
Avg. Interval: 0.328 (ft)

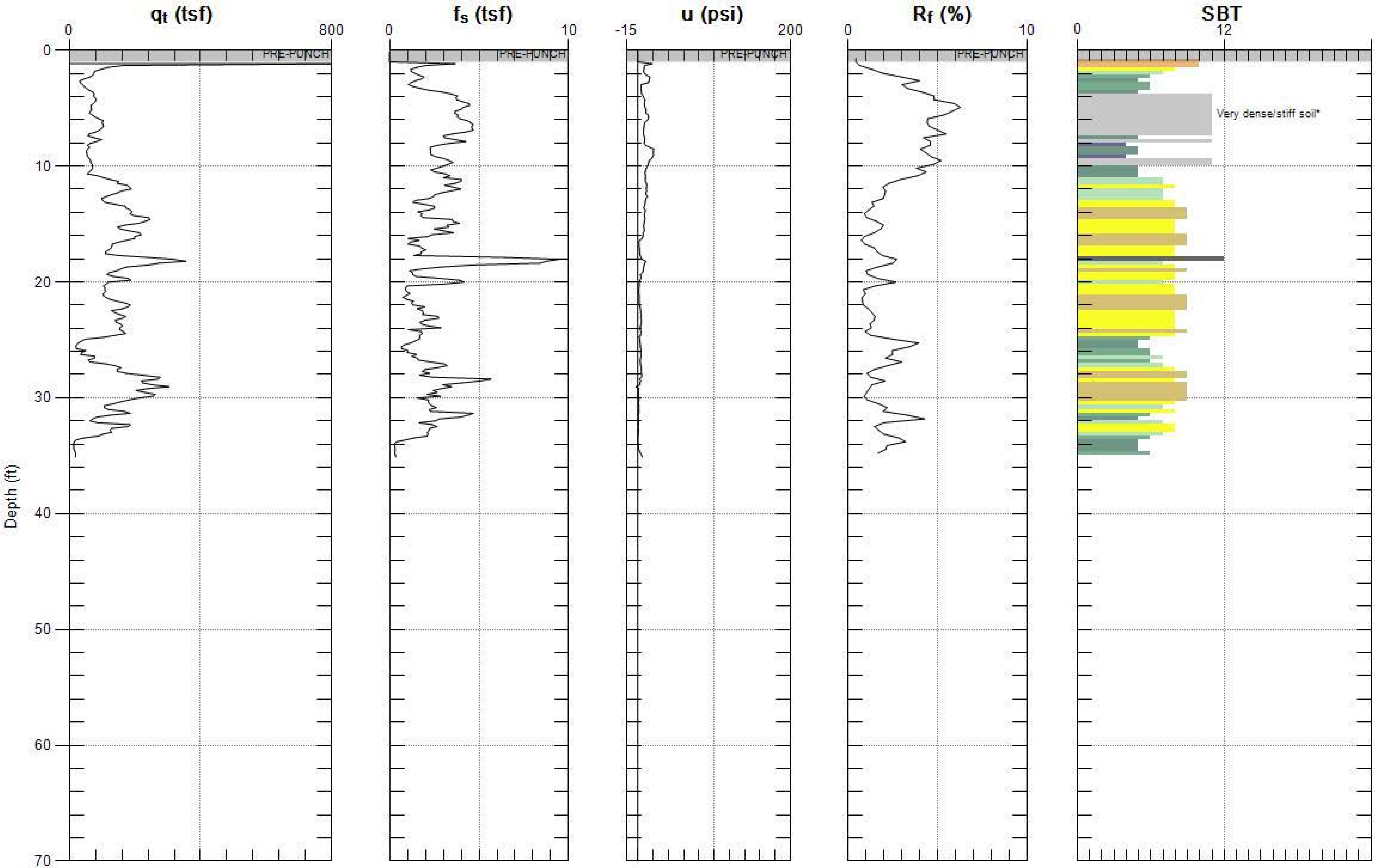
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL
Sounding: B-4

Engineer: V.VO
Date: 12/21/16 11:07



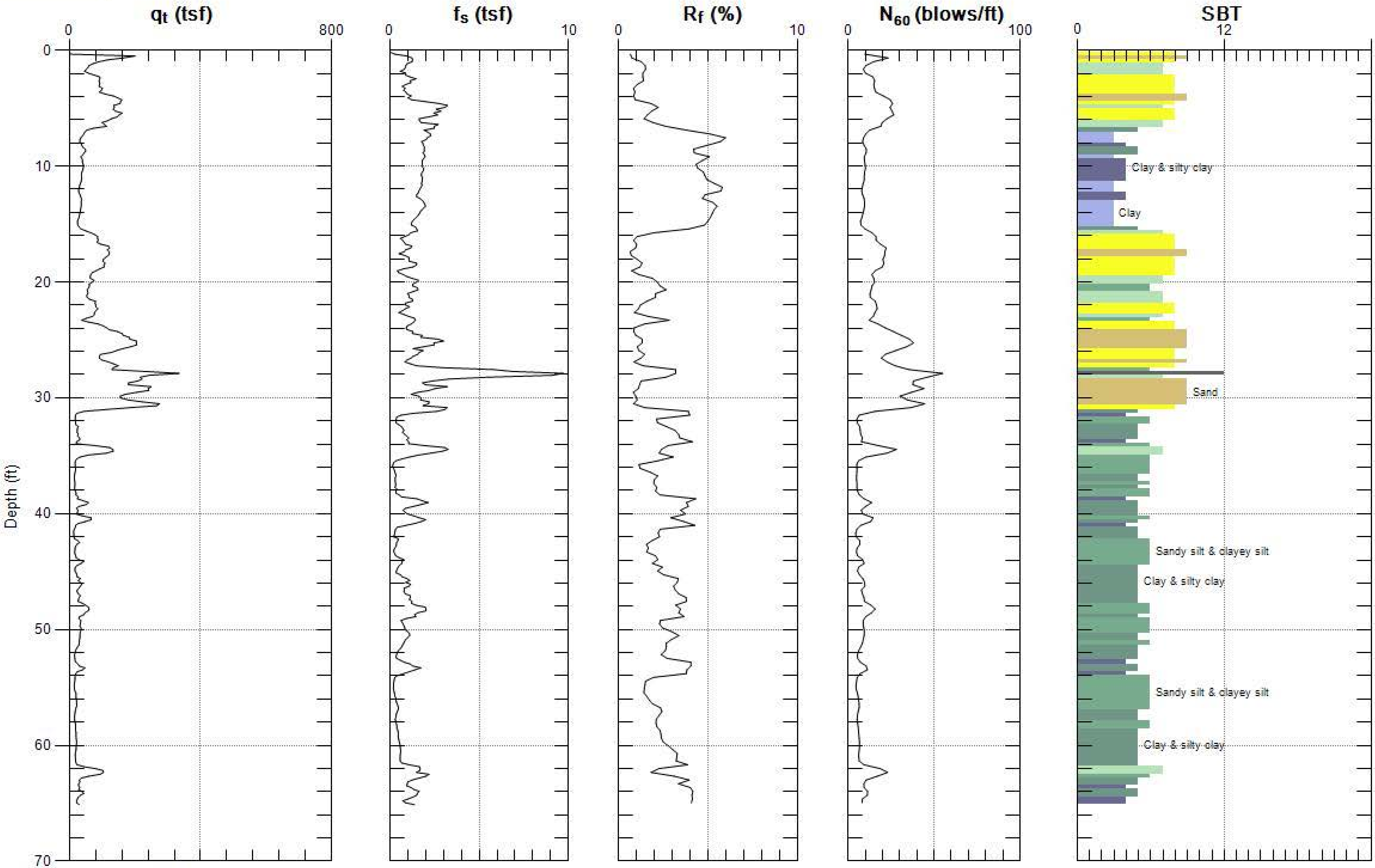
Max. Depth: 35.105 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

SILICON VALLEY SOIL ENG.

GREGG

Site: CASTILLEJA SCHOOL
Engineer: V.VO
Sounding: B-6
Date: 12/21/16 02:18



Max. Depth: 65.125 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

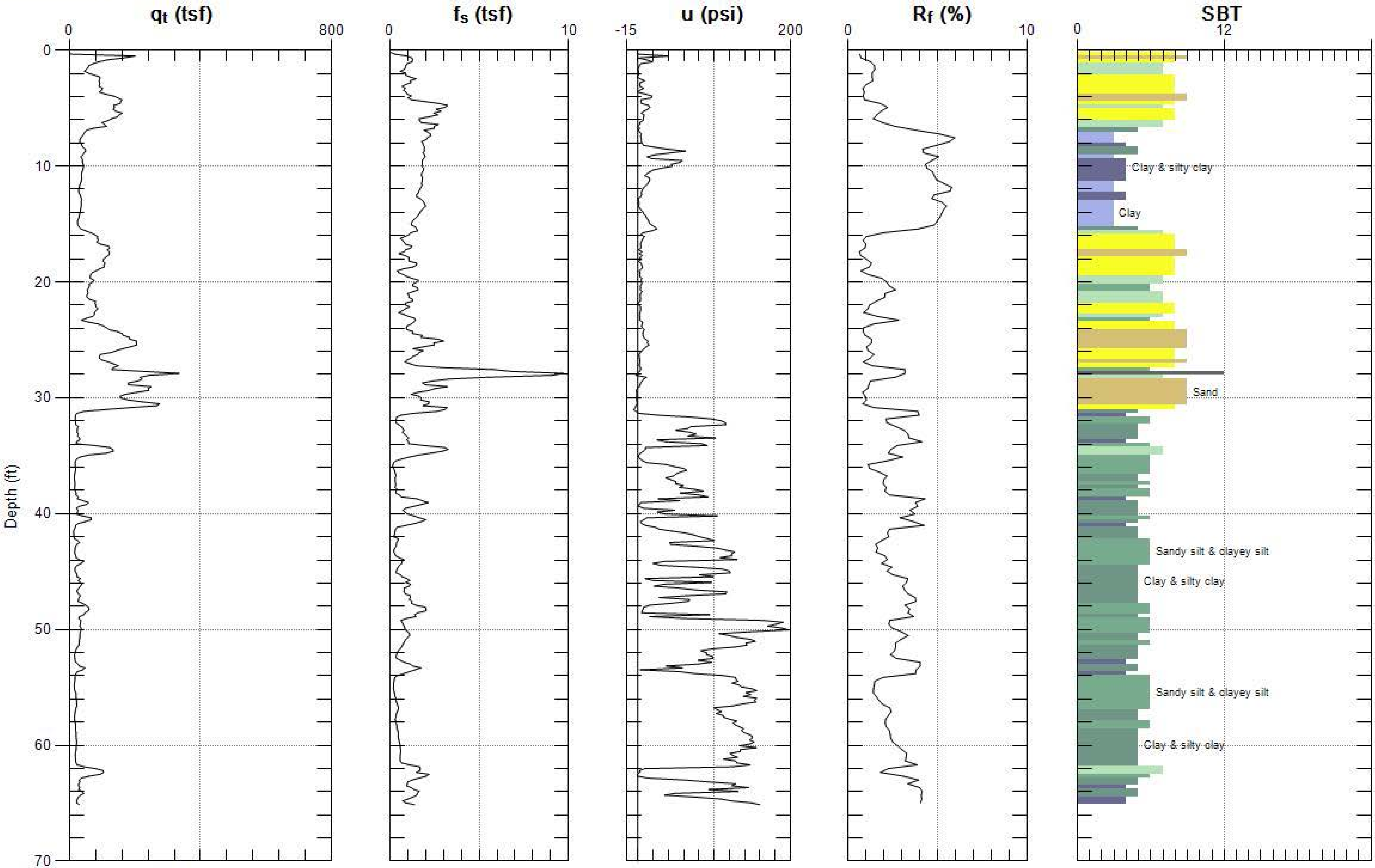
SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL

Sounding: B-6

Engineer: V.VO

Date: 12/21/16 02:18



Max. Depth: 65.125 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

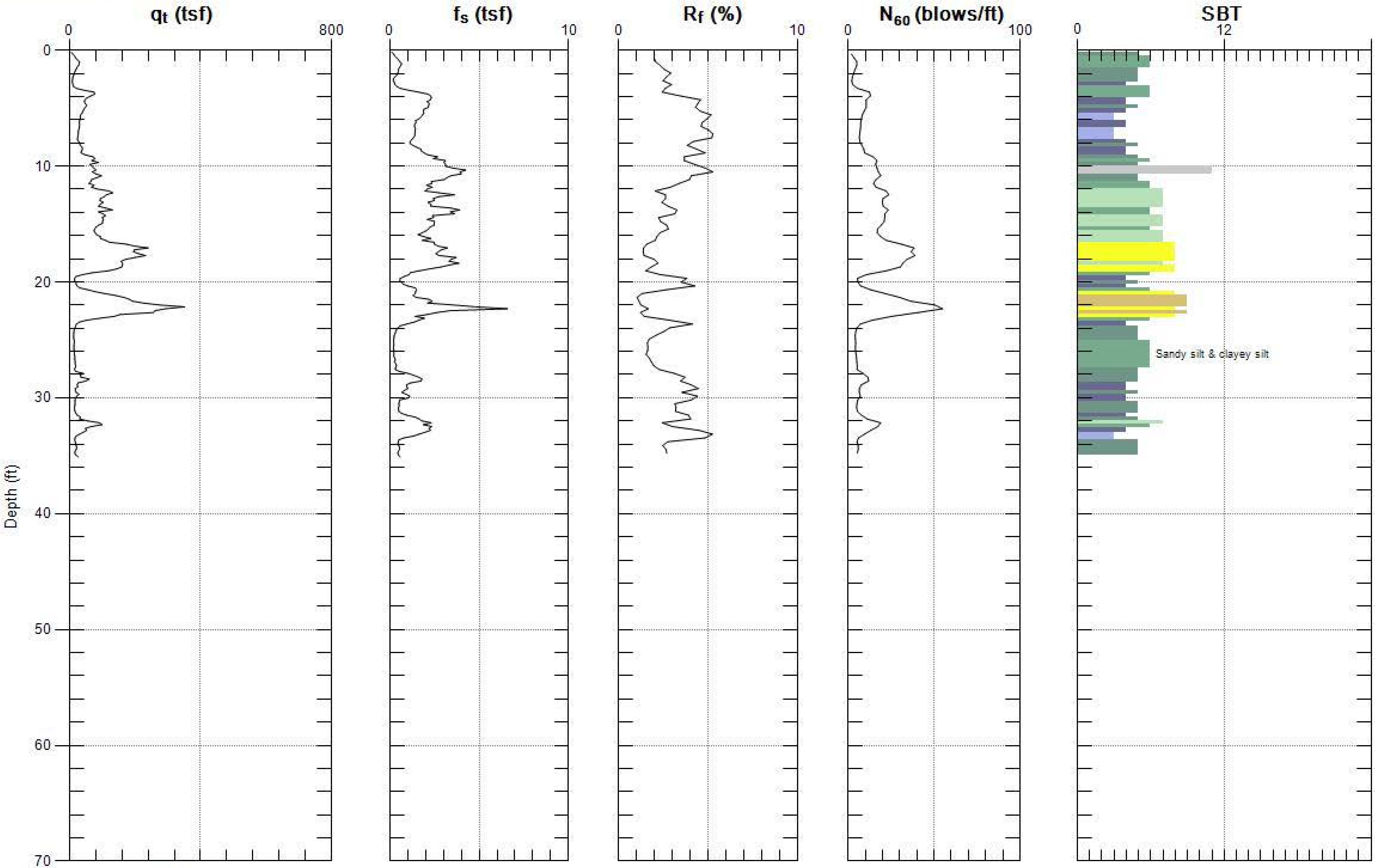
SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL

Engineer: V.VO

Sounding: B-8

Date: 12/21/16 12:25



Max. Depth: 35.105 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

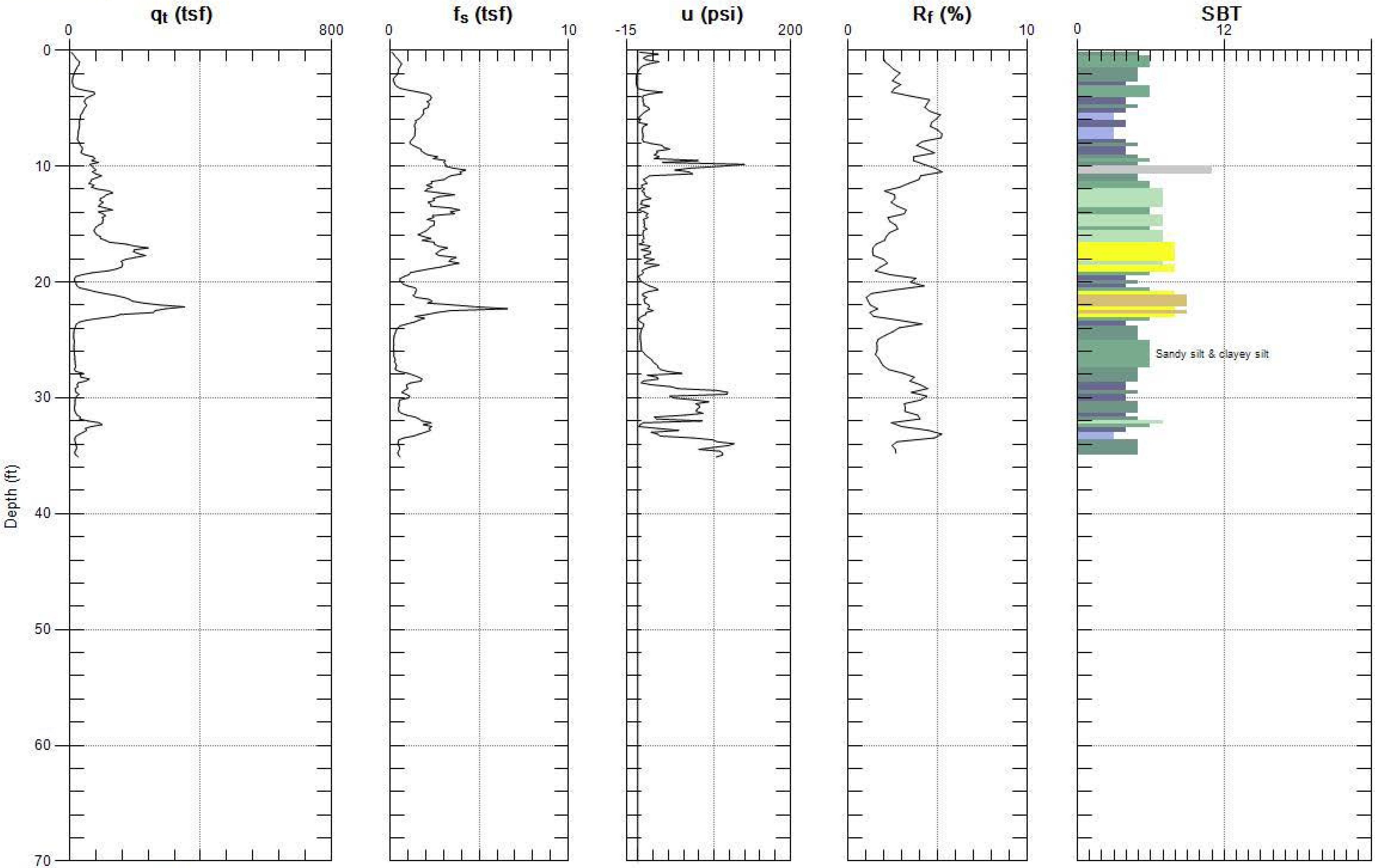
SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL

Sounding: B-8

Engineer: V.VO

Date: 12/21/16 12:25



Max. Depth: 35.105 (ft)
Avg. Interval: 0.328 (ft)

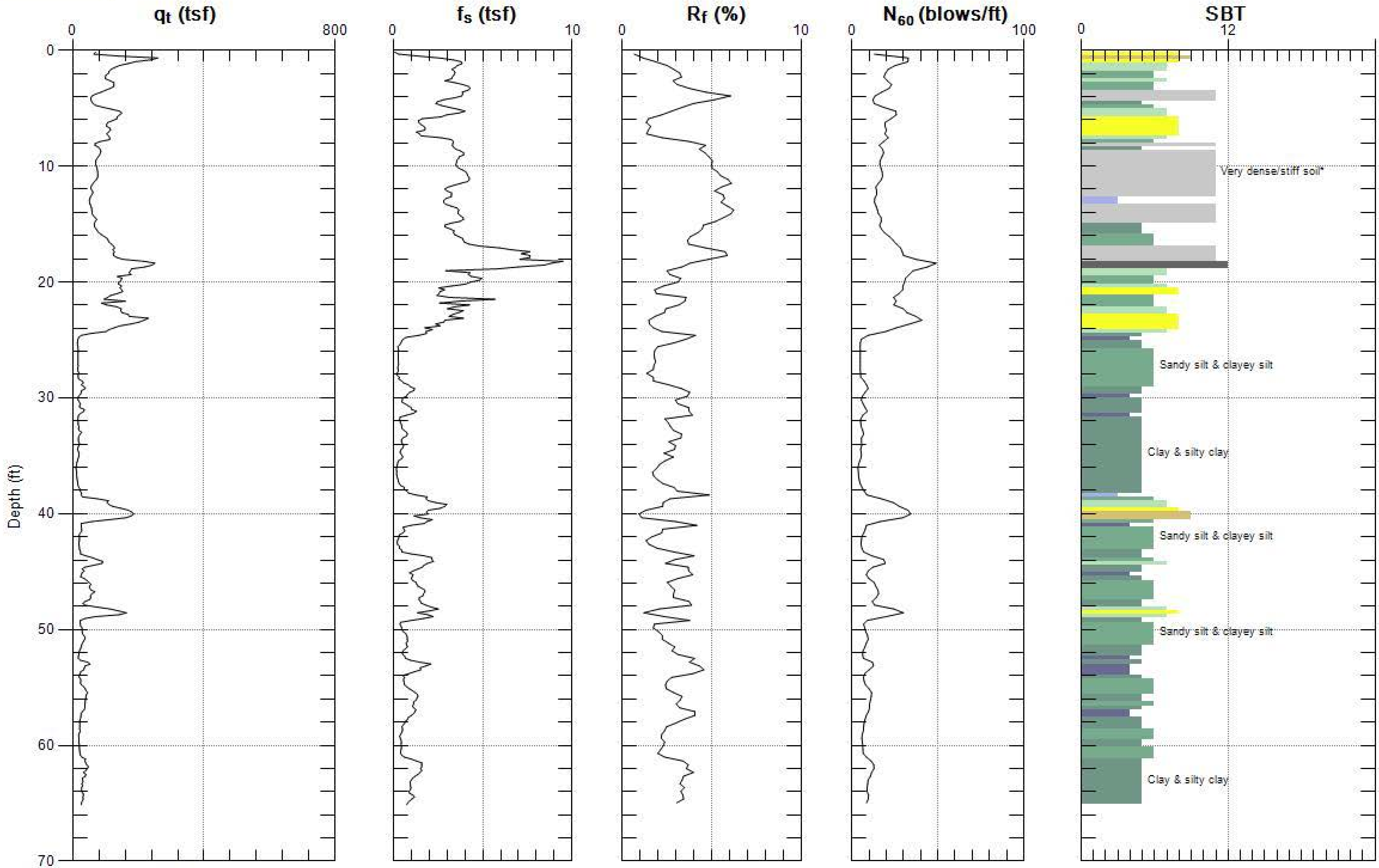
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL | Engineer: V.VO

Sounding: B-9 | Date: 12/21/16 01:15



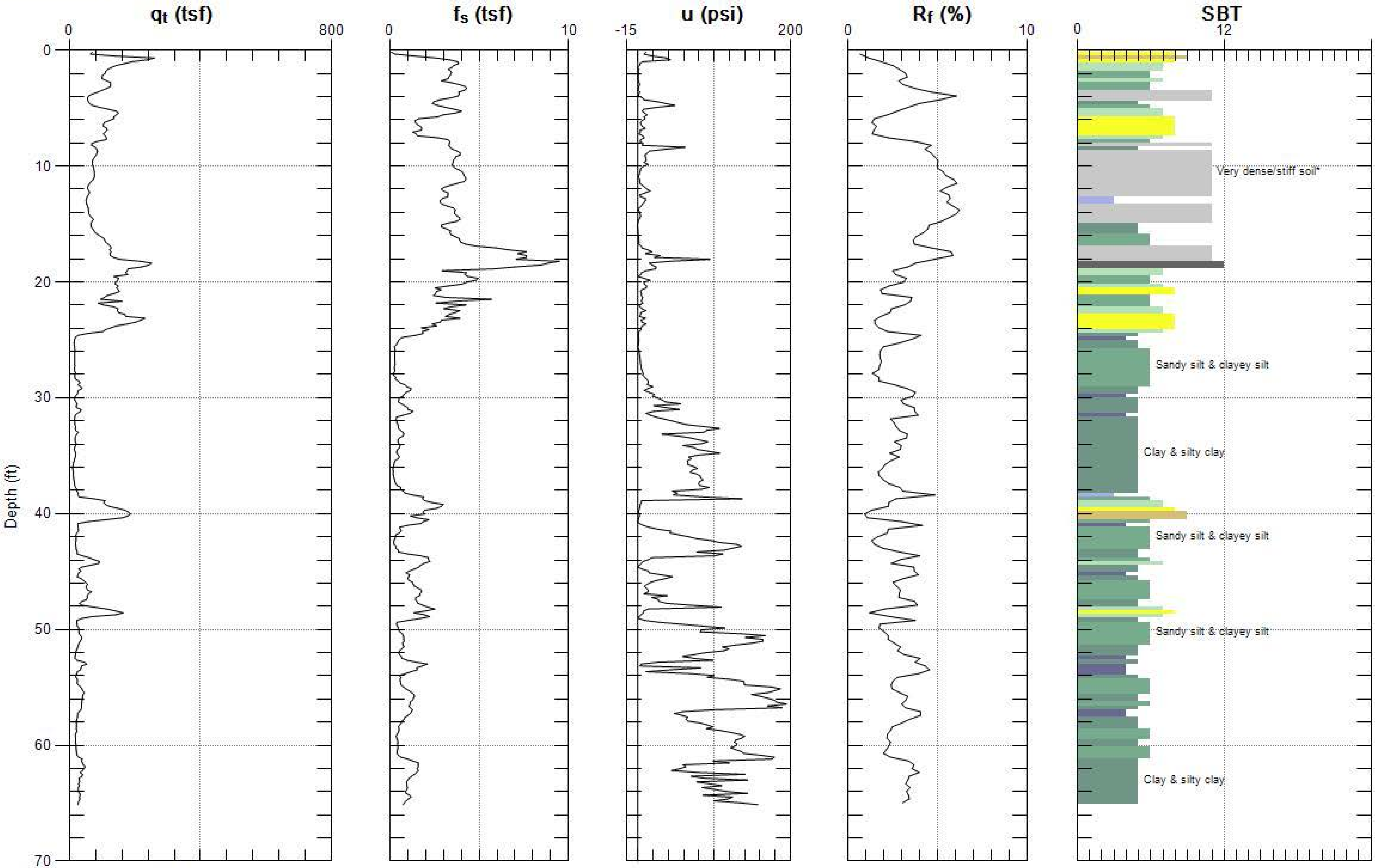
Max. Depth: 65.125 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

SILICON VALLEY SOIL ENG.

Site: CASTILLEJA SCHOOL
Sounding: B-9
Engineer: V.VO
Date: 12/21/16 01:15



Max. Depth: 65.125 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*.

The cone takes measurements of tip resistance (q_c), sleeve resistance (f_s), and penetration pore water pressure (u_2). Measurements are taken at either 2.5 or 5 cm intervals during penetration to provide a nearly continuous profile. CPT data reduction and basic interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored electronically for further analysis and reference. All CPT soundings are performed in accordance with revised ASTM standards (D 5778-12).

The 5mm thick porous plastic filter element is located directly behind the cone tip in the u_2 location. A new saturated filter element is used on each sounding to measure both penetration pore pressures as well as measurements during a dissipation test (*PPDT*). Prior to each test, the filter element is fully saturated with oil under vacuum pressure to improve accuracy.

When the sounding is completed, the test hole is backfilled according to client specifications. If grouting is used, the procedure generally consists of pushing a hollow tremie pipe with a "knock out" plug to the termination depth of the CPT hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

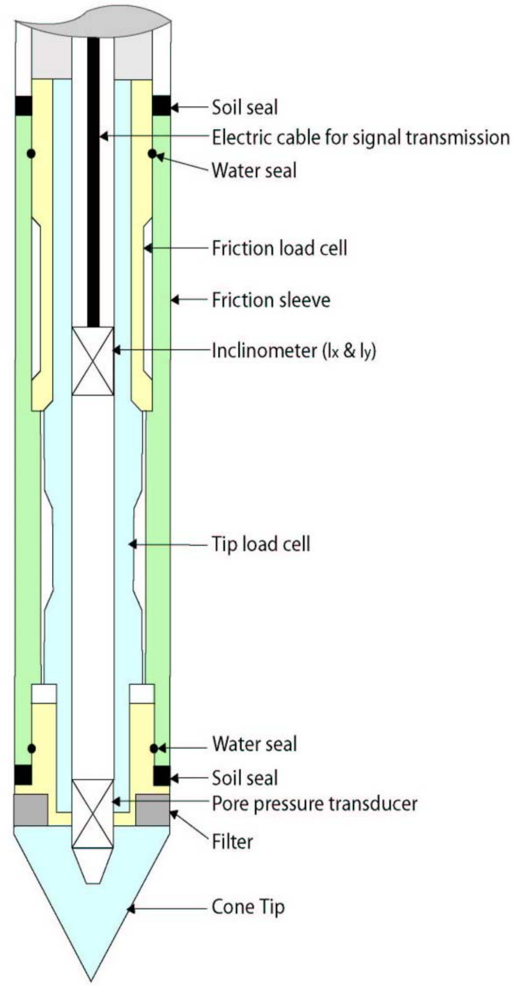


Figure CPT

Gregg 15cm^2 Standard Cone Specifications

Dimensions	
Cone base area	15 cm^2
Sleeve surface area	225 cm^2
Cone net area ratio	0.80
Specifications	
Cone load cell	
Full scale range	180 kN (20 tons)
Overload capacity	150%
Full scale tip stress	120 MPa (1,200 tsf)
Repeatability	120 kPa (1.2 tsf)
Sleeve load cell	
Full scale range	31 kN (3.5 tons)
Overload capacity	150%
Full scale sleeve stress	1,400 kPa (15 tsf)
Repeatability	1.4 kPa (0.015 tsf)
Pore pressure transducer	
Full scale range	7,000 kPa (1,000 psi)
Overload capacity	150%
Repeatability	7 kPa (1 psi)

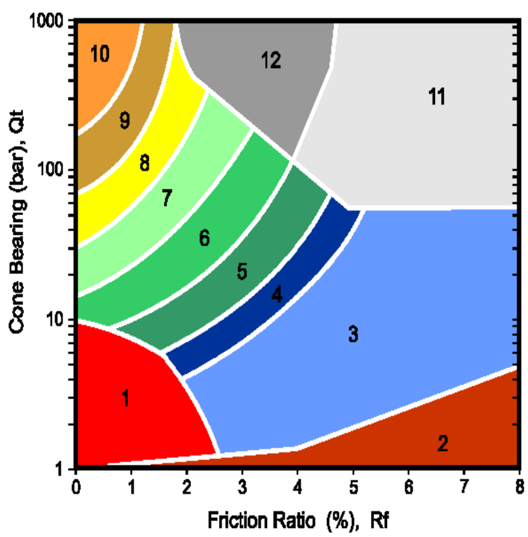
Note: The repeatability during field use will depend somewhat on ground conditions, abrasion, maintenance and zero load stability.

Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected are presented in graphical and electronic form in the report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings deeper than 30m, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson (Guide to Cone Penetration Testing, 2015). The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software. Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



ZONE		SBT
1		Sensitive, fine grained
2		Organic materials
3		Clay
4		Silty clay to clay
5		Clayey silt to silty clay
6		Sandy silt to clayey silt
7		Silty sand to sandy silt
8		Sand to silty sand
9		Sand
10		Gravely sand to sand
11		Very stiff fine grained*
12		Sand to clayey sand*

*over consolidated or cemented

Figure SBT (After Robertson et al., 1986) – Note: Colors may vary slightly compared to plots

Cone Penetration Test (CPT) Interpretation

Gregg uses a proprietary CPT interpretation and plotting software. The software takes the CPT data and performs basic interpretation in terms of soil behavior type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by Lunne, Robertson and Powell (1997). The interpretation is presented in tabular format using MS Excel. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

The following provides a summary of the methods used for the interpretation. Many of the empirical correlations to estimate geotechnical parameters have constants that have a range of values depending on soil type, geologic origin and other factors. The software uses 'default' values that have been selected to provide, in general, conservatively low estimates of the various geotechnical parameters.

Input:

1 Units for display (Imperial or metric) (atm. pressure, p_a = 0.96 tsf or 0.1 MPa)
2 Depth interval to average results (ft or m). Data are collected at either 0.02 or 0.05m and can be averaged every 1, 3 or 5 intervals.
3 Elevation of ground surface (ft or m)
4 Depth to water table, z_w (ft or m) – input required
5 Net area ratio for cone, a (default to 0.80)
6 Relative Density constant, C_{Dr} (default to 350)
7 Young's modulus number for sands, α (default to 5)
8 Small strain shear modulus number
   a. for sands, S_G (default to 180 for SBT_n 5, 6, 7)
   b. for clays, C_G (default to 50 for SBT_n 1, 2, 3 & 4)
9 Undrained shear strength cone factor for clays, N_{kt} (default to 15)
10 Over Consolidation ratio number, k_{ocr} (default to 0.3)
11 Unit weight of water, (default to γ_w = 62.4 lb/ft^3 or 9.81 kN/m^3)

Column

1 Depth, z, (m) – CPT data is collected in meters
2 Depth (ft)
3 Cone resistance, q_c (tsf or MPa)
4 Sleeve resistance, f_s (tsf or MPa)
5 Penetration pore pressure, u (psi or MPa), measured behind the cone (i.e. u_2)
6 Other – any additional data
7 Total cone resistance, q_t (tsf or MPa) $q_t = q_c + u\,(1-a)$

8	Friction Ratio, R_f (%)	$R_f = (f_s/q_t) \times 100\%$
9	Soil Behavior Type (non-normalized), SBT	see note
10	Unit weight, γ (pcf or kN/m^3)	based on SBT, see note
11	Total overburden stress, σ_v (tsf)	$\sigma_{vo} = \sigma\ z$
12	In-situ pore pressure, u_o (tsf)	$u_o = \gamma_w (z - z_w)$
13	Effective overburden stress, σ'_{vo} (tsf)	$\sigma'_{vo} = \sigma_{vo} - u_o$
14	Normalized cone resistance, Q_{t1}	$Q_{t1} = (q_t - \sigma_{vo}) / \sigma'_{vo}$
15	Normalized friction ratio, F_r (%)	$F_r = f_s / (q_t - \sigma_{vo}) \times 100\%$
16	Normalized Pore Pressure ratio, B_q	$B_q = u - u_o / (q_t - \sigma_{vo})$
17	Soil Behavior Type (normalized), SBT_n	see note
18	SBT_n Index, I_c	see note
19	Normalized Cone resistance, Q_{tn} (n varies with I_c)	see note
20	Estimated permeability, k_{SBT} (cm/sec or ft/sec)	see note
21	Equivalent SPT N_{60}, blows/ft	see note
22	Equivalent SPT $(N_1)_{60}$ blows/ft	see note
23	Estimated Relative Density, D_r, (%)	see note
24	Estimated Friction Angle, ϕ', (degrees)	see note
25	Estimated Young's modulus, E_s (tsf)	see note
26	Estimated small strain Shear modulus, Go (tsf)	see note
27	Estimated Undrained shear strength, s_u (tsf)	see note
28	Estimated Undrained strength ratio	s_u/σ_v'
29	Estimated Over Consolidation ratio, OCR	see note

Notes:

1 Soil Behavior Type (non-normalized), SBT (Lunne et al., 1997 and table below)

2 Unit weight, γ either constant at 119 pcf or based on Non-normalized SBT (Lunne et al., 1997 and table below)

3 Soil Behavior Type (Normalized), SBT_n Lunne et al. (1997)

4 SBT_n Index, I_c $I_c = ((3.47 - \log Q_{t1})^2 + (\log F_r + 1.22)^2)^{0.5}$

5 Normalized Cone resistance, Q_{tn} (n varies with Ic)

$Q_{tn} = ((q_t - \sigma_{vo})/pa)\ (pa/(\sigma'_{vo})^n$ and recalculate I_c, then iterate:

When $I_c < 1.64$, n = 0.5 (clean sand)
When $I_c > 3.30$, n = 1.0 (clays)
When $1.64 < I_c < 3.30$, $n = (I_c - 1.64)0.3 + 0.5$
Iterate until the change in n, $\Delta n < 0.01$

6 Estimated permeability, k_{SBT} based on Normalized SBT_n (Lunne et al., 1997 and table below)

7 Equivalent SPT N_{60}, blows/ft Lunne et al. (1997)

$$\frac{(q_t/p_a)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

8 Equivalent SPT $(N_1)_{60}$ blows/ft $(N_1)_{60} = N_{60}\, C_N,$
where $C_N = (pa/\sigma'_{vo})^{0.5}$

9 Relative Density, D_r, (%) $D_r^2 = Q_{tn} / C_{Dr}$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

10 Friction Angle, φ', (degrees) $\tan\phi' = \frac{1}{2.68}\left[\log\left(\frac{q_c}{\sigma'_{vo}}\right) + 0.29\right]$

Only SBT_n 5, 6, 7 & 8 *Show'N/A' in zones 1, 2, 3, 4 & 9*

11 Young's modulus, E_s $E_s = \alpha\, q_t$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

12 Small strain shear modulus, Go
a. $G_o = S_G (q_t\ \sigma'_{vo}\ pa)^{1/3}$ *For SBT_n 5, 6, 7*
b. $G_o = C_G\, q_t$ *For SBT_n 1, 2, 3& 4*
Show 'N/A' in zones 8 & 9

13 Undrained shear strength, s_u $s_u = (q_t - \sigma_{vo}) / N_{kt}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

14 Over Consolidation ratio, OCR $OCR = k_{ocr}\, Q_{t1}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

The following updated and simplified SBT descriptions have been used in the software:

SBT Zones		**SBT_n Zones**	
1	sensitive fine grained	1	sensitive fine grained
2	organic soil	2	organic soil
3	clay	3	clay
4	clay & silty clay	4	clay & silty clay
5	clay & silty clay		
6	sandy silt & clayey silt		

7	silty sand & sandy silt	5	silty sand & sandy silt
8	sand & silty sand	6	sand & silty sand
9	sand		
10	sand	7	sand
11	very dense/stiff soil*	8	very dense/stiff soil*
12	very dense/stiff soil*	9	very dense/stiff soil*

*heavily overconsolidated and/or cemented

Track when soils fall with zones of same description and print that description (i.e. if soils fall only within SBT zones 4 & 5, print 'clays & silty clays')

Estimated Permeability (see Lunne et al., 1997)

SBT_n	Permeability (ft/sec)	(m/sec)
1	$3x\ 10^{-8}$	$1x\ 10^{-8}$
2	$3x\ 10^{-7}$	$1x\ 10^{-7}$
3	$1x\ 10^{-9}$	$3x\ 10^{-10}$
4	$3x\ 10^{-8}$	$1x\ 10^{-8}$
5	$3x\ 10^{-6}$	$1x\ 10^{-6}$
6	$3x\ 10^{-4}$	$1x\ 10^{-4}$
7	$3x\ 10^{-2}$	$1x\ 10^{-2}$
8	$3x\ 10^{-6}$	$1x\ 10^{-6}$
9	$1x\ 10^{-8}$	$3x\ 10^{-9}$

Estimated Unit Weight (see Lunne et al., 1997)

SBT	Approximate Unit Weight (lb/ft^3)	(kN/m^3)
1	111.4	17.5
2	79.6	12.5
3	111.4	17.5
4	114.6	18.0
5	114.6	18.0
6	114.6	18.0
7	117.8	18.5
8	120.9	19.0
9	124.1	19.5
10	127.3	20.0
11	130.5	20.5
12	120.9	19.0

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (feet)	Depth of Groundwater Samples (feet)	Depth of Soil Samples (feet)	Depth of Pore Pressure Dissipation Tests (feet)
B-1	12/21/16	65	-	-	-
B-3	12/21/16	35	-	-	-
B-4	12/21/16	35	-	-	-
B-6	12/21/16	65	-	-	-
B-8	12/21/16	35	-	-	-
B-9	12/21/16	65	-	-	-

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****
LIQUEFACTION ANALYSIS SUMMARY

****
Font: Courier New, Regular, Size 8 is recommended for this report.
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Input File Name: \\FILE-SERVER\use\SVSE Files\SV Main File\SV MAIN FILE\SV (1590-1599)\SV1598 - Castilleja School\SV1598.GI\SV1598. CPT B-1.liq
Title: Castilleja School - Proposed Improvements
Subtitle: 1310 Bryant Street, Palo Alto, CA

Surface Elev.=100
Hole No.=B-1
Depth of Hole= 65.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 31.00 ft
Max. Acceleration= 0.62 g
Earthquake Magnitude= 7.90

Input Data:
Surface Elev.=100
Hole No.=B-1
Depth of Hole=65.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 31.00 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.90
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
9. User request factor of safety (apply to CSR) , User= 1
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	Rf pcf	gamma %	Fines mm	D50
0.98	66.07	0.57	0.86	121.00	0.00	0.50
1.97	91.15	2.19	2.40	118.00	0.00	0.50
2.95	123.50	3.02	2.44	118.00	0.00	0.50
3.94	86.70	4.20	4.84	131.00	NoLiq	0.50
4.92	62.23	3.88	6.23	131.00	NoLiq	0.50
5.91	64.11	4.03	6.28	131.00	NoLiq	0.50
6.89	87.10	5.34	6.14	131.00	NoLiq	0.50
7.87	87.44	5.81	6.64	131.00	NoLiq	0.50
8.86	100.40	6.15	6.13	131.00	NoLiq	0.50
9.84	113.10	4.80	4.25	131.00	NoLiq	0.50
10.82	93.60	3.36	3.59	115.00	NoLiq	0.50
11.81	95.56	2.64	2.77	115.00	NoLiq	0.50
13.12	83.96	1.72	2.05	118.00	0.00	0.50

14.10	145.50	1.29	0.89	124.00	0.00	0.50
15.09	159.00	1.75	1.10	124.00	0.00	0.50
16.07	178.80	1.63	0.91	124.00	0.00	0.50
17.06	158.20	1.93	1.22	121.00	0.00	0.50
18.04	160.00	2.45	1.53	121.00	0.00	0.50
19.02	149.60	1.30	0.87	124.00	0.00	0.50
20.01	150.80	1.42	0.94	124.00	0.00	0.50
20.99	145.30	1.92	1.32	121.00	0.00	0.50
21.98	110.80	1.73	1.56	121.00	0.00	0.50
22.96	84.07	1.73	2.06	118.00	0.00	0.50
23.95	42.20	1.49	3.53	115.00	NoLiq	0.50
24.93	59.91	2.10	3.51	115.00	NoLiq	0.50
25.91	27.41	0.71	2.59	115.00	NoLiq	0.50
26.90	24.51	0.82	3.34	115.00	NoLiq	0.50
27.88	21.20	0.64	3.00	115.00	NoLiq	0.50
28.87	52.44	2.27	4.33	115.00	NoLiq	0.50
29.85	51.01	1.25	2.44	115.00	NoLiq	0.50
30.84	17.80	0.63	3.54	115.00	NoLiq	0.50
31.82	18.60	0.60	3.20	115.00	NoLiq	0.50
33.13	43.50	1.85	4.24	115.00	NoLiq	0.50
34.12	26.68	0.91	3.40	115.00	NoLiq	0.50
35.10	32.68	1.37	4.19	115.00	NoLiq	0.50
36.08	19.50	0.71	3.65	115.00	NoLiq	0.50
37.07	19.92	0.64	3.20	115.00	NoLiq	0.50
38.05	17.85	0.53	2.97	115.00	NoLiq	0.50
39.04	19.40	0.54	2.78	115.00	NoLiq	0.50
40.02	31.39	1.11	3.53	115.00	NoLiq	0.50
41.01	26.79	0.73	2.71	115.00	NoLiq	0.50
41.99	16.44	0.34	2.09	115.00	NoLiq	0.50
42.97	24.34	0.69	2.85	115.00	NoLiq	0.50
43.96	18.71	0.54	2.86	115.00	NoLiq	0.50
44.94	17.38	0.44	2.53	115.00	NoLiq	0.50
45.93	18.55	0.42	2.27	115.00	NoLiq	0.50
46.91	34.42	1.02	2.98	115.00	NoLiq	0.50
47.90	42.50	1.58	3.71	115.00	NoLiq	0.50
48.88	50.34	1.57	3.12	115.00	NoLiq	0.50
49.86	24.66	0.65	2.62	115.00	NoLiq	0.50
51.18	27.15	0.83	3.05	115.00	NoLiq	0.50
52.16	25.59	0.77	3.01	115.00	NoLiq	0.50
53.15	10.64	0.34	3.15	115.00	NoLiq	0.50
54.13	24.65	0.76	3.08	115.00	NoLiq	0.50
55.11	20.39	0.39	1.92	115.00	NoLiq	0.50
56.10	26.33	0.72	2.72	115.00	NoLiq	0.50
57.08	17.76	0.47	2.62	115.00	NoLiq	0.50
58.07	18.51	0.43	2.34	115.00	NoLiq	0.50
59.05	20.43	0.47	2.31	115.00	NoLiq	0.50
60.03	23.99	0.76	3.15	115.00	NoLiq	0.50
61.02	19.81	0.62	3.12	115.00	NoLiq	0.50
62.00	22.77	0.80	3.51	115.00	NoLiq	0.50
62.99	36.14	1.35	3.73	115.00	NoLiq	0.50
63.97	39.24	1.75	4.45	115.00	NoLiq	0.50
64.96	28.46	1.31	4.61	115.00	NoLiq	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.18 in.
Total Settlement of Saturated and Unsaturated Sands=0.18 in.
Differential Settlement=0.091 to 0.120 in.

Depth CRRm CSRfs F.S. S_sat. S_dry S_all

ft				in.	in.	in.
0.98	1.82	0.40	5.00	0.00	0.18	0.18
1.98	1.82	0.40	5.00	0.00	0.18	0.18
2.98	1.82	0.40	5.00	0.00	0.18	0.18
3.98	2.00	0.40	5.00	0.00	0.18	0.18
4.98	2.00	0.40	5.00	0.00	0.18	0.18
5.98	2.00	0.40	5.00	0.00	0.18	0.18
6.98	2.00	0.40	5.00	0.00	0.18	0.18
7.98	2.00	0.40	5.00	0.00	0.18	0.18
8.98	2.00	0.39	5.00	0.00	0.18	0.18
9.98	2.00	0.39	5.00	0.00	0.18	0.18
10.98	2.00	0.39	5.00	0.00	0.18	0.18
11.98	2.00	0.39	5.00	0.00	0.18	0.18
12.98	0.32	0.39	5.00	0.00	0.17	0.17
13.98	0.42	0.39	5.00	0.00	0.16	0.16
14.98	0.54	0.39	5.00	0.00	0.14	0.14
15.98	0.61	0.39	5.00	0.00	0.13	0.13
16.98	0.52	0.39	5.00	0.00	0.12	0.12
17.98	0.56	0.39	5.00	0.00	0.10	0.10
18.98	0.36	0.39	5.00	0.00	0.08	0.08
19.98	0.35	0.38	5.00	0.00	0.05	0.05
20.98	0.37	0.38	5.00	0.00	0.04	0.04
21.98	0.25	0.38	5.00	0.00	0.02	0.02
22.98	0.21	0.38	5.00	0.00	0.00	0.00
23.98	2.00	0.39	5.00	0.00	0.00	0.00
24.98	2.00	0.40	5.00	0.00	0.00	0.00
25.98	2.00	0.40	5.00	0.00	0.00	0.00
26.98	2.00	0.41	5.00	0.00	0.00	0.00
27.98	2.00	0.41	5.00	0.00	0.00	0.00
28.98	2.00	0.42	5.00	0.00	0.00	0.00
29.98	2.00	0.43	5.00	0.00	0.00	0.00
30.98	2.00	0.43	5.00	0.00	0.00	0.00
31.98	2.00	0.43	5.00	0.00	0.00	0.00
32.98	2.00	0.43	5.00	0.00	0.00	0.00
33.98	2.00	0.43	5.00	0.00	0.00	0.00
34.98	2.00	0.44	5.00	0.00	0.00	0.00
35.98	2.00	0.44	5.00	0.00	0.00	0.00
36.98	2.00	0.44	5.00	0.00	0.00	0.00
37.98	2.00	0.44	5.00	0.00	0.00	0.00
38.98	2.00	0.44	5.00	0.00	0.00	0.00
39.98	2.00	0.44	5.00	0.00	0.00	0.00
40.98	2.00	0.44	5.00	0.00	0.00	0.00
41.98	2.00	0.44	5.00	0.00	0.00	0.00
42.98	2.00	0.44	5.00	0.00	0.00	0.00
43.98	2.00	0.44	5.00	0.00	0.00	0.00
44.98	2.00	0.44	5.00	0.00	0.00	0.00
45.98	2.00	0.44	5.00	0.00	0.00	0.00
46.98	2.00	0.44	5.00	0.00	0.00	0.00
47.98	2.00	0.43	5.00	0.00	0.00	0.00
48.98	2.00	0.43	5.00	0.00	0.00	0.00
49.98	2.00	0.43	5.00	0.00	0.00	0.00
50.98	2.00	0.43	5.00	0.00	0.00	0.00
51.98	2.00	0.43	5.00	0.00	0.00	0.00
52.98	2.00	0.43	5.00	0.00	0.00	0.00
53.98	2.00	0.42	5.00	0.00	0.00	0.00
54.98	2.00	0.42	5.00	0.00	0.00	0.00
55.98	2.00	0.42	5.00	0.00	0.00	0.00
56.98	2.00	0.42	5.00	0.00	0.00	0.00
57.98	2.00	0.41	5.00	0.00	0.00	0.00
58.98	2.00	0.41	5.00	0.00	0.00	0.00
59.98	2.00	0.41	5.00	0.00	0.00	0.00
60.98	2.00	0.41	5.00	0.00	0.00	0.00

61.98	2.00	0.40	5.00	0.00	0.00	0.00
62.98	2.00	0.40	5.00	0.00	0.00	0.00
63.98	2.00	0.40	5.00	0.00	0.00	0.00
64.98	2.00	0.39	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: \\FILE-SERVER\use\SVSE Files\SV Main File\SV MAIN FILE\SV (1590-1599)\SV1598 - Castilleja School\SV1598.GI\SV1598. CPT B-6.liq
Title: Castilleja School - Proposed Improvements
Subtitle: 1310 Bryant Street, Palo Alto, CA

Surface Elev.=100
Hole No.=B-6
Depth of Hole= 65.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 31.00 ft
Max. Acceleration= 0.62 g
Earthquake Magnitude= 7.90

Input Data:
Surface Elev.=100
Hole No.=B-6
Depth of Hole=65.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 31.00 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.90
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
9. User request factor of safety (apply to CSR) ,   User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	Rf pcf	gamma %	Fines mm	D50
0.98	93.17	1.18	1.26	121.00	0.00	0.50
1.97	60.08	0.80	1.33	118.00	0.00	0.50
2.95	91.83	0.94	1.02	121.00	0.00	0.50
3.94	130.10	1.08	0.83	124.00	0.00	0.50
4.92	135.30	2.98	2.20	118.00	0.00	0.50
5.91	130.60	1.84	1.41	121.00	0.00	0.50
6.89	57.85	2.18	3.78	115.00	NoLiq	0.50
7.87	33.39	1.90	5.68	111.00	NoLiq	0.50
8.86	44.94	1.92	4.27	115.00	NoLiq	0.50
9.84	41.39	1.82	4.39	115.00	NoLiq	0.50
10.82	37.30	1.80	4.82	115.00	NoLiq	0.50
11.81	30.33	1.76	5.80	111.00	NoLiq	0.50
13.12	36.48	1.91	5.23	111.00	NoLiq	0.50

14.10	31.61	1.65	5.24	111.00	NoLiq	0.50
15.09	26.83	1.30	4.83	111.00	NoLiq	0.50
16.07	83.46	0.85	1.02	121.00	0.00	0.50
17.06	119.10	1.12	0.94	121.00	0.00	0.50
18.04	105.60	1.09	1.04	121.00	0.00	0.50
19.02	81.52	0.58	0.71	121.00	0.00	0.50
20.01	68.65	1.48	2.15	118.00	NoLiq	0.50
20.99	55.12	1.13	2.06	118.00	NoLiq	0.50
21.98	80.07	0.97	1.21	121.00	NoLiq	0.50
22.96	66.68	1.09	1.63	118.00	0.00	0.50
23.95	112.50	0.97	0.86	121.00	0.00	0.50
24.93	190.40	2.49	1.31	124.00	0.00	0.50
25.91	144.80	1.62	1.12	121.00	0.00	0.50
26.90	118.90	1.01	0.85	124.00	0.00	0.50
27.88	269.40	8.55	3.17	121.00	0.00	0.50
28.87	203.30	2.36	1.16	124.00	0.00	0.50
29.85	160.80	1.53	0.95	124.00	0.00	0.50
30.84	189.40	2.72	1.44	121.00	0.00	0.50
31.82	17.02	0.38	2.26	115.00	NoLiq	0.50
33.13	24.32	0.84	3.47	115.00	NoLiq	0.50
34.12	72.76	2.02	2.78	115.00	NoLiq	0.50
35.10	37.91	1.15	3.05	115.00	NoLiq	0.50
36.08	17.95	0.22	1.25	115.00	NoLiq	0.50
37.07	15.35	0.32	2.07	115.00	NoLiq	0.50
38.05	17.68	0.38	2.17	115.00	NoLiq	0.50
39.04	50.56	1.92	3.79	115.00	NoLiq	0.50
40.02	28.03	1.08	3.84	115.00	NoLiq	0.50
41.01	21.60	0.92	4.27	115.00	NoLiq	0.50
41.99	13.29	0.33	2.47	115.00	NoLiq	0.50
42.97	16.78	0.30	1.79	115.00	NoLiq	0.50
43.96	29.83	0.68	2.27	115.00	NoLiq	0.50
44.94	16.71	0.39	2.33	115.00	NoLiq	0.50
45.93	32.28	1.08	3.33	115.00	NoLiq	0.50
46.91	26.99	0.95	3.51	115.00	NoLiq	0.50
47.90	48.87	1.56	3.19	115.00	NoLiq	0.50
48.88	34.10	1.27	3.73	115.00	NoLiq	0.50
49.86	31.93	1.01	3.17	115.00	NoLiq	0.50
51.18	27.74	0.79	2.84	115.00	NoLiq	0.50
52.16	15.57	0.40	2.57	115.00	NoLiq	0.50
53.15	33.96	1.40	4.11	115.00	NoLiq	0.50
54.13	15.70	0.34	2.17	115.00	NoLiq	0.50
55.11	13.74	0.23	1.64	115.00	NoLiq	0.50
56.10	19.46	0.37	1.90	115.00	NoLiq	0.50
57.08	16.68	0.44	2.61	115.00	NoLiq	0.50
58.07	16.09	0.37	2.30	115.00	NoLiq	0.50
59.05	18.58	0.49	2.62	115.00	NoLiq	0.50
60.03	19.31	0.59	3.06	115.00	NoLiq	0.50
61.02	16.69	0.60	3.57	115.00	NoLiq	0.50
62.00	74.98	1.69	2.26	118.00	NoLiq	0.50
62.99	32.55	1.31	4.03	115.00	NoLiq	0.50
63.97	35.65	1.53	4.28	115.00	NoLiq	0.50
64.96	23.03	1.01	4.40	115.00	NoLiq	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.86 in.
Settlement of Unsaturated Sands=0.80 in.
Total Settlement of Saturated and Unsaturated Sands=1.66 in.
Differential Settlement=0.832 to 1.098 in.

Depth	CRRm	CSRfs	F.S.	S_sat.	S_dry	S_all

ft				in.	in.	in.
0.98	1.82	0.52	5.00	0.86	0.80	1.66
1.98	0.70	0.52	5.00	0.86	0.80	1.66
2.98	1.04	0.52	5.00	0.86	0.80	1.66
3.98	1.74	0.52	5.00	0.86	0.79	1.65
4.98	1.82	0.52	5.00	0.86	0.79	1.65
5.98	1.11	0.52	5.00	0.86	0.79	1.65
6.98	2.00	0.52	5.00	0.86	0.79	1.65
7.98	2.00	0.51	5.00	0.86	0.79	1.65
8.98	2.00	0.51	5.00	0.86	0.79	1.65
9.98	2.00	0.51	5.00	0.86	0.79	1.65
10.98	2.00	0.51	5.00	0.86	0.79	1.65
11.98	2.00	0.51	5.00	0.86	0.79	1.65
12.98	2.00	0.51	5.00	0.86	0.79	1.65
13.98	2.00	0.51	5.00	0.86	0.79	1.65
14.98	2.00	0.51	5.00	0.86	0.79	1.65
15.98	2.00	0.50	5.00	0.86	0.79	1.65
16.98	0.27	0.50	5.00	0.86	0.66	1.52
17.98	0.23	0.50	5.00	0.86	0.54	1.40
18.98	0.14	0.50	5.00	0.86	0.32	1.18
19.98	0.20	0.50	5.00	0.86	0.08	0.94
20.98	2.00	0.50	5.00	0.86	0.08	0.94
21.98	2.00	0.50	5.00	0.86	0.08	0.94
22.98	0.15	0.50	5.00	0.86	0.00	0.86
23.98	0.19	0.51	0.38*	0.63	0.00	0.63
24.98	0.54	0.51	1.04	0.51	0.00	0.51
25.98	0.28	0.52	0.54*	0.44	0.00	0.44
26.98	0.25	0.53	0.47*	0.23	0.00	0.23
27.98	1.83	0.54	3.38	0.21	0.00	0.21
28.98	0.48	0.55	0.87*	0.20	0.00	0.20
29.98	0.30	0.56	0.55*	0.09	0.00	0.09
30.98	0.35	0.56	0.63*	0.00	0.00	0.00
31.98	2.00	0.56	5.00	0.00	0.00	0.00
32.98	2.00	0.56	5.00	0.00	0.00	0.00
33.98	2.00	0.57	5.00	0.00	0.00	0.00
34.98	2.00	0.57	5.00	0.00	0.00	0.00
35.98	2.00	0.57	5.00	0.00	0.00	0.00
36.98	2.00	0.57	5.00	0.00	0.00	0.00
37.98	2.00	0.57	5.00	0.00	0.00	0.00
38.98	2.00	0.57	5.00	0.00	0.00	0.00
39.98	2.00	0.57	5.00	0.00	0.00	0.00
40.98	2.00	0.57	5.00	0.00	0.00	0.00
41.98	2.00	0.57	5.00	0.00	0.00	0.00
42.98	2.00	0.57	5.00	0.00	0.00	0.00
43.98	2.00	0.57	5.00	0.00	0.00	0.00
44.98	2.00	0.57	5.00	0.00	0.00	0.00
45.98	2.00	0.57	5.00	0.00	0.00	0.00
46.98	2.00	0.57	5.00	0.00	0.00	0.00
47.98	2.00	0.57	5.00	0.00	0.00	0.00
48.98	2.00	0.57	5.00	0.00	0.00	0.00
49.98	2.00	0.56	5.00	0.00	0.00	0.00
50.98	2.00	0.56	5.00	0.00	0.00	0.00
51.98	2.00	0.56	5.00	0.00	0.00	0.00
52.98	2.00	0.56	5.00	0.00	0.00	0.00
53.98	2.00	0.55	5.00	0.00	0.00	0.00
54.98	2.00	0.55	5.00	0.00	0.00	0.00
55.98	2.00	0.55	5.00	0.00	0.00	0.00
56.98	2.00	0.55	5.00	0.00	0.00	0.00
57.98	2.00	0.54	5.00	0.00	0.00	0.00
58.98	2.00	0.54	5.00	0.00	0.00	0.00
59.98	2.00	0.54	5.00	0.00	0.00	0.00
60.98	2.00	0.53	5.00	0.00	0.00	0.00

61.98	2.00	0.53	5.00	0.00	0.00	0.00
62.98	2.00	0.52	5.00	0.00	0.00	0.00
63.98	2.00	0.52	5.00	0.00	0.00	0.00
64.98	2.00	0.52	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: \\FILE-SERVER\use\SVSE Files\SV Main File\SV MAIN FILE\SV (1590-1599)\SV1598 - Castilleja School\SV1598.GI\SV1598. CPT B-9.liq
Title: Castilleja School - Proposed Improvements
Subtitle: 1310 Bryant Street, Palo Alto, CA

Surface Elev.=100
Hole No.=B-9
Depth of Hole= 65.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 31.00 ft
Max. Acceleration= 0.62 g
Earthquake Magnitude= 7.90

Input Data:
Surface Elev.=100
Hole No.=B-9
Depth of Hole=65.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 31.00 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.90
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	Rf pcf	gamma %	Fines mm	D50
0.98	198.30	3.67	1.85	121.00	0.00	0.50
1.97	107.50	3.43	3.19	115.00	NoLiq	0.50
2.95	125.70	3.85	3.06	115.00	NoLiq	0.50
3.94	61.69	3.72	6.03	131.00	NoLiq	0.50
4.92	94.00	3.15	3.35	115.00	NoLiq	0.50
5.91	130.50	1.91	1.47	121.00	NoLiq	0.50
6.89	112.80	1.63	1.44	121.00	0.00	0.50
7.87	88.11	3.32	3.76	115.00	0.00	0.50
8.86	84.19	3.89	4.62	131.00	NoLiq	0.50
9.84	70.82	3.53	4.99	131.00	NoLiq	0.50
10.82	76.47	4.18	5.47	131.00	NoLiq	0.50
11.81	56.57	3.12	5.51	131.00	NoLiq	0.50
13.12	51.92	2.86	5.52	111.00	NoLiq	0.50

14.10	60.65	3.67	6.06	131.00	NoLiq	0.50
15.09	66.47	3.01	4.52	115.00	NoLiq	0.50
16.07	96.51	3.66	3.79	115.00	NoLiq	0.50
17.06	124.60	5.81	4.66	131.00	NoLiq	0.50
18.04	167.50	8.06	4.81	131.00	NoLiq	0.50
19.02	175.70	4.37	2.49	118.00	NoLiq	0.50
20.01	142.50	4.39	3.08	115.00	0.00	0.50
20.99	134.80	2.55	1.89	121.00	0.00	0.50
21.98	108.90	3.43	3.15	115.00	NoLiq	0.50
22.96	190.60	3.46	1.82	121.00	NoLiq	0.50
23.95	127.10	2.20	1.73	121.00	0.00	0.50
24.93	16.86	0.60	3.55	115.00	NoLiq	0.50
25.91	16.76	0.30	1.80	115.00	NoLiq	0.50
26.90	16.32	0.30	1.85	115.00	NoLiq	0.50
27.88	17.77	0.24	1.35	115.00	NoLiq	0.50
28.87	31.14	0.80	2.58	115.00	NoLiq	0.50
29.85	18.89	0.70	3.68	115.00	NoLiq	0.50
30.84	25.66	0.97	3.77	115.00	NoLiq	0.50
31.82	16.00	0.39	2.43	115.00	NoLiq	0.50
33.13	22.52	0.77	3.42	115.00	NoLiq	0.50
34.12	17.78	0.56	3.13	115.00	NoLiq	0.50
35.10	16.78	0.51	3.02	115.00	NoLiq	0.50
36.08	9.81	0.21	2.12	115.00	NoLiq	0.50
37.07	12.95	0.28	2.14	115.00	NoLiq	0.50
38.05	23.60	0.75	3.18	115.00	NoLiq	0.50
39.04	107.90	2.45	2.27	118.00	0.00	0.50
40.02	181.70	1.67	0.92	124.00	0.00	0.50
41.01	26.33	1.10	4.17	115.00	NoLiq	0.50
41.99	19.27	0.33	1.72	115.00	NoLiq	0.50
42.97	19.02	0.40	2.11	115.00	NoLiq	0.50
43.96	75.24	2.20	2.92	115.00	NoLiq	0.50
44.94	30.84	1.14	3.71	115.00	NoLiq	0.50
45.93	49.25	1.24	2.51	115.00	NoLiq	0.50
46.91	60.00	1.72	2.87	115.00	NoLiq	0.50
47.90	46.90	1.85	3.95	115.00	NoLiq	0.50
48.88	83.87	1.96	2.34	118.00	NoLiq	0.50
49.86	26.05	0.47	1.81	115.00	NoLiq	0.50
51.18	27.98	0.77	2.76	115.00	NoLiq	0.50
52.16	17.30	0.57	3.30	115.00	NoLiq	0.50
53.15	41.82	1.82	4.34	115.00	NoLiq	0.50
54.13	19.97	0.59	2.96	115.00	NoLiq	0.50
55.11	35.26	0.93	2.63	115.00	NoLiq	0.50
56.10	36.52	1.25	3.43	115.00	NoLiq	0.50
57.08	29.31	1.22	4.17	115.00	NoLiq	0.50
58.07	20.64	0.65	3.15	115.00	NoLiq	0.50
59.05	17.65	0.43	2.42	115.00	NoLiq	0.50
60.03	18.50	0.46	2.51	115.00	NoLiq	0.50
61.20	27.95	0.72	2.57	115.00	NoLiq	0.50
62.00	43.72	1.58	3.62	115.00	NoLiq	0.50
62.99	29.30	1.02	3.49	115.00	NoLiq	0.50
63.97	26.86	0.93	3.47	115.00	NoLiq	0.50
64.96	25.89	0.84	3.25	115.00	NoLiq	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.39 in.
Settlement of Unsaturated Sands=0.03 in.
Total Settlement of Saturated and Unsaturated Sands=0.42 in.
Differential Settlement=0.211 to 0.278 in.

Depth CRRm CSRfs F.S. S_sat. S_dry S_all

ft				in.	in.	in.
0.98	1.82	0.52	5.00	0.39	0.03	0.42
1.98	2.00	0.52	5.00	0.39	0.03	0.42
2.98	2.00	0.52	5.00	0.39	0.03	0.42
3.98	2.00	0.52	5.00	0.39	0.03	0.42
4.98	2.00	0.52	5.00	0.39	0.03	0.42
5.98	2.00	0.52	5.00	0.39	0.03	0.42
6.98	0.75	0.52	5.00	0.39	0.02	0.42
7.98	1.04	0.51	5.00	0.39	0.01	0.41
8.98	2.00	0.51	5.00	0.39	0.01	0.41
9.98	2.00	0.51	5.00	0.39	0.01	0.41
10.98	2.00	0.51	5.00	0.39	0.01	0.41
11.98	2.00	0.51	5.00	0.39	0.01	0.41
12.98	2.00	0.51	5.00	0.39	0.01	0.41
13.98	2.00	0.51	5.00	0.39	0.01	0.41
14.98	2.00	0.51	5.00	0.39	0.01	0.41
15.98	2.00	0.50	5.00	0.39	0.01	0.41
16.98	2.00	0.50	5.00	0.39	0.01	0.41
17.98	2.00	0.50	5.00	0.39	0.01	0.41
18.98	2.00	0.50	5.00	0.39	0.01	0.41
19.98	2.00	0.50	5.00	0.39	0.01	0.41
20.98	0.42	0.50	5.00	0.39	0.00	0.39
21.98	2.00	0.50	5.00	0.39	0.00	0.39
22.98	2.00	0.50	5.00	0.39	0.00	0.39
23.98	0.30	0.50	0.60*	0.37	0.00	0.37
24.98	2.00	0.51	5.00	0.37	0.00	0.37
25.98	2.00	0.52	5.00	0.37	0.00	0.37
26.98	2.00	0.53	5.00	0.37	0.00	0.37
27.98	2.00	0.54	5.00	0.37	0.00	0.37
28.98	2.00	0.55	5.00	0.37	0.00	0.37
29.98	2.00	0.55	5.00	0.37	0.00	0.37
30.98	2.00	0.56	5.00	0.37	0.00	0.37
31.98	2.00	0.56	5.00	0.37	0.00	0.37
32.98	2.00	0.56	5.00	0.37	0.00	0.37
33.98	2.00	0.56	5.00	0.37	0.00	0.37
34.98	2.00	0.57	5.00	0.37	0.00	0.37
35.98	2.00	0.57	5.00	0.37	0.00	0.37
36.98	2.00	0.57	5.00	0.37	0.00	0.37
37.98	2.00	0.57	5.00	0.37	0.00	0.37
38.98	2.00	0.57	5.00	0.37	0.00	0.37
39.98	0.28	0.57	0.49*	0.20	0.00	0.20
40.98	2.00	0.57	5.00	0.00	0.00	0.00
41.98	2.00	0.57	5.00	0.00	0.00	0.00
42.98	2.00	0.57	5.00	0.00	0.00	0.00
43.98	2.00	0.57	5.00	0.00	0.00	0.00
44.98	2.00	0.57	5.00	0.00	0.00	0.00
45.98	2.00	0.57	5.00	0.00	0.00	0.00
46.98	2.00	0.57	5.00	0.00	0.00	0.00
47.98	2.00	0.56	5.00	0.00	0.00	0.00
48.98	2.00	0.56	5.00	0.00	0.00	0.00
49.98	2.00	0.56	5.00	0.00	0.00	0.00
50.98	2.00	0.56	5.00	0.00	0.00	0.00
51.98	2.00	0.56	5.00	0.00	0.00	0.00
52.98	2.00	0.55	5.00	0.00	0.00	0.00
53.98	2.00	0.55	5.00	0.00	0.00	0.00
54.98	2.00	0.55	5.00	0.00	0.00	0.00
55.98	2.00	0.55	5.00	0.00	0.00	0.00
56.98	2.00	0.54	5.00	0.00	0.00	0.00
57.98	2.00	0.54	5.00	0.00	0.00	0.00
58.98	2.00	0.54	5.00	0.00	0.00	0.00
59.98	2.00	0.53	5.00	0.00	0.00	0.00
60.98	2.00	0.53	5.00	0.00	0.00	0.00

61.98	2.00	0.53	5.00	0.00	0.00	0.00
62.98	2.00	0.52	5.00	0.00	0.00	0.00
63.98	2.00	0.52	5.00	0.00	0.00	0.00
64.98	2.00	0.51	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Corrosivity Tests Summary

CTL # 768-045 **Date:** 1/3/2017 **Tested By:** PJ **Checked:** PJ
Client: Silicon Valley Soil Engineering **Project:** 1310 Bryant St, PA, CA **Proj. No:** SV1598
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		(Redox)		Qualitative	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		E_H (mv)	At Test	by Lead	%	
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
5-1B	-	2-2.5	-	-	3,045	3	100	0.0100	5.9	472	18	-	16.6	Strong Brown Sandy CLAY
5-3B	-	9.5	-	-	-	2	68	0.0068	-	-	-	-	19.9	Brownish Yellow Sandy CLAY
5-5B	-	19.5	-	-	-	<2	27	0.0027	-	-	-	-	7.4	Yellowish Brown Silty SAND w/ Gravel

Santa Clara Valley Water District

5750 Almaden Expressway
San Jose, CA 95118-3686
(408) 265-2600

APPLICATION TO DRILL EXPLORATORY BORINGS

FC 285 (03-26-15)

Date Issued: 12-19-16	Expiration Date: 12-19-17	District Permit No.: E20161219001
Client (if different from property owner):	**Property Owner**: Castilleja School	Name of Business/Residence at Site: Castilleja School
Client's Address: City, State, Zip	Property Owner's Address: 1310 Bryant Street City, State, Zip: Palo Alto, CA 94301	Address of Site: 1310 Bryant Street City, State, Zip: Palo Alto, California
Telephone No.:	Telephone No.: 650-470-7749	Assessor's Parcel No. of Site: Book 124 Page 12 Parcel 34

Consulting Company Name: Silicon Valley Soil Engineering	Drilling Company Name: Gregg Drilling & Testing, Inc.	
Address: 2391 Zanker Road, Suite 350 City, State, Zip: San Jose, CA 95131	Address: 950 Howe Road City, State, Zip: Martinez, CA 94553	
Telephone No.: 408-324-1400	Telephone No.: 925-313-5800	C-57/C-61 License No.: 485165
☐ Check if address or phone number has changed	☐ Check if address or phone number has changed	

In space at right, sketch location of proposed boring(s) in sufficient detail to identify location. In addition to distances to nearest street and intersection, show distances to any existing structures, landmarks, or topographic features.

How many borings will be installed on parcel? 3

☐ Proposed borings on District property/easement (See General Condition F, page 2.)

☐ Within 50 feet of the top of a creek bank or District facility

Proposed depth of boring(s):

☒ 45 to 150 feet
☐ 151 to 300 feet
☐ Over 300 feet

NOTE: No permit is required for borings under 45 feet deep.

Boring Type:	Boring Use:
☐ Hollow stem	☒ Geotechnical Investigation
☐ Rotary	☐ Environmental Investigation
☒ CPT	☐ Material Emplacement
☐ Hydropunch	☐ Sensor Emplacement
☐ Other:	☐ Other:

SITE PLAN
(Please draw accurately)

See Attached

N

SIGNATURES

I understand and agree that all work associated with this permit is required to be done in accordance with Santa Clara Valley Water District (District) Well Ordinance 90-1, the District Well Standards, and conditions of this permit (see page 2). I certify that the information given in this permit is correct to the best of my knowledge and that the signature below, whether original, electronic, or photocopied, is authorized and valid, and is affixed with the intent to be enforceable. I also certify that a right of entry/encroachment agreement has been formalized between the well owner and property owner, if parties differ.

Signature of Property Owner/Agent:	Print/Type Name: SEAN [illegible]	Date: 12/9/16
Signature of Client/Agent:	Print/Type Name: SEAN [illegible]	Date: 12/9/16
Signature of Driller/Agent:	Print/Type Name: SEAN [illegible]	Date: 12/9/16
Signature of Consultant/Agent:	Print/Type Name: SEAN [illegible]	Date: 12/9/16

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686
(408) 265-2600

APPLICATION TO DRILL EXPLORATORY BORINGS

IMPORTANT: A minimum 24-hour notice must be given to Santa Clara Valley Water District Well Inspection Department prior to installing the annular seal. Call (408) 265-2607, ext. 2660. Please allow 10 working days to process permit application.

GENERAL CONDITIONS

A. **District** (telephone 408-630-2660) **must be notified a minimum of one working day before the exploratory boring is backfilled**. An authorized District representative must be on site to witness the sealing operation. This requirement may be waived by an authorized District representative. If the District waives the inspection requirement, the District may request the permittee(s) to furnish certification under penalty of perjury that the seal was constructed in accordance with the District Well Standards.

B. This permit is valid only for the purpose specified herein. Boring destruction methods authorized under this permit may not be changed except by written approval of an authorized District representative, and only if the District believes that such a change will result in equal or superior compliance with the District and State Well Standards (e.g., if the District representative finds that site conditions warrant such a change).

C. This permit is only valid for the Assessor's Parcel No. indicated on it.

D. This permit may be voided if it contains incorrect information.

E. Borings shall be sealed within 24 hours following completion of testing or sampling activities. Borings shall not be left in such a condition as to allow for the introduction of surface waters or foreign materials into them. Borings shall be secured such that they do not endanger public health.

F. If any work associated with this permit will take place on District property/easement, an encroachment or construction permit must be granted by the District's Community Projects Review Unit (telephone 408-630-2350, -2217, or -2253).

G. The permittee(s) shall assume entire responsibility for all activities and uses under this permit and shall indemnify, defend, and hold the District, its officers, agents, and employees, free and harmless from any and all expense, cost, and liability in connection with or resulting from the granting or exercise of this permit including, but not limited to, property damage, personal injury, and wrongful death.

H. Permittees are required to be in full compliance with Cal/OSHA California Labor Code Section 6300.

I. A current C-57 or C-61 Contractor's License is required for work associated with this permit.

J. Permittee, permittee's contractors, consultants, or agents shall be responsible to assure that all materials or waters generated during drilling, boring destruction, and/or other activities associated with this permit will be safely handled, properly managed, and disposed of according to all applicable federal, state, and local statues regulating such. In no case shall these materials and/or waters be allowed to enter, or potentially enter, on- or off-site storm sewers, dry wells, or waterways or be allowed to move off the property where the work is being completed.

K. The driller and consultants (if applicable) shall have an active copy of their Worker's Compensation Insurance on file with District.

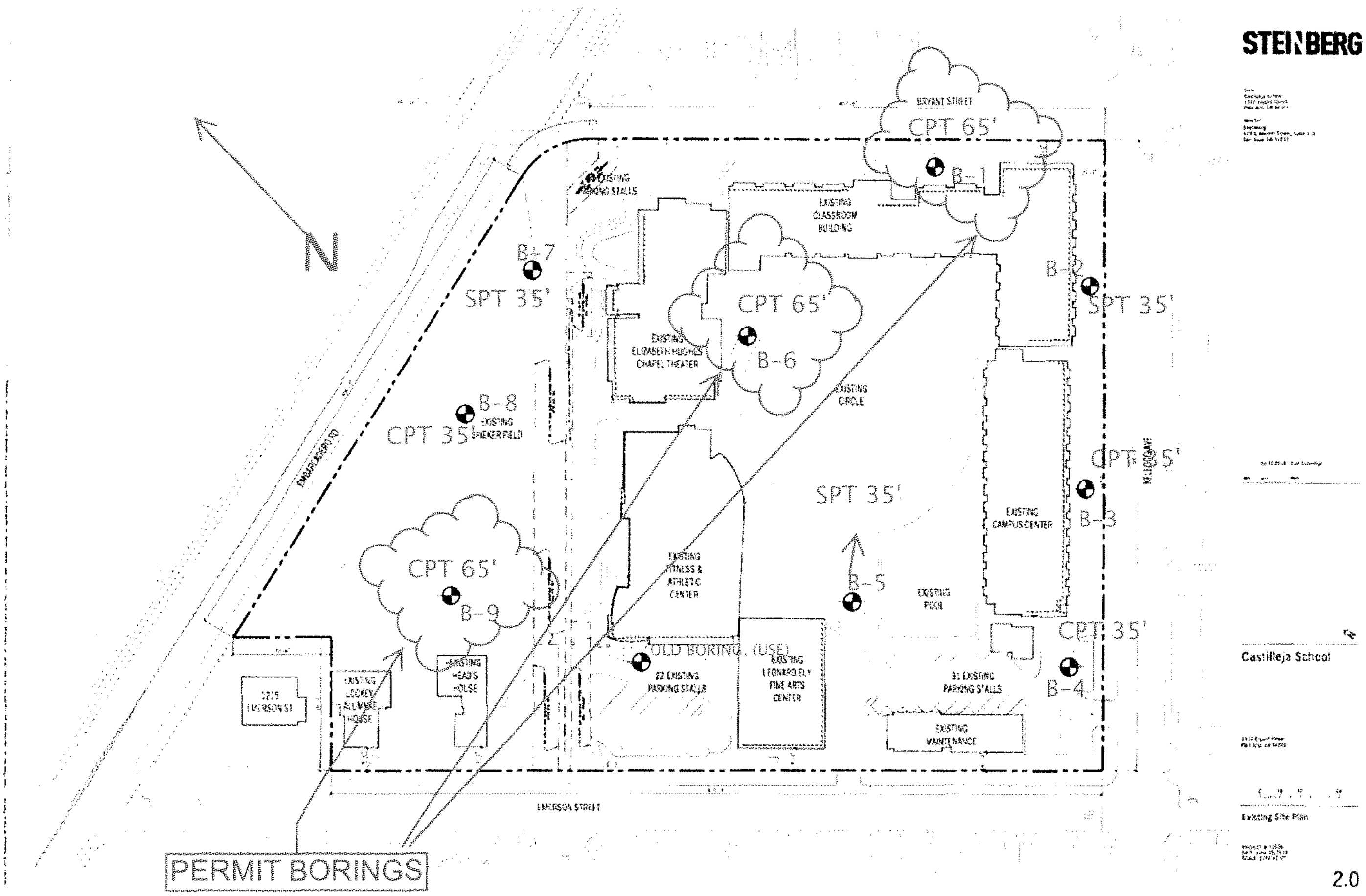
L. This permit shall expire if not exercised within 180 calendar days of its approval, unless an extension of the permit expiration date is granted by an authorized District representative.

M. This permit shall be kept on site during all activities associated with it and shall immediately be presented to an authorized District representative upon request.

N. Permittee shall notify Underground Service Alert (USA) at 1-800-227-2600 or 811 prior to any digging.

Permit Approved by:	Date: 12-19-16

Please allow 10 working days to process this application.



NOTE: ⊕ DENOTES APPROXIMATE EXPLORATORY SOIL BORING LOCATION