GEOTECHNICAL INVESTIGATION
For
Pippin Phase II
APN 048-221-09
APN 019-236-01
Watsonville, California

Prepared For
MidPen Housing
Watsonville, California

Prepared By
HARO, KASUNICH & ASSOCIATES, INC.
Geotechnical & Coastal Engineers
Project No. SC11647
June 2021

Project No. SC11647
30 June 2021

MidPen Housing
275 Main Street, Suite 204
Watsonville, CA 95076

Attention: Mr. Luis Preciado

Subject: Geotechnical Investigation

Reference: Proposed Pippin Phase II Development
APN 048-221-09 (Santa Cruz County)
APN 019-236-01 (City of Watsonville)
Brewington Avenue (no situs address) and 78 Atkinson Lane
Watsonville, California

Dear Mr. Preciado:

In accordance with your authorization, we have performed a Geotechnical Investigation for the referenced properties in Watsonville, California. The accompanying report presents our conclusions and geotechnical design criteria and recommendations, along with the results and methodology of our investigation.

In summary, the proposed construction of 80 multi-unit apartments is feasible from a geotechnical standpoint provided the design criteria and recommendations presented in this report are followed during project design and construction.

Conventional spread footing foundations embedded into an earthen mat of engineered fill are recommended for buildings on the top of a near level hilltop on the north portion of the 14-acre APN 048-221-09. Structural mat slab foundations are recommended for areas underlain by near surface, potentially expansive soil on slopes descending to the wetland development setback line from the hilltop.

If the recommendations in our geotechnical report are followed during project design and construction, the project will be subject to “ordinary risks” as defined in the Scale of Acceptable Risks from Geologic Hazards” in Appendix D of this report. If this level of risk is unacceptable, more extensive mitigation of the hazards is recommended.

If you have any questions concerning the results, conclusions or recommendations presented in this report, please contact our office.

Respectfully Submitted,

HARO, KASUNICH AND ASSOCIATES, INC.

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GEOTECHNICAL INVESTIGATION

Introduction

This report presents the results of our Geotechnical Investigation for the proposed construction of a new 80-unit development, roadway, and improvements on the north portion of an undeveloped 14-acre parcel, APN 048-221-09. Architectural Plans prepared by Dahlin Group, dated 11 January 2021, and Civil Plans prepared by Ifland Engineers, dated 11 January 2021 for the development were provided for our review. We understand that the construction will consist of three, three-story, garden style apartment buildings made of Type V framing with surface parking and site improvements. Site improvements include a new access road off Brewington Avenue, temporary Emergency Vehicle Access (EVA) road off Atkinson Lane, drainage improvements, site retaining walls, and common area.

Purpose

The purpose of our geotechnical investigation was to evaluate the surface and subsurface soil conditions at the site and provide geotechnical design criteria and recommendations for site grading, foundations, slabs-on-grade, retaining walls, drainage, and site improvements.

Scope of Services

The specific scope of our services consisted of the following:

A. Preliminary and Administration. We reviewed geotechnical and geologic information in our files and the Santa Cruz County GIS Website regarding the site and region. We coordinated the field investigation and marked and scheduled Underground Service Alert (USA). We reviewed the report titled *"Feasibility Level Geotechnical Investigation and Engineering Geology Report for Atkinson Lane Development*" prepared by Pacific Crest Engineering Inc., dated March 2009, and the "*Geotechnical Engineering Report Pippen Lane Apartments 56 Atkinson Lane"*, prepared by Earth Systems Pacific, dated 29 April 2013.

B. Subsurface exploration consisting of logging and interval sampling of soils encountered in nine (9) hollow stem augered exploratory test borings utilizing track mounted drilling equipment. Test bore holes were 8 inch in diameter and 20.0 to 51.5 feet deep. The soil samples obtained were sealed and returned to the laboratory for testing.

C. Laboratory testing and classification of select samples obtained was performed. Moisture content and dry density tests of selected samples was performed to evaluate the consistency of the in-situ soils. Soil strength parameters were derived from in-situ field penetration tests (SPT), laboratory saturated direct shear tests, and unconfined compression tests. Atterberg limits tests were performed on select soil samples to evaluate the soil expansion potential. R-Value tests were performed to aid in pavement design by others.

D. Engineering analysis and evaluation using the resulting field and laboratory test data was performed. The analysis included quantitative liquefaction analysis at two locations. Based on our findings, we developed geotechnical criteria and recommendations concerning site grading, foundations, slabs-on-grade, retaining walls, pavement design, and site drainage.

E. Preparation and submittal of this report presenting results of our investigation.

<u>Site Location and Project Description</u>

The project site consists of two privately owned parcels located in Watsonville, California (see Site Vicinity Map, Figure 1 in Appendix A). The primary focus of our investigation is APN 048-221-09, a parcel located at the end of Brewington Avenue. APN 019-236-01 is located 1,300 feet northeast of the intersection of Atkinson Lane and Freedom Boulevard. APN 048-221-09, located in the County of Santa Cruz, is an approximately 14-acre undeveloped parcel with a low-lying wetland in the southwest corner and agricultural farmland over the remainder of the parcel. Parcel 019-236-01, located within the City of Watsonville, is an approximately 0.5-acre undeveloped parcel with a seasonal stream running north to south towards to the wetland. The site is bound by residential development to the north, south, west, and agricultural farmland to the east.

The proposed site of the apartment buildings and improvements is located north of the wetland area, on the near level top of a knoll on APN 048-221-09 with gentle slopes descending to the wetlands. A new roadway will extend from Brewington Avenue, providing access to the new development. A temporary Emergency Vehicle Access (EVA) road off Atkinson Lane is proposed on APN 019-236-01. The wetland area has been determined to be undevelopable. Numerous trees and wetland vegetation surround the low-lying wetland and stream. The developable area on the parcel slopes down to the south at gradients ranging from near level to 6:1 (horizontal to vertical) and is covered with grasses and low-lying shrubs.

Previous Investigation

A previous feasibility geotechnical and geologic study was performed for a 68-acre site that included the 14-acre project parcel studied in this report. The *Feasibility Level Geotechnical Investigation and Engineering Geology Report for Atkinson Lane Development, Watsonville, California,* by Pacific Crest Engineering, Inc., and Zinn Geology is dated 2 March 2009. The investigation included seven (7) borings and four (4) cone penetrometer tests (CPT) near or within the project site. Quantitative liquefaction analysis was performed to assess the potential for soil liquefaction, seismically induced settlement, and lateral spreading. The study concluded seismically induced settlement and lateral spreading exist near the wetland pond in the southwest corner of the project site. A minimum 50 feet development setback from the high-water mark of the pond or the existing riparian/wetlands boundary, whichever distance is greater, was recommended.

Logs of the test borings, laboratory results, and CPT data and analysis has been in included in Appendix A, B, and C of this report.

Field Exploration

On 12 April 2019 and 19 April 2019, nine (9) test bore holes were advanced on APN 048-221-09. Test bore hole locations were distributed around the proposed development area on the hilltop and slopes, around the wetland, and along the presumed alignment of the new street to the development area from Brewington Avenue. The approximate location of test bore holes advanced for this study are shown on our Boring Site Plan (see Figure 3 in Appendix A).

The bore holes were advanced to depths of 20.0 feet and 51.5 feet below ground surface (bgs). The test holes were advanced using a track mounted Geoprobe rig with hollow stem augers.

Representative soil samples were obtained from the exploratory borings at selected depths, or at major strata changes. These samples were recovered using the 3.0-inch O.D. Modified California Sampler (L), the Standard Terzaghi Sampler (T), or loose bulk sample (B).

The penetration resistance blow counts noted on the boring logs were obtained as the sampler was dynamically driven into the in-situ soil. The process was performed by dropping a 140-pound hammer a 30-inch free fall distance and driving the sampler 6 to 18 inches and recording the number of blows for each 6-inch penetration interval. The blows recorded on the boring log represent the accumulated number of blows that were required to drive the last 12 inches are presented on our logs of test borings (see Figures 7 to 17, Appendix A).

The soils encountered in the borings were continuously logged in the field and described in accordance with the Unified Soil Classification System (ASTM D2487). The Boring Logs are included in Appendix B of this report. The Boring Logs denote subsurface conditions at the location and time observed, and it is not warranted as representative of subsurface conditions at other locations or times.

Laboratory Testing

The laboratory testing program was directed toward determining pertinent soil engineering and index properties.

The natural moisture content and density was determined on select samples and is recorded on the Logs of Test Borings at the appropriate depths. Since water has a significant influence on soil, the natural moisture content provides a rough indicator of the soil's compressibility, strength, and potential expansion characteristics. Atterberg limits tests and consolidation tests were performed on select clay samples to index the expansion potential as well as quantify soil swell and settlement. Grain size analysis was performed on select samples to aid liquefaction analysis and soil classification.

Saturated direct shear tests were performed on the in-situ soils. Unconfined compression tests were performed on select samples to determine total stress or undrained strength parameters.

Two R-values tests were performed on bulk samples along the roadway alignment. The R-value test measures the response of a compacted sample of soil or aggregate to a vertically applied pressure under specific conditions.

The results of the field and laboratory testing appear on the "Logs of Test Borings" found in Appendix A and the lab results can be found in Appendix B.

Subsurface Conditions

Soil conditions at the site varied depending on the bore hole locations. The upper 10 feet of soil in our bore holes located on the top of the knoll (B-1, B-4, B-5, and B-6) is comprised of medium dense to dense silty sand and clayey sand and firm to stiff sandy lean clay with weak to moderate cementation. From 10 to 20 feet below ground surface (bgs), the soil in our bore holes consisted of firm to stiff orange brown and olive brown silt, sandy silt, clay, and sandy clay. From 20 to 50 feet the soil in our borings consisted of interbedded layers of firm to very stiff gray, grayish brown, and gray with orange mottled fat clay and plastic silt.

In bore holes on the slope descending to the pond (B-2, B-3, and B-7), the upper 10 feet of soil in our borings is comprised of medium dense clayey sand or firm to stiff lean sandy clay. From 10 to 20 feet bgs, the soil in our bore holes was comprised of firm to stiff clay and silt. From 20 to 50 feet

In Boring B-8, drilled on the east side of the wetland, we encountered firm to stiff olive brown, black, and orange clay from ground surface to the depths explored of 20 feet. In Boring B-9, also drilled on the east side of the wetland, we encountered loose, dark brown silty sand, clayey sand, and sand from the ground surface to the depths explored of 20 feet. See Site Sections, Figure 4 in Appendix A, for a graphical presentation of soil encountered in our bore holes.

Site Geology

A review of the Geologic Map of Santa Cruz County, California (Brabb, Graham, Wentworth, et al, 1997) indicates the site and vicinity is mapped as Qwf: Fluvial Facies (Pleistocene) and Qof: Older Flood Plain Deposits (Holocene). The Fluvial Facies are described as partially consolidated, moderately to well graded silt, sand, silty clay, and gravel. The Older Flood Plain Deposits are described as unconsolidated sand, silt, and clay that are fine-grained (see Site Geologic Map, Figure 2 in Appendix A). The native soils encountered during field exploration are consistent with the mapped geologic deposits. A more detailed description of the site geology is presented in the 2009 PCE report.

Groundwater

Groundwater was encountered during our subsurface exploration at various depths depending on the elevation of the boring. We encountered initial groundwater at 25 feet in Boring B-2, 35 feet in Boring B-4, 18 feet in Boring B-7, 15 feet in Boring B-8, and 9 feet in Boring B-9. At the end of drilling, groundwater levels were recorded at 12 feet in

Boring B-2, 30 feet in Boring B-4, and 5 feet in Boring B-9. At the time of drilling free standing water was present in the wetland. The depth of groundwater is noted on the logs of test borings.

It should be noted that groundwater levels will fluctuate due to variations in rainfall or other factors not evident during our investigation. Groundwater levels were only allowed to stabilize for a few hours. It should be anticipated groundwater conditions will fluctuate based on seasonal factors.

<u>Erosion</u>

Surficial soils at the site have low to moderate erosion potential which can be exacerbated where there are steep slopes and uncontrolled runoff, particularly where the natural drainage is modified by impermeably surfaces common in development. Typically, once the upper surface of the material is breached by a rill or a gully, erosion proceeds at an accelerated rate, and the rills and gullies deepen and migrate headward (upslope). This process may contribute to the initiation of shallow slides if rills and gullies are not mitigated or maintained and if surface drainage controls are not adequately designed and constructed.

<u>Surface Drainage</u>

The project site is located upon a hillside that is mostly undeveloped within the subject parcel. Based on review of our borings at the site the near surface soils have relatively low permeability and will shed surface runoff from the knoll on all sides in a sheet flow type manner. We did not observe indications of runnels or accelerated erosion during our field investigation.

Concentrated runoff from future development should be collected in a controlled manner and conveyed to an appropriate discharge location approved by a representative from our office.

Seismicity

This site is located in the seismically active Monterey Bay Region. The known active faults nearest to the site are the potentially active Zayante Fault zone which passes 0.75 miles (1.28 km) to the northeast, and San Andreas Fault zone, which passes 3.69 miles (5.94 km) to the northeast.

This site, as all sites in Monterey Bay, could be significantly affected by a major earthquake with an epicenter on any one of the active or potentially active faults of the area. At present, it is not possible to predict when or where movement will occur on these or any other faults. However, based on historic records and the general seismicity of this region, it is probable that this site will be shaken by at least one moderate to major earthquake and by numerous minor earthquakes during the next 50 years. Should a moderate to major earthquake occur with an epicenter location close to the property, ground shaking at the site would probably be severe.

Since it is probable that the site will be shaken by at least one moderate to major earthquake, seismic disturbance in addition to ground shaking could include liquefaction, soil densification, and ground rupture.

Another significant seismic hazard for the Bay area is ground rupture. As no faults are known to cross the property, the likelihood of earthquake-induced ground rupture appears remote.

Geotechnical Related Seismicity

The improvements should be designed in conformance with the most current California Building Code (2019 CBC). For seismic design, the soil properties at the site are classified as **Site Class "D"** based on definitions presented in Section 1613.2.2 in the 2019 CBC which refers to Chapter 20 of ASCE 7. The longitude and latitude were determined using a satellite image generated by Google Earth. These coordinates were taken from the approximate middle of the area of the proposed improvements: Longitude = -121.762520°, Latitude = 36.932102°.

The coordinates listed above were used as inputs in the OSHPD seismic design maps created by California Office of Statewide Health Planning and Development (OSHPD) to determine the ground motion associated with the maximum considered earthquake (MCE) S_M and the reduced ground motion for design S_D.

The results are as follows:

Site Class D

S_S= 2.262 g

S_1= 0.861 g

S_{MS}= 2.262 g

S_{M1}= 1.464 g

refer to section 11.4.8 ASCE7-16 for site specific ground motions and exceptions[1]

S_{DS}= 1.508 g

S_{D1}= 0.976 g

refer to section 11.4.8 ASCE7-16 for site specific ground motions and exceptions[1]

A maximum considered earthquake geometric mean (MCE_G) peak ground acceleration (PGA) was estimated using the Figure 22-9 of the ASCE Standard 7-16. The mapped PGA was 0.947 g and the site coefficient F_{PGA} for Site Class D is 1.1. The MCE_G peak ground acceleration adjusted for Site Class effects is $PGA_M = F_{PGA} * PGA$.

$$PGA_M = 1.1 * 0.947 \text{ g} = 1.042 \text{ g}$$

Liquefaction Potential

General

Liquefaction is the rapid loss of shear strength in cohesionless soils subject to dynamic loading, such as from an earthquake. Sometimes the shear strength falls to nearly zero, while other times it drops to a lower-than-normal value. In either case, liquefaction can

1 "EXCEPTION: A ground motion hazard analysis is not required for structures other than seismically isolated structures and structures with damping systems where: … [Exception] 2. Structures on Site Class D sites with S_1 greater than or equal to 0.2 provided the value of the seismic response coefficient C_S is determined by Eq. (12.8-2) for values of $T \leq 1.5 T_S$ and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for $T_L \geq T > 1.5T_S$ or Eq. (12.8-4) for $T > T_L$." ASCE7-16

lead to many kinds of failures, so its evaluation is one of the most important aspects of geotechnical earthquake engineering (Coduto, 1999).

The physical process of seismically induced liquefaction has been documented by numerous researchers (Youd, 1973; Seed and Idriss, 1982; National Research Council, 1985). During an earthquake seismic waves travel through the earth and vibrate the ground. In cohesionless, granular materials having low relative density (e.g., loose sands), this vibration can disturb the particle framework, this leading to increased compaction of the material and reduction of pore space between the framework grains. If the sediment is saturated, water occupying the pore spaces resists this compaction and exerts pore pressure that reduces the contact stress between the sediment grains. With continued shaking, transfer of inter-granular stress to pore water can generate pore pressures great enough to cause the sediment to lose strength and change from a solid state to a liquid state. This mechanical transformation can cause various kinds of ground failure at or near the ground surface.

The liquefaction process typically occurs at depths less than 50 feet below the ground surface. Liquefaction can occur at deeper intervals, given the right conditions. However, ground manifestations have been found to be relatively minor. The most susceptible zone occurs at depths shallower than 30 feet below the ground surface. Diminished susceptibility with increase in depth can be attributed mainly to two factors: increased overburden pressure resulting from the load of overlying sediment layers and increase geologic age. These two factors tend to create a denser packing of sediment grains in the deeper sedimentary materials, which thus are less likely to experience the additional compaction and elevated pore pressures that are necessary to induce loss of shear strength and liquefaction during earthquake.

Liquefaction can lead to several types of ground failure, depending on slope conditions and the geologic and hydrologic setting (Seed, 1968; Youd, 1973; Tinsley et al, 1985). The four most common types of ground failure are: lateral spreading; flow failures; ground oscillation; and loss of bearing strength. Sand boils (injection of fluidized sediment) commonly accompany these different types of ground failure and form sand volcanoes at the ground surface or convolute layering and sand dikes in subsurface sediment layers.

Analysis of Liquefaction Potential and Soil Settlement with Liquefy Pro 5.8b

For both liquefaction potential and soil settlement the methods described above were used with aid of the computer program Liquefy Pro 5.8b Liquefaction and Settlement Analysis.

The program evaluates liquefaction potential and calculates settlement of soil deposits due to seismic loads. The program is based on the most recent publications and gives the user options for selecting different published data and charts to determine adjustment factors to calculate soil settlement. The program was used to determine factors of safety against liquefaction and soil settlement at specified intervals.

Results of Analysis

We analyzed the potential for liquefaction in 50-foot-deep borings at the proposed building areas closest to the wetlands. The results of the liquefaction potential and soil settlement analysis are summarized in the table below for the boundary conditions and methods used. Graphic representations of the analysis are presented in the Appendix C of this report.

Table 1: Liquefaction Potential and Settlement Results

Bore hole No.	Liquefiable zones (ft)	Total Surface Settlement (in.)	Depth of Groundwater Table (ft)
B-2	None	1.19	25
B-4	None	0.27	30

In Boring 9, adjacent to Brewington Avenue, we found loose sand and clayey sand from the surface to the depth explored (20 feet), and groundwater which rose to a depth of 5 feet. There is potential for liquefaction effects in this area, but the effects would most likely be limited to the street pavement and utility lines.

It is noted that liquefaction analysis is an inexact science and mathematical models of the subsurface profiles are simplified, many assumptions are made in construction of the model, not the least of which are isotropy and homogeneity. Factors of safety against liquefaction and calculated soil settlement are used to indicate trend lines. A soil layer with a factor of safety against liquefaction less than one will not necessarily liquefy, but the probability is greater than a layer of soil with a factor of safety against liquefaction greater than one. Conversely a soil layer with a factor of safety against liquefaction greater than one may liquefy, but the probability of this is less than that of a soil layer with a lower factor of safety. The same is true for calculated total soil settlement. A subsurface model with total soil settlement of 2 inches does not mean after a seismic event the surface will have exactly 2 inches of settlement aerially. A better interpretation of this information is the probability of settlement to occur after a seismic event on a subsurface model with 2 inches of total settlement is greater than that of a subsurface model with 1 inch of settlement.

The peak horizontal ground acceleration (a_{max}) was used to calculate the cyclic stress ratio (CSR). We used Figure 22-7 of the ASCE Standard 7-10 to determine the horizontal peak ground acceleration (a_{max}) of 1.042.

Previous Study

As part of the feasibility study conducted by Pacific Crest Engineering, Inc., liquefaction potential, settlement, and lateral spreading were analyzed near the building site with CPT-12, CPT-13, and CPT-14, as shown on Figure 3 in Appendix A. The assessment concluded that the potential for seismically induced liquefaction and lateral spreading are high near the wetland. We concur with the report that the recommended 50 feet setback from the wetland area or high-water mark, whichever is greater, will mitigate the risk due to lateral spreading to an ordinary level. The recommended setback is adhered to in this report.

Table 2: Pacific Crest Engineering, Inc. Liquefaction, Lateral Spreading, and Settlement Results

Bore hole No.	Liquefiable zones (ft)	Total Surface Settlement (in.)	Lateral Spreading (in.)	Depth of Groundwater Table (ft)
CPT-12	None	0.14	0.59	25
CPT-13	None	0.00	0.00	25
CPT-14	0 – 30	4.31	16.57	0

Discussion of Liquefaction Risk

The results of our liquefaction assessment are presented in Table 1 and the results of the PCE analysis is presented in Table 2. The potential for liquefaction phenomena occurrence appears minimal at the proposed building area within the prescribed setback. Southeast of the wetland, near the proposed road alignment, there is higher potential for liquefaction effects as indicated by the loose sand and high groundwater found in Boring B-9. The proposed road and utilities in this area may be damaged in the event of a major earthquake. Sub-excavation of loose near near-surface soil in the roadway alignment and re-densification of the soil as a thickened earthen mat of engineered fill will reduce the potential for damage to the road from liquefaction effects during strong seismic shaking. Flexible connections for utility lines in this area will reduce the potential for damage to utility lines.

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our subsurface exploration, laboratory testing, and analysis, the proposed development at the referenced site is acceptable from a geotechnical standpoint provided the geotechnical criteria and recommendations presented in this report are followed during plan preparation and construction.

The primary geotechnical considerations at the site include providing adequate foundation support for new buildings, settlement potential, cut/fill slopes, the recommended 50-foot setback from the wetland, expansion potential of clay soil on the slope descending to the wetlands, and control of concentrated surface runoff.

Based on the results our subsurface exploration and the previous study, we concur with the recommendation presented in the 2009 PCE Feasibility Study that a minimum 50 feet development setback from the existing riparian/wetlands boundary or high-water mark of the pond, whichever is greater, will mitigate the risk due to lateral spreading to an ordinary level.

The top 5 to 10 feet of soil on the hilltop consists of loose tilled topsoil, underlain by medium dense silty and clayey sand and lean stiff clay of low expansion potential. The loose tilled soil extended to depths of 12 inches in our borings and was reported to be up to 2 feet deep in the Feasibility Report by PCE. To provide firm uniform support for building foundations and minimize the potential for settlement, we recommend the soil within building footprints and 5 feet beyond be removed to a depth of 2 feet below the bottom of footings and redensified as engineered fill. Provided the soil on the hilltop is removed and replaced as engineered fill, as recommended, conventional spread footing foundations may be used for the apartment structures. We estimate the total depth of soil to be removed and replaced as engineered fill will be 3–4 feet, depending on footing depth. On site native soils with a PI < 15 are suitable for reuse as engineered fill.

As the 6:1(H: V) slope descends to the wetlands, the thickness of surficial silty sand and clayey sand in the top 5 feet thins and clay soil with moderate to high expansion potential will be exposed at or near the ground surface. To provide firm uniform support for proposed buildings which will be constructed on the slope and reduce the potential for damage due to expansive soil, we recommend structures be supported on reinforced concrete structural mat foundations or post-tension slab foundations. The foundations should be underlain by a minimum of 12 inches of non-expansive engineered fill. We have indicated the preliminary limits of the area where structural mat foundations are recommended on the Boring Site Plan (see Figure 3 in Appendix A).

The proposed structures and improvements at the referenced site will be subject to "ordinary risks", as defined in the "Scale of Acceptable Risks from Geologic Hazards" in Appendix D of this report provided the design criteria and recommendations presented in this report are incorporated into the design and construction of the proposed project and maintained for the life of the development.

We recommend **Haro, Kasunich & Associates, Inc.** be commissioned to review project grading and foundation plans before construction and to observe, test and advise during earthwork and foundation construction. This additional opportunity to examine the site will allow us to compare subsurface conditions exposed during construction with those inferred from this investigation. Unusual or unforeseen soil conditions may require supplemental evaluation by the geotechnical engineer.

The following recommendations should be used as guidelines for preparing project plans and specifications,

Site Grading

1. The geotechnical engineer should be notified **at least four (4) working days prior to any grading or foundation excavating** so the work in the field can be coordinated with the grading contractor and arrangements for testing and observation can be made. The recommendations of this report presume that a

representative from HKA will perform the required testing and observation during grading and construction. It is the owner's responsibility to make the necessary arrangements for these required services.

2. Where referenced in this report, Percent Relative Compaction and Optimum Moisture Content shall be based on ASTM Test Designation D1557.

3. Areas to be graded or to receive proposed improvements should be cleared of all obstructions and fill materials, including trees not designated to remain and other unsuitable material. Existing depressions or voids created during site clearing should be backfilled with engineered fill. Any surface or subsurface obstructions, or questionable material encountered during grading, should be brought immediately to our attention for proper exposure, removal and processing as directed.

4. Cleared areas should then be stripped of organic-laden topsoil. Stripping depth is anticipated to be from 2 to 4 inches, although the actual depth of stripping should be determined in the field by a representative from HKA. Strippings should be wasted off-site or stockpiled for use in landscaped areas, if desired.

5. Following clearing and stripping of the building areas, soil within the proposed building footprints and 5 feet beyond should be sub-excavated to a minimum depth of 2 feet below the bottom of footings on the top of the knoll and 1 foot below the bottom of the structural mat foundation in the area on the slope where structural mat foundations are recommended. If loose soil is found at the bottom of the recommended sub-excavation, it should be removed and replaced with engineered fill. The base of the sub-excavations should be scarified, moisture conditioned (or allowed to dry as necessary) to produce a moisture content about 3 – 5 percent above the laboratory optimum value and uniformly compacted at 90 percent relative compaction.

6. On site clayey sand, silty sand, and sandy clay (PI<15) soil may be re-used as engineered fill for building pads on the hilltop. Engineered fill in the area designated for structural mat slab foundations should be select non-expansive engineered fill such as Class II or Class IV aggregate base should be placed in thin lifts not exceeding 8 inches in loose thickness, water conditioned to a moisture content about 3–5 percent above optimum moisture content and compacted to a minimum of 90 percent relative compaction. The upper 6-inches of slab subgrade should be compacted to a minimum of 95 percent relative compaction. Aggregate base below pavements should likewise be compacted to a minimum of 95 percent relative compaction.

7. If grading is performed during or shortly after the rainy season, the grading contractor may encounter compaction difficulty, such as pumping or bringing free water to the ground surface. If compaction cannot be achieved after adjusting the soil moisture content, it may be necessary to over excavate the subgrade soil, replace it with angular crushed rock and stabilize it with soil stabilization fabric. We estimate the depth of over excavation will range from 12” to 24”, depending on conditions. The need for ground stabilization should be determined in the field during construction by the geotechnical engineer.

8. Provided the on site can be adequately moisture conditioned (or dried back) prior to use, the on-site soils appear generally suitable for use as engineered fill. Material which must be imported should be free of organic and deleterious material, contain no rocks or clods over 4 inches in dimension, and should contain no more than 15 percent by weight of rocks larger than 2½ inches. Imported select fill should also have a Plasticity Index of less than 15 and should have sufficient binder to allow excavations to stand without caving. Prior to delivery to the site, a representative sample of proposed import should be sent to our laboratory for evaluation.

9. We estimate shrinkage factors of about 15 and 25 percent for the import select fill and on-site materials respectively when used in engineered fills.

Cut and Fill Slopes

10. Temporary excavations should be properly shored and braced during construction to prevent sloughing and caving at sidewalls. The contractor should be aware of all CAL OSHA and local safety requirements and codes dealing with excavations and trenches.

11. Temporary cut slopes into native soils over 5 feet high should be inclined no steeper than 1½:1(horizontal to vertical) up to 10 feet in height. Temporary cut slopes are considered those that will remain from 24 hours up to the following rain season. Permanent cut slopes should be inclined no steeper than 3:1. Cut slopes with a height greater than 10 feet must be evaluated by the geotechnical engineer so that additional recommendations can be provided, as needed. The top of all cut slopes should be rounded off to remove topsoil and reduce soil sloughing. If seepage is observed, HKA should be notified immediately. Cut slopes with these recommended gradients may require periodic maintenance to remove minor soil sloughing and will be subject to soil creep.

12. Compacted fill slopes up to 10 feet high should be constructed at slope inclinations no steeper than 3:1 (horizontal to vertical). Fill slopes over 10 feet high should be evaluated and approved by the geotechnical engineer. Fill slopes with these recommended gradients may require periodic maintenance to remove minor soil sloughing and may be subject to creep. All fills must be constructed with base keys at the toe of the embankment and subsequent benches. The base keys and benches should be excavated into stiff or medium dense native soils. Base keys and benches should be at least 8 feet wide and sloped into the hillside a minimum of 2 percent. Fill slope keyway and benches should have subdrains. The location of subdrains and outlets should be determined by the geotechnical engineer in the field during grading.

13. Long term creep may occur on cut and fill slopes at this site from swelling and shrinking of the clay soils. Drainage features, patios, and landscapes areas should account for this in planning and design.

14. Following grading, exposed soil should be planted as soon as possible with erosion-resistant vegetation.

15. After the earthwork operations have been completed and HKA has made the required observations of the work, no further earthwork operations shall be performed without the direct observation of HKA.

Soil Settlement

16. If fill slopes up to 10 feet are proposed the increase in overburden stress on the clay soils is anticipated to result in soil settlement. Designers of near surface features in these areas such as walkways, patios, and utilities should anticipate total settlement of 2 inches and differential settlement of 1 inch. As the fill wedge thins out to 3 feet thick or less, a more typical 1 inch and ½ inch of total and differential settlement can be expected.

Building Codes

17. Project design and construction should conform to the following current building codes:
    - 2019 California Building Code (CBC)
    - 2019 Green Building Standards Code (CAL Green)

Conventional Spread Footing Foundations

18. The buildings on the hilltop may be supported on conventional spread footing foundations embedded into an earthen mat of engineered fill as described in the section title “General Site Grading”.

19. The continuous spread footing foundations should be founded a minimum 18 inches into engineered fill and be a minimum of 15 inches wide. Actual footing depths and widths should be determined in accordance with anticipated use and applicable building code and design standards. The continuous footings should have a minimum of four (4) No. 4 reinforcement bars, two in the bottom and two in the top. Continuous footings should be reinforced as required by the structural designer based on the actual loads transmitted to the foundation.

20. Spread footing foundations designed in accordance with the above may be designed for an allowable soil bearing pressure of 2,000 psf for dead plus live loads. This value may be increased by one-third to include short-term seismic and wind loads. Structural reinforcing should be determined by the structural engineer based on loads (live and dead) that are transmitted to the foundation.

21. Lateral load resistance for structures supported on spread footings may be developed in friction between the foundation bottom and the supporting subgrade. A friction coefficient of 0.33 is considered applicable.

22. Footings located adjacent to other footings or utility trenches should have their bearing surfaces founded below an imaginary 1½:1 plane projected upward from the bottom edge of the adjacent footings or utility trenches.

23. Total and differential settlements under the proposed light building loads are estimated to be less than 1 inch and ½ inch, respectively.

24. All footing excavations should be thoroughly cleaned and observed by the geotechnical engineer <u>prior to placing forms and steel.</u> Observation of foundation excavations allows anticipated soil conditions to be correlated to those inferred from our investigation and to verify that the footings are in accordance with our recommendations.

Structural Mat Slab Foundation

25. Buildings constructed within the area designated for Mat Slab Foundations (see Boring Site Plan, Figure 3 in Appendix A) should be supported by reinforced concrete structural mat slab foundations. Structural mat slabs should be 8 to 12 inches thick. Alternatively, post-tension slabs may be constructed. Design criteria and recommendations for post-tension slabs was beyond the scope of our work. If requested, post-tension slab criteria and recommendations can be developed.

26. Structural mat slab foundations should be supported by a 12-inch-thick mat of select engineered fill placed and compacted as recommended in the grading section of this report.

27. The mat of select non-expansive engineered fill should extend a minimum of 5 horizontal feet beyond the outer edges of the slab in all directions.

28. Stiffened foundations constructed to the given criteria may be designed for the following allowable bearing capacities:
    a) *Use 1,200 pounds per square foot as an allowable bearing capacity.*
    b) A one-third increase for seismic loading
    c) Coefficient of friction of 0.30. As an alternative an adhesion value of 1000 psf can be applied to the bottom surface of the slabs.
    d) Use 58 pounds per cubic inch (pci) for a modulus of subgrade reaction for soils encountered in basement floor of Building C and 145 pci for modulus of subgrade reaction for soil encountered in the first-floor level of Building C.

Concrete Slabs-On-Grade

29. Slabs-on-grade should be supported by a minimum of 12 inches of engineered fill prepared in accordance with our section title, “General Site Grading”.

30. To reduce the potential for cracking and curling as well as other undesirable defects the concrete slab-on-grade design, placement, and curing should be done in accordance with the most recent version of ACI 302.1R-04.

31. HKA presumes floor wetness would be unacceptable for these buildings for reasons such as moisture sensitive floor covering and interior humidity control. To minimize potential for floor wetness, the interior concrete slab floor should be underlain with a vapor retardant membrane such as Stego Wrap Vapor Barrier (15 mil thickness). Vapor retardant membranes should be overlapped a minimum of 6 inches at the joints and carefully fitted around service openings. Whether to locate the vapor barrier in direct contact with the slab or beneath a blotter layer of granular fill should be made with careful considerations to many factors directly and indirectly related to concrete construction. Such factors include but are not limited to, whether a water-tight roof membrane is in place prior to slab construction, sequence of slab construction in relation to other construction activities requiring water, and the floor covering manufacturer's recommendations. Proposed installation should be independently evaluated as to the moisture-related sensitivity of subsequent floor finishes, project conditions, schedule, and the potential effects of slab curling and cracking.

32. If a blotter layer of granular fill over the vapor barrier is selected it should be a minimum of 4 inches thick, trimmable, and compactible at low moisture content (4 to 5 percent). The use of cushion or clean sand with uniform particle size is not recommended for use as a blotter layer of granular fill. Crusher run material graded from 3/4 inch down to rock dust is suitable. The blotter layer of granular fill should be compacted to a minimum of 95 percent relative compaction in accordance with ASTM D1557. Following compaction, the surface should be choked off with a fine graded material and proof rolled to reduce friction between the granular fill and the slab. To prevent the granular fill from becoming a water reservoir (contributing to floor wetness) it will be imperative to keep it dry after preparation has been completed.

33. Considering the reduced permeability of the redensified on-site soils and the possibility of consistent irrigation of landscaping around the development, a free draining granular material to act as capillary break is recommended below the slab. The granular material should be comprised of a minimum 4-inch-thick layer of a permeable material that meets the requirements of a Caltrans Class I Type A gradation (Section 68.202F(2) Cal Trans Std. Spec.). A thin layer approximately 1 inch thick of fine graded material should be proof rolled over the permeable material using a drum roller before installation of the vapor barrier to reduce the possibility of puncture.

34. We recommend the specifications for slab-on-grade floors require moisture emission tests be performed on the slab prior to the installation of flooring. No flooring should be installed until safe moisture emission levels are recorded for the type of flooring to be used.

Retaining Wall Lateral Pressures

35. Retaining walls should be designed to resist both lateral earth pressures and any additional surcharge loads. For design of retaining walls up to 12 feet high and fully drained, the following design criteria may be used.

   A. Active earth pressure for walls allowed to yield is that exerted by an equivalent fluid weighing 45 pcf for a level backslope gradient; and 55 pcf for a 3:1 (horizontal to vertical) backslope gradient. This assumes a fully drained condition.

   B. Where walls are restrained from moving at the top, design for a uniform rectangular distribution equivalent to 30H psf per foot for a level backslope, and 36H psf per foot for a 3:1 backslope, where H is the height of the wall.

   C. Retaining walls can be supported by shallow foundations embedded a minimum of 12 inches into engineered fill or firm native soil provide there is a minimum horizontal distance of 5 feet between the bottom of footings and adjacent slopes.

D. Walls with footings embedded in and underlain by engineered fill may be designed for an allowable bearing capacity of 2,000 psf. This value may be increased by one-third to include short-term seismic and wind loads. A coefficient of friction between concrete and soil = 0.33 may be used.

E. Walls with footings embedded in undisturbed native soil may be designed for an allowable bearing capacity of 1,250 psf. This value may be increased by one-third to include short-term seismic and wind loads. A coefficient of friction between concrete and soil = 0.30 may be used.

F. In addition, the walls should be designed for any adjacent live or dead loads which will exert a force on the wall (garage and/or auto traffic).

G. Retaining walls that act as interior house walls should be thoroughly waterproofed. A waterproofing expert should be consulted with to ensure proper installation.

36. To account for seismic loading, a horizontal line load surcharge equal to 12H pounds per linear foot of wall may be assumed to act at 0.6H above the base of the wall (where H is the height of the wall).

37. The above lateral pressure values assume that the walls are fully drained to prevent hydrostatic pressure behind the walls. Drainage materials behind the wall should consist of either Class 1, Type A permeable material complying with Section 68 of Caltrans Standard Specifications, latest edition.

38. The drainage material should be at least 12 inches thick. The drains should extend from the base of the walls to within 12 inches of the top of the backfill. A perforated pipe should be placed (holes down) about 4 inches above the bottom of the wall and be tied to a suitable drain outlet. Wall backdrains should be capped at the surface with clayey material to prevent infiltration of surface runoff

into the backdrains. A layer of filter fabric (Mirafi 140N or equivalent) should separate the subdrain material from the overlying soil cap.

Surface Drainage

39. An engineered drainage plan to handle surface runoff should be developed for this site. Site drainage should be adequately controlled both during and after construction.

40. Due to the impermeable nature of the in-situ clay soils on-site retention is not recommended for this project site.

41. All exposed soil should be landscaped and permanently protected against erosion as soon as possible after grading.

42. We recommend that full gutters be used along all roof down eaves to collect storm runoff water and channel it through closed rigid conduits to a suitable discharge point away from all structural improvements.

43. Surface runoff should **not** be allowed to flow onto graded or natural slopes. Consideration should be given to catch basins, berms, concrete v-ditches, or drainage swales at the top of all slopes to intercept runoff and direct it to a suitable discharge point.

44. Surface drainage should include provisions for positive gradients so that surface runoff is not permitted to pond adjacent to foundations and on pavements. Surface drainage should be directed away from the building foundations, at a minimum gradient of 5 percent for a distance of at least 10 feet to an adequate discharge point. Concentrations of surface water runoff should be handled by providing necessary structures, solid pipes, catch basins, etc.

45. Irrigation activities at the site should be done in a controlled and reasonable manner. Planter areas should not be sited adjacent to walls; otherwise, measures should be implemented to contain irrigation water and prevent it from seeping into walls and under foundations.

46. The migration of water or spread of extensive root systems below foundations, slabs, or pavements may cause undesirable differential movements and subsequent damage to these structures. Landscaping should be planned accordingly.

47. Drainage patterns approved at the time of fine grading should be maintained throughout the life of proposed structures.

Pavement Design

48. R-value tests were performed on representative soil samples collected from the east side of the wetland area on 19 April 2019. The results of the testing indicated an R-value = 20 at Boring B-9 and R-value <5 at Boring B-8. We designed the roadway with an R-value of 5 considering the clay type soils found around the wetland perimeter.

49. Three traffic indices (TI) of 5, 6, and 7 were evaluated for the design of the asphalt pavement sections for the new roadway and parking areas. The project Civil Engineer should determine the appropriate traffic index for the anticipated traffic usage. If a different traffic index is desired or required, please contact our office and a recommended asphalt concrete pavement structural section can be provided.

50. Flexible (asphalt concrete) pavement sections have been designed according to Caltrans methods including a factor of safety on the asphalt layer thickness and using a 20-year pavement life. The pavement section designs, based on a design R-value <5, are shown on the table below.

TABLE 1: Pavement Sections

Subgrade R-Value	Traffic Index	Pavement Section		
-	-	Asphalt Concrete[1] (Inches)	Aggregate Base[2] (Inches)	Aggregate Sub-base[3] (Inches)
5	5	3.0	10.0	-
5	5	3.0	5.0	6.0
5	6	4.0	13.0	-
5	6	4.0	5.0	8.0
5	7	5.0	12.0	-
5	7	5.0	7.0	9.0

1) Type A or B Asphalt Concrete
2) Class 2 Aggregate Base (minimum R-value = 78)
3) Class 2 Aggregate Sub-base (minimum R-value = 50)

51. Pavement areas should not be allowed to be contaminated with organic materials. Where stripping involves topsoil and organics then these materials should be removed including loose soils, etcetera, and any required cuts. A minimum of 12 inches of compacted subgrade should be provided beneath the pavement sections. The subgrade should be moisture conditioned to over the optimum moisture percentage and compacted to at least 95 percent relative compaction based on ASTM Test Method D1557. Class 2 Aggregate base should be moisture conditioned to slightly over the optimum moisture percentage and compacted to at least 95 percent relative compaction based on ASTM Test Method D1557.

52. Studies have indicated that a major factor in extending pavement life is to provide adequate drainage for both the pavement surface and subgrade. Care should be taken during the development of the grading plan to plan for good drainage. Landscaped and irrigated planters that are adjacent to the pavements should

have cut-off curbing constructed around them that extends a minimum of 6 inches into the subgrade soil (subgrade in this case is that material beneath the pavement structural section). The recommend pavement sections assume periodic maintenance, such as crack sealing, will be performed over the life of the pavements. Where heavy trucks, such as garbage trucks or buses will travel or make sharp turns, heavier asphalt sections or rigid concrete pavements should be considered.

Soil Corrosivity

53. Based on review of the documents in our file and results of laboratory tests run by Pacific Crest Engineers, Inc., soil samples collected from the site are not considered corrosive.

Utility Trenches

54. Trenches must be properly shored and braced during construction or laid back at an appropriate angle to prevent sloughing and caving at sidewalls. The project plans and specifications should direct the attention of the contractor to all CAL OSHA and local safety requirements and codes dealing with excavations and trenches.

55. Utility trenches that are parallel to the sides of buildings should be placed so that they do not extend below an imaginary line sloping down and away at a 1.5:1 (horizontal to vertical) slope from the bottom outside edge of footing elements. The structural design professional should coordinate this requirement with the utility layout plans for the project.

56. Trenches should be backfilled with granular-type material and uniformly compacted by mechanical means to the relative compaction as required by county specifications, but not less than 95 percent under paved areas and 90 percent elsewhere. The relative compaction will be based on the maximum dry density

obtained from a laboratory compaction curve run in accordance with ASTM Procedure D1557-10.

57. We strongly recommend placing a three-foot (3') concrete plug in each trench where it passes under the exterior foundations. Care should be taken not to damage utility lines.

58. Trenches should be capped with a minimum 1 foot of relatively impermeable soil.

Plan Review, Construction Observation and Testing

59. HKA should be provided the opportunity for review of the project plans during project planning and prior to construction so we can evaluate if our geotechnical recommendations were properly interpreted and implemented. The review also allows us to determine if this report is adequate and complete for the final planned grading and construction and update this report and include additions or qualifications, as necessary. If our firm is not accorded the opportunity of making the recommended reviews, we can assume no responsibility for misinterpretation of our recommendations.

60. We recommend that HKA review the final project plans prior to submittal to public agencies, to expedite project review. The recommendations presented in this report require our observation and testing of the earthwork and foundation excavations. Observation of grading and foundation excavations allows anticipated soil conditions to be correlated to those actually encountered in the field during construction.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The conclusions and recommendations noted in this report are based on probability and in no way imply that the proposed improvements will not possibly be subjected to ground failure or seismic shaking so intense they will be severely damaged or destroyed.

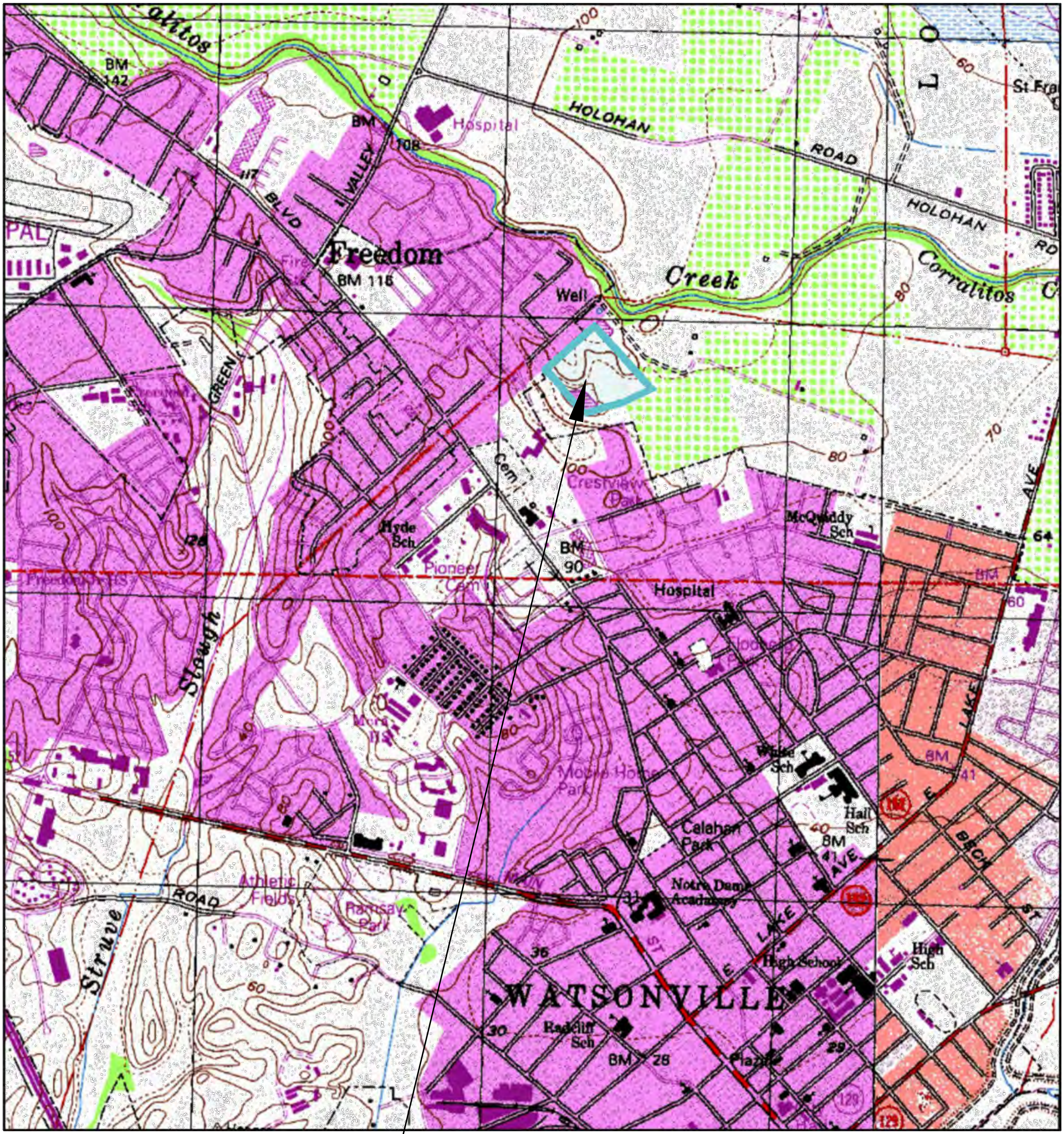
2. This report is issued with the understanding that it is the duty and responsibility of the owner or his representative or agent to ensure that the recommendations contained in this report are brought to the attention of the architects and engineers and contractors for the project, incorporated into the plans and specifications, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The conclusions and recommendations contained herein are professional opinions derived in accordance with current standards of professional practice in the Santa Cruz County area. No other warranty, expressed or implied, is made.

4. If any unexpected variations in soil conditions, or if adverse soil conditions are encountered during construction, or if the proposed construction will differ from that planned at the present time, Haro, Kasunich and Associates should be notified so that supplemental recommendations can be given.

5. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or partially, by changes outside our control. Therefore, this report should not be relied upon after a period of three years without being reviewed by a geotechnical engineer.

APPENDIX A



1:19,200

0 0.15 0.3 0.6 mi

0 0.25 0.5 1 km

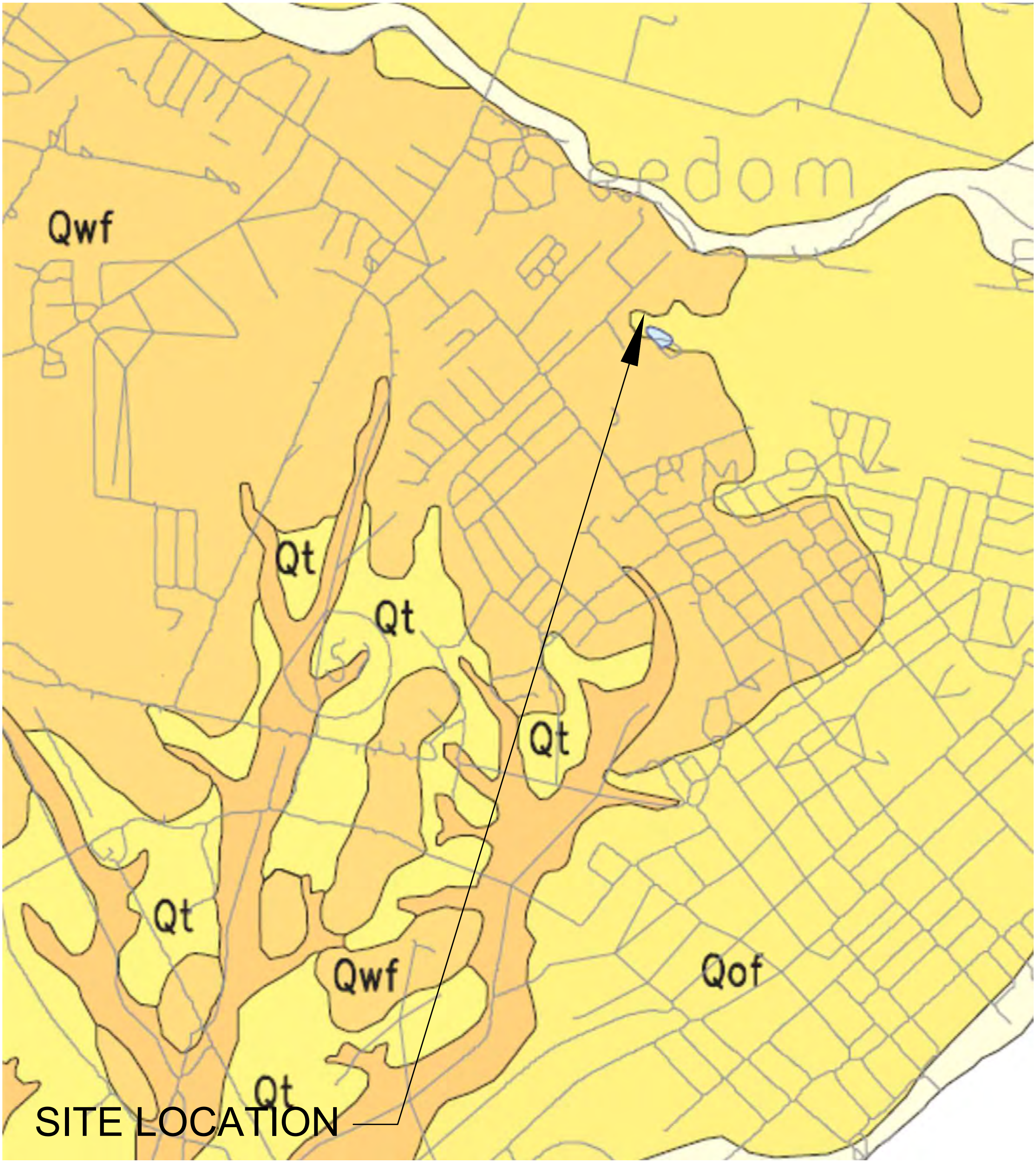
FROM:

SANTA CRUZ COUNTY GIS, DATED MAY 2019.

SITE VICINITY MAP
BREWINGTON AVENUE SUBDIVISION
WATSONVILLE, CALIFORNIA
APN: 019-236-01 & 048-221-09

SCALE: AS SHOWN	
DRAWN BY: AJB	
DATE: APR 2019	HARO, KASUNICH & ASSOCIATES, INC. GEOTECHNICAL AND COASTAL ENGINEERS 116 E. LAKE AVENUE, WATSONVILLE, CA 95076 (831) 722-4175
REVISED:	
JOB NO. SC11647	SHEET NO.

FIGURE NO. 1



KEY:

Qwf: FLUVIAL FACIES (PLEISTOCENE)
Qof: OLDER FLOOD-PLAIN DEPOSITS (HOLOCENE)
Qt: TERRACE DEPOSITS, UNDIFFERENTIATED (PLEISTOCENE)

FROM:

GEOLOGIC MAP OF SANTA CRUZ COUNTY, CALIFORNIA
COMPILED BY
EARL E. BRABB
DIGITAL DATABASE PREPARED BY S. GRAHAM, C. WENTWORTH, D. KNIFONG, R. GRAYMER AND J. BLISSENBACHH
1997

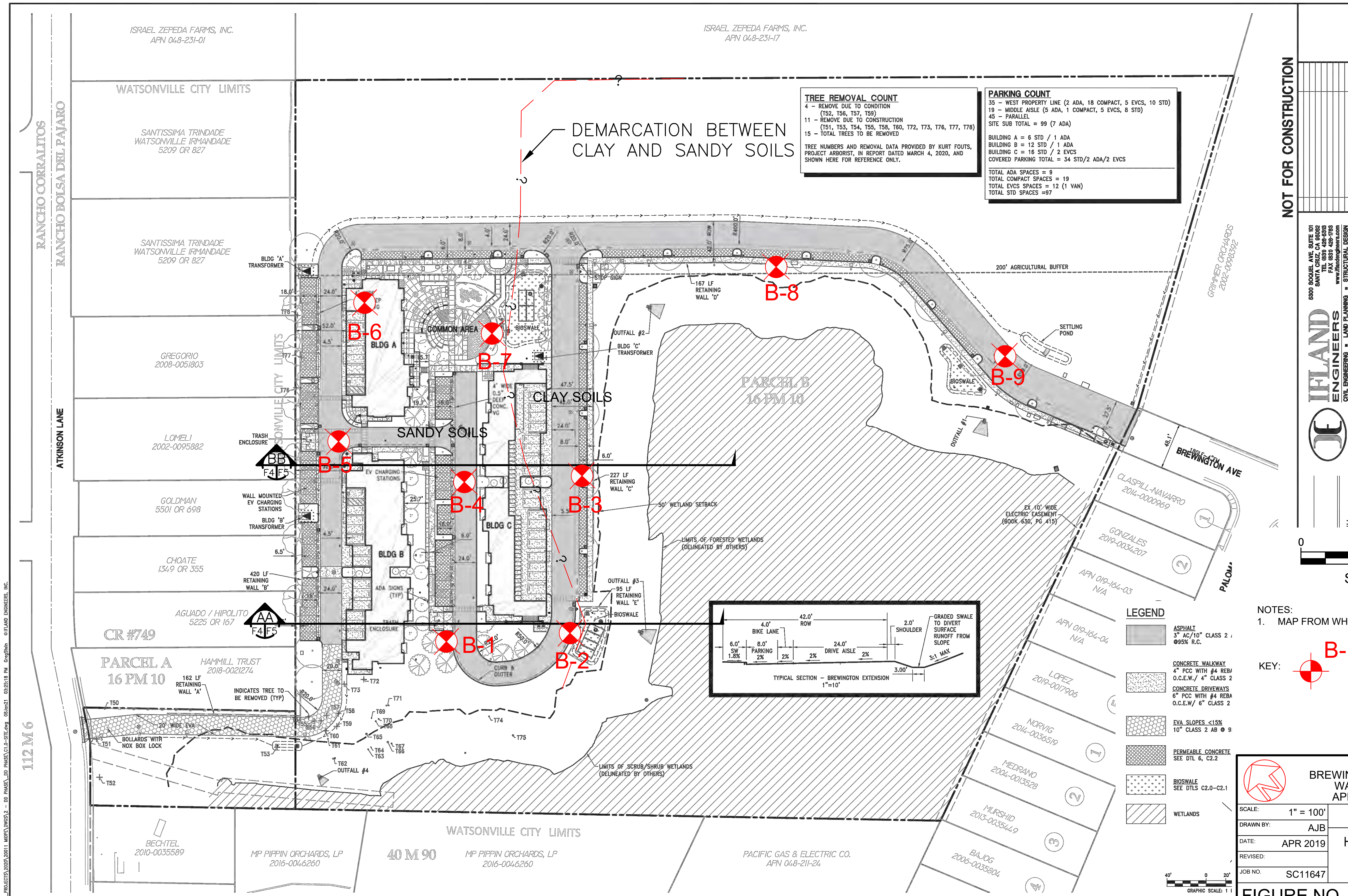
REGIONAL GEOLOGIC MAP
BREWINGTON AVENUE SUBDIVISION
WATSONVILLE, CALIFORNIA
APN: 019-236-01 & 048-221-09

SCALE:	NTS
DRAWN BY:	AJB
DATE:	APR 2019
REVISED:	
JOB NO.	SC11647

HARO, KASUNICH & ASSOCIATES, INC.
GEOTECHNICAL AND COASTAL ENGINEERS
116 E. LAKE AVENUE, WATSONVILLE, CA 95076
(831) 722-4175

FIGURE NO. 2

SHEET NO.



0 100' 200'

SCALE: 1" = 100'

NOTES:

1. MAP FROM WHITSON ENGINEERS, DATED 11 JANUARY 2021.

KEY: B-1 = HKA SOIL BORING LOCATION

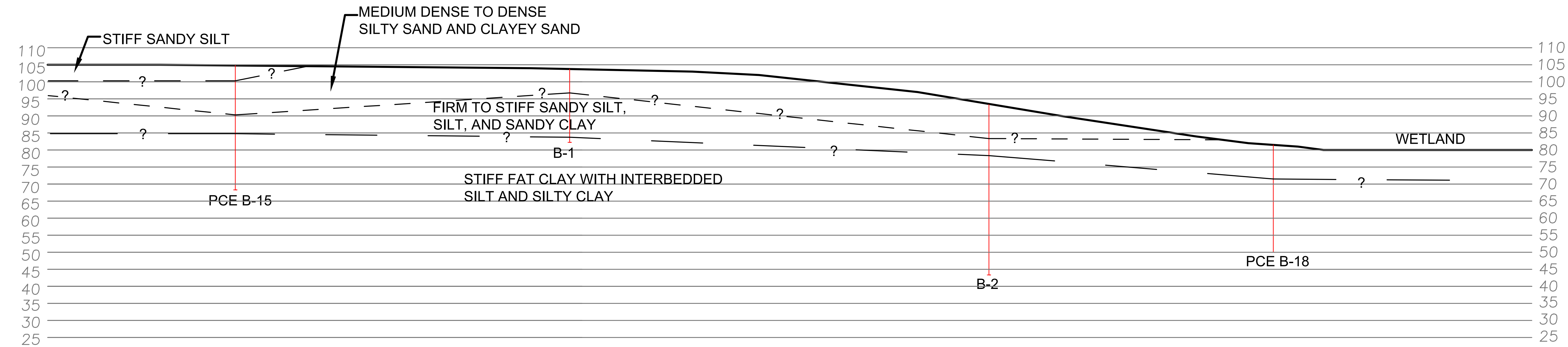
BORING SITE PLAN
BREWINGTON AVENUE SUBDIVISION
WATSONVILLE, CALIFORNIA
APN: 019-236-01 & 048-221-09

SCALE:	1" = 100'
DRAWN BY:	AJB
DATE:	APR 2019
REVISED:	
JOB NO.	SC11647

HARO, KASUNICH & ASSOCIATES, INC.
GEOTECHNICAL AND COASTAL ENGINEERS
116 E. LAKE AVENUE, WATSONVILLE, CA 95076
(831) 722-4175

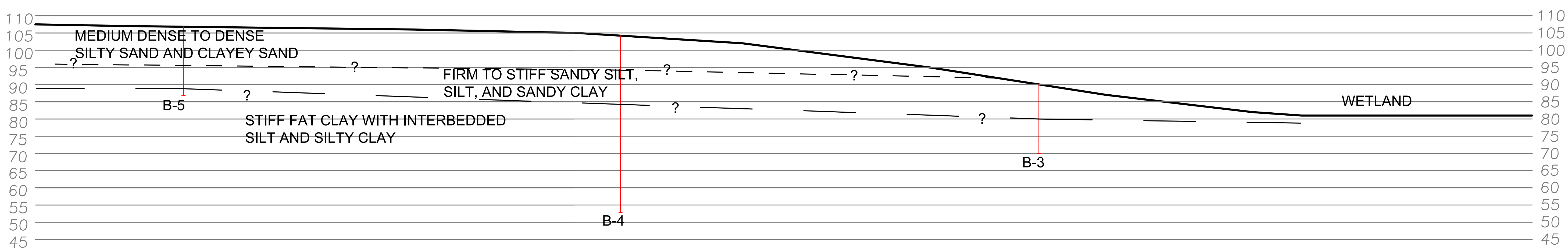
FIGURE NO. 3

SHEET NO.



SECTION AA F4 F5

SCALE: 1" = 30'



SECTION BB F4 F5

SCALE: 1" = 30'

0 30' 60'

SCALE: 1" = 30'

SECTIONS
BREWINGTON AVENUE SUBDIVISION
WATSONVILLE, CALIFORNIA
APN & 048-221-09

SCALE:	1" = 30'
DRAWN BY:	AJB
DATE:	APR 2019
REVISED:	
JOB NO.	SC11647

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GEOTECHNICAL AND COASTAL ENGINEERS
116 E. LAKE AVENUE, WATSONVILLE, CA 95076
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FIGURE NO. 4

SHEET NO.

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRADED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
			GP	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
		GRAVEL WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES.
	SAND — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTYRES, NON-PLASTIC FINES.
			SC	CLAYEY SANDS, SAND-CLAY MIXTYRES, PLASTIC FINES.
FINE GRADED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYES — LIQUID LIMIT LESS THAN 50%		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY.
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY.
	SILTS AND CLAYES — LIQUID LIMIT GREATER THAN 50%		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS.
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS.
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS.
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS.

U.S. STANDARD SERIES SIEVE **GRAIN SIZES** CLEAR SQUARE SIEVE OPENINGS

200 40 10 4 3/4" 2" 12"

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

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS PER FOOT*
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH (TSF)**	BLOWS PER FOOT*
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

SAMPLING METHOD

STANDARD PENETRATION TEST	T	
MODIFIED CALIFORNIA	MC	
PITCHER BARREL	P	
SHELBY TUBE	S	
BULK	B	

WATER

FINAL	
INITIAL	
WATER LEVEL DESIGNATION	

KEY TO LOGS
BREWINGTON AVENUE SUBDIVISION
WATSONVILLE, CALIFORNIA
APN: 019-236-01 & 048-221-09

SCALE:	NTS
DRAWN BY:	AJB
DATE:	APR 2019
REVISED:	
JOB NO.	SC11647

HARO, KASUNICH & ASSOCIATES, INC.
GEOTECHNICAL AND COASTAL ENGINEERS
116 E. LAKE AVENUE, WATSONVILLE, CA 95076
(831) 722-4175

FIGURE NO. 5

SHEET NO.

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-12-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-1

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0	1-1-1 (L)		Brown and orange mottled Sandy CLAY, damp, stiff	CL	23				
	1-2 (T)		Brown Silty SAND, damp, dense, weak to moderate cementation	SM	32			12.0	(1-2) Sieve Analysis Gravel = 1% Sand = 57% Fines = 42% (1-2) Atterberg Limits LL = 18 PL = 15 PI = 4
5									
	1-3-1 (L)		Orangish brown Sandy SILT, moist, stiff, weak cementation	ML	18		96.7	22.4	
10									
15									
20	1-4 (T)		Orange and olive brown Fat CLAY, damp, stiff	CH	9				
			Boring terminated at 21.5 feet						
25									
30									
35									

SuperLog CivilTech Software, USA www.civiltech.com File: C:\superlog4\HKALOGS\SC11647 Brewington Avenue Subdivision.log Date: 6/18/2019

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr **FIGURE NO.** 6

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-19-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-2

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0	2-1-1 (L)		Brown with orange mottling Clayey SAND, moist, medium dense, weak cementation	SC	29		105	21	(2-1-1) Direct Shear C = 500 psf ϕ = 35 degrees
	2-2 (T)		Same		20				
5	2-3-1 (L)				33		104	13	(2-3-1) #200 Wash Fines = 23%
10	2-4-1 (L)		Olive brown with orange mottling, SILT, firm-stiff	ML	11		82	37	(2-4-1) #200 Wash Fines = 97%
15	2-5-1 (L)		Grayish brown FAT CLAY, moist, stiff	CH	17		87	36	(2-5-1) #200 Wash Fines = 100% (2-5-1) Atterberg Limits LL = 79% PL = 18 PI = 62
20	2-6-1 (L)				17		96	28	(2-6-1) #200 Wash Fines = 100%
25	2-7-1 (L)				12		104	17	(2-7-1) #200 Wash Fines = 100%
30	2-8-1 (L)		Gray and orange mottled plastic SILT, moist, stiff	ML	12		94	31	(2-8-2) #200 Wash Fines = 99%
35									

SuperLog CivilTech Software, USA www.civiltech.com File: C:\superlog4\HKALOGS\SC11647 Brewington Avenue Subdivision.log Date: 6/18/2019

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-19-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-2

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
35	2-9-1 (L)		Dark gray with orange mottling, FAT CLAY, very moist, very stiff	CH	16		92	32	(2-9-1) #200 Wash Fines = 100%
40	2-10-1 (L)		Dark gray Silty CLAY, very moist, stiff, interbedded layers of CLAY and SILT	CL	16		90	33	(2-10-1) #200 Wash Fines = 100%
45	2-11-1 (L)				21		93	33	(2-11-1) #200 Wash Fines = 100%
50	2-12-1 (L)		Gray FAT CLAY, very moist, very stiff	CH	23		92	30	(2-12-1) #200 Wash Fines = 100%
			Boring terminated at 51.5 feet						
55									
60									
65									
70									

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr FIGURE NO. 8

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-19-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-3

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0									
	3-1-1 (L)		Brownish orange Sandy CLAY, damp, stiff	CL	13				
	3-2 (T)		Firm		4				
5									
	3-3-1 (L)		Orange and olive brown Silty CLAY, damp, firm	CL	8				
10									
	3-4-1 (L)		Grayish brown CLAY, damp, firm	CL-CH	13				
	3-5 (T)				9				
			Stiff						
15									
20			Boring terminated at 20 feet						
25									
30									
35									

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HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-12-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-4

Depth, ft.	Sample No. and type	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0	4-1-1 (L)	Dark brown and orange Sandy CLAY/Clayey SAND, moist, medium dense	SC-CL	46		119	15	(4-1-1) Unconfined Qu = 4884 psf
		Brown Clayey SAND, dense, damp	SC					
5	4-2-1 (L)	Brown Sandy CLAY, moist, very stiff	CL	25		104.8	22.1	
10	4-3-1 (L)	Olive brown and orange organic SILT, very moist, stiff	CL	22		100	30	(4-3-1) #200 Wash Fines = 91% (4-3-1) Atterberg Limits LL = 32 PL = 15 PI = 18
15	4-4-1 (L)	More SAND	ML	14		93	33	(4-4-1) #200 Wash Fines = 74%
20	4-5-1 (L)	Brownish gray FAT CLAY, very moist, stiff	CH	18		91	28	(4-5-1) #200 Wash Fines = 100%
25	4-6-1 (L)			23		100	25	(4-6-1) #200 Wash Fines = 100%
30	4-7-1 (L)			14		91	30	(4-7-1) #200 Wash Fines = 100%
35								

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr FIGURE NO. 10

HKA Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-12-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-4

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
35	4-8-1 (L)		Olive brown and orange plastic SILT, very moist, firm	MH	13		91	34	(4-8-1) #200 Wash Fines = 100%
40	4-9-1 (L)		Grey FAT CLAY, very moist, firm, decomposed wood	CH	12		91	30	(4-9-2) #200 Wash Fines = 98%
45	4-10-1 (L)		Gray SILT, very moist, stiff, plastic	ML-MH	28		97	31	(4-10-1) #200 Wash Fines = 95%
50	4-11-1 (L)		Gray with brown mottling FAT CLAY, very moist, stiff, decomposed wood Boring terminated at 51.5 feet	CH	24		95	28	(4-11-1) #200 Wash Fines = 100%
55									
60									
65									
70									

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr **FIGURE NO.** 11

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-12-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-5

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0			Dark brown Clayey SAND (tilled topsoil)						
	5-1-1 (L)		Olive brown and orange Clayey SAND, moist, medium dense, moist	SC	20		105	22	(5-1-1) Unconfined Qu = 7,870 psf
	5-2 (T)		Brown Clayey SAND, moist, very dense, moderate cementation		70				
5	5-1-3 (L)		Dense		55				
10	5-4 (T)		Mottled orangish brown and olive brown, Clayey SAND, moist, medium dense	SC	10				
15									
	5-5 (T)		Olive brown and orange CLAY, moist, soft	CL-CH	3				
20			Boring terminated at 20 feet						
25									
30									
35									

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr **FIGURE NO.** 12

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-12-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-6

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0			Dark brown Clayey SAND (tilled topsoil)	SC					
	6-1-1 (L)		Olive brown Sandy Lean CLAY, moist, stiff	CL	7		115	15	(6-1-1) Unconfined Qu = 5,135 psf
	6-2 (T)		Light brown Silty SAND, damp, dense	SM	38			10	(6-1-1) Atterberg Limits LL = 26 PL = 15 PI = 12
5	6-3 (T)		Very dense		52				(6-2) #200 Wash Fines=44%
10	6-4 (T)		Medium dense		15				
15	6-5 (T)		Olive brown and orangish brown Sandy SILT, damp, stiff	ML	11				
20			Boring terminated at 20 feet						
25									
30									
35									

HARO, KASUNICH AND ASSOCIATES, INC.

HARO, KASUNICH & ASSOCIATES, INC.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-12-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-7

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0	7-1-1 (L)		Olive brown Clayey SAND, damp, medium dense	SC	24		132	15	(7-1-1) Direct Shear C = 200 psf ϕ = 39 degrees
	7-2 (T)				12				
5	7-3-1 (L)		Olive brown and orange mottled Sandy CLAY	CL	17				
	7-4 (T)				7				
10									
15									
	7-5 (T)		Grayish brown FAT CLAY, moist, stiff	CH	7				
20			Boring terminated at 20 feet						
25									
30									
35									

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr **FIGURE NO.** 14

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-19-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-8

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0									
	8-1-1 (L)		Olive brown and black CLAY, very moist, firm	CL	7		83	40.2	R-value < 5 (8-1-1) Unconfined Qu = 1,340 psf
	8-2 (T)		Olive brown and orange CLAY, very moist, stiff		7				
5	8-3 (T)		Stiff		9				
10									
15	8-4-1 (L)		Olive brown and orange Silty CLAY, firm, very moist	CL	10				
	8-5 (T)				4				
20			Boring terminated at 20 feet						
25									
30									
35									

HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr FIGURE NO. 15

Haro, Kasunich & Associates, Inc.

Brewington Avenue Subdivision

PROJECT NO. SC11647

LOGGED BY AJB **DATE DRILLED** 4-19-19 **BORING DIAMETER** 6" HSA **BORING NO.** B-9

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft - lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0	9-1-1 (L)		Dark brown silty fine SAND, moist, loose	SM	2			9.5	R-value = 20
5	9-2-1 (L)		Dark brown Clayey SAND, moist, loose	SC					
10	9-3-1 (L)		Dark brown medium SAND, wet, loose	SP	3				
15	9-4-1 (L)		Brown with olive brown Clayey SAND, moist, loose	SC	7				
20			Boring terminated at 20 feet						
25									
30									
35									

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HARO, KASUNICH AND ASSOCIATES, INC.

BY: sr **FIGURE NO.** 16

APPENDIX B

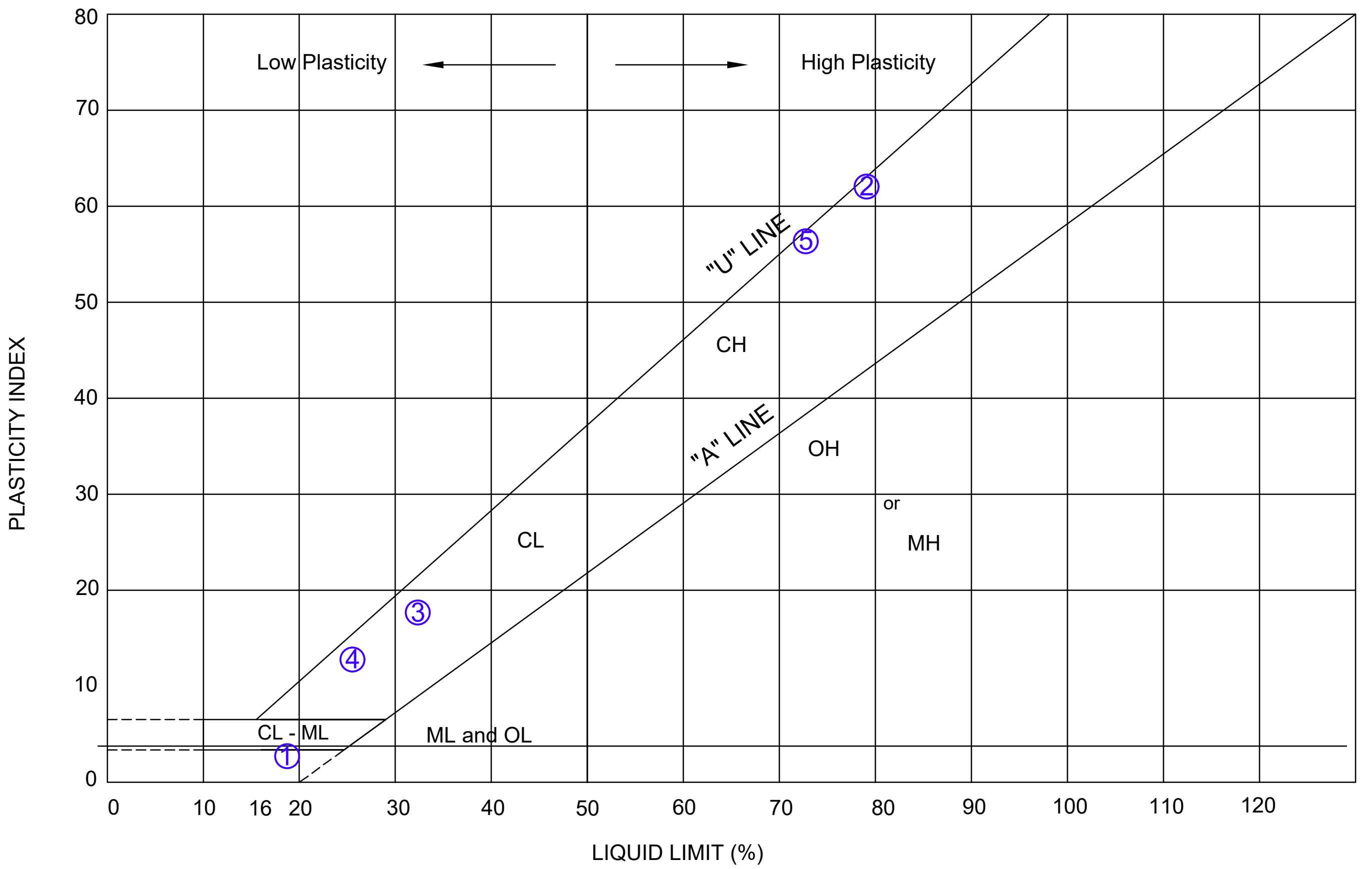
Atterberg Limits Test (Figure 1)

Unconfined Compress Test (Figure 2-5)

Direct Shear Test Result (Figures 6-7)

R-Value Test (Figures 8-9)

PLASTICITY CHART



PLASTICITY DATA

Key Symbol	Sample Number	Depth (feet)	Natural Water Content W(%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index	Liquidity Index W - PL / LL -PL	Unified Soil Classification Symbol
①	1-2	2.5	12	15	18	4	-1.00	ML
②	2-5-1	15.0	36	18	79	62	0.30	CH
③	4-3-1	10.0	30	15	32	18	0.90	OL
④	6-1-1	2.5	15	15	26	12	0.00	CL
⑤	8-1-1	2.5	-	16	72	57	-	CH

ATTERBURG LIMITS TEST RESULTS
BREWINGTON AVENUE SUBDIVISION
WATSONVILLE, CALIFORNIA
APN: 019-236-01 & 048-221-009

SCALE:	NA
DRAWN BY:	AJB
DATE:	APR 2019
REVISED:	
JOB NO.	SC11647

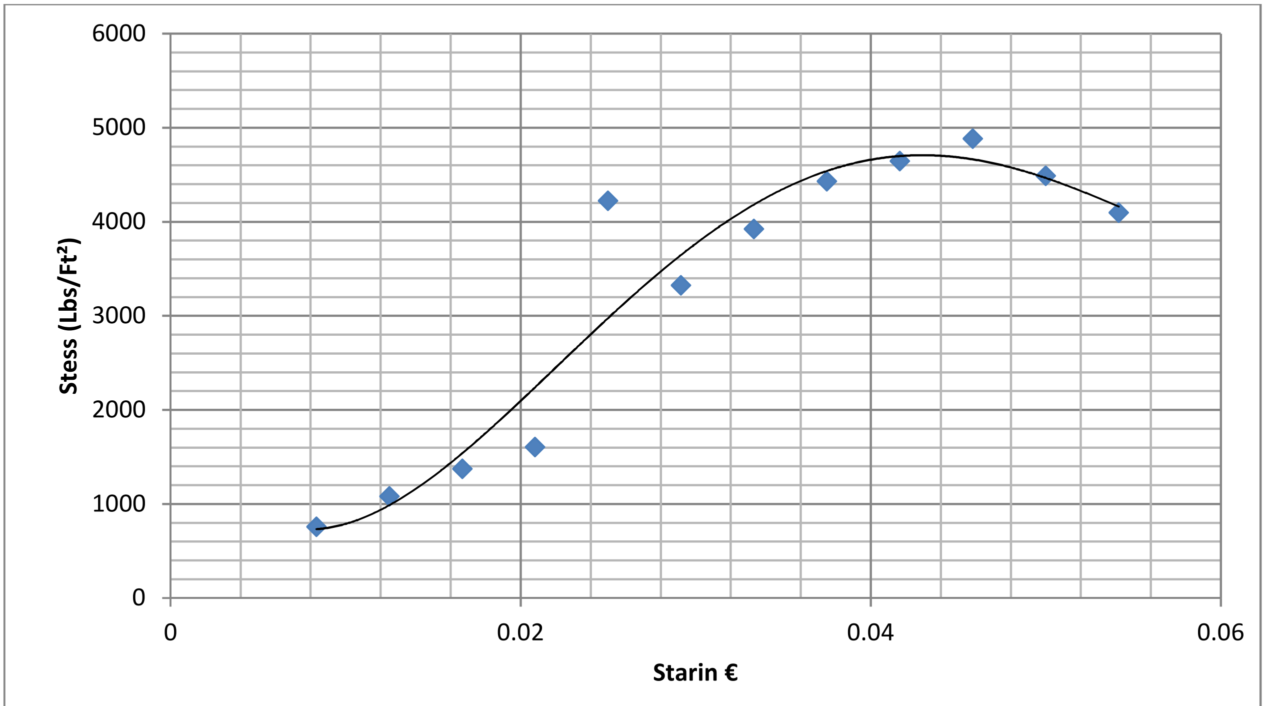
HARO, KASUNICH & ASSOCIATES, INC.
GEOTECHNICAL AND COASTAL ENGINEERS
116 E. LAKE AVENUE, WATSONVILLE, CA 95076
(831) 722-4175

FIGURE NO. 1

SHEET NO.

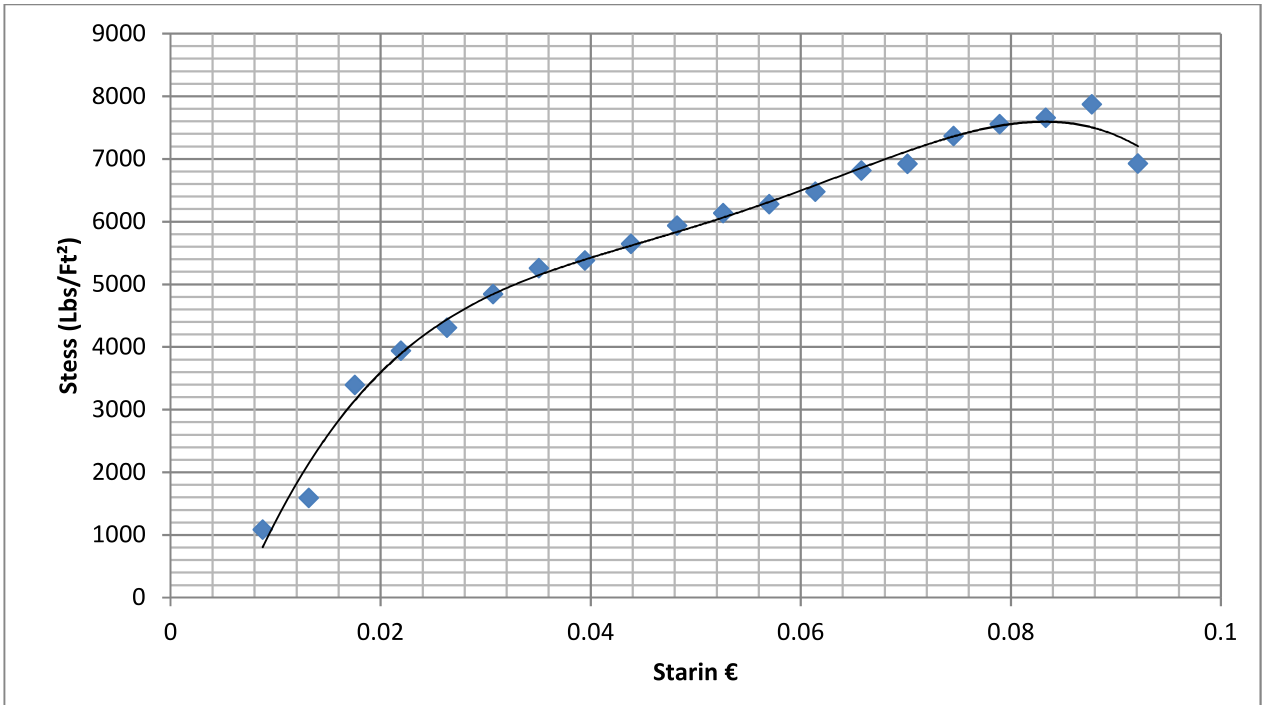
`

Triaxial and Unconfined Compression Test



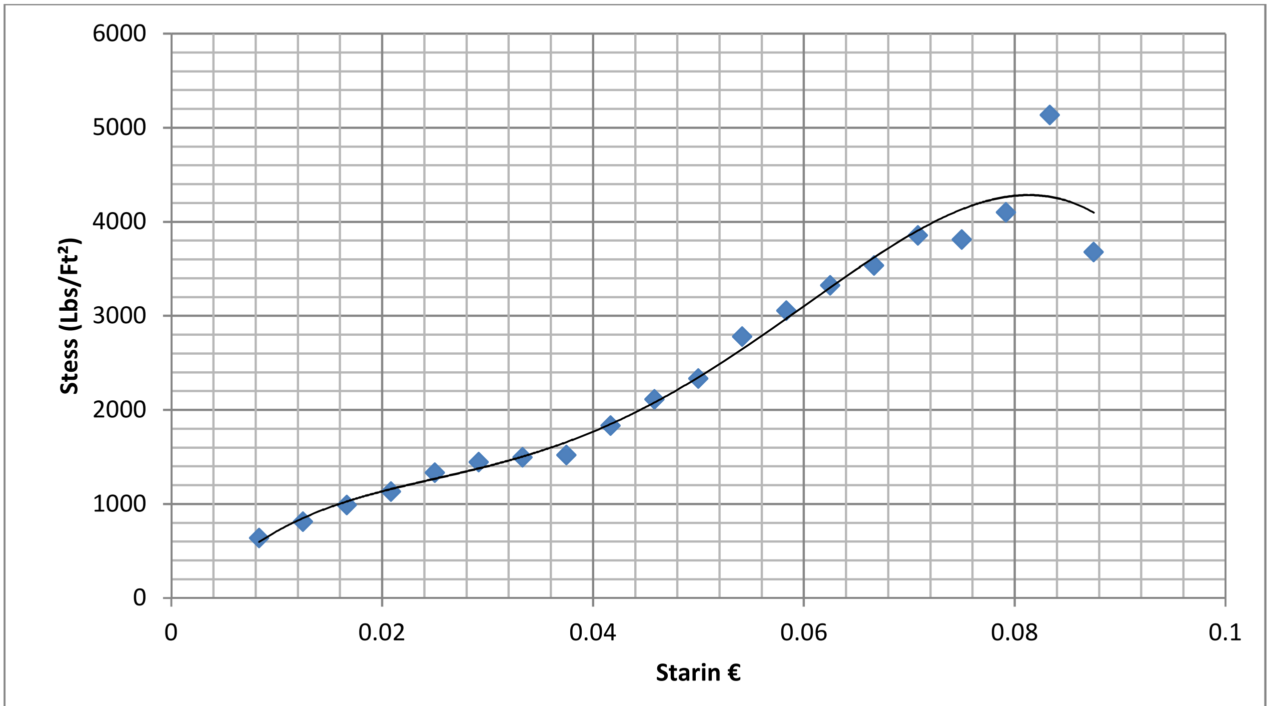
Job	SC11647
Sample	4-1-1
Depth (ft)	2.5

Triaxial and Unconfined Compression Test



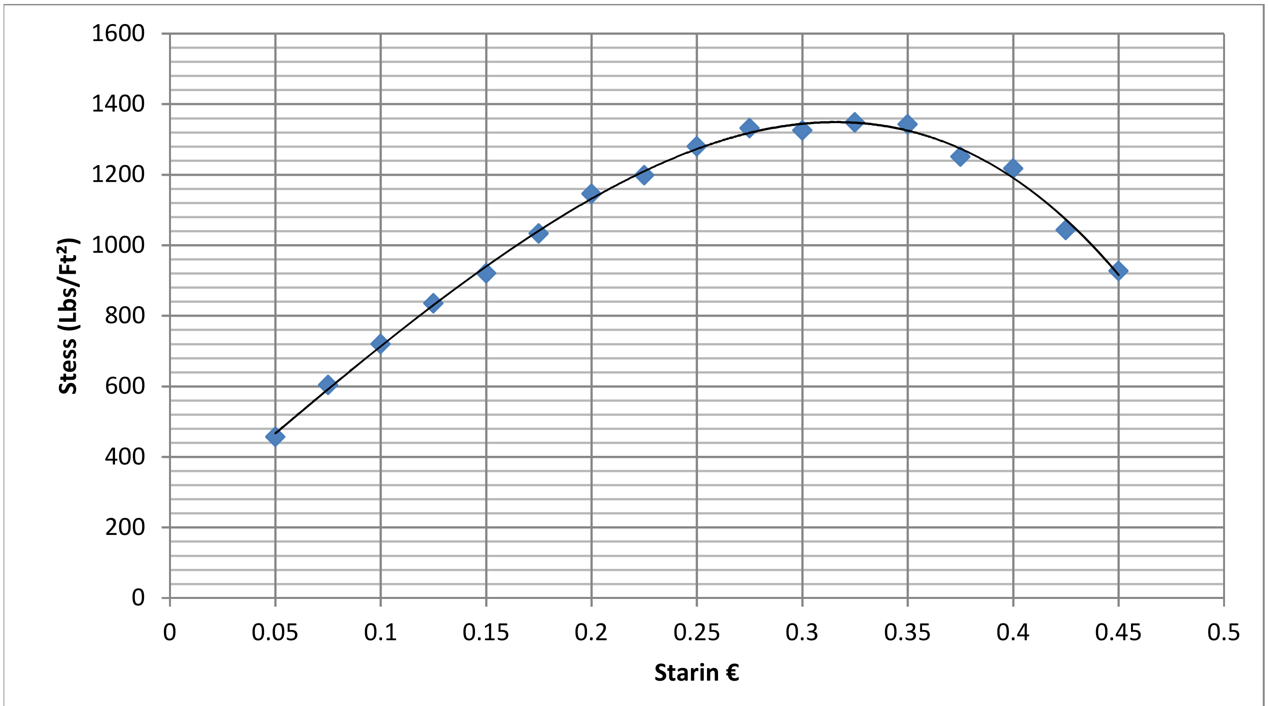
Job	SC11647
Sample	5-1-1
Depth (ft)	2.5

Triaxial and Unconfined Compression Test



Job	SC11647
Sample	6/1/2001
Depth (ft)	2.5

Triaxial and Unconfined Compression Test



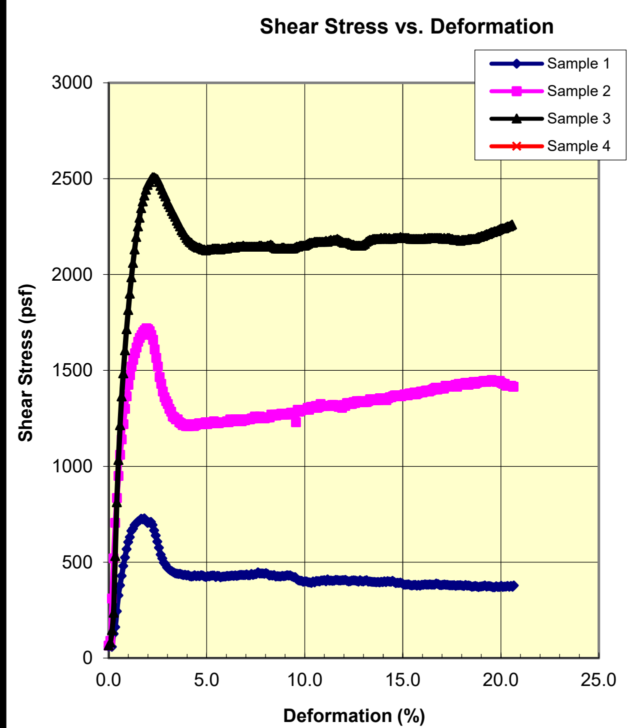
Job	SC11647
Sample	8-1-1
Depth (ft)	2.5

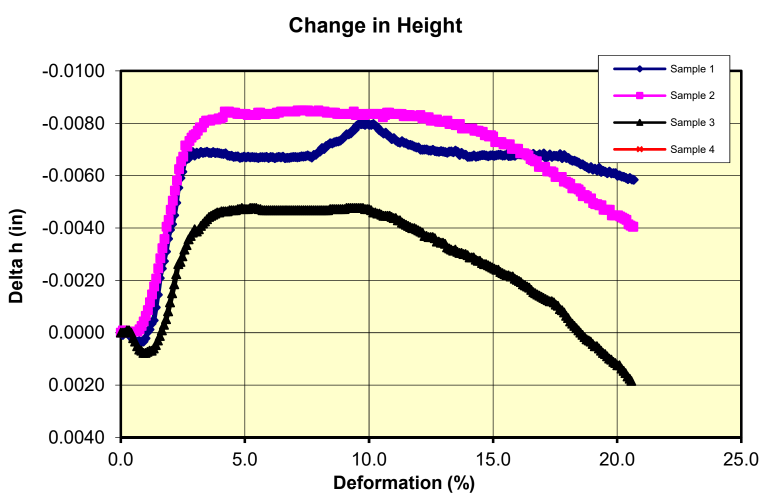
Consolidated Drained Direct Shear (ASTM D3080)

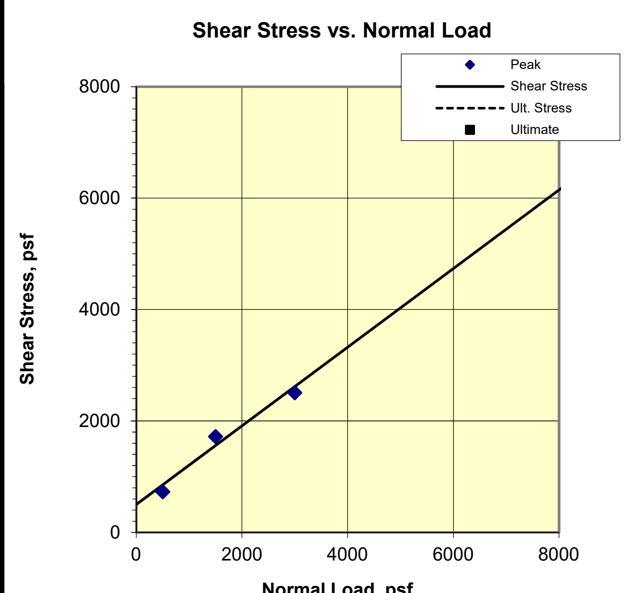
CTL Job #:	032-486	Project #:	SC11647	By:	MD
Client:	Haro, Kasunich & Associates	Date:	5/29/2019	Checked:	PJ
Project Name:	Brewington Ave Subdivision	Remolding Info:			

Phi (deg)	35.2	Ult. Phi (deg)	
Cohesion (psf)	500	Ult. Cohesion (psf)	

Specimen Data	1	2	3	4
Boring:	HKA-2	HKA-2	HKA-2	
Sample:	2-1-1	2-1-1	2-1-1	
Depth (ft):	2	2	2	
Visual Description:	Brownish Yellow Clayey SAND (Cemented)	Brownish Yellow Clayey SAND (Cemented)	Brownish Yellow Clayey SAND (Cemented)	
Normal Load (psf)	500	1500	3000	
Dry Mass of Specimen (g)	128.4	127.6	128.4	
Initial Height (in)	1.01	1.01	1.02	
Initial Diameter (in)	2.42	2.42	2.42	
Initial Void Ratio	0.624	0.647	0.638	
Initial Moisture (%)	20.6	22.0	21.6	
Initial Wet Density (pcf)	127.5	127.2	127.5	
Initial Dry Density (pcf)	105.7	104.3	104.8	
Initial Saturation (%)	90.9	93.5	93.2	
ΔHeight Consol (in)	0.0008	0.0121	0.0134	
At Test Void Ratio	0.622	0.627	0.617	
At Test Moisture (%)	21.8	22.8	22.3	
At Test Wet Density (pcf)	128.9	129.5	129.8	
At Test Dry Density (pcf)	105.8	105.5	106.2	
At Test Saturation (%)	96.2	99.9	99.3	
Strain Rate (%/min)	0.01	0.01	0.01	
Strengths Picked at	Peak	Peak	Peak	
Shear Stress (psf)	728	1720	2507	
ΔHeight (in) at Peak	-0.0031	-0.0043	-0.0022	
Ultimate Stress (psf)				







Remarks:

Figure No.: 6

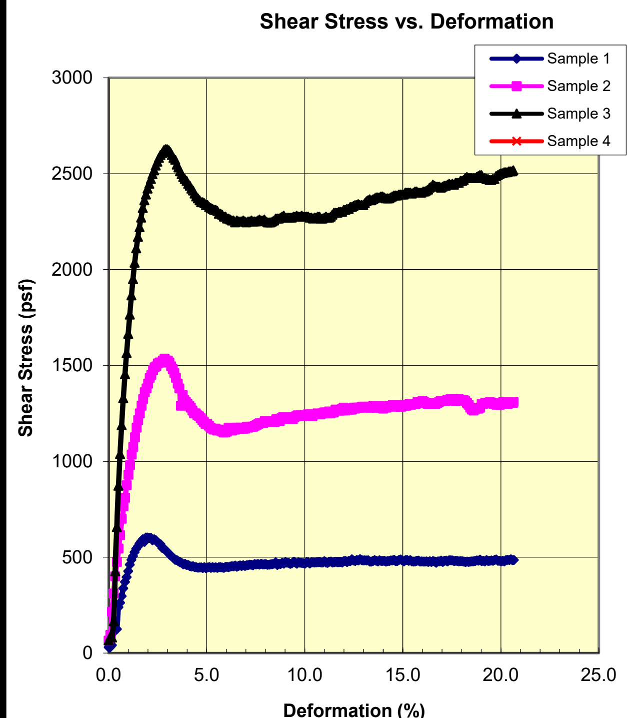
Consolidated Drained Direct Shear (ASTM D3080)

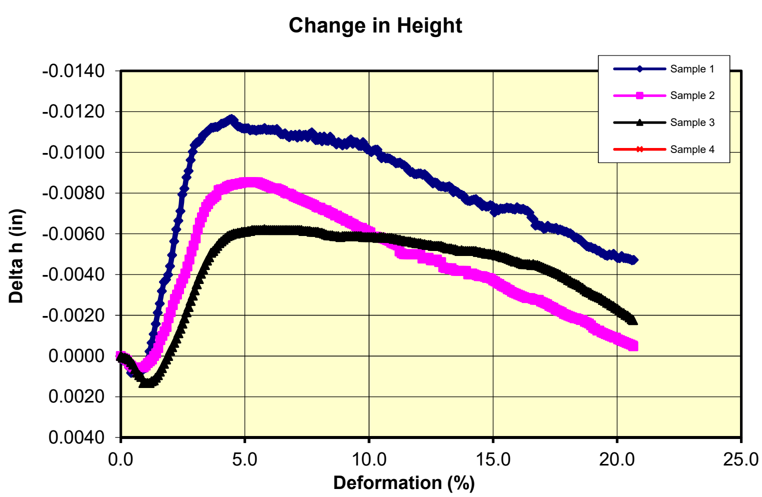
COOPER TESTING LABORATORY

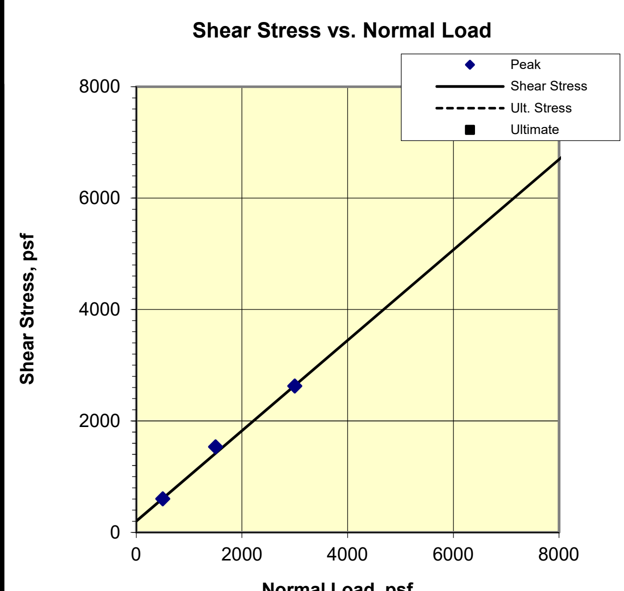
CTL Job #:	032-486	Project #:	SC11647	By:	MD
Client:	Haro, Kasunich & Associates	Date:	5/31/2019	Checked:	PJ
Project Name:	Brewington Ave Subdivision	Remolding Info:			

Phi (deg)	39.1	Ult. Phi (deg)	
Cohesion (psf)	200	Ult. Cohesion (psf)	

Specimen Data	1	2	3	4
Boring:	HKA-7	HKA-7	HKA-7	
Sample:	7-1-1	7-1-1	7-1-1	
Depth (ft):	2	2	2	
Visual Description:	Brownish Yellow Clayey SAND near Sandy CLAY	Brownish Yellow Clayey SAND near Sandy CLAY	Brownish Yellow Clayey SAND near Sandy CLAY	
Normal Load (psf)	500	1500	3000	
Dry Mass of Specimen (g)	140.4	139.8	142.2	
Initial Height (in)	1.01	1.01	1.02	
Initial Diameter (in)	2.42	2.42	2.42	
Initial Void Ratio	0.463	0.463	0.456	
Initial Moisture (%)	14.9	14.3	14.7	
Initial Wet Density (pcf)	132.4	131.6	132.7	
Initial Dry Density (pcf)	115.2	115.2	115.8	
Initial Saturation (%)	87.1	83.1	86.8	
ΔHeight Consol (in)	0.0051	0.0081	0.0209	
At Test Void Ratio	0.456	0.451	0.426	
At Test Moisture (%)	16.1	15.8	15.7	
At Test Wet Density (pcf)	134.4	134.4	136.8	
At Test Dry Density (pcf)	115.8	116.1	118.2	
At Test Saturation (%)	95.3	94.2	99.6	
Strain Rate (%/min)	0.01	0.01	0.01	
Strengths Picked at	Peak	Peak	Peak	
Shear Stress (psf)	603	1535	2627	
ΔHeight (in) at Peak	-0.0044	-0.0051	-0.0030	
Ultimate Stress (psf)				







Remarks:

©

Figure No.: 7

R-value Test Report (Caltrans 301)

COOPER TESTING LABORATORY

Job No.:	032-486	**Date:**	05/17/19	**Initial Moisture,**	14.2
Client:	Haro, Kasunich & Associates	**Tested**	PJ	**R-value**	**<5**
Project:	SC11647	**Reduced**	RU		
Sample	HKA-8_Bulk @ 0-3'	**Checked**	DC	**Expansion Pressure**	**psf**
Soil Type:	Dark Brown CLAY				

Specimen Number	A	B	C	D
Exudation Pressure, psi	670			
Prepaired Weight, grams	1200			
Final Water Added, grams/cc	100			
Weight of Soil & Mold, grams	3135			
Weight of Mold, grams	2102			
Height After Compaction, in.	2.61			
Moisture Content, %	23.7			
Dry Density, pcf	97.0			
Expansion Pressure, psf	151			
Stabilometer @ 1000				
Stabilometer @ 2000	135			
Turns Displacement	3.75			
R-value	12			

Remarks:

Soil extruded from the mold giving a false exudation pressure. Per Caltrans, the R-value test was terminated and an R-value of less than 5 was reported.

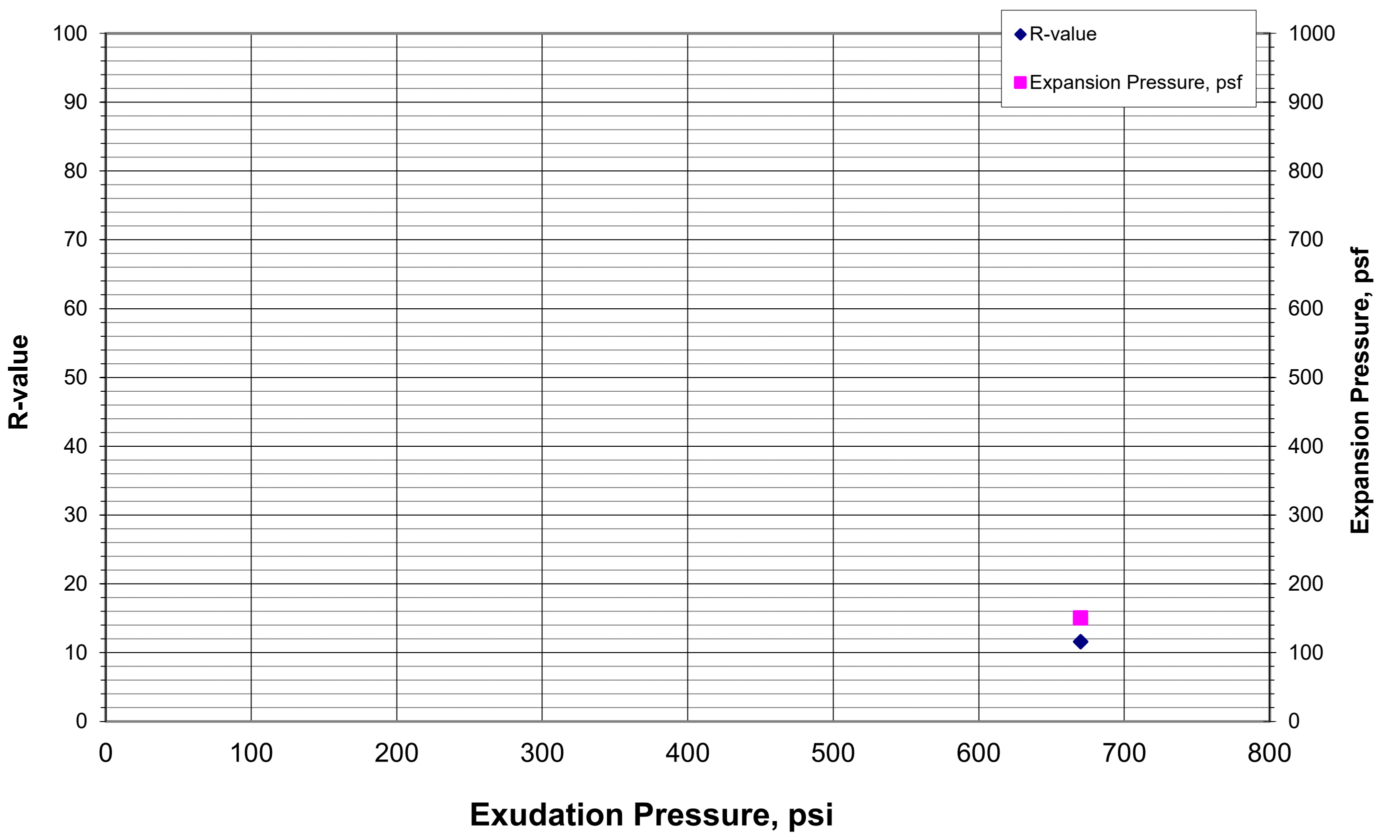


Figure No.: 8

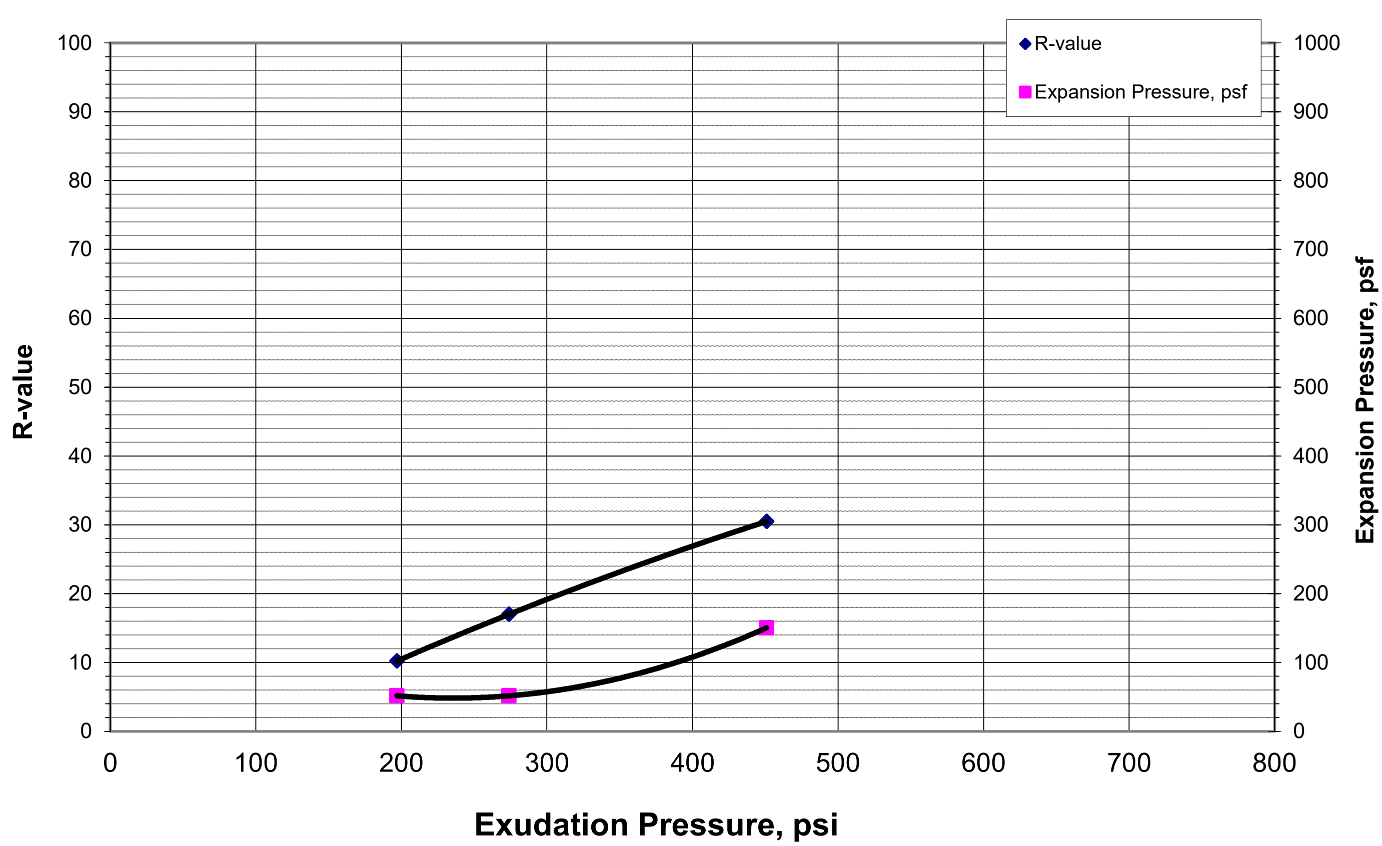
R-value Test Report (Caltrans 301)

COOPER TESTING LABORATORY

Job No.:	032-486	**Date:**	05/17/19	**Initial Moisture,**	9.5
Client:	Haro, Kasunich & Associates	**Tested**	PJ	**R-value**	**20**
Project:	SC11647	**Reduced**	RU		
Sample	HKA-9; Bulk @ 0-3'	**Checked**	DC	**Expansion Pressure**	**60** psf
Soil Type:	Olive Brown Sandy CLAY				

Specimen Number	A	B	C	D
Exudation Pressure, psi	274	197	451	
Prepaired Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	80	95	60	
Weight of Soil & Mold, grams	3158	3166	3127	
Weight of Mold, grams	2084	2106	2106	
Height After Compaction, in.	2.58	2.57	2.42	
Moisture Content, %	16.8	18.2	15.0	
Dry Density, pcf	108.0	105.8	111.2	
Expansion Pressure, psf	52	52	151	
Stabilometer @ 1000				
Stabilometer @ 2000	121	134	91	
Turns Displacement	4.16	4.42	4.00	
R-value	17	10	30	

Remarks:



APPENDIX C

Liquefaction Analysis Graphical Results (Figures 1 and 2)

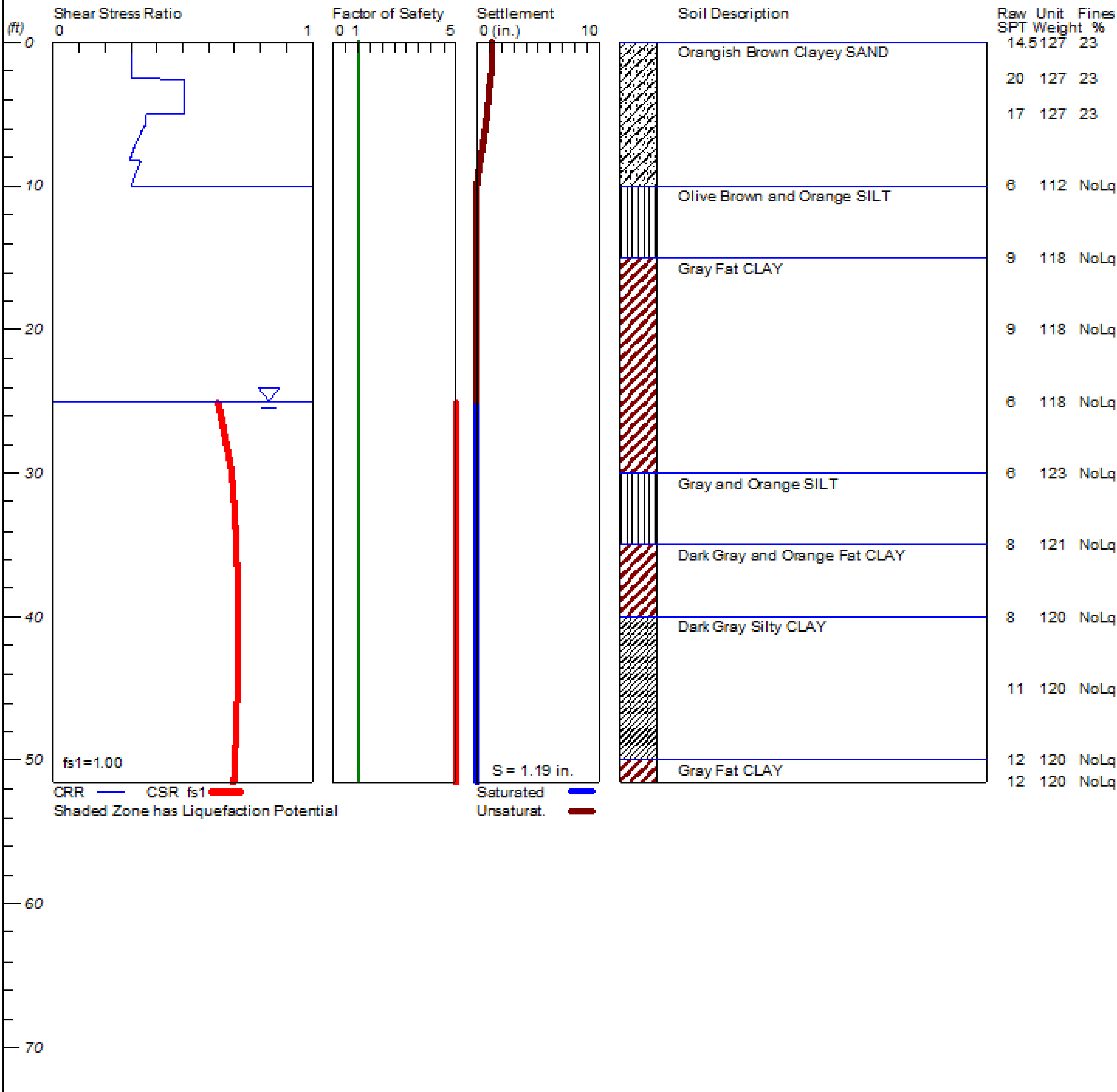
Liquefaction Analysis Input Data and Output Results

LIQUEFACTION ANALYSIS

SC11647

Hole No.=B-2 Water Depth=25 ft Surface Elev.=94

Magnitude=7.0
Acceleration=1.042g



CivilTech Corporation

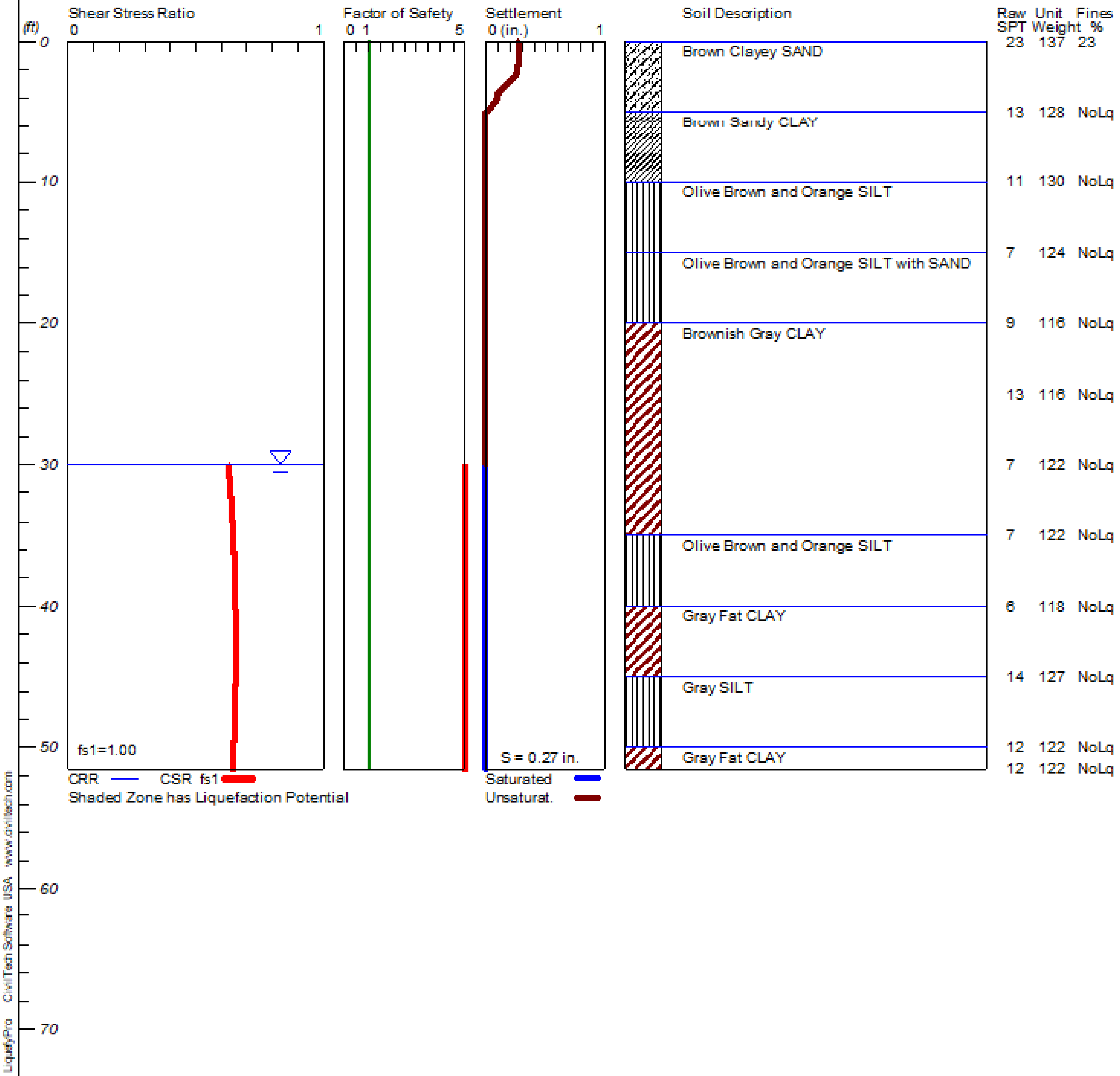
Brewington Ave. Subdivison

Figure 1

LIQUEFACTION ANALYSIS
SC11647

Hole No.=B-4 Water Depth=30 ft Surface Elev.=104

Magnitude=7
Acceleration=1.042g



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LIQUEFACTION ANALYSIS SUMMARY

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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to ,   6/25/2021   11:24:04 AM

Input File Name: H:\PROJECTS\11000s\11647 folder, Brewington Ave Subdivision, MidPen Housing\Liquifaction\F1_Boring 2.liq
Title: SC11647
Subtitle: Brewington Ave. Subdivison

Surface Elev.=94
Hole No.=B-2
Depth of Hole= 51.50 ft
Water Table during Earthquake= 25.00 ft
Water Table during In-Situ Testing= 25.00 ft
Max. Acceleration= 1.04 g
Earthquake Magnitude= 7.00

Input Data:
Surface Elev.=94
Hole No.=B-2
Depth of Hole=51.50 ft
Water Table during Earthquake= 25.00 ft
Water Table during In-Situ Testing= 25.00 ft
Max. Acceleration=1.04 g
Earthquake Magnitude=7.00
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
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*
6. Hammer Energy Ratio,   Ce = 1
7. Borehole Diameter,   Cb= 1
8. Sampling Method,   Cs= 1
9. User request factor of safety (apply to CSR) ,   User= 1

10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	14.50	127.00	23.00
2.50	20.00	127.00	23.00
5.00	17.00	127.00	23.00
10.00	6.00	112.00	NoLiq
15.00	9.00	118.00	NoLiq
20.00	9.00	118.00	NoLiq
25.00	6.00	118.00	NoLiq
30.00	6.00	123.00	NoLiq
35.00	8.00	121.00	NoLiq
40.00	8.00	120.00	NoLiq
45.00	11.00	120.00	NoLiq
50.00	12.00	120.00	NoLiq
51.50	12.00	120.00	NoLiq

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=1.19 in.
Total Settlement of Saturated and Unsaturated Sands=1.19 in.
Differential Settlement=0.595 to 0.786 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.30	0.68	5.00	0.00	1.19	1.19
0.05	0.30	0.68	5.00	0.00	1.19	1.19
0.10	0.30	0.68	5.00	0.00	1.19	1.19
0.15	0.30	0.68	5.00	0.00	1.19	1.19
0.20	0.30	0.68	5.00	0.00	1.19	1.19
0.25	0.30	0.68	5.00	0.00	1.19	1.19
0.30	0.30	0.68	5.00	0.00	1.19	1.19
0.35	0.30	0.68	5.00	0.00	1.19	1.19
0.40	0.30	0.68	5.00	0.00	1.19	1.19
0.45	0.30	0.68	5.00	0.00	1.19	1.19
0.50	0.30	0.68	5.00	0.00	1.19	1.19
0.55	0.30	0.68	5.00	0.00	1.19	1.19
0.60	0.30	0.68	5.00	0.00	1.19	1.19
0.65	0.30	0.68	5.00	0.00	1.19	1.19
0.70	0.30	0.68	5.00	0.00	1.19	1.19
0.75	0.30	0.68	5.00	0.00	1.19	1.19
0.80	0.30	0.68	5.00	0.00	1.19	1.19
0.85	0.30	0.68	5.00	0.00	1.19	1.19
0.90	0.30	0.68	5.00	0.00	1.19	1.19
0.95	0.30	0.68	5.00	0.00	1.19	1.19
1.00	0.30	0.68	5.00	0.00	1.19	1.19
1.05	0.30	0.68	5.00	0.00	1.19	1.19

1.10	0.30	0.68	5.00	0.00	1.19	1.19
1.15	0.30	0.68	5.00	0.00	1.19	1.19
1.20	0.30	0.68	5.00	0.00	1.19	1.19
1.25	0.30	0.68	5.00	0.00	1.19	1.19
1.30	0.30	0.68	5.00	0.00	1.19	1.19
1.35	0.30	0.68	5.00	0.00	1.18	1.18
1.40	0.30	0.68	5.00	0.00	1.18	1.18
1.45	0.30	0.68	5.00	0.00	1.18	1.18
1.50	0.30	0.67	5.00	0.00	1.18	1.18
1.55	0.30	0.67	5.00	0.00	1.18	1.18
1.60	0.30	0.67	5.00	0.00	1.18	1.18
1.65	0.30	0.67	5.00	0.00	1.18	1.18
1.70	0.30	0.67	5.00	0.00	1.18	1.18
1.75	0.30	0.67	5.00	0.00	1.18	1.18
1.80	0.30	0.67	5.00	0.00	1.18	1.18
1.85	0.30	0.67	5.00	0.00	1.18	1.18
1.90	0.30	0.67	5.00	0.00	1.17	1.17
1.95	0.30	0.67	5.00	0.00	1.17	1.17
2.00	0.30	0.67	5.00	0.00	1.17	1.17
2.05	0.30	0.67	5.00	0.00	1.16	1.16
2.10	0.30	0.67	5.00	0.00	1.16	1.16
2.15	0.30	0.67	5.00	0.00	1.15	1.15
2.20	0.30	0.67	5.00	0.00	1.14	1.14
2.25	0.30	0.67	5.00	0.00	1.13	1.13
2.30	0.30	0.67	5.00	0.00	1.12	1.12
2.35	0.30	0.67	5.00	0.00	1.11	1.11
2.40	0.30	0.67	5.00	0.00	1.10	1.10
2.45	0.30	0.67	5.00	0.00	1.09	1.09
2.50	0.30	0.67	5.00	0.00	1.08	1.08
2.55	0.51	0.67	5.00	0.00	1.08	1.08
2.60	0.51	0.67	5.00	0.00	1.07	1.07
2.65	0.51	0.67	5.00	0.00	1.06	1.06
2.70	0.51	0.67	5.00	0.00	1.06	1.06
2.75	0.51	0.67	5.00	0.00	1.05	1.05
2.80	0.51	0.67	5.00	0.00	1.04	1.04
2.85	0.51	0.67	5.00	0.00	1.04	1.04
2.90	0.51	0.67	5.00	0.00	1.03	1.03
2.95	0.51	0.67	5.00	0.00	1.02	1.02
3.00	0.51	0.67	5.00	0.00	1.02	1.02
3.05	0.51	0.67	5.00	0.00	1.01	1.01
3.10	0.51	0.67	5.00	0.00	1.01	1.01
3.15	0.51	0.67	5.00	0.00	1.00	1.00
3.20	0.51	0.67	5.00	0.00	0.99	0.99
3.25	0.51	0.67	5.00	0.00	0.99	0.99
3.30	0.51	0.67	5.00	0.00	0.98	0.98
3.35	0.51	0.67	5.00	0.00	0.97	0.97
3.40	0.51	0.67	5.00	0.00	0.97	0.97
3.45	0.51	0.67	5.00	0.00	0.96	0.96
3.50	0.51	0.67	5.00	0.00	0.95	0.95
3.55	0.51	0.67	5.00	0.00	0.95	0.95

3.60	0.51	0.67	5.00	0.00	0.94	0.94
3.65	0.51	0.67	5.00	0.00	0.94	0.94
3.70	0.51	0.67	5.00	0.00	0.93	0.93
3.75	0.51	0.67	5.00	0.00	0.92	0.92
3.80	0.51	0.67	5.00	0.00	0.92	0.92
3.85	0.51	0.67	5.00	0.00	0.91	0.91
3.90	0.51	0.67	5.00	0.00	0.91	0.91
3.95	0.51	0.67	5.00	0.00	0.91	0.91
4.00	0.51	0.67	5.00	0.00	0.90	0.90
4.05	0.51	0.67	5.00	0.00	0.90	0.90
4.10	0.51	0.67	5.00	0.00	0.90	0.90
4.15	0.51	0.67	5.00	0.00	0.90	0.90
4.20	0.51	0.67	5.00	0.00	0.90	0.90
4.25	0.51	0.67	5.00	0.00	0.89	0.89
4.30	0.51	0.67	5.00	0.00	0.89	0.89
4.35	0.51	0.67	5.00	0.00	0.89	0.89
4.40	0.51	0.67	5.00	0.00	0.89	0.89
4.45	0.51	0.67	5.00	0.00	0.88	0.88
4.50	0.51	0.67	5.00	0.00	0.88	0.88
4.55	0.51	0.67	5.00	0.00	0.88	0.88
4.60	0.51	0.67	5.00	0.00	0.87	0.87
4.65	0.51	0.67	5.00	0.00	0.87	0.87
4.70	0.51	0.67	5.00	0.00	0.86	0.86
4.75	0.51	0.67	5.00	0.00	0.86	0.86
4.80	0.51	0.67	5.00	0.00	0.85	0.85
4.85	0.51	0.67	5.00	0.00	0.84	0.84
4.90	0.51	0.67	5.00	0.00	0.84	0.84
4.95	0.51	0.67	5.00	0.00	0.83	0.83
5.00	0.36	0.67	5.00	0.00	0.83	0.83
5.05	0.36	0.67	5.00	0.00	0.82	0.82
5.10	0.36	0.67	5.00	0.00	0.81	0.81
5.15	0.36	0.67	5.00	0.00	0.80	0.80
5.20	0.36	0.67	5.00	0.00	0.79	0.79
5.25	0.36	0.67	5.00	0.00	0.79	0.79
5.30	0.36	0.67	5.00	0.00	0.78	0.78
5.35	0.36	0.67	5.00	0.00	0.77	0.77
5.40	0.36	0.67	5.00	0.00	0.76	0.76
5.45	0.36	0.67	5.00	0.00	0.76	0.76
5.50	0.36	0.67	5.00	0.00	0.75	0.75
5.55	0.36	0.67	5.00	0.00	0.74	0.74
5.60	0.36	0.67	5.00	0.00	0.73	0.73
5.65	0.36	0.67	5.00	0.00	0.72	0.72
5.70	0.36	0.67	5.00	0.00	0.72	0.72
5.75	0.36	0.67	5.00	0.00	0.71	0.71
5.80	0.36	0.67	5.00	0.00	0.70	0.70
5.85	0.35	0.67	5.00	0.00	0.69	0.69
5.90	0.35	0.67	5.00	0.00	0.68	0.68
5.95	0.35	0.67	5.00	0.00	0.68	0.68
6.00	0.35	0.67	5.00	0.00	0.67	0.67
6.05	0.35	0.67	5.00	0.00	0.66	0.66

6.10	0.34	0.67	5.00	0.00	0.65	0.65
6.15	0.34	0.67	5.00	0.00	0.65	0.65
6.20	0.34	0.67	5.00	0.00	0.64	0.64
6.25	0.34	0.67	5.00	0.00	0.63	0.63
6.30	0.34	0.67	5.00	0.00	0.62	0.62
6.35	0.34	0.67	5.00	0.00	0.61	0.61
6.40	0.34	0.67	5.00	0.00	0.60	0.60
6.45	0.33	0.67	5.00	0.00	0.60	0.60
6.50	0.33	0.67	5.00	0.00	0.59	0.59
6.55	0.33	0.67	5.00	0.00	0.58	0.58
6.60	0.33	0.67	5.00	0.00	0.57	0.57
6.65	0.33	0.67	5.00	0.00	0.56	0.56
6.70	0.33	0.67	5.00	0.00	0.55	0.55
6.75	0.33	0.67	5.00	0.00	0.55	0.55
6.80	0.32	0.67	5.00	0.00	0.54	0.54
6.85	0.32	0.67	5.00	0.00	0.53	0.53
6.90	0.32	0.67	5.00	0.00	0.52	0.52
6.95	0.32	0.67	5.00	0.00	0.51	0.51
7.00	0.32	0.67	5.00	0.00	0.50	0.50
7.05	0.32	0.67	5.00	0.00	0.49	0.49
7.10	0.32	0.67	5.00	0.00	0.49	0.49
7.15	0.31	0.67	5.00	0.00	0.48	0.48
7.20	0.31	0.67	5.00	0.00	0.47	0.47
7.25	0.31	0.67	5.00	0.00	0.46	0.46
7.30	0.31	0.67	5.00	0.00	0.45	0.45
7.35	0.31	0.67	5.00	0.00	0.44	0.44
7.40	0.31	0.67	5.00	0.00	0.43	0.43
7.45	0.31	0.67	5.00	0.00	0.42	0.42
7.50	0.31	0.67	5.00	0.00	0.42	0.42
7.55	0.31	0.67	5.00	0.00	0.41	0.41
7.60	0.31	0.67	5.00	0.00	0.40	0.40
7.65	0.30	0.67	5.00	0.00	0.39	0.39
7.70	0.30	0.67	5.00	0.00	0.38	0.38
7.75	0.30	0.67	5.00	0.00	0.37	0.37
7.80	0.30	0.66	5.00	0.00	0.36	0.36
7.85	0.30	0.66	5.00	0.00	0.35	0.35
7.90	0.30	0.66	5.00	0.00	0.34	0.34
7.95	0.30	0.66	5.00	0.00	0.33	0.33
8.00	0.30	0.66	5.00	0.00	0.32	0.32
8.05	0.30	0.66	5.00	0.00	0.31	0.31
8.10	0.30	0.66	5.00	0.00	0.31	0.31
8.15	0.29	0.66	5.00	0.00	0.30	0.30
8.20	0.29	0.66	5.00	0.00	0.29	0.29
8.25	0.33	0.66	5.00	0.00	0.28	0.28
8.30	0.33	0.66	5.00	0.00	0.27	0.27
8.35	0.33	0.66	5.00	0.00	0.26	0.26
8.40	0.33	0.66	5.00	0.00	0.25	0.25
8.45	0.33	0.66	5.00	0.00	0.24	0.24
8.50	0.33	0.66	5.00	0.00	0.24	0.24
8.55	0.33	0.66	5.00	0.00	0.23	0.23

8.60	0.33	0.66	5.00	0.00	0.22	0.22
8.65	0.33	0.66	5.00	0.00	0.21	0.21
8.70	0.32	0.66	5.00	0.00	0.20	0.20
8.75	0.32	0.66	5.00	0.00	0.19	0.19
8.80	0.32	0.66	5.00	0.00	0.18	0.18
8.85	0.32	0.66	5.00	0.00	0.18	0.18
8.90	0.32	0.66	5.00	0.00	0.17	0.17
8.95	0.32	0.66	5.00	0.00	0.16	0.16
9.00	0.32	0.66	5.00	0.00	0.15	0.15
9.05	0.32	0.66	5.00	0.00	0.14	0.14
9.10	0.32	0.66	5.00	0.00	0.14	0.14
9.15	0.32	0.66	5.00	0.00	0.13	0.13
9.20	0.31	0.66	5.00	0.00	0.13	0.13
9.25	0.31	0.66	5.00	0.00	0.12	0.12
9.30	0.31	0.66	5.00	0.00	0.11	0.11
9.35	0.31	0.66	5.00	0.00	0.11	0.11
9.40	0.31	0.66	5.00	0.00	0.10	0.10
9.45	0.31	0.66	5.00	0.00	0.09	0.09
9.50	0.31	0.66	5.00	0.00	0.08	0.08
9.55	0.31	0.66	5.00	0.00	0.08	0.08
9.60	0.31	0.66	5.00	0.00	0.07	0.07
9.65	0.31	0.66	5.00	0.00	0.06	0.06
9.70	0.31	0.66	5.00	0.00	0.05	0.05
9.75	0.31	0.66	5.00	0.00	0.04	0.04
9.80	0.30	0.66	5.00	0.00	0.04	0.04
9.85	0.30	0.66	5.00	0.00	0.03	0.03
9.90	0.30	0.66	5.00	0.00	0.02	0.02
9.95	0.30	0.66	5.00	0.00	0.01	0.01
10.00	2.00	0.66	5.00	0.00	0.00	0.00
10.05	2.00	0.66	5.00	0.00	0.00	0.00
10.10	2.00	0.66	5.00	0.00	0.00	0.00
10.15	2.00	0.66	5.00	0.00	0.00	0.00
10.20	2.00	0.66	5.00	0.00	0.00	0.00
10.25	2.00	0.66	5.00	0.00	0.00	0.00
10.30	2.00	0.66	5.00	0.00	0.00	0.00
10.35	2.00	0.66	5.00	0.00	0.00	0.00
10.40	2.00	0.66	5.00	0.00	0.00	0.00
10.45	2.00	0.66	5.00	0.00	0.00	0.00
10.50	2.00	0.66	5.00	0.00	0.00	0.00
10.55	2.00	0.66	5.00	0.00	0.00	0.00
10.60	2.00	0.66	5.00	0.00	0.00	0.00
10.65	2.00	0.66	5.00	0.00	0.00	0.00
10.70	2.00	0.66	5.00	0.00	0.00	0.00
10.75	2.00	0.66	5.00	0.00	0.00	0.00
10.80	2.00	0.66	5.00	0.00	0.00	0.00
10.85	2.00	0.66	5.00	0.00	0.00	0.00
10.90	2.00	0.66	5.00	0.00	0.00	0.00
10.95	2.00	0.66	5.00	0.00	0.00	0.00
11.00	2.00	0.66	5.00	0.00	0.00	0.00
11.05	2.00	0.66	5.00	0.00	0.00	0.00

11.10	2.00	0.66	5.00	0.00	0.00	0.00
11.15	2.00	0.66	5.00	0.00	0.00	0.00
11.20	2.00	0.66	5.00	0.00	0.00	0.00
11.25	2.00	0.66	5.00	0.00	0.00	0.00
11.30	2.00	0.66	5.00	0.00	0.00	0.00
11.35	2.00	0.66	5.00	0.00	0.00	0.00
11.40	2.00	0.66	5.00	0.00	0.00	0.00
11.45	2.00	0.66	5.00	0.00	0.00	0.00
11.50	2.00	0.66	5.00	0.00	0.00	0.00
11.55	2.00	0.66	5.00	0.00	0.00	0.00
11.60	2.00	0.66	5.00	0.00	0.00	0.00
11.65	2.00	0.66	5.00	0.00	0.00	0.00
11.70	2.00	0.66	5.00	0.00	0.00	0.00
11.75	2.00	0.66	5.00	0.00	0.00	0.00
11.80	2.00	0.66	5.00	0.00	0.00	0.00
11.85	2.00	0.66	5.00	0.00	0.00	0.00
11.90	2.00	0.66	5.00	0.00	0.00	0.00
11.95	2.00	0.66	5.00	0.00	0.00	0.00
12.00	2.00	0.66	5.00	0.00	0.00	0.00
12.05	2.00	0.66	5.00	0.00	0.00	0.00
12.10	2.00	0.66	5.00	0.00	0.00	0.00
12.15	2.00	0.66	5.00	0.00	0.00	0.00
12.20	2.00	0.66	5.00	0.00	0.00	0.00
12.25	2.00	0.66	5.00	0.00	0.00	0.00
12.30	2.00	0.66	5.00	0.00	0.00	0.00
12.35	2.00	0.66	5.00	0.00	0.00	0.00
12.40	2.00	0.66	5.00	0.00	0.00	0.00
12.45	2.00	0.66	5.00	0.00	0.00	0.00
12.50	2.00	0.66	5.00	0.00	0.00	0.00
12.55	2.00	0.66	5.00	0.00	0.00	0.00
12.60	2.00	0.66	5.00	0.00	0.00	0.00
12.65	2.00	0.66	5.00	0.00	0.00	0.00
12.70	2.00	0.66	5.00	0.00	0.00	0.00
12.75	2.00	0.66	5.00	0.00	0.00	0.00
12.80	2.00	0.66	5.00	0.00	0.00	0.00
12.85	2.00	0.66	5.00	0.00	0.00	0.00
12.90	2.00	0.66	5.00	0.00	0.00	0.00
12.95	2.00	0.66	5.00	0.00	0.00	0.00
13.00	2.00	0.66	5.00	0.00	0.00	0.00
13.05	2.00	0.66	5.00	0.00	0.00	0.00
13.10	2.00	0.66	5.00	0.00	0.00	0.00
13.15	2.00	0.66	5.00	0.00	0.00	0.00
13.20	2.00	0.66	5.00	0.00	0.00	0.00
13.25	2.00	0.66	5.00	0.00	0.00	0.00
13.30	2.00	0.66	5.00	0.00	0.00	0.00
13.35	2.00	0.66	5.00	0.00	0.00	0.00
13.40	2.00	0.66	5.00	0.00	0.00	0.00
13.45	2.00	0.66	5.00	0.00	0.00	0.00
13.50	2.00	0.66	5.00	0.00	0.00	0.00
13.55	2.00	0.66	5.00	0.00	0.00	0.00

13.60	2.00	0.66	5.00	0.00	0.00	0.00
13.65	2.00	0.66	5.00	0.00	0.00	0.00
13.70	2.00	0.66	5.00	0.00	0.00	0.00
13.75	2.00	0.66	5.00	0.00	0.00	0.00
13.80	2.00	0.66	5.00	0.00	0.00	0.00
13.85	2.00	0.66	5.00	0.00	0.00	0.00
13.90	2.00	0.66	5.00	0.00	0.00	0.00
13.95	2.00	0.66	5.00	0.00	0.00	0.00
14.00	2.00	0.66	5.00	0.00	0.00	0.00
14.05	2.00	0.66	5.00	0.00	0.00	0.00
14.10	2.00	0.66	5.00	0.00	0.00	0.00
14.15	2.00	0.65	5.00	0.00	0.00	0.00
14.20	2.00	0.65	5.00	0.00	0.00	0.00
14.25	2.00	0.65	5.00	0.00	0.00	0.00
14.30	2.00	0.65	5.00	0.00	0.00	0.00
14.35	2.00	0.65	5.00	0.00	0.00	0.00
14.40	2.00	0.65	5.00	0.00	0.00	0.00
14.45	2.00	0.65	5.00	0.00	0.00	0.00
14.50	2.00	0.65	5.00	0.00	0.00	0.00
14.55	2.00	0.65	5.00	0.00	0.00	0.00
14.60	2.00	0.65	5.00	0.00	0.00	0.00
14.65	2.00	0.65	5.00	0.00	0.00	0.00
14.70	2.00	0.65	5.00	0.00	0.00	0.00
14.75	2.00	0.65	5.00	0.00	0.00	0.00
14.80	2.00	0.65	5.00	0.00	0.00	0.00
14.85	2.00	0.65	5.00	0.00	0.00	0.00
14.90	2.00	0.65	5.00	0.00	0.00	0.00
14.95	2.00	0.65	5.00	0.00	0.00	0.00
15.00	2.00	0.65	5.00	0.00	0.00	0.00
15.05	2.00	0.65	5.00	0.00	0.00	0.00
15.10	2.00	0.65	5.00	0.00	0.00	0.00
15.15	2.00	0.65	5.00	0.00	0.00	0.00
15.20	2.00	0.65	5.00	0.00	0.00	0.00
15.25	2.00	0.65	5.00	0.00	0.00	0.00
15.30	2.00	0.65	5.00	0.00	0.00	0.00
15.35	2.00	0.65	5.00	0.00	0.00	0.00
15.40	2.00	0.65	5.00	0.00	0.00	0.00
15.45	2.00	0.65	5.00	0.00	0.00	0.00
15.50	2.00	0.65	5.00	0.00	0.00	0.00
15.55	2.00	0.65	5.00	0.00	0.00	0.00
15.60	2.00	0.65	5.00	0.00	0.00	0.00
15.65	2.00	0.65	5.00	0.00	0.00	0.00
15.70	2.00	0.65	5.00	0.00	0.00	0.00
15.75	2.00	0.65	5.00	0.00	0.00	0.00
15.80	2.00	0.65	5.00	0.00	0.00	0.00
15.85	2.00	0.65	5.00	0.00	0.00	0.00
15.90	2.00	0.65	5.00	0.00	0.00	0.00
15.95	2.00	0.65	5.00	0.00	0.00	0.00
16.00	2.00	0.65	5.00	0.00	0.00	0.00
16.05	2.00	0.65	5.00	0.00	0.00	0.00

16.10	2.00	0.65	5.00	0.00	0.00	0.00
16.15	2.00	0.65	5.00	0.00	0.00	0.00
16.20	2.00	0.65	5.00	0.00	0.00	0.00
16.25	2.00	0.65	5.00	0.00	0.00	0.00
16.30	2.00	0.65	5.00	0.00	0.00	0.00
16.35	2.00	0.65	5.00	0.00	0.00	0.00
16.40	2.00	0.65	5.00	0.00	0.00	0.00
16.45	2.00	0.65	5.00	0.00	0.00	0.00
16.50	2.00	0.65	5.00	0.00	0.00	0.00
16.55	2.00	0.65	5.00	0.00	0.00	0.00
16.60	2.00	0.65	5.00	0.00	0.00	0.00
16.65	2.00	0.65	5.00	0.00	0.00	0.00
16.70	2.00	0.65	5.00	0.00	0.00	0.00
16.75	2.00	0.65	5.00	0.00	0.00	0.00
16.80	2.00	0.65	5.00	0.00	0.00	0.00
16.85	2.00	0.65	5.00	0.00	0.00	0.00
16.90	2.00	0.65	5.00	0.00	0.00	0.00
16.95	2.00	0.65	5.00	0.00	0.00	0.00
17.00	2.00	0.65	5.00	0.00	0.00	0.00
17.05	2.00	0.65	5.00	0.00	0.00	0.00
17.10	2.00	0.65	5.00	0.00	0.00	0.00
17.15	2.00	0.65	5.00	0.00	0.00	0.00
17.20	2.00	0.65	5.00	0.00	0.00	0.00
17.25	2.00	0.65	5.00	0.00	0.00	0.00
17.30	2.00	0.65	5.00	0.00	0.00	0.00
17.35	2.00	0.65	5.00	0.00	0.00	0.00
17.40	2.00	0.65	5.00	0.00	0.00	0.00
17.45	2.00	0.65	5.00	0.00	0.00	0.00
17.50	2.00	0.65	5.00	0.00	0.00	0.00
17.55	2.00	0.65	5.00	0.00	0.00	0.00
17.60	2.00	0.65	5.00	0.00	0.00	0.00
17.65	2.00	0.65	5.00	0.00	0.00	0.00
17.70	2.00	0.65	5.00	0.00	0.00	0.00
17.75	2.00	0.65	5.00	0.00	0.00	0.00
17.80	2.00	0.65	5.00	0.00	0.00	0.00
17.85	2.00	0.65	5.00	0.00	0.00	0.00
17.90	2.00	0.65	5.00	0.00	0.00	0.00
17.95	2.00	0.65	5.00	0.00	0.00	0.00
18.00	2.00	0.65	5.00	0.00	0.00	0.00
18.05	2.00	0.65	5.00	0.00	0.00	0.00
18.10	2.00	0.65	5.00	0.00	0.00	0.00
18.15	2.00	0.65	5.00	0.00	0.00	0.00
18.20	2.00	0.65	5.00	0.00	0.00	0.00
18.25	2.00	0.65	5.00	0.00	0.00	0.00
18.30	2.00	0.65	5.00	0.00	0.00	0.00
18.35	2.00	0.65	5.00	0.00	0.00	0.00
18.40	2.00	0.65	5.00	0.00	0.00	0.00
18.45	2.00	0.65	5.00	0.00	0.00	0.00
18.50	2.00	0.65	5.00	0.00	0.00	0.00
18.55	2.00	0.65	5.00	0.00	0.00	0.00

18.60	2.00	0.65	5.00	0.00	0.00	0.00
18.65	2.00	0.65	5.00	0.00	0.00	0.00
18.70	2.00	0.65	5.00	0.00	0.00	0.00
18.75	2.00	0.65	5.00	0.00	0.00	0.00
18.80	2.00	0.65	5.00	0.00	0.00	0.00
18.85	2.00	0.65	5.00	0.00	0.00	0.00
18.90	2.00	0.65	5.00	0.00	0.00	0.00
18.95	2.00	0.65	5.00	0.00	0.00	0.00
19.00	2.00	0.65	5.00	0.00	0.00	0.00
19.05	2.00	0.65	5.00	0.00	0.00	0.00
19.10	2.00	0.65	5.00	0.00	0.00	0.00
19.15	2.00	0.65	5.00	0.00	0.00	0.00
19.20	2.00	0.65	5.00	0.00	0.00	0.00
19.25	2.00	0.65	5.00	0.00	0.00	0.00
19.30	2.00	0.65	5.00	0.00	0.00	0.00
19.35	2.00	0.65	5.00	0.00	0.00	0.00
19.40	2.00	0.65	5.00	0.00	0.00	0.00
19.45	2.00	0.65	5.00	0.00	0.00	0.00
19.50	2.00	0.65	5.00	0.00	0.00	0.00
19.55	2.00	0.65	5.00	0.00	0.00	0.00
19.60	2.00	0.65	5.00	0.00	0.00	0.00
19.65	2.00	0.65	5.00	0.00	0.00	0.00
19.70	2.00	0.65	5.00	0.00	0.00	0.00
19.75	2.00	0.65	5.00	0.00	0.00	0.00
19.80	2.00	0.65	5.00	0.00	0.00	0.00
19.85	2.00	0.65	5.00	0.00	0.00	0.00
19.90	2.00	0.65	5.00	0.00	0.00	0.00
19.95	2.00	0.65	5.00	0.00	0.00	0.00
20.00	2.00	0.65	5.00	0.00	0.00	0.00
20.05	2.00	0.65	5.00	0.00	0.00	0.00
20.10	2.00	0.65	5.00	0.00	0.00	0.00
20.15	2.00	0.65	5.00	0.00	0.00	0.00
20.20	2.00	0.65	5.00	0.00	0.00	0.00
20.25	2.00	0.65	5.00	0.00	0.00	0.00
20.30	2.00	0.65	5.00	0.00	0.00	0.00
20.35	2.00	0.65	5.00	0.00	0.00	0.00
20.40	2.00	0.65	5.00	0.00	0.00	0.00
20.45	2.00	0.65	5.00	0.00	0.00	0.00
20.50	2.00	0.64	5.00	0.00	0.00	0.00
20.55	2.00	0.64	5.00	0.00	0.00	0.00
20.60	2.00	0.64	5.00	0.00	0.00	0.00
20.65	2.00	0.64	5.00	0.00	0.00	0.00
20.70	2.00	0.64	5.00	0.00	0.00	0.00
20.75	2.00	0.64	5.00	0.00	0.00	0.00
20.80	2.00	0.64	5.00	0.00	0.00	0.00
20.85	2.00	0.64	5.00	0.00	0.00	0.00
20.90	2.00	0.64	5.00	0.00	0.00	0.00
20.95	2.00	0.64	5.00	0.00	0.00	0.00
21.00	2.00	0.64	5.00	0.00	0.00	0.00
21.05	2.00	0.64	5.00	0.00	0.00	0.00

21.10	2.00	0.64	5.00	0.00	0.00	0.00
21.15	2.00	0.64	5.00	0.00	0.00	0.00
21.20	2.00	0.64	5.00	0.00	0.00	0.00
21.25	2.00	0.64	5.00	0.00	0.00	0.00
21.30	2.00	0.64	5.00	0.00	0.00	0.00
21.35	2.00	0.64	5.00	0.00	0.00	0.00
21.40	2.00	0.64	5.00	0.00	0.00	0.00
21.45	2.00	0.64	5.00	0.00	0.00	0.00
21.50	2.00	0.64	5.00	0.00	0.00	0.00
21.55	2.00	0.64	5.00	0.00	0.00	0.00
21.60	2.00	0.64	5.00	0.00	0.00	0.00
21.65	2.00	0.64	5.00	0.00	0.00	0.00
21.70	2.00	0.64	5.00	0.00	0.00	0.00
21.75	2.00	0.64	5.00	0.00	0.00	0.00
21.80	2.00	0.64	5.00	0.00	0.00	0.00
21.85	2.00	0.64	5.00	0.00	0.00	0.00
21.90	2.00	0.64	5.00	0.00	0.00	0.00
21.95	2.00	0.64	5.00	0.00	0.00	0.00
22.00	2.00	0.64	5.00	0.00	0.00	0.00
22.05	2.00	0.64	5.00	0.00	0.00	0.00
22.10	2.00	0.64	5.00	0.00	0.00	0.00
22.15	2.00	0.64	5.00	0.00	0.00	0.00
22.20	2.00	0.64	5.00	0.00	0.00	0.00
22.25	2.00	0.64	5.00	0.00	0.00	0.00
22.30	2.00	0.64	5.00	0.00	0.00	0.00
22.35	2.00	0.64	5.00	0.00	0.00	0.00
22.40	2.00	0.64	5.00	0.00	0.00	0.00
22.45	2.00	0.64	5.00	0.00	0.00	0.00
22.50	2.00	0.64	5.00	0.00	0.00	0.00
22.55	2.00	0.64	5.00	0.00	0.00	0.00
22.60	2.00	0.64	5.00	0.00	0.00	0.00
22.65	2.00	0.64	5.00	0.00	0.00	0.00
22.70	2.00	0.64	5.00	0.00	0.00	0.00
22.75	2.00	0.64	5.00	0.00	0.00	0.00
22.80	2.00	0.64	5.00	0.00	0.00	0.00
22.85	2.00	0.64	5.00	0.00	0.00	0.00
22.90	2.00	0.64	5.00	0.00	0.00	0.00
22.95	2.00	0.64	5.00	0.00	0.00	0.00
23.00	2.00	0.64	5.00	0.00	0.00	0.00
23.05	2.00	0.64	5.00	0.00	0.00	0.00
23.10	2.00	0.64	5.00	0.00	0.00	0.00
23.15	2.00	0.64	5.00	0.00	0.00	0.00
23.20	2.00	0.64	5.00	0.00	0.00	0.00
23.25	2.00	0.64	5.00	0.00	0.00	0.00
23.30	2.00	0.64	5.00	0.00	0.00	0.00
23.35	2.00	0.64	5.00	0.00	0.00	0.00
23.40	2.00	0.64	5.00	0.00	0.00	0.00
23.45	2.00	0.64	5.00	0.00	0.00	0.00
23.50	2.00	0.64	5.00	0.00	0.00	0.00
23.55	2.00	0.64	5.00	0.00	0.00	0.00

23.60	2.00	0.64	5.00	0.00	0.00	0.00
23.65	2.00	0.64	5.00	0.00	0.00	0.00
23.70	2.00	0.64	5.00	0.00	0.00	0.00
23.75	2.00	0.64	5.00	0.00	0.00	0.00
23.80	2.00	0.64	5.00	0.00	0.00	0.00
23.85	2.00	0.64	5.00	0.00	0.00	0.00
23.90	2.00	0.64	5.00	0.00	0.00	0.00
23.95	2.00	0.64	5.00	0.00	0.00	0.00
24.00	2.00	0.64	5.00	0.00	0.00	0.00
24.05	2.00	0.64	5.00	0.00	0.00	0.00
24.10	2.00	0.64	5.00	0.00	0.00	0.00
24.15	2.00	0.64	5.00	0.00	0.00	0.00
24.20	2.00	0.64	5.00	0.00	0.00	0.00
24.25	2.00	0.64	5.00	0.00	0.00	0.00
24.30	2.00	0.64	5.00	0.00	0.00	0.00
24.35	2.00	0.64	5.00	0.00	0.00	0.00
24.40	2.00	0.64	5.00	0.00	0.00	0.00
24.45	2.00	0.64	5.00	0.00	0.00	0.00
24.50	2.00	0.64	5.00	0.00	0.00	0.00
24.55	2.00	0.64	5.00	0.00	0.00	0.00
24.60	2.00	0.64	5.00	0.00	0.00	0.00
24.65	2.00	0.64	5.00	0.00	0.00	0.00
24.70	2.00	0.64	5.00	0.00	0.00	0.00
24.75	2.00	0.64	5.00	0.00	0.00	0.00
24.80	2.00	0.64	5.00	0.00	0.00	0.00
24.85	2.00	0.64	5.00	0.00	0.00	0.00
24.90	2.00	0.64	5.00	0.00	0.00	0.00
24.95	2.00	0.64	5.00	0.00	0.00	0.00
25.00	2.00	0.64	5.00	0.00	0.00	0.00
25.05	2.00	0.64	5.00	0.00	0.00	0.00
25.10	2.00	0.64	5.00	0.00	0.00	0.00
25.15	2.00	0.64	5.00	0.00	0.00	0.00
25.20	2.00	0.64	5.00	0.00	0.00	0.00
25.25	2.00	0.64	5.00	0.00	0.00	0.00
25.30	2.00	0.64	5.00	0.00	0.00	0.00
25.35	2.00	0.64	5.00	0.00	0.00	0.00
25.40	2.00	0.64	5.00	0.00	0.00	0.00
25.45	2.00	0.64	5.00	0.00	0.00	0.00
25.50	2.00	0.64	5.00	0.00	0.00	0.00
25.55	2.00	0.64	5.00	0.00	0.00	0.00
25.60	2.00	0.64	5.00	0.00	0.00	0.00
25.65	2.00	0.64	5.00	0.00	0.00	0.00
25.70	2.00	0.65	5.00	0.00	0.00	0.00
25.75	2.00	0.65	5.00	0.00	0.00	0.00
25.80	2.00	0.65	5.00	0.00	0.00	0.00
25.85	2.00	0.65	5.00	0.00	0.00	0.00
25.90	2.00	0.65	5.00	0.00	0.00	0.00
25.95	2.00	0.65	5.00	0.00	0.00	0.00
26.00	2.00	0.65	5.00	0.00	0.00	0.00
26.05	2.00	0.65	5.00	0.00	0.00	0.00

26.10	2.00	0.65	5.00	0.00	0.00	0.00
26.15	2.00	0.65	5.00	0.00	0.00	0.00
26.20	2.00	0.65	5.00	0.00	0.00	0.00
26.25	2.00	0.65	5.00	0.00	0.00	0.00
26.30	2.00	0.65	5.00	0.00	0.00	0.00
26.35	2.00	0.65	5.00	0.00	0.00	0.00
26.40	2.00	0.65	5.00	0.00	0.00	0.00
26.45	2.00	0.65	5.00	0.00	0.00	0.00
26.50	2.00	0.65	5.00	0.00	0.00	0.00
26.55	2.00	0.65	5.00	0.00	0.00	0.00
26.60	2.00	0.66	5.00	0.00	0.00	0.00
26.65	2.00	0.66	5.00	0.00	0.00	0.00
26.70	2.00	0.66	5.00	0.00	0.00	0.00
26.75	2.00	0.66	5.00	0.00	0.00	0.00
26.80	2.00	0.66	5.00	0.00	0.00	0.00
26.85	2.00	0.66	5.00	0.00	0.00	0.00
26.90	2.00	0.66	5.00	0.00	0.00	0.00
26.95	2.00	0.66	5.00	0.00	0.00	0.00
27.00	2.00	0.66	5.00	0.00	0.00	0.00
27.05	2.00	0.66	5.00	0.00	0.00	0.00
27.10	2.00	0.66	5.00	0.00	0.00	0.00
27.15	2.00	0.66	5.00	0.00	0.00	0.00
27.20	2.00	0.66	5.00	0.00	0.00	0.00
27.25	2.00	0.66	5.00	0.00	0.00	0.00
27.30	2.00	0.66	5.00	0.00	0.00	0.00
27.35	2.00	0.66	5.00	0.00	0.00	0.00
27.40	2.00	0.66	5.00	0.00	0.00	0.00
27.45	2.00	0.66	5.00	0.00	0.00	0.00
27.50	2.00	0.66	5.00	0.00	0.00	0.00
27.55	2.00	0.67	5.00	0.00	0.00	0.00
27.60	2.00	0.67	5.00	0.00	0.00	0.00
27.65	2.00	0.67	5.00	0.00	0.00	0.00
27.70	2.00	0.67	5.00	0.00	0.00	0.00
27.75	2.00	0.67	5.00	0.00	0.00	0.00
27.80	2.00	0.67	5.00	0.00	0.00	0.00
27.85	2.00	0.67	5.00	0.00	0.00	0.00
27.90	2.00	0.67	5.00	0.00	0.00	0.00
27.95	2.00	0.67	5.00	0.00	0.00	0.00
28.00	2.00	0.67	5.00	0.00	0.00	0.00
28.05	2.00	0.67	5.00	0.00	0.00	0.00
28.10	2.00	0.67	5.00	0.00	0.00	0.00
28.15	2.00	0.67	5.00	0.00	0.00	0.00
28.20	2.00	0.67	5.00	0.00	0.00	0.00
28.25	2.00	0.67	5.00	0.00	0.00	0.00
28.30	2.00	0.67	5.00	0.00	0.00	0.00
28.35	2.00	0.67	5.00	0.00	0.00	0.00
28.40	2.00	0.67	5.00	0.00	0.00	0.00
28.45	2.00	0.67	5.00	0.00	0.00	0.00
28.50	2.00	0.67	5.00	0.00	0.00	0.00
28.55	2.00	0.68	5.00	0.00	0.00	0.00

28.60	2.00	0.68	5.00	0.00	0.00	0.00
28.65	2.00	0.68	5.00	0.00	0.00	0.00
28.70	2.00	0.68	5.00	0.00	0.00	0.00
28.75	2.00	0.68	5.00	0.00	0.00	0.00
28.80	2.00	0.68	5.00	0.00	0.00	0.00
28.85	2.00	0.68	5.00	0.00	0.00	0.00
28.90	2.00	0.68	5.00	0.00	0.00	0.00
28.95	2.00	0.68	5.00	0.00	0.00	0.00
29.00	2.00	0.68	5.00	0.00	0.00	0.00
29.05	2.00	0.68	5.00	0.00	0.00	0.00
29.10	2.00	0.68	5.00	0.00	0.00	0.00
29.15	2.00	0.68	5.00	0.00	0.00	0.00
29.20	2.00	0.68	5.00	0.00	0.00	0.00
29.25	2.00	0.68	5.00	0.00	0.00	0.00
29.30	2.00	0.68	5.00	0.00	0.00	0.00
29.35	2.00	0.68	5.00	0.00	0.00	0.00
29.40	2.00	0.68	5.00	0.00	0.00	0.00
29.45	2.00	0.68	5.00	0.00	0.00	0.00
29.50	2.00	0.68	5.00	0.00	0.00	0.00
29.55	2.00	0.68	5.00	0.00	0.00	0.00
29.60	2.00	0.69	5.00	0.00	0.00	0.00
29.65	2.00	0.69	5.00	0.00	0.00	0.00
29.70	2.00	0.69	5.00	0.00	0.00	0.00
29.75	2.00	0.69	5.00	0.00	0.00	0.00
29.80	2.00	0.69	5.00	0.00	0.00	0.00
29.85	2.00	0.69	5.00	0.00	0.00	0.00
29.90	2.00	0.69	5.00	0.00	0.00	0.00
29.95	2.00	0.69	5.00	0.00	0.00	0.00
30.00	2.00	0.69	5.00	0.00	0.00	0.00
30.05	2.00	0.69	5.00	0.00	0.00	0.00
30.10	2.00	0.69	5.00	0.00	0.00	0.00
30.15	2.00	0.69	5.00	0.00	0.00	0.00
30.20	2.00	0.69	5.00	0.00	0.00	0.00
30.25	2.00	0.69	5.00	0.00	0.00	0.00
30.30	2.00	0.69	5.00	0.00	0.00	0.00
30.35	2.00	0.69	5.00	0.00	0.00	0.00
30.40	2.00	0.69	5.00	0.00	0.00	0.00
30.45	2.00	0.69	5.00	0.00	0.00	0.00
30.50	2.00	0.69	5.00	0.00	0.00	0.00
30.55	2.00	0.69	5.00	0.00	0.00	0.00
30.60	2.00	0.69	5.00	0.00	0.00	0.00
30.65	2.00	0.69	5.00	0.00	0.00	0.00
30.70	2.00	0.69	5.00	0.00	0.00	0.00
30.75	2.00	0.69	5.00	0.00	0.00	0.00
30.80	2.00	0.69	5.00	0.00	0.00	0.00
30.85	2.00	0.69	5.00	0.00	0.00	0.00
30.90	2.00	0.69	5.00	0.00	0.00	0.00
30.95	2.00	0.69	5.00	0.00	0.00	0.00
31.00	2.00	0.69	5.00	0.00	0.00	0.00
31.05	2.00	0.69	5.00	0.00	0.00	0.00

31.10	2.00	0.69	5.00	0.00	0.00	0.00
31.15	2.00	0.69	5.00	0.00	0.00	0.00
31.20	2.00	0.69	5.00	0.00	0.00	0.00
31.25	2.00	0.69	5.00	0.00	0.00	0.00
31.30	2.00	0.69	5.00	0.00	0.00	0.00
31.35	2.00	0.69	5.00	0.00	0.00	0.00
31.40	2.00	0.70	5.00	0.00	0.00	0.00
31.45	2.00	0.70	5.00	0.00	0.00	0.00
31.50	2.00	0.70	5.00	0.00	0.00	0.00
31.55	2.00	0.70	5.00	0.00	0.00	0.00
31.60	2.00	0.70	5.00	0.00	0.00	0.00
31.65	2.00	0.70	5.00	0.00	0.00	0.00
31.70	2.00	0.70	5.00	0.00	0.00	0.00
31.75	2.00	0.70	5.00	0.00	0.00	0.00
31.80	2.00	0.70	5.00	0.00	0.00	0.00
31.85	2.00	0.70	5.00	0.00	0.00	0.00
31.90	2.00	0.70	5.00	0.00	0.00	0.00
31.95	2.00	0.70	5.00	0.00	0.00	0.00
32.00	2.00	0.70	5.00	0.00	0.00	0.00
32.05	2.00	0.70	5.00	0.00	0.00	0.00
32.10	2.00	0.70	5.00	0.00	0.00	0.00
32.15	2.00	0.70	5.00	0.00	0.00	0.00
32.20	2.00	0.70	5.00	0.00	0.00	0.00
32.25	2.00	0.70	5.00	0.00	0.00	0.00
32.30	2.00	0.70	5.00	0.00	0.00	0.00
32.35	2.00	0.70	5.00	0.00	0.00	0.00
32.40	2.00	0.70	5.00	0.00	0.00	0.00
32.45	2.00	0.70	5.00	0.00	0.00	0.00
32.50	2.00	0.70	5.00	0.00	0.00	0.00
32.55	2.00	0.70	5.00	0.00	0.00	0.00
32.60	2.00	0.70	5.00	0.00	0.00	0.00
32.65	2.00	0.70	5.00	0.00	0.00	0.00
32.70	2.00	0.70	5.00	0.00	0.00	0.00
32.75	2.00	0.70	5.00	0.00	0.00	0.00
32.80	2.00	0.70	5.00	0.00	0.00	0.00
32.85	2.00	0.70	5.00	0.00	0.00	0.00
32.90	2.00	0.70	5.00	0.00	0.00	0.00
32.95	2.00	0.70	5.00	0.00	0.00	0.00
33.00	2.00	0.70	5.00	0.00	0.00	0.00
33.05	2.00	0.70	5.00	0.00	0.00	0.00
33.10	2.00	0.70	5.00	0.00	0.00	0.00
33.15	2.00	0.70	5.00	0.00	0.00	0.00
33.20	2.00	0.70	5.00	0.00	0.00	0.00
33.25	2.00	0.70	5.00	0.00	0.00	0.00
33.30	2.00	0.70	5.00	0.00	0.00	0.00
33.35	2.00	0.70	5.00	0.00	0.00	0.00
33.40	2.00	0.70	5.00	0.00	0.00	0.00
33.45	2.00	0.70	5.00	0.00	0.00	0.00
33.50	2.00	0.70	5.00	0.00	0.00	0.00
33.55	2.00	0.70	5.00	0.00	0.00	0.00

33.60	2.00	0.70	5.00	0.00	0.00	0.00
33.65	2.00	0.70	5.00	0.00	0.00	0.00
33.70	2.00	0.70	5.00	0.00	0.00	0.00
33.75	2.00	0.70	5.00	0.00	0.00	0.00
33.80	2.00	0.70	5.00	0.00	0.00	0.00
33.85	2.00	0.70	5.00	0.00	0.00	0.00
33.90	2.00	0.70	5.00	0.00	0.00	0.00
33.95	2.00	0.70	5.00	0.00	0.00	0.00
34.00	2.00	0.70	5.00	0.00	0.00	0.00
34.05	2.00	0.70	5.00	0.00	0.00	0.00
34.10	2.00	0.70	5.00	0.00	0.00	0.00
34.15	2.00	0.70	5.00	0.00	0.00	0.00
34.20	2.00	0.70	5.00	0.00	0.00	0.00
34.25	2.00	0.70	5.00	0.00	0.00	0.00
34.30	2.00	0.70	5.00	0.00	0.00	0.00
34.35	2.00	0.70	5.00	0.00	0.00	0.00
34.40	2.00	0.70	5.00	0.00	0.00	0.00
34.45	2.00	0.70	5.00	0.00	0.00	0.00
34.50	2.00	0.71	5.00	0.00	0.00	0.00
34.55	2.00	0.71	5.00	0.00	0.00	0.00
34.60	2.00	0.71	5.00	0.00	0.00	0.00
34.65	2.00	0.71	5.00	0.00	0.00	0.00
34.70	2.00	0.71	5.00	0.00	0.00	0.00
34.75	2.00	0.71	5.00	0.00	0.00	0.00
34.80	2.00	0.71	5.00	0.00	0.00	0.00
34.85	2.00	0.71	5.00	0.00	0.00	0.00
34.90	2.00	0.71	5.00	0.00	0.00	0.00
34.95	2.00	0.71	5.00	0.00	0.00	0.00
35.00	2.00	0.71	5.00	0.00	0.00	0.00
35.05	2.00	0.71	5.00	0.00	0.00	0.00
35.10	2.00	0.71	5.00	0.00	0.00	0.00
35.15	2.00	0.71	5.00	0.00	0.00	0.00
35.20	2.00	0.71	5.00	0.00	0.00	0.00
35.25	2.00	0.71	5.00	0.00	0.00	0.00
35.30	2.00	0.71	5.00	0.00	0.00	0.00
35.35	2.00	0.71	5.00	0.00	0.00	0.00
35.40	2.00	0.71	5.00	0.00	0.00	0.00
35.45	2.00	0.71	5.00	0.00	0.00	0.00
35.50	2.00	0.71	5.00	0.00	0.00	0.00
35.55	2.00	0.71	5.00	0.00	0.00	0.00
35.60	2.00	0.71	5.00	0.00	0.00	0.00
35.65	2.00	0.71	5.00	0.00	0.00	0.00
35.70	2.00	0.71	5.00	0.00	0.00	0.00
35.75	2.00	0.71	5.00	0.00	0.00	0.00
35.80	2.00	0.71	5.00	0.00	0.00	0.00
35.85	2.00	0.71	5.00	0.00	0.00	0.00
35.90	2.00	0.71	5.00	0.00	0.00	0.00
35.95	2.00	0.71	5.00	0.00	0.00	0.00
36.00	2.00	0.71	5.00	0.00	0.00	0.00
36.05	2.00	0.71	5.00	0.00	0.00	0.00

36.10	2.00	0.71	5.00	0.00	0.00	0.00
36.15	2.00	0.71	5.00	0.00	0.00	0.00
36.20	2.00	0.71	5.00	0.00	0.00	0.00
36.25	2.00	0.71	5.00	0.00	0.00	0.00
36.30	2.00	0.71	5.00	0.00	0.00	0.00
36.35	2.00	0.71	5.00	0.00	0.00	0.00
36.40	2.00	0.71	5.00	0.00	0.00	0.00
36.45	2.00	0.71	5.00	0.00	0.00	0.00
36.50	2.00	0.71	5.00	0.00	0.00	0.00
36.55	2.00	0.71	5.00	0.00	0.00	0.00
36.60	2.00	0.71	5.00	0.00	0.00	0.00
36.65	2.00	0.71	5.00	0.00	0.00	0.00
36.70	2.00	0.71	5.00	0.00	0.00	0.00
36.75	2.00	0.71	5.00	0.00	0.00	0.00
36.80	2.00	0.71	5.00	0.00	0.00	0.00
36.85	2.00	0.71	5.00	0.00	0.00	0.00
36.90	2.00	0.71	5.00	0.00	0.00	0.00
36.95	2.00	0.71	5.00	0.00	0.00	0.00
37.00	2.00	0.71	5.00	0.00	0.00	0.00
37.05	2.00	0.71	5.00	0.00	0.00	0.00
37.10	2.00	0.71	5.00	0.00	0.00	0.00
37.15	2.00	0.71	5.00	0.00	0.00	0.00
37.20	2.00	0.71	5.00	0.00	0.00	0.00
37.25	2.00	0.71	5.00	0.00	0.00	0.00
37.30	2.00	0.71	5.00	0.00	0.00	0.00
37.35	2.00	0.71	5.00	0.00	0.00	0.00
37.40	2.00	0.71	5.00	0.00	0.00	0.00
37.45	2.00	0.71	5.00	0.00	0.00	0.00
37.50	2.00	0.71	5.00	0.00	0.00	0.00
37.55	2.00	0.71	5.00	0.00	0.00	0.00
37.60	2.00	0.71	5.00	0.00	0.00	0.00
37.65	2.00	0.71	5.00	0.00	0.00	0.00
37.70	2.00	0.71	5.00	0.00	0.00	0.00
37.75	2.00	0.71	5.00	0.00	0.00	0.00
37.80	2.00	0.71	5.00	0.00	0.00	0.00
37.85	2.00	0.71	5.00	0.00	0.00	0.00
37.90	2.00	0.71	5.00	0.00	0.00	0.00
37.95	2.00	0.71	5.00	0.00	0.00	0.00
38.00	2.00	0.71	5.00	0.00	0.00	0.00
38.05	2.00	0.71	5.00	0.00	0.00	0.00
38.10	2.00	0.71	5.00	0.00	0.00	0.00
38.15	2.00	0.71	5.00	0.00	0.00	0.00
38.20	2.00	0.71	5.00	0.00	0.00	0.00
38.25	2.00	0.71	5.00	0.00	0.00	0.00
38.30	2.00	0.71	5.00	0.00	0.00	0.00
38.35	2.00	0.71	5.00	0.00	0.00	0.00
38.40	2.00	0.71	5.00	0.00	0.00	0.00
38.45	2.00	0.71	5.00	0.00	0.00	0.00
38.50	2.00	0.71	5.00	0.00	0.00	0.00
38.55	2.00	0.71	5.00	0.00	0.00	0.00

38.60	2.00	0.71	5.00	0.00	0.00	0.00
38.65	2.00	0.71	5.00	0.00	0.00	0.00
38.70	2.00	0.71	5.00	0.00	0.00	0.00
38.75	2.00	0.71	5.00	0.00	0.00	0.00
38.80	2.00	0.71	5.00	0.00	0.00	0.00
38.85	2.00	0.71	5.00	0.00	0.00	0.00
38.90	2.00	0.71	5.00	0.00	0.00	0.00
38.95	2.00	0.71	5.00	0.00	0.00	0.00
39.00	2.00	0.71	5.00	0.00	0.00	0.00
39.05	2.00	0.71	5.00	0.00	0.00	0.00
39.10	2.00	0.71	5.00	0.00	0.00	0.00
39.15	2.00	0.71	5.00	0.00	0.00	0.00
39.20	2.00	0.71	5.00	0.00	0.00	0.00
39.25	2.00	0.71	5.00	0.00	0.00	0.00
39.30	2.00	0.71	5.00	0.00	0.00	0.00
39.35	2.00	0.71	5.00	0.00	0.00	0.00
39.40	2.00	0.71	5.00	0.00	0.00	0.00
39.45	2.00	0.71	5.00	0.00	0.00	0.00
39.50	2.00	0.71	5.00	0.00	0.00	0.00
39.55	2.00	0.71	5.00	0.00	0.00	0.00
39.60	2.00	0.71	5.00	0.00	0.00	0.00
39.65	2.00	0.71	5.00	0.00	0.00	0.00
39.70	2.00	0.71	5.00	0.00	0.00	0.00
39.75	2.00	0.71	5.00	0.00	0.00	0.00
39.80	2.00	0.71	5.00	0.00	0.00	0.00
39.85	2.00	0.71	5.00	0.00	0.00	0.00
39.90	2.00	0.71	5.00	0.00	0.00	0.00
39.95	2.00	0.71	5.00	0.00	0.00	0.00
40.00	2.00	0.71	5.00	0.00	0.00	0.00
40.05	2.00	0.71	5.00	0.00	0.00	0.00
40.10	2.00	0.71	5.00	0.00	0.00	0.00
40.15	2.00	0.71	5.00	0.00	0.00	0.00
40.20	2.00	0.71	5.00	0.00	0.00	0.00
40.25	2.00	0.71	5.00	0.00	0.00	0.00
40.30	2.00	0.71	5.00	0.00	0.00	0.00
40.35	2.00	0.71	5.00	0.00	0.00	0.00
40.40	2.00	0.71	5.00	0.00	0.00	0.00
40.45	2.00	0.71	5.00	0.00	0.00	0.00
40.50	2.00	0.71	5.00	0.00	0.00	0.00
40.55	2.00	0.71	5.00	0.00	0.00	0.00
40.60	2.00	0.71	5.00	0.00	0.00	0.00
40.65	2.00	0.71	5.00	0.00	0.00	0.00
40.70	2.00	0.71	5.00	0.00	0.00	0.00
40.75	2.00	0.71	5.00	0.00	0.00	0.00
40.80	2.00	0.71	5.00	0.00	0.00	0.00
40.85	2.00	0.71	5.00	0.00	0.00	0.00
40.90	2.00	0.71	5.00	0.00	0.00	0.00
40.95	2.00	0.71	5.00	0.00	0.00	0.00
41.00	2.00	0.71	5.00	0.00	0.00	0.00
41.05	2.00	0.71	5.00	0.00	0.00	0.00

41.10	2.00	0.71	5.00	0.00	0.00	0.00
41.15	2.00	0.71	5.00	0.00	0.00	0.00
41.20	2.00	0.71	5.00	0.00	0.00	0.00
41.25	2.00	0.71	5.00	0.00	0.00	0.00
41.30	2.00	0.71	5.00	0.00	0.00	0.00
41.35	2.00	0.71	5.00	0.00	0.00	0.00
41.40	2.00	0.71	5.00	0.00	0.00	0.00
41.45	2.00	0.71	5.00	0.00	0.00	0.00
41.50	2.00	0.71	5.00	0.00	0.00	0.00
41.55	2.00	0.71	5.00	0.00	0.00	0.00
41.60	2.00	0.71	5.00	0.00	0.00	0.00
41.65	2.00	0.71	5.00	0.00	0.00	0.00
41.70	2.00	0.71	5.00	0.00	0.00	0.00
41.75	2.00	0.71	5.00	0.00	0.00	0.00
41.80	2.00	0.71	5.00	0.00	0.00	0.00
41.85	2.00	0.71	5.00	0.00	0.00	0.00
41.90	2.00	0.71	5.00	0.00	0.00	0.00
41.95	2.00	0.71	5.00	0.00	0.00	0.00
42.00	2.00	0.71	5.00	0.00	0.00	0.00
42.05	2.00	0.71	5.00	0.00	0.00	0.00
42.10	2.00	0.71	5.00	0.00	0.00	0.00
42.15	2.00	0.71	5.00	0.00	0.00	0.00
42.20	2.00	0.71	5.00	0.00	0.00	0.00
42.25	2.00	0.71	5.00	0.00	0.00	0.00
42.30	2.00	0.71	5.00	0.00	0.00	0.00
42.35	2.00	0.71	5.00	0.00	0.00	0.00
42.40	2.00	0.71	5.00	0.00	0.00	0.00
42.45	2.00	0.71	5.00	0.00	0.00	0.00
42.50	2.00	0.71	5.00	0.00	0.00	0.00
42.55	2.00	0.71	5.00	0.00	0.00	0.00
42.60	2.00	0.71	5.00	0.00	0.00	0.00
42.65	2.00	0.71	5.00	0.00	0.00	0.00
42.70	2.00	0.71	5.00	0.00	0.00	0.00
42.75	2.00	0.71	5.00	0.00	0.00	0.00
42.80	2.00	0.71	5.00	0.00	0.00	0.00
42.85	2.00	0.71	5.00	0.00	0.00	0.00
42.90	2.00	0.71	5.00	0.00	0.00	0.00
42.95	2.00	0.71	5.00	0.00	0.00	0.00
43.00	2.00	0.71	5.00	0.00	0.00	0.00
43.05	2.00	0.71	5.00	0.00	0.00	0.00
43.10	2.00	0.71	5.00	0.00	0.00	0.00
43.15	2.00	0.71	5.00	0.00	0.00	0.00
43.20	2.00	0.71	5.00	0.00	0.00	0.00
43.25	2.00	0.71	5.00	0.00	0.00	0.00
43.30	2.00	0.71	5.00	0.00	0.00	0.00
43.35	2.00	0.71	5.00	0.00	0.00	0.00
43.40	2.00	0.71	5.00	0.00	0.00	0.00
43.45	2.00	0.71	5.00	0.00	0.00	0.00
43.50	2.00	0.71	5.00	0.00	0.00	0.00
43.55	2.00	0.71	5.00	0.00	0.00	0.00

43.60	2.00	0.71	5.00	0.00	0.00	0.00
43.65	2.00	0.71	5.00	0.00	0.00	0.00
43.70	2.00	0.71	5.00	0.00	0.00	0.00
43.75	2.00	0.71	5.00	0.00	0.00	0.00
43.80	2.00	0.71	5.00	0.00	0.00	0.00
43.85	2.00	0.71	5.00	0.00	0.00	0.00
43.90	2.00	0.71	5.00	0.00	0.00	0.00
43.95	2.00	0.71	5.00	0.00	0.00	0.00
44.00	2.00	0.71	5.00	0.00	0.00	0.00
44.05	2.00	0.71	5.00	0.00	0.00	0.00
44.10	2.00	0.71	5.00	0.00	0.00	0.00
44.15	2.00	0.71	5.00	0.00	0.00	0.00
44.20	2.00	0.71	5.00	0.00	0.00	0.00
44.25	2.00	0.71	5.00	0.00	0.00	0.00
44.30	2.00	0.71	5.00	0.00	0.00	0.00
44.35	2.00	0.71	5.00	0.00	0.00	0.00
44.40	2.00	0.71	5.00	0.00	0.00	0.00
44.45	2.00	0.71	5.00	0.00	0.00	0.00
44.50	2.00	0.71	5.00	0.00	0.00	0.00
44.55	2.00	0.71	5.00	0.00	0.00	0.00
44.60	2.00	0.71	5.00	0.00	0.00	0.00
44.65	2.00	0.71	5.00	0.00	0.00	0.00
44.70	2.00	0.71	5.00	0.00	0.00	0.00
44.75	2.00	0.71	5.00	0.00	0.00	0.00
44.80	2.00	0.71	5.00	0.00	0.00	0.00
44.85	2.00	0.71	5.00	0.00	0.00	0.00
44.90	2.00	0.71	5.00	0.00	0.00	0.00
44.95	2.00	0.71	5.00	0.00	0.00	0.00
45.00	2.00	0.71	5.00	0.00	0.00	0.00
45.05	2.00	0.71	5.00	0.00	0.00	0.00
45.10	2.00	0.71	5.00	0.00	0.00	0.00
45.15	2.00	0.71	5.00	0.00	0.00	0.00
45.20	2.00	0.71	5.00	0.00	0.00	0.00
45.25	2.00	0.71	5.00	0.00	0.00	0.00
45.30	2.00	0.71	5.00	0.00	0.00	0.00
45.35	2.00	0.71	5.00	0.00	0.00	0.00
45.40	2.00	0.71	5.00	0.00	0.00	0.00
45.45	2.00	0.71	5.00	0.00	0.00	0.00
45.50	2.00	0.71	5.00	0.00	0.00	0.00
45.55	2.00	0.71	5.00	0.00	0.00	0.00
45.60	2.00	0.71	5.00	0.00	0.00	0.00
45.65	2.00	0.71	5.00	0.00	0.00	0.00
45.70	2.00	0.71	5.00	0.00	0.00	0.00
45.75	2.00	0.71	5.00	0.00	0.00	0.00
45.80	2.00	0.71	5.00	0.00	0.00	0.00
45.85	2.00	0.71	5.00	0.00	0.00	0.00
45.90	2.00	0.71	5.00	0.00	0.00	0.00
45.95	2.00	0.71	5.00	0.00	0.00	0.00
46.00	2.00	0.71	5.00	0.00	0.00	0.00
46.05	2.00	0.71	5.00	0.00	0.00	0.00

46.10	2.00	0.71	5.00	0.00	0.00	0.00
46.15	2.00	0.71	5.00	0.00	0.00	0.00
46.20	2.00	0.71	5.00	0.00	0.00	0.00
46.25	2.00	0.71	5.00	0.00	0.00	0.00
46.30	2.00	0.71	5.00	0.00	0.00	0.00
46.35	2.00	0.71	5.00	0.00	0.00	0.00
46.40	2.00	0.71	5.00	0.00	0.00	0.00
46.45	2.00	0.71	5.00	0.00	0.00	0.00
46.50	2.00	0.71	5.00	0.00	0.00	0.00
46.55	2.00	0.71	5.00	0.00	0.00	0.00
46.60	2.00	0.71	5.00	0.00	0.00	0.00
46.65	2.00	0.71	5.00	0.00	0.00	0.00
46.70	2.00	0.71	5.00	0.00	0.00	0.00
46.75	2.00	0.71	5.00	0.00	0.00	0.00
46.80	2.00	0.71	5.00	0.00	0.00	0.00
46.85	2.00	0.71	5.00	0.00	0.00	0.00
46.90	2.00	0.71	5.00	0.00	0.00	0.00
46.95	2.00	0.71	5.00	0.00	0.00	0.00
47.00	2.00	0.71	5.00	0.00	0.00	0.00
47.05	2.00	0.71	5.00	0.00	0.00	0.00
47.10	2.00	0.71	5.00	0.00	0.00	0.00
47.15	2.00	0.71	5.00	0.00	0.00	0.00
47.20	2.00	0.71	5.00	0.00	0.00	0.00
47.25	2.00	0.71	5.00	0.00	0.00	0.00
47.30	2.00	0.71	5.00	0.00	0.00	0.00
47.35	2.00	0.71	5.00	0.00	0.00	0.00
47.40	2.00	0.71	5.00	0.00	0.00	0.00
47.45	2.00	0.71	5.00	0.00	0.00	0.00
47.50	2.00	0.71	5.00	0.00	0.00	0.00
47.55	2.00	0.71	5.00	0.00	0.00	0.00
47.60	2.00	0.71	5.00	0.00	0.00	0.00
47.65	2.00	0.71	5.00	0.00	0.00	0.00
47.70	2.00	0.71	5.00	0.00	0.00	0.00
47.75	2.00	0.71	5.00	0.00	0.00	0.00
47.80	2.00	0.71	5.00	0.00	0.00	0.00
47.85	2.00	0.71	5.00	0.00	0.00	0.00
47.90	2.00	0.71	5.00	0.00	0.00	0.00
47.95	2.00	0.71	5.00	0.00	0.00	0.00
48.00	2.00	0.71	5.00	0.00	0.00	0.00
48.05	2.00	0.71	5.00	0.00	0.00	0.00
48.10	2.00	0.71	5.00	0.00	0.00	0.00
48.15	2.00	0.71	5.00	0.00	0.00	0.00
48.20	2.00	0.70	5.00	0.00	0.00	0.00
48.25	2.00	0.70	5.00	0.00	0.00	0.00
48.30	2.00	0.70	5.00	0.00	0.00	0.00
48.35	2.00	0.70	5.00	0.00	0.00	0.00
48.40	2.00	0.70	5.00	0.00	0.00	0.00
48.45	2.00	0.70	5.00	0.00	0.00	0.00
48.50	2.00	0.70	5.00	0.00	0.00	0.00
48.55	2.00	0.70	5.00	0.00	0.00	0.00

48.60	2.00	0.70	5.00	0.00	0.00	0.00
48.65	2.00	0.70	5.00	0.00	0.00	0.00
48.70	2.00	0.70	5.00	0.00	0.00	0.00
48.75	2.00	0.70	5.00	0.00	0.00	0.00
48.80	2.00	0.70	5.00	0.00	0.00	0.00
48.85	2.00	0.70	5.00	0.00	0.00	0.00
48.90	2.00	0.70	5.00	0.00	0.00	0.00
48.95	2.00	0.70	5.00	0.00	0.00	0.00
49.00	2.00	0.70	5.00	0.00	0.00	0.00
49.05	2.00	0.70	5.00	0.00	0.00	0.00
49.10	2.00	0.70	5.00	0.00	0.00	0.00
49.15	2.00	0.70	5.00	0.00	0.00	0.00
49.20	2.00	0.70	5.00	0.00	0.00	0.00
49.25	2.00	0.70	5.00	0.00	0.00	0.00
49.30	2.00	0.70	5.00	0.00	0.00	0.00
49.35	2.00	0.70	5.00	0.00	0.00	0.00
49.40	2.00	0.70	5.00	0.00	0.00	0.00
49.45	2.00	0.70	5.00	0.00	0.00	0.00
49.50	2.00	0.70	5.00	0.00	0.00	0.00
49.55	2.00	0.70	5.00	0.00	0.00	0.00
49.60	2.00	0.70	5.00	0.00	0.00	0.00
49.65	2.00	0.70	5.00	0.00	0.00	0.00
49.70	2.00	0.70	5.00	0.00	0.00	0.00
49.75	2.00	0.70	5.00	0.00	0.00	0.00
49.80	2.00	0.70	5.00	0.00	0.00	0.00
49.85	2.00	0.70	5.00	0.00	0.00	0.00
49.90	2.00	0.70	5.00	0.00	0.00	0.00
49.95	2.00	0.70	5.00	0.00	0.00	0.00
50.00	2.00	0.70	5.00	0.00	0.00	0.00
50.05	2.00	0.70	5.00	0.00	0.00	0.00
50.10	2.00	0.70	5.00	0.00	0.00	0.00
50.15	2.00	0.70	5.00	0.00	0.00	0.00
50.20	2.00	0.70	5.00	0.00	0.00	0.00
50.25	2.00	0.70	5.00	0.00	0.00	0.00
50.30	2.00	0.70	5.00	0.00	0.00	0.00
50.35	2.00	0.70	5.00	0.00	0.00	0.00
50.40	2.00	0.70	5.00	0.00	0.00	0.00
50.45	2.00	0.70	5.00	0.00	0.00	0.00
50.50	2.00	0.70	5.00	0.00	0.00	0.00
50.55	2.00	0.70	5.00	0.00	0.00	0.00
50.60	2.00	0.70	5.00	0.00	0.00	0.00
50.65	2.00	0.70	5.00	0.00	0.00	0.00
50.70	2.00	0.70	5.00	0.00	0.00	0.00
50.75	2.00	0.70	5.00	0.00	0.00	0.00
50.80	2.00	0.70	5.00	0.00	0.00	0.00
50.85	2.00	0.70	5.00	0.00	0.00	0.00
50.90	2.00	0.70	5.00	0.00	0.00	0.00
50.95	2.00	0.70	5.00	0.00	0.00	0.00
51.00	2.00	0.70	5.00	0.00	0.00	0.00
51.05	2.00	0.70	5.00	0.00	0.00	0.00

51.10	2.00	0.70	5.00	0.00	0.00	0.00
51.15	2.00	0.70	5.00	0.00	0.00	0.00
51.20	2.00	0.70	5.00	0.00	0.00	0.00
51.25	2.00	0.70	5.00	0.00	0.00	0.00
51.30	2.00	0.70	5.00	0.00	0.00	0.00
51.35	2.00	0.70	5.00	0.00	0.00	0.00
51.40	2.00	0.70	5.00	0.00	0.00	0.00
51.45	2.00	0.70	5.00	0.00	0.00	0.00
51.50	2.00	0.70	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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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 6/25/2021 11:14:19 AM

Input File Name: H:\PROJECTS\11000s\11647 folder, Brewington Ave Subdivision, MidPen Housing\Liquifaction\F2_Boring 4.liq
Title: SC11647
Subtitle: Brewington Ave Subdivision

Surface Elev.=104
Hole No.=B-4
Depth of Hole= 51.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 30.00 ft
Max. Acceleration= 1.04 g
Earthquake Magnitude= 7.00

Input Data:
Surface Elev.=104
Hole No.=B-4
Depth of Hole=51.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 30.00 ft
Max. Acceleration=1.04 g
Earthquake Magnitude=7.00
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: Post Liquefaction
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1

10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	23.00	137.00	23.00
5.00	13.00	128.00	NoLiq
10.00	11.00	130.00	NoLiq
15.00	7.00	124.00	NoLiq
20.00	9.00	116.00	NoLiq
25.00	13.00	116.00	NoLiq
30.00	7.00	122.00	NoLiq
35.00	7.00	122.00	NoLiq
40.00	6.00	118.00	NoLiq
45.00	14.00	127.00	NoLiq
50.00	12.00	122.00	NoLiq
51.50	12.00	122.00	NoLiq

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.27 in.
Total Settlement of Saturated and Unsaturated Sands=0.27 in.
Differential Settlement=0.133 to 0.176 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.39	0.68	5.00	0.00	0.27	0.27
0.05	2.39	0.68	5.00	0.00	0.27	0.27
0.10	2.39	0.68	5.00	0.00	0.27	0.27
0.15	2.39	0.68	5.00	0.00	0.27	0.27
0.20	2.39	0.68	5.00	0.00	0.27	0.27
0.25	2.39	0.68	5.00	0.00	0.27	0.27
0.30	2.39	0.68	5.00	0.00	0.27	0.27
0.35	2.39	0.68	5.00	0.00	0.27	0.27
0.40	2.39	0.68	5.00	0.00	0.27	0.27
0.45	2.39	0.68	5.00	0.00	0.27	0.27
0.50	2.39	0.68	5.00	0.00	0.27	0.27
0.55	2.39	0.68	5.00	0.00	0.27	0.27
0.60	2.39	0.68	5.00	0.00	0.27	0.27
0.65	2.39	0.68	5.00	0.00	0.27	0.27
0.70	2.39	0.68	5.00	0.00	0.27	0.27
0.75	2.39	0.68	5.00	0.00	0.27	0.27
0.80	2.39	0.68	5.00	0.00	0.27	0.27
0.85	2.39	0.68	5.00	0.00	0.27	0.27
0.90	2.39	0.68	5.00	0.00	0.27	0.27
0.95	2.39	0.68	5.00	0.00	0.26	0.26
1.00	2.39	0.68	5.00	0.00	0.26	0.26
1.05	2.39	0.68	5.00	0.00	0.26	0.26
1.10	2.39	0.68	5.00	0.00	0.26	0.26

1.15	2.39	0.68	5.00	0.00	0.26	0.26
1.20	2.39	0.68	5.00	0.00	0.26	0.26
1.25	2.39	0.68	5.00	0.00	0.26	0.26
1.30	2.39	0.68	5.00	0.00	0.26	0.26
1.35	2.39	0.68	5.00	0.00	0.26	0.26
1.40	2.39	0.68	5.00	0.00	0.26	0.26
1.45	2.39	0.68	5.00	0.00	0.26	0.26
1.50	2.39	0.67	5.00	0.00	0.26	0.26
1.55	2.39	0.67	5.00	0.00	0.26	0.26
1.60	2.39	0.67	5.00	0.00	0.26	0.26
1.65	2.39	0.67	5.00	0.00	0.26	0.26
1.70	2.39	0.67	5.00	0.00	0.26	0.26
1.75	2.39	0.67	5.00	0.00	0.26	0.26
1.80	2.39	0.67	5.00	0.00	0.26	0.26
1.85	2.39	0.67	5.00	0.00	0.26	0.26
1.90	2.39	0.67	5.00	0.00	0.26	0.26
1.95	2.39	0.67	5.00	0.00	0.26	0.26
2.00	2.39	0.67	5.00	0.00	0.26	0.26
2.05	2.39	0.67	5.00	0.00	0.26	0.26
2.10	2.39	0.67	5.00	0.00	0.26	0.26
2.15	2.39	0.67	5.00	0.00	0.25	0.25
2.20	2.39	0.67	5.00	0.00	0.25	0.25
2.25	2.39	0.67	5.00	0.00	0.25	0.25
2.30	2.39	0.67	5.00	0.00	0.25	0.25
2.35	2.39	0.67	5.00	0.00	0.25	0.25
2.40	2.39	0.67	5.00	0.00	0.24	0.24
2.45	2.39	0.67	5.00	0.00	0.24	0.24
2.50	2.39	0.67	5.00	0.00	0.23	0.23
2.55	2.39	0.67	5.00	0.00	0.23	0.23
2.60	2.39	0.67	5.00	0.00	0.22	0.22
2.65	2.39	0.67	5.00	0.00	0.21	0.21
2.70	2.39	0.67	5.00	0.00	0.21	0.21
2.75	2.39	0.67	5.00	0.00	0.20	0.20
2.80	2.39	0.67	5.00	0.00	0.20	0.20
2.85	2.39	0.67	5.00	0.00	0.19	0.19
2.90	2.39	0.67	5.00	0.00	0.18	0.18
2.95	2.39	0.67	5.00	0.00	0.18	0.18
3.00	2.39	0.67	5.00	0.00	0.17	0.17
3.05	2.39	0.67	5.00	0.00	0.17	0.17
3.10	2.39	0.67	5.00	0.00	0.16	0.16
3.15	2.39	0.67	5.00	0.00	0.16	0.16
3.20	2.39	0.67	5.00	0.00	0.15	0.15
3.25	2.39	0.67	5.00	0.00	0.14	0.14
3.30	2.39	0.67	5.00	0.00	0.14	0.14
3.35	2.39	0.67	5.00	0.00	0.13	0.13
3.40	2.39	0.67	5.00	0.00	0.13	0.13
3.45	2.39	0.67	5.00	0.00	0.12	0.12
3.50	2.39	0.67	5.00	0.00	0.11	0.11
3.55	2.39	0.67	5.00	0.00	0.11	0.11
3.60	2.39	0.67	5.00	0.00	0.10	0.10

3.65	2.39	0.67	5.00	0.00	0.10	0.10
3.70	2.39	0.67	5.00	0.00	0.10	0.10
3.75	2.39	0.67	5.00	0.00	0.10	0.10
3.80	2.39	0.67	5.00	0.00	0.10	0.10
3.85	2.39	0.67	5.00	0.00	0.09	0.09
3.90	2.39	0.67	5.00	0.00	0.09	0.09
3.95	2.39	0.67	5.00	0.00	0.09	0.09
4.00	2.39	0.67	5.00	0.00	0.09	0.09
4.05	2.39	0.67	5.00	0.00	0.09	0.09
4.10	2.39	0.67	5.00	0.00	0.08	0.08
4.15	2.39	0.67	5.00	0.00	0.08	0.08
4.20	2.39	0.67	5.00	0.00	0.08	0.08
4.25	2.39	0.67	5.00	0.00	0.08	0.08
4.30	2.39	0.67	5.00	0.00	0.07	0.07
4.35	2.39	0.67	5.00	0.00	0.07	0.07
4.40	2.39	0.67	5.00	0.00	0.07	0.07
4.45	2.39	0.67	5.00	0.00	0.06	0.06
4.50	2.39	0.67	5.00	0.00	0.06	0.06
4.55	2.39	0.67	5.00	0.00	0.05	0.05
4.60	2.39	0.67	5.00	0.00	0.05	0.05
4.65	2.39	0.67	5.00	0.00	0.04	0.04
4.70	2.39	0.67	5.00	0.00	0.04	0.04
4.75	2.39	0.67	5.00	0.00	0.03	0.03
4.80	2.39	0.67	5.00	0.00	0.02	0.02
4.85	2.39	0.67	5.00	0.00	0.02	0.02
4.90	2.39	0.67	5.00	0.00	0.01	0.01
4.95	2.39	0.67	5.00	0.00	0.01	0.01
5.00	2.00	0.67	5.00	0.00	0.00	0.00
5.05	2.00	0.67	5.00	0.00	0.00	0.00
5.10	2.00	0.67	5.00	0.00	0.00	0.00
5.15	2.00	0.67	5.00	0.00	0.00	0.00
5.20	2.00	0.67	5.00	0.00	0.00	0.00
5.25	2.00	0.67	5.00	0.00	0.00	0.00
5.30	2.00	0.67	5.00	0.00	0.00	0.00
5.35	2.00	0.67	5.00	0.00	0.00	0.00
5.40	2.00	0.67	5.00	0.00	0.00	0.00
5.45	2.00	0.67	5.00	0.00	0.00	0.00
5.50	2.00	0.67	5.00	0.00	0.00	0.00
5.55	2.00	0.67	5.00	0.00	0.00	0.00
5.60	2.00	0.67	5.00	0.00	0.00	0.00
5.65	2.00	0.67	5.00	0.00	0.00	0.00
5.70	2.00	0.67	5.00	0.00	0.00	0.00
5.75	2.00	0.67	5.00	0.00	0.00	0.00
5.80	2.00	0.67	5.00	0.00	0.00	0.00
5.85	2.00	0.67	5.00	0.00	0.00	0.00
5.90	2.00	0.67	5.00	0.00	0.00	0.00
5.95	2.00	0.67	5.00	0.00	0.00	0.00
6.00	2.00	0.67	5.00	0.00	0.00	0.00
6.05	2.00	0.67	5.00	0.00	0.00	0.00
6.10	2.00	0.67	5.00	0.00	0.00	0.00

6.15	2.00	0.67	5.00	0.00	0.00	0.00
6.20	2.00	0.67	5.00	0.00	0.00	0.00
6.25	2.00	0.67	5.00	0.00	0.00	0.00
6.30	2.00	0.67	5.00	0.00	0.00	0.00
6.35	2.00	0.67	5.00	0.00	0.00	0.00
6.40	2.00	0.67	5.00	0.00	0.00	0.00
6.45	2.00	0.67	5.00	0.00	0.00	0.00
6.50	2.00	0.67	5.00	0.00	0.00	0.00
6.55	2.00	0.67	5.00	0.00	0.00	0.00
6.60	2.00	0.67	5.00	0.00	0.00	0.00
6.65	2.00	0.67	5.00	0.00	0.00	0.00
6.70	2.00	0.67	5.00	0.00	0.00	0.00
6.75	2.00	0.67	5.00	0.00	0.00	0.00
6.80	2.00	0.67	5.00	0.00	0.00	0.00
6.85	2.00	0.67	5.00	0.00	0.00	0.00
6.90	2.00	0.67	5.00	0.00	0.00	0.00
6.95	2.00	0.67	5.00	0.00	0.00	0.00
7.00	2.00	0.67	5.00	0.00	0.00	0.00
7.05	2.00	0.67	5.00	0.00	0.00	0.00
7.10	2.00	0.67	5.00	0.00	0.00	0.00
7.15	2.00	0.67	5.00	0.00	0.00	0.00
7.20	2.00	0.67	5.00	0.00	0.00	0.00
7.25	2.00	0.67	5.00	0.00	0.00	0.00
7.30	2.00	0.67	5.00	0.00	0.00	0.00
7.35	2.00	0.67	5.00	0.00	0.00	0.00
7.40	2.00	0.67	5.00	0.00	0.00	0.00
7.45	2.00	0.67	5.00	0.00	0.00	0.00
7.50	2.00	0.67	5.00	0.00	0.00	0.00
7.55	2.00	0.67	5.00	0.00	0.00	0.00
7.60	2.00	0.67	5.00	0.00	0.00	0.00
7.65	2.00	0.67	5.00	0.00	0.00	0.00
7.70	2.00	0.67	5.00	0.00	0.00	0.00
7.75	2.00	0.67	5.00	0.00	0.00	0.00
7.80	2.00	0.66	5.00	0.00	0.00	0.00
7.85	2.00	0.66	5.00	0.00	0.00	0.00
7.90	2.00	0.66	5.00	0.00	0.00	0.00
7.95	2.00	0.66	5.00	0.00	0.00	0.00
8.00	2.00	0.66	5.00	0.00	0.00	0.00
8.05	2.00	0.66	5.00	0.00	0.00	0.00
8.10	2.00	0.66	5.00	0.00	0.00	0.00
8.15	2.00	0.66	5.00	0.00	0.00	0.00
8.20	2.00	0.66	5.00	0.00	0.00	0.00
8.25	2.00	0.66	5.00	0.00	0.00	0.00
8.30	2.00	0.66	5.00	0.00	0.00	0.00
8.35	2.00	0.66	5.00	0.00	0.00	0.00
8.40	2.00	0.66	5.00	0.00	0.00	0.00
8.45	2.00	0.66	5.00	0.00	0.00	0.00
8.50	2.00	0.66	5.00	0.00	0.00	0.00
8.55	2.00	0.66	5.00	0.00	0.00	0.00
8.60	2.00	0.66	5.00	0.00	0.00	0.00

8.65	2.00	0.66	5.00	0.00	0.00	0.00
8.70	2.00	0.66	5.00	0.00	0.00	0.00
8.75	2.00	0.66	5.00	0.00	0.00	0.00
8.80	2.00	0.66	5.00	0.00	0.00	0.00
8.85	2.00	0.66	5.00	0.00	0.00	0.00
8.90	2.00	0.66	5.00	0.00	0.00	0.00
8.95	2.00	0.66	5.00	0.00	0.00	0.00
9.00	2.00	0.66	5.00	0.00	0.00	0.00
9.05	2.00	0.66	5.00	0.00	0.00	0.00
9.10	2.00	0.66	5.00	0.00	0.00	0.00
9.15	2.00	0.66	5.00	0.00	0.00	0.00
9.20	2.00	0.66	5.00	0.00	0.00	0.00
9.25	2.00	0.66	5.00	0.00	0.00	0.00
9.30	2.00	0.66	5.00	0.00	0.00	0.00
9.35	2.00	0.66	5.00	0.00	0.00	0.00
9.40	2.00	0.66	5.00	0.00	0.00	0.00
9.45	2.00	0.66	5.00	0.00	0.00	0.00
9.50	2.00	0.66	5.00	0.00	0.00	0.00
9.55	2.00	0.66	5.00	0.00	0.00	0.00
9.60	2.00	0.66	5.00	0.00	0.00	0.00
9.65	2.00	0.66	5.00	0.00	0.00	0.00
9.70	2.00	0.66	5.00	0.00	0.00	0.00
9.75	2.00	0.66	5.00	0.00	0.00	0.00
9.80	2.00	0.66	5.00	0.00	0.00	0.00
9.85	2.00	0.66	5.00	0.00	0.00	0.00
9.90	2.00	0.66	5.00	0.00	0.00	0.00
9.95	2.00	0.66	5.00	0.00	0.00	0.00
10.00	2.00	0.66	5.00	0.00	0.00	0.00
10.05	2.00	0.66	5.00	0.00	0.00	0.00
10.10	2.00	0.66	5.00	0.00	0.00	0.00
10.15	2.00	0.66	5.00	0.00	0.00	0.00
10.20	2.00	0.66	5.00	0.00	0.00	0.00
10.25	2.00	0.66	5.00	0.00	0.00	0.00
10.30	2.00	0.66	5.00	0.00	0.00	0.00
10.35	2.00	0.66	5.00	0.00	0.00	0.00
10.40	2.00	0.66	5.00	0.00	0.00	0.00
10.45	2.00	0.66	5.00	0.00	0.00	0.00
10.50	2.00	0.66	5.00	0.00	0.00	0.00
10.55	2.00	0.66	5.00	0.00	0.00	0.00
10.60	2.00	0.66	5.00	0.00	0.00	0.00
10.65	2.00	0.66	5.00	0.00	0.00	0.00
10.70	2.00	0.66	5.00	0.00	0.00	0.00
10.75	2.00	0.66	5.00	0.00	0.00	0.00
10.80	2.00	0.66	5.00	0.00	0.00	0.00
10.85	2.00	0.66	5.00	0.00	0.00	0.00
10.90	2.00	0.66	5.00	0.00	0.00	0.00
10.95	2.00	0.66	5.00	0.00	0.00	0.00
11.00	2.00	0.66	5.00	0.00	0.00	0.00
11.05	2.00	0.66	5.00	0.00	0.00	0.00
11.10	2.00	0.66	5.00	0.00	0.00	0.00

11.15	2.00	0.66	5.00	0.00	0.00	0.00
11.20	2.00	0.66	5.00	0.00	0.00	0.00
11.25	2.00	0.66	5.00	0.00	0.00	0.00
11.30	2.00	0.66	5.00	0.00	0.00	0.00
11.35	2.00	0.66	5.00	0.00	0.00	0.00
11.40	2.00	0.66	5.00	0.00	0.00	0.00
11.45	2.00	0.66	5.00	0.00	0.00	0.00
11.50	2.00	0.66	5.00	0.00	0.00	0.00
11.55	2.00	0.66	5.00	0.00	0.00	0.00
11.60	2.00	0.66	5.00	0.00	0.00	0.00
11.65	2.00	0.66	5.00	0.00	0.00	0.00
11.70	2.00	0.66	5.00	0.00	0.00	0.00
11.75	2.00	0.66	5.00	0.00	0.00	0.00
11.80	2.00	0.66	5.00	0.00	0.00	0.00
11.85	2.00	0.66	5.00	0.00	0.00	0.00
11.90	2.00	0.66	5.00	0.00	0.00	0.00
11.95	2.00	0.66	5.00	0.00	0.00	0.00
12.00	2.00	0.66	5.00	0.00	0.00	0.00
12.05	2.00	0.66	5.00	0.00	0.00	0.00
12.10	2.00	0.66	5.00	0.00	0.00	0.00
12.15	2.00	0.66	5.00	0.00	0.00	0.00
12.20	2.00	0.66	5.00	0.00	0.00	0.00
12.25	2.00	0.66	5.00	0.00	0.00	0.00
12.30	2.00	0.66	5.00	0.00	0.00	0.00
12.35	2.00	0.66	5.00	0.00	0.00	0.00
12.40	2.00	0.66	5.00	0.00	0.00	0.00
12.45	2.00	0.66	5.00	0.00	0.00	0.00
12.50	2.00	0.66	5.00	0.00	0.00	0.00
12.55	2.00	0.66	5.00	0.00	0.00	0.00
12.60	2.00	0.66	5.00	0.00	0.00	0.00
12.65	2.00	0.66	5.00	0.00	0.00	0.00
12.70	2.00	0.66	5.00	0.00	0.00	0.00
12.75	2.00	0.66	5.00	0.00	0.00	0.00
12.80	2.00	0.66	5.00	0.00	0.00	0.00
12.85	2.00	0.66	5.00	0.00	0.00	0.00
12.90	2.00	0.66	5.00	0.00	0.00	0.00
12.95	2.00	0.66	5.00	0.00	0.00	0.00
13.00	2.00	0.66	5.00	0.00	0.00	0.00
13.05	2.00	0.66	5.00	0.00	0.00	0.00
13.10	2.00	0.66	5.00	0.00	0.00	0.00
13.15	2.00	0.66	5.00	0.00	0.00	0.00
13.20	2.00	0.66	5.00	0.00	0.00	0.00
13.25	2.00	0.66	5.00	0.00	0.00	0.00
13.30	2.00	0.66	5.00	0.00	0.00	0.00
13.35	2.00	0.66	5.00	0.00	0.00	0.00
13.40	2.00	0.66	5.00	0.00	0.00	0.00
13.45	2.00	0.66	5.00	0.00	0.00	0.00
13.50	2.00	0.66	5.00	0.00	0.00	0.00
13.55	2.00	0.66	5.00	0.00	0.00	0.00
13.60	2.00	0.66	5.00	0.00	0.00	0.00

13.65	2.00	0.66	5.00	0.00	0.00	0.00
13.70	2.00	0.66	5.00	0.00	0.00	0.00
13.75	2.00	0.66	5.00	0.00	0.00	0.00
13.80	2.00	0.66	5.00	0.00	0.00	0.00
13.85	2.00	0.66	5.00	0.00	0.00	0.00
13.90	2.00	0.66	5.00	0.00	0.00	0.00
13.95	2.00	0.66	5.00	0.00	0.00	0.00
14.00	2.00	0.66	5.00	0.00	0.00	0.00
14.05	2.00	0.66	5.00	0.00	0.00	0.00
14.10	2.00	0.66	5.00	0.00	0.00	0.00
14.15	2.00	0.65	5.00	0.00	0.00	0.00
14.20	2.00	0.65	5.00	0.00	0.00	0.00
14.25	2.00	0.65	5.00	0.00	0.00	0.00
14.30	2.00	0.65	5.00	0.00	0.00	0.00
14.35	2.00	0.65	5.00	0.00	0.00	0.00
14.40	2.00	0.65	5.00	0.00	0.00	0.00
14.45	2.00	0.65	5.00	0.00	0.00	0.00
14.50	2.00	0.65	5.00	0.00	0.00	0.00
14.55	2.00	0.65	5.00	0.00	0.00	0.00
14.60	2.00	0.65	5.00	0.00	0.00	0.00
14.65	2.00	0.65	5.00	0.00	0.00	0.00
14.70	2.00	0.65	5.00	0.00	0.00	0.00
14.75	2.00	0.65	5.00	0.00	0.00	0.00
14.80	2.00	0.65	5.00	0.00	0.00	0.00
14.85	2.00	0.65	5.00	0.00	0.00	0.00
14.90	2.00	0.65	5.00	0.00	0.00	0.00
14.95	2.00	0.65	5.00	0.00	0.00	0.00
15.00	2.00	0.65	5.00	0.00	0.00	0.00
15.05	2.00	0.65	5.00	0.00	0.00	0.00
15.10	2.00	0.65	5.00	0.00	0.00	0.00
15.15	2.00	0.65	5.00	0.00	0.00	0.00
15.20	2.00	0.65	5.00	0.00	0.00	0.00
15.25	2.00	0.65	5.00	0.00	0.00	0.00
15.30	2.00	0.65	5.00	0.00	0.00	0.00
15.35	2.00	0.65	5.00	0.00	0.00	0.00
15.40	2.00	0.65	5.00	0.00	0.00	0.00
15.45	2.00	0.65	5.00	0.00	0.00	0.00
15.50	2.00	0.65	5.00	0.00	0.00	0.00
15.55	2.00	0.65	5.00	0.00	0.00	0.00
15.60	2.00	0.65	5.00	0.00	0.00	0.00
15.65	2.00	0.65	5.00	0.00	0.00	0.00
15.70	2.00	0.65	5.00	0.00	0.00	0.00
15.75	2.00	0.65	5.00	0.00	0.00	0.00
15.80	2.00	0.65	5.00	0.00	0.00	0.00
15.85	2.00	0.65	5.00	0.00	0.00	0.00
15.90	2.00	0.65	5.00	0.00	0.00	0.00
15.95	2.00	0.65	5.00	0.00	0.00	0.00
16.00	2.00	0.65	5.00	0.00	0.00	0.00
16.05	2.00	0.65	5.00	0.00	0.00	0.00
16.10	2.00	0.65	5.00	0.00	0.00	0.00

16.15	2.00	0.65	5.00	0.00	0.00	0.00
16.20	2.00	0.65	5.00	0.00	0.00	0.00
16.25	2.00	0.65	5.00	0.00	0.00	0.00
16.30	2.00	0.65	5.00	0.00	0.00	0.00
16.35	2.00	0.65	5.00	0.00	0.00	0.00
16.40	2.00	0.65	5.00	0.00	0.00	0.00
16.45	2.00	0.65	5.00	0.00	0.00	0.00
16.50	2.00	0.65	5.00	0.00	0.00	0.00
16.55	2.00	0.65	5.00	0.00	0.00	0.00
16.60	2.00	0.65	5.00	0.00	0.00	0.00
16.65	2.00	0.65	5.00	0.00	0.00	0.00
16.70	2.00	0.65	5.00	0.00	0.00	0.00
16.75	2.00	0.65	5.00	0.00	0.00	0.00
16.80	2.00	0.65	5.00	0.00	0.00	0.00
16.85	2.00	0.65	5.00	0.00	0.00	0.00
16.90	2.00	0.65	5.00	0.00	0.00	0.00
16.95	2.00	0.65	5.00	0.00	0.00	0.00
17.00	2.00	0.65	5.00	0.00	0.00	0.00
17.05	2.00	0.65	5.00	0.00	0.00	0.00
17.10	2.00	0.65	5.00	0.00	0.00	0.00
17.15	2.00	0.65	5.00	0.00	0.00	0.00
17.20	2.00	0.65	5.00	0.00	0.00	0.00
17.25	2.00	0.65	5.00	0.00	0.00	0.00
17.30	2.00	0.65	5.00	0.00	0.00	0.00
17.35	2.00	0.65	5.00	0.00	0.00	0.00
17.40	2.00	0.65	5.00	0.00	0.00	0.00
17.45	2.00	0.65	5.00	0.00	0.00	0.00
17.50	2.00	0.65	5.00	0.00	0.00	0.00
17.55	2.00	0.65	5.00	0.00	0.00	0.00
17.60	2.00	0.65	5.00	0.00	0.00	0.00
17.65	2.00	0.65	5.00	0.00	0.00	0.00
17.70	2.00	0.65	5.00	0.00	0.00	0.00
17.75	2.00	0.65	5.00	0.00	0.00	0.00
17.80	2.00	0.65	5.00	0.00	0.00	0.00
17.85	2.00	0.65	5.00	0.00	0.00	0.00
17.90	2.00	0.65	5.00	0.00	0.00	0.00
17.95	2.00	0.65	5.00	0.00	0.00	0.00
18.00	2.00	0.65	5.00	0.00	0.00	0.00
18.05	2.00	0.65	5.00	0.00	0.00	0.00
18.10	2.00	0.65	5.00	0.00	0.00	0.00
18.15	2.00	0.65	5.00	0.00	0.00	0.00
18.20	2.00	0.65	5.00	0.00	0.00	0.00
18.25	2.00	0.65	5.00	0.00	0.00	0.00
18.30	2.00	0.65	5.00	0.00	0.00	0.00
18.35	2.00	0.65	5.00	0.00	0.00	0.00
18.40	2.00	0.65	5.00	0.00	0.00	0.00
18.45	2.00	0.65	5.00	0.00	0.00	0.00
18.50	2.00	0.65	5.00	0.00	0.00	0.00
18.55	2.00	0.65	5.00	0.00	0.00	0.00
18.60	2.00	0.65	5.00	0.00	0.00	0.00

18.65	2.00	0.65	5.00	0.00	0.00	0.00
18.70	2.00	0.65	5.00	0.00	0.00	0.00
18.75	2.00	0.65	5.00	0.00	0.00	0.00
18.80	2.00	0.65	5.00	0.00	0.00	0.00
18.85	2.00	0.65	5.00	0.00	0.00	0.00
18.90	2.00	0.65	5.00	0.00	0.00	0.00
18.95	2.00	0.65	5.00	0.00	0.00	0.00
19.00	2.00	0.65	5.00	0.00	0.00	0.00
19.05	2.00	0.65	5.00	0.00	0.00	0.00
19.10	2.00	0.65	5.00	0.00	0.00	0.00
19.15	2.00	0.65	5.00	0.00	0.00	0.00
19.20	2.00	0.65	5.00	0.00	0.00	0.00
19.25	2.00	0.65	5.00	0.00	0.00	0.00
19.30	2.00	0.65	5.00	0.00	0.00	0.00
19.35	2.00	0.65	5.00	0.00	0.00	0.00
19.40	2.00	0.65	5.00	0.00	0.00	0.00
19.45	2.00	0.65	5.00	0.00	0.00	0.00
19.50	2.00	0.65	5.00	0.00	0.00	0.00
19.55	2.00	0.65	5.00	0.00	0.00	0.00
19.60	2.00	0.65	5.00	0.00	0.00	0.00
19.65	2.00	0.65	5.00	0.00	0.00	0.00
19.70	2.00	0.65	5.00	0.00	0.00	0.00
19.75	2.00	0.65	5.00	0.00	0.00	0.00
19.80	2.00	0.65	5.00	0.00	0.00	0.00
19.85	2.00	0.65	5.00	0.00	0.00	0.00
19.90	2.00	0.65	5.00	0.00	0.00	0.00
19.95	2.00	0.65	5.00	0.00	0.00	0.00
20.00	2.00	0.65	5.00	0.00	0.00	0.00
20.05	2.00	0.65	5.00	0.00	0.00	0.00
20.10	2.00	0.65	5.00	0.00	0.00	0.00
20.15	2.00	0.65	5.00	0.00	0.00	0.00
20.20	2.00	0.65	5.00	0.00	0.00	0.00
20.25	2.00	0.65	5.00	0.00	0.00	0.00
20.30	2.00	0.65	5.00	0.00	0.00	0.00
20.35	2.00	0.65	5.00	0.00	0.00	0.00
20.40	2.00	0.65	5.00	0.00	0.00	0.00
20.45	2.00	0.65	5.00	0.00	0.00	0.00
20.50	2.00	0.64	5.00	0.00	0.00	0.00
20.55	2.00	0.64	5.00	0.00	0.00	0.00
20.60	2.00	0.64	5.00	0.00	0.00	0.00
20.65	2.00	0.64	5.00	0.00	0.00	0.00
20.70	2.00	0.64	5.00	0.00	0.00	0.00
20.75	2.00	0.64	5.00	0.00	0.00	0.00
20.80	2.00	0.64	5.00	0.00	0.00	0.00
20.85	2.00	0.64	5.00	0.00	0.00	0.00
20.90	2.00	0.64	5.00	0.00	0.00	0.00
20.95	2.00	0.64	5.00	0.00	0.00	0.00
21.00	2.00	0.64	5.00	0.00	0.00	0.00
21.05	2.00	0.64	5.00	0.00	0.00	0.00
21.10	2.00	0.64	5.00	0.00	0.00	0.00

21.15	2.00	0.64	5.00	0.00	0.00	0.00
21.20	2.00	0.64	5.00	0.00	0.00	0.00
21.25	2.00	0.64	5.00	0.00	0.00	0.00
21.30	2.00	0.64	5.00	0.00	0.00	0.00
21.35	2.00	0.64	5.00	0.00	0.00	0.00
21.40	2.00	0.64	5.00	0.00	0.00	0.00
21.45	2.00	0.64	5.00	0.00	0.00	0.00
21.50	2.00	0.64	5.00	0.00	0.00	0.00
21.55	2.00	0.64	5.00	0.00	0.00	0.00
21.60	2.00	0.64	5.00	0.00	0.00	0.00
21.65	2.00	0.64	5.00	0.00	0.00	0.00
21.70	2.00	0.64	5.00	0.00	0.00	0.00
21.75	2.00	0.64	5.00	0.00	0.00	0.00
21.80	2.00	0.64	5.00	0.00	0.00	0.00
21.85	2.00	0.64	5.00	0.00	0.00	0.00
21.90	2.00	0.64	5.00	0.00	0.00	0.00
21.95	2.00	0.64	5.00	0.00	0.00	0.00
22.00	2.00	0.64	5.00	0.00	0.00	0.00
22.05	2.00	0.64	5.00	0.00	0.00	0.00
22.10	2.00	0.64	5.00	0.00	0.00	0.00
22.15	2.00	0.64	5.00	0.00	0.00	0.00
22.20	2.00	0.64	5.00	0.00	0.00	0.00
22.25	2.00	0.64	5.00	0.00	0.00	0.00
22.30	2.00	0.64	5.00	0.00	0.00	0.00
22.35	2.00	0.64	5.00	0.00	0.00	0.00
22.40	2.00	0.64	5.00	0.00	0.00	0.00
22.45	2.00	0.64	5.00	0.00	0.00	0.00
22.50	2.00	0.64	5.00	0.00	0.00	0.00
22.55	2.00	0.64	5.00	0.00	0.00	0.00
22.60	2.00	0.64	5.00	0.00	0.00	0.00
22.65	2.00	0.64	5.00	0.00	0.00	0.00
22.70	2.00	0.64	5.00	0.00	0.00	0.00
22.75	2.00	0.64	5.00	0.00	0.00	0.00
22.80	2.00	0.64	5.00	0.00	0.00	0.00
22.85	2.00	0.64	5.00	0.00	0.00	0.00
22.90	2.00	0.64	5.00	0.00	0.00	0.00
22.95	2.00	0.64	5.00	0.00	0.00	0.00
23.00	2.00	0.64	5.00	0.00	0.00	0.00
23.05	2.00	0.64	5.00	0.00	0.00	0.00
23.10	2.00	0.64	5.00	0.00	0.00	0.00
23.15	2.00	0.64	5.00	0.00	0.00	0.00
23.20	2.00	0.64	5.00	0.00	0.00	0.00
23.25	2.00	0.64	5.00	0.00	0.00	0.00
23.30	2.00	0.64	5.00	0.00	0.00	0.00
23.35	2.00	0.64	5.00	0.00	0.00	0.00
23.40	2.00	0.64	5.00	0.00	0.00	0.00
23.45	2.00	0.64	5.00	0.00	0.00	0.00
23.50	2.00	0.64	5.00	0.00	0.00	0.00
23.55	2.00	0.64	5.00	0.00	0.00	0.00
23.60	2.00	0.64	5.00	0.00	0.00	0.00

23.65	2.00	0.64	5.00	0.00	0.00	0.00
23.70	2.00	0.64	5.00	0.00	0.00	0.00
23.75	2.00	0.64	5.00	0.00	0.00	0.00
23.80	2.00	0.64	5.00	0.00	0.00	0.00
23.85	2.00	0.64	5.00	0.00	0.00	0.00
23.90	2.00	0.64	5.00	0.00	0.00	0.00
23.95	2.00	0.64	5.00	0.00	0.00	0.00
24.00	2.00	0.64	5.00	0.00	0.00	0.00
24.05	2.00	0.64	5.00	0.00	0.00	0.00
24.10	2.00	0.64	5.00	0.00	0.00	0.00
24.15	2.00	0.64	5.00	0.00	0.00	0.00
24.20	2.00	0.64	5.00	0.00	0.00	0.00
24.25	2.00	0.64	5.00	0.00	0.00	0.00
24.30	2.00	0.64	5.00	0.00	0.00	0.00
24.35	2.00	0.64	5.00	0.00	0.00	0.00
24.40	2.00	0.64	5.00	0.00	0.00	0.00
24.45	2.00	0.64	5.00	0.00	0.00	0.00
24.50	2.00	0.64	5.00	0.00	0.00	0.00
24.55	2.00	0.64	5.00	0.00	0.00	0.00
24.60	2.00	0.64	5.00	0.00	0.00	0.00
24.65	2.00	0.64	5.00	0.00	0.00	0.00
24.70	2.00	0.64	5.00	0.00	0.00	0.00
24.75	2.00	0.64	5.00	0.00	0.00	0.00
24.80	2.00	0.64	5.00	0.00	0.00	0.00
24.85	2.00	0.64	5.00	0.00	0.00	0.00
24.90	2.00	0.64	5.00	0.00	0.00	0.00
24.95	2.00	0.64	5.00	0.00	0.00	0.00
25.00	2.00	0.64	5.00	0.00	0.00	0.00
25.05	2.00	0.64	5.00	0.00	0.00	0.00
25.10	2.00	0.64	5.00	0.00	0.00	0.00
25.15	2.00	0.64	5.00	0.00	0.00	0.00
25.20	2.00	0.64	5.00	0.00	0.00	0.00
25.25	2.00	0.64	5.00	0.00	0.00	0.00
25.30	2.00	0.64	5.00	0.00	0.00	0.00
25.35	2.00	0.64	5.00	0.00	0.00	0.00
25.40	2.00	0.64	5.00	0.00	0.00	0.00
25.45	2.00	0.64	5.00	0.00	0.00	0.00
25.50	2.00	0.64	5.00	0.00	0.00	0.00
25.55	2.00	0.64	5.00	0.00	0.00	0.00
25.60	2.00	0.64	5.00	0.00	0.00	0.00
25.65	2.00	0.64	5.00	0.00	0.00	0.00
25.70	2.00	0.64	5.00	0.00	0.00	0.00
25.75	2.00	0.64	5.00	0.00	0.00	0.00
25.80	2.00	0.64	5.00	0.00	0.00	0.00
25.85	2.00	0.64	5.00	0.00	0.00	0.00
25.90	2.00	0.64	5.00	0.00	0.00	0.00
25.95	2.00	0.64	5.00	0.00	0.00	0.00
26.00	2.00	0.64	5.00	0.00	0.00	0.00
26.05	2.00	0.64	5.00	0.00	0.00	0.00
26.10	2.00	0.64	5.00	0.00	0.00	0.00

26.15	2.00	0.64	5.00	0.00	0.00	0.00
26.20	2.00	0.64	5.00	0.00	0.00	0.00
26.25	2.00	0.64	5.00	0.00	0.00	0.00
26.30	2.00	0.64	5.00	0.00	0.00	0.00
26.35	2.00	0.64	5.00	0.00	0.00	0.00
26.40	2.00	0.64	5.00	0.00	0.00	0.00
26.45	2.00	0.64	5.00	0.00	0.00	0.00
26.50	2.00	0.64	5.00	0.00	0.00	0.00
26.55	2.00	0.64	5.00	0.00	0.00	0.00
26.60	2.00	0.64	5.00	0.00	0.00	0.00
26.65	2.00	0.64	5.00	0.00	0.00	0.00
26.70	2.00	0.64	5.00	0.00	0.00	0.00
26.75	2.00	0.64	5.00	0.00	0.00	0.00
26.80	2.00	0.63	5.00	0.00	0.00	0.00
26.85	2.00	0.63	5.00	0.00	0.00	0.00
26.90	2.00	0.63	5.00	0.00	0.00	0.00
26.95	2.00	0.63	5.00	0.00	0.00	0.00
27.00	2.00	0.63	5.00	0.00	0.00	0.00
27.05	2.00	0.63	5.00	0.00	0.00	0.00
27.10	2.00	0.63	5.00	0.00	0.00	0.00
27.15	2.00	0.63	5.00	0.00	0.00	0.00
27.20	2.00	0.63	5.00	0.00	0.00	0.00
27.25	2.00	0.63	5.00	0.00	0.00	0.00
27.30	2.00	0.63	5.00	0.00	0.00	0.00
27.35	2.00	0.63	5.00	0.00	0.00	0.00
27.40	2.00	0.63	5.00	0.00	0.00	0.00
27.45	2.00	0.63	5.00	0.00	0.00	0.00
27.50	2.00	0.63	5.00	0.00	0.00	0.00
27.55	2.00	0.63	5.00	0.00	0.00	0.00
27.60	2.00	0.63	5.00	0.00	0.00	0.00
27.65	2.00	0.63	5.00	0.00	0.00	0.00
27.70	2.00	0.63	5.00	0.00	0.00	0.00
27.75	2.00	0.63	5.00	0.00	0.00	0.00
27.80	2.00	0.63	5.00	0.00	0.00	0.00
27.85	2.00	0.63	5.00	0.00	0.00	0.00
27.90	2.00	0.63	5.00	0.00	0.00	0.00
27.95	2.00	0.63	5.00	0.00	0.00	0.00
28.00	2.00	0.63	5.00	0.00	0.00	0.00
28.05	2.00	0.63	5.00	0.00	0.00	0.00
28.10	2.00	0.63	5.00	0.00	0.00	0.00
28.15	2.00	0.63	5.00	0.00	0.00	0.00
28.20	2.00	0.63	5.00	0.00	0.00	0.00
28.25	2.00	0.63	5.00	0.00	0.00	0.00
28.30	2.00	0.63	5.00	0.00	0.00	0.00
28.35	2.00	0.63	5.00	0.00	0.00	0.00
28.40	2.00	0.63	5.00	0.00	0.00	0.00
28.45	2.00	0.63	5.00	0.00	0.00	0.00
28.50	2.00	0.63	5.00	0.00	0.00	0.00
28.55	2.00	0.63	5.00	0.00	0.00	0.00
28.60	2.00	0.63	5.00	0.00	0.00	0.00

28.65	2.00	0.63	5.00	0.00	0.00	0.00
28.70	2.00	0.63	5.00	0.00	0.00	0.00
28.75	2.00	0.63	5.00	0.00	0.00	0.00
28.80	2.00	0.63	5.00	0.00	0.00	0.00
28.85	2.00	0.63	5.00	0.00	0.00	0.00
28.90	2.00	0.63	5.00	0.00	0.00	0.00
28.95	2.00	0.63	5.00	0.00	0.00	0.00
29.00	2.00	0.63	5.00	0.00	0.00	0.00
29.05	2.00	0.63	5.00	0.00	0.00	0.00
29.10	2.00	0.63	5.00	0.00	0.00	0.00
29.15	2.00	0.63	5.00	0.00	0.00	0.00
29.20	2.00	0.63	5.00	0.00	0.00	0.00
29.25	2.00	0.63	5.00	0.00	0.00	0.00
29.30	2.00	0.63	5.00	0.00	0.00	0.00
29.35	2.00	0.63	5.00	0.00	0.00	0.00
29.40	2.00	0.63	5.00	0.00	0.00	0.00
29.45	2.00	0.63	5.00	0.00	0.00	0.00
29.50	2.00	0.63	5.00	0.00	0.00	0.00
29.55	2.00	0.63	5.00	0.00	0.00	0.00
29.60	2.00	0.63	5.00	0.00	0.00	0.00
29.65	2.00	0.63	5.00	0.00	0.00	0.00
29.70	2.00	0.63	5.00	0.00	0.00	0.00
29.75	2.00	0.63	5.00	0.00	0.00	0.00
29.80	2.00	0.63	5.00	0.00	0.00	0.00
29.85	2.00	0.63	5.00	0.00	0.00	0.00
29.90	2.00	0.63	5.00	0.00	0.00	0.00
29.95	2.00	0.63	5.00	0.00	0.00	0.00
30.00	2.00	0.63	5.00	0.00	0.00	0.00
30.05	2.00	0.63	5.00	0.00	0.00	0.00
30.10	2.00	0.63	5.00	0.00	0.00	0.00
30.15	2.00	0.63	5.00	0.00	0.00	0.00
30.20	2.00	0.63	5.00	0.00	0.00	0.00
30.25	2.00	0.63	5.00	0.00	0.00	0.00
30.30	2.00	0.63	5.00	0.00	0.00	0.00
30.35	2.00	0.63	5.00	0.00	0.00	0.00
30.40	2.00	0.63	5.00	0.00	0.00	0.00
30.45	2.00	0.63	5.00	0.00	0.00	0.00
30.50	2.00	0.63	5.00	0.00	0.00	0.00
30.55	2.00	0.63	5.00	0.00	0.00	0.00
30.60	2.00	0.63	5.00	0.00	0.00	0.00
30.65	2.00	0.63	5.00	0.00	0.00	0.00
30.70	2.00	0.63	5.00	0.00	0.00	0.00
30.75	2.00	0.63	5.00	0.00	0.00	0.00
30.80	2.00	0.63	5.00	0.00	0.00	0.00
30.85	2.00	0.63	5.00	0.00	0.00	0.00
30.90	2.00	0.63	5.00	0.00	0.00	0.00
30.95	2.00	0.63	5.00	0.00	0.00	0.00
31.00	2.00	0.63	5.00	0.00	0.00	0.00
31.05	2.00	0.63	5.00	0.00	0.00	0.00
31.10	2.00	0.63	5.00	0.00	0.00	0.00

31.15	2.00	0.63	5.00	0.00	0.00	0.00
31.20	2.00	0.63	5.00	0.00	0.00	0.00
31.25	2.00	0.64	5.00	0.00	0.00	0.00
31.30	2.00	0.64	5.00	0.00	0.00	0.00
31.35	2.00	0.64	5.00	0.00	0.00	0.00
31.40	2.00	0.64	5.00	0.00	0.00	0.00
31.45	2.00	0.64	5.00	0.00	0.00	0.00
31.50	2.00	0.64	5.00	0.00	0.00	0.00
31.55	2.00	0.64	5.00	0.00	0.00	0.00
31.60	2.00	0.64	5.00	0.00	0.00	0.00
31.65	2.00	0.64	5.00	0.00	0.00	0.00
31.70	2.00	0.64	5.00	0.00	0.00	0.00
31.75	2.00	0.64	5.00	0.00	0.00	0.00
31.80	2.00	0.64	5.00	0.00	0.00	0.00
31.85	2.00	0.64	5.00	0.00	0.00	0.00
31.90	2.00	0.64	5.00	0.00	0.00	0.00
31.95	2.00	0.64	5.00	0.00	0.00	0.00
32.00	2.00	0.64	5.00	0.00	0.00	0.00
32.05	2.00	0.64	5.00	0.00	0.00	0.00
32.10	2.00	0.64	5.00	0.00	0.00	0.00
32.15	2.00	0.64	5.00	0.00	0.00	0.00
32.20	2.00	0.64	5.00	0.00	0.00	0.00
32.25	2.00	0.64	5.00	0.00	0.00	0.00
32.30	2.00	0.64	5.00	0.00	0.00	0.00
32.35	2.00	0.64	5.00	0.00	0.00	0.00
32.40	2.00	0.64	5.00	0.00	0.00	0.00
32.45	2.00	0.64	5.00	0.00	0.00	0.00
32.50	2.00	0.64	5.00	0.00	0.00	0.00
32.55	2.00	0.64	5.00	0.00	0.00	0.00
32.60	2.00	0.64	5.00	0.00	0.00	0.00
32.65	2.00	0.64	5.00	0.00	0.00	0.00
32.70	2.00	0.64	5.00	0.00	0.00	0.00
32.75	2.00	0.64	5.00	0.00	0.00	0.00
32.80	2.00	0.64	5.00	0.00	0.00	0.00
32.85	2.00	0.64	5.00	0.00	0.00	0.00
32.90	2.00	0.64	5.00	0.00	0.00	0.00
32.95	2.00	0.64	5.00	0.00	0.00	0.00
33.00	2.00	0.64	5.00	0.00	0.00	0.00
33.05	2.00	0.64	5.00	0.00	0.00	0.00
33.10	2.00	0.64	5.00	0.00	0.00	0.00
33.15	2.00	0.64	5.00	0.00	0.00	0.00
33.20	2.00	0.64	5.00	0.00	0.00	0.00
33.25	2.00	0.64	5.00	0.00	0.00	0.00
33.30	2.00	0.64	5.00	0.00	0.00	0.00
33.35	2.00	0.64	5.00	0.00	0.00	0.00
33.40	2.00	0.64	5.00	0.00	0.00	0.00
33.45	2.00	0.64	5.00	0.00	0.00	0.00
33.50	2.00	0.64	5.00	0.00	0.00	0.00
33.55	2.00	0.64	5.00	0.00	0.00	0.00
33.60	2.00	0.64	5.00	0.00	0.00	0.00

33.65	2.00	0.64	5.00	0.00	0.00	0.00
33.70	2.00	0.64	5.00	0.00	0.00	0.00
33.75	2.00	0.64	5.00	0.00	0.00	0.00
33.80	2.00	0.64	5.00	0.00	0.00	0.00
33.85	2.00	0.64	5.00	0.00	0.00	0.00
33.90	2.00	0.64	5.00	0.00	0.00	0.00
33.95	2.00	0.65	5.00	0.00	0.00	0.00
34.00	2.00	0.65	5.00	0.00	0.00	0.00
34.05	2.00	0.65	5.00	0.00	0.00	0.00
34.10	2.00	0.65	5.00	0.00	0.00	0.00
34.15	2.00	0.65	5.00	0.00	0.00	0.00
34.20	2.00	0.65	5.00	0.00	0.00	0.00
34.25	2.00	0.65	5.00	0.00	0.00	0.00
34.30	2.00	0.65	5.00	0.00	0.00	0.00
34.35	2.00	0.65	5.00	0.00	0.00	0.00
34.40	2.00	0.65	5.00	0.00	0.00	0.00
34.45	2.00	0.65	5.00	0.00	0.00	0.00
34.50	2.00	0.65	5.00	0.00	0.00	0.00
34.55	2.00	0.65	5.00	0.00	0.00	0.00
34.60	2.00	0.65	5.00	0.00	0.00	0.00
34.65	2.00	0.65	5.00	0.00	0.00	0.00
34.70	2.00	0.65	5.00	0.00	0.00	0.00
34.75	2.00	0.65	5.00	0.00	0.00	0.00
34.80	2.00	0.65	5.00	0.00	0.00	0.00
34.85	2.00	0.65	5.00	0.00	0.00	0.00
34.90	2.00	0.65	5.00	0.00	0.00	0.00
34.95	2.00	0.65	5.00	0.00	0.00	0.00
35.00	2.00	0.65	5.00	0.00	0.00	0.00
35.05	2.00	0.65	5.00	0.00	0.00	0.00
35.10	2.00	0.65	5.00	0.00	0.00	0.00
35.15	2.00	0.65	5.00	0.00	0.00	0.00
35.20	2.00	0.65	5.00	0.00	0.00	0.00
35.25	2.00	0.65	5.00	0.00	0.00	0.00
35.30	2.00	0.65	5.00	0.00	0.00	0.00
35.35	2.00	0.65	5.00	0.00	0.00	0.00
35.40	2.00	0.65	5.00	0.00	0.00	0.00
35.45	2.00	0.65	5.00	0.00	0.00	0.00
35.50	2.00	0.65	5.00	0.00	0.00	0.00
35.55	2.00	0.65	5.00	0.00	0.00	0.00
35.60	2.00	0.65	5.00	0.00	0.00	0.00
35.65	2.00	0.65	5.00	0.00	0.00	0.00
35.70	2.00	0.65	5.00	0.00	0.00	0.00
35.75	2.00	0.65	5.00	0.00	0.00	0.00
35.80	2.00	0.65	5.00	0.00	0.00	0.00
35.85	2.00	0.65	5.00	0.00	0.00	0.00
35.90	2.00	0.65	5.00	0.00	0.00	0.00
35.95	2.00	0.65	5.00	0.00	0.00	0.00
36.00	2.00	0.65	5.00	0.00	0.00	0.00
36.05	2.00	0.65	5.00	0.00	0.00	0.00
36.10	2.00	0.65	5.00	0.00	0.00	0.00

36.15	2.00	0.65	5.00	0.00	0.00	0.00
36.20	2.00	0.65	5.00	0.00	0.00	0.00
36.25	2.00	0.65	5.00	0.00	0.00	0.00
36.30	2.00	0.65	5.00	0.00	0.00	0.00
36.35	2.00	0.65	5.00	0.00	0.00	0.00
36.40	2.00	0.65	5.00	0.00	0.00	0.00
36.45	2.00	0.65	5.00	0.00	0.00	0.00
36.50	2.00	0.65	5.00	0.00	0.00	0.00
36.55	2.00	0.65	5.00	0.00	0.00	0.00
36.60	2.00	0.65	5.00	0.00	0.00	0.00
36.65	2.00	0.65	5.00	0.00	0.00	0.00
36.70	2.00	0.65	5.00	0.00	0.00	0.00
36.75	2.00	0.65	5.00	0.00	0.00	0.00
36.80	2.00	0.65	5.00	0.00	0.00	0.00
36.85	2.00	0.65	5.00	0.00	0.00	0.00
36.90	2.00	0.65	5.00	0.00	0.00	0.00
36.95	2.00	0.65	5.00	0.00	0.00	0.00
37.00	2.00	0.65	5.00	0.00	0.00	0.00
37.05	2.00	0.65	5.00	0.00	0.00	0.00
37.10	2.00	0.65	5.00	0.00	0.00	0.00
37.15	2.00	0.65	5.00	0.00	0.00	0.00
37.20	2.00	0.65	5.00	0.00	0.00	0.00
37.25	2.00	0.65	5.00	0.00	0.00	0.00
37.30	2.00	0.65	5.00	0.00	0.00	0.00
37.35	2.00	0.65	5.00	0.00	0.00	0.00
37.40	2.00	0.65	5.00	0.00	0.00	0.00
37.45	2.00	0.65	5.00	0.00	0.00	0.00
37.50	2.00	0.65	5.00	0.00	0.00	0.00
37.55	2.00	0.65	5.00	0.00	0.00	0.00
37.60	2.00	0.65	5.00	0.00	0.00	0.00
37.65	2.00	0.65	5.00	0.00	0.00	0.00
37.70	2.00	0.65	5.00	0.00	0.00	0.00
37.75	2.00	0.65	5.00	0.00	0.00	0.00
37.80	2.00	0.65	5.00	0.00	0.00	0.00
37.85	2.00	0.65	5.00	0.00	0.00	0.00
37.90	2.00	0.65	5.00	0.00	0.00	0.00
37.95	2.00	0.65	5.00	0.00	0.00	0.00
38.00	2.00	0.65	5.00	0.00	0.00	0.00
38.05	2.00	0.65	5.00	0.00	0.00	0.00
38.10	2.00	0.65	5.00	0.00	0.00	0.00
38.15	2.00	0.65	5.00	0.00	0.00	0.00
38.20	2.00	0.65	5.00	0.00	0.00	0.00
38.25	2.00	0.65	5.00	0.00	0.00	0.00
38.30	2.00	0.65	5.00	0.00	0.00	0.00
38.35	2.00	0.65	5.00	0.00	0.00	0.00
38.40	2.00	0.65	5.00	0.00	0.00	0.00
38.45	2.00	0.65	5.00	0.00	0.00	0.00
38.50	2.00	0.66	5.00	0.00	0.00	0.00
38.55	2.00	0.66	5.00	0.00	0.00	0.00
38.60	2.00	0.66	5.00	0.00	0.00	0.00

38.65	2.00	0.66	5.00	0.00	0.00	0.00
38.70	2.00	0.66	5.00	0.00	0.00	0.00
38.75	2.00	0.66	5.00	0.00	0.00	0.00
38.80	2.00	0.66	5.00	0.00	0.00	0.00
38.85	2.00	0.66	5.00	0.00	0.00	0.00
38.90	2.00	0.66	5.00	0.00	0.00	0.00
38.95	2.00	0.66	5.00	0.00	0.00	0.00
39.00	2.00	0.66	5.00	0.00	0.00	0.00
39.05	2.00	0.66	5.00	0.00	0.00	0.00
39.10	2.00	0.66	5.00	0.00	0.00	0.00
39.15	2.00	0.66	5.00	0.00	0.00	0.00
39.20	2.00	0.66	5.00	0.00	0.00	0.00
39.25	2.00	0.66	5.00	0.00	0.00	0.00
39.30	2.00	0.66	5.00	0.00	0.00	0.00
39.35	2.00	0.66	5.00	0.00	0.00	0.00
39.40	2.00	0.66	5.00	0.00	0.00	0.00
39.45	2.00	0.66	5.00	0.00	0.00	0.00
39.50	2.00	0.66	5.00	0.00	0.00	0.00
39.55	2.00	0.66	5.00	0.00	0.00	0.00
39.60	2.00	0.66	5.00	0.00	0.00	0.00
39.65	2.00	0.66	5.00	0.00	0.00	0.00
39.70	2.00	0.66	5.00	0.00	0.00	0.00
39.75	2.00	0.66	5.00	0.00	0.00	0.00
39.80	2.00	0.66	5.00	0.00	0.00	0.00
39.85	2.00	0.66	5.00	0.00	0.00	0.00
39.90	2.00	0.66	5.00	0.00	0.00	0.00
39.95	2.00	0.66	5.00	0.00	0.00	0.00
40.00	2.00	0.66	5.00	0.00	0.00	0.00
40.05	2.00	0.66	5.00	0.00	0.00	0.00
40.10	2.00	0.66	5.00	0.00	0.00	0.00
40.15	2.00	0.66	5.00	0.00	0.00	0.00
40.20	2.00	0.66	5.00	0.00	0.00	0.00
40.25	2.00	0.66	5.00	0.00	0.00	0.00
40.30	2.00	0.66	5.00	0.00	0.00	0.00
40.35	2.00	0.66	5.00	0.00	0.00	0.00
40.40	2.00	0.66	5.00	0.00	0.00	0.00
40.45	2.00	0.66	5.00	0.00	0.00	0.00
40.50	2.00	0.66	5.00	0.00	0.00	0.00
40.55	2.00	0.66	5.00	0.00	0.00	0.00
40.60	2.00	0.66	5.00	0.00	0.00	0.00
40.65	2.00	0.66	5.00	0.00	0.00	0.00
40.70	2.00	0.66	5.00	0.00	0.00	0.00
40.75	2.00	0.66	5.00	0.00	0.00	0.00
40.80	2.00	0.66	5.00	0.00	0.00	0.00
40.85	2.00	0.66	5.00	0.00	0.00	0.00
40.90	2.00	0.66	5.00	0.00	0.00	0.00
40.95	2.00	0.66	5.00	0.00	0.00	0.00
41.00	2.00	0.66	5.00	0.00	0.00	0.00
41.05	2.00	0.66	5.00	0.00	0.00	0.00
41.10	2.00	0.66	5.00	0.00	0.00	0.00

41.15	2.00	0.66	5.00	0.00	0.00	0.00
41.20	2.00	0.66	5.00	0.00	0.00	0.00
41.25	2.00	0.66	5.00	0.00	0.00	0.00
41.30	2.00	0.66	5.00	0.00	0.00	0.00
41.35	2.00	0.66	5.00	0.00	0.00	0.00
41.40	2.00	0.66	5.00	0.00	0.00	0.00
41.45	2.00	0.66	5.00	0.00	0.00	0.00
41.50	2.00	0.66	5.00	0.00	0.00	0.00
41.55	2.00	0.66	5.00	0.00	0.00	0.00
41.60	2.00	0.66	5.00	0.00	0.00	0.00
41.65	2.00	0.66	5.00	0.00	0.00	0.00
41.70	2.00	0.66	5.00	0.00	0.00	0.00
41.75	2.00	0.66	5.00	0.00	0.00	0.00
41.80	2.00	0.66	5.00	0.00	0.00	0.00
41.85	2.00	0.66	5.00	0.00	0.00	0.00
41.90	2.00	0.66	5.00	0.00	0.00	0.00
41.95	2.00	0.66	5.00	0.00	0.00	0.00
42.00	2.00	0.66	5.00	0.00	0.00	0.00
42.05	2.00	0.66	5.00	0.00	0.00	0.00
42.10	2.00	0.66	5.00	0.00	0.00	0.00
42.15	2.00	0.66	5.00	0.00	0.00	0.00
42.20	2.00	0.66	5.00	0.00	0.00	0.00
42.25	2.00	0.66	5.00	0.00	0.00	0.00
42.30	2.00	0.66	5.00	0.00	0.00	0.00
42.35	2.00	0.66	5.00	0.00	0.00	0.00
42.40	2.00	0.66	5.00	0.00	0.00	0.00
42.45	2.00	0.66	5.00	0.00	0.00	0.00
42.50	2.00	0.66	5.00	0.00	0.00	0.00
42.55	2.00	0.66	5.00	0.00	0.00	0.00
42.60	2.00	0.66	5.00	0.00	0.00	0.00
42.65	2.00	0.66	5.00	0.00	0.00	0.00
42.70	2.00	0.66	5.00	0.00	0.00	0.00
42.75	2.00	0.66	5.00	0.00	0.00	0.00
42.80	2.00	0.66	5.00	0.00	0.00	0.00
42.85	2.00	0.66	5.00	0.00	0.00	0.00
42.90	2.00	0.66	5.00	0.00	0.00	0.00
42.95	2.00	0.66	5.00	0.00	0.00	0.00
43.00	2.00	0.66	5.00	0.00	0.00	0.00
43.05	2.00	0.66	5.00	0.00	0.00	0.00
43.10	2.00	0.66	5.00	0.00	0.00	0.00
43.15	2.00	0.66	5.00	0.00	0.00	0.00
43.20	2.00	0.66	5.00	0.00	0.00	0.00
43.25	2.00	0.66	5.00	0.00	0.00	0.00
43.30	2.00	0.66	5.00	0.00	0.00	0.00
43.35	2.00	0.66	5.00	0.00	0.00	0.00
43.40	2.00	0.66	5.00	0.00	0.00	0.00
43.45	2.00	0.66	5.00	0.00	0.00	0.00
43.50	2.00	0.66	5.00	0.00	0.00	0.00
43.55	2.00	0.66	5.00	0.00	0.00	0.00
43.60	2.00	0.66	5.00	0.00	0.00	0.00

43.65	2.00	0.66	5.00	0.00	0.00	0.00
43.70	2.00	0.66	5.00	0.00	0.00	0.00
43.75	2.00	0.66	5.00	0.00	0.00	0.00
43.80	2.00	0.66	5.00	0.00	0.00	0.00
43.85	2.00	0.66	5.00	0.00	0.00	0.00
43.90	2.00	0.66	5.00	0.00	0.00	0.00
43.95	2.00	0.66	5.00	0.00	0.00	0.00
44.00	2.00	0.66	5.00	0.00	0.00	0.00
44.05	2.00	0.66	5.00	0.00	0.00	0.00
44.10	2.00	0.66	5.00	0.00	0.00	0.00
44.15	2.00	0.66	5.00	0.00	0.00	0.00
44.20	2.00	0.66	5.00	0.00	0.00	0.00
44.25	2.00	0.66	5.00	0.00	0.00	0.00
44.30	2.00	0.66	5.00	0.00	0.00	0.00
44.35	2.00	0.66	5.00	0.00	0.00	0.00
44.40	2.00	0.66	5.00	0.00	0.00	0.00
44.45	2.00	0.66	5.00	0.00	0.00	0.00
44.50	2.00	0.66	5.00	0.00	0.00	0.00
44.55	2.00	0.66	5.00	0.00	0.00	0.00
44.60	2.00	0.66	5.00	0.00	0.00	0.00
44.65	2.00	0.66	5.00	0.00	0.00	0.00
44.70	2.00	0.66	5.00	0.00	0.00	0.00
44.75	2.00	0.66	5.00	0.00	0.00	0.00
44.80	2.00	0.66	5.00	0.00	0.00	0.00
44.85	2.00	0.66	5.00	0.00	0.00	0.00
44.90	2.00	0.66	5.00	0.00	0.00	0.00
44.95	2.00	0.66	5.00	0.00	0.00	0.00
45.00	2.00	0.66	5.00	0.00	0.00	0.00
45.05	2.00	0.66	5.00	0.00	0.00	0.00
45.10	2.00	0.66	5.00	0.00	0.00	0.00
45.15	2.00	0.66	5.00	0.00	0.00	0.00
45.20	2.00	0.66	5.00	0.00	0.00	0.00
45.25	2.00	0.66	5.00	0.00	0.00	0.00
45.30	2.00	0.66	5.00	0.00	0.00	0.00
45.35	2.00	0.66	5.00	0.00	0.00	0.00
45.40	2.00	0.66	5.00	0.00	0.00	0.00
45.45	2.00	0.66	5.00	0.00	0.00	0.00
45.50	2.00	0.66	5.00	0.00	0.00	0.00
45.55	2.00	0.66	5.00	0.00	0.00	0.00
45.60	2.00	0.66	5.00	0.00	0.00	0.00
45.65	2.00	0.66	5.00	0.00	0.00	0.00
45.70	2.00	0.66	5.00	0.00	0.00	0.00
45.75	2.00	0.66	5.00	0.00	0.00	0.00
45.80	2.00	0.66	5.00	0.00	0.00	0.00
45.85	2.00	0.66	5.00	0.00	0.00	0.00
45.90	2.00	0.66	5.00	0.00	0.00	0.00
45.95	2.00	0.66	5.00	0.00	0.00	0.00
46.00	2.00	0.66	5.00	0.00	0.00	0.00
46.05	2.00	0.66	5.00	0.00	0.00	0.00
46.10	2.00	0.66	5.00	0.00	0.00	0.00

46.15	2.00	0.66	5.00	0.00	0.00	0.00
46.20	2.00	0.66	5.00	0.00	0.00	0.00
46.25	2.00	0.66	5.00	0.00	0.00	0.00
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46.35	2.00	0.66	5.00	0.00	0.00	0.00
46.40	2.00	0.66	5.00	0.00	0.00	0.00
46.45	2.00	0.66	5.00	0.00	0.00	0.00
46.50	2.00	0.66	5.00	0.00	0.00	0.00
46.55	2.00	0.66	5.00	0.00	0.00	0.00
46.60	2.00	0.66	5.00	0.00	0.00	0.00
46.65	2.00	0.66	5.00	0.00	0.00	0.00
46.70	2.00	0.66	5.00	0.00	0.00	0.00
46.75	2.00	0.66	5.00	0.00	0.00	0.00
46.80	2.00	0.66	5.00	0.00	0.00	0.00
46.85	2.00	0.66	5.00	0.00	0.00	0.00
46.90	2.00	0.66	5.00	0.00	0.00	0.00
46.95	2.00	0.66	5.00	0.00	0.00	0.00
47.00	2.00	0.66	5.00	0.00	0.00	0.00
47.05	2.00	0.66	5.00	0.00	0.00	0.00
47.10	2.00	0.66	5.00	0.00	0.00	0.00
47.15	2.00	0.65	5.00	0.00	0.00	0.00
47.20	2.00	0.65	5.00	0.00	0.00	0.00
47.25	2.00	0.65	5.00	0.00	0.00	0.00
47.30	2.00	0.65	5.00	0.00	0.00	0.00
47.35	2.00	0.65	5.00	0.00	0.00	0.00
47.40	2.00	0.65	5.00	0.00	0.00	0.00
47.45	2.00	0.65	5.00	0.00	0.00	0.00
47.50	2.00	0.65	5.00	0.00	0.00	0.00
47.55	2.00	0.65	5.00	0.00	0.00	0.00
47.60	2.00	0.65	5.00	0.00	0.00	0.00
47.65	2.00	0.65	5.00	0.00	0.00	0.00
47.70	2.00	0.65	5.00	0.00	0.00	0.00
47.75	2.00	0.65	5.00	0.00	0.00	0.00
47.80	2.00	0.65	5.00	0.00	0.00	0.00
47.85	2.00	0.65	5.00	0.00	0.00	0.00
47.90	2.00	0.65	5.00	0.00	0.00	0.00
47.95	2.00	0.65	5.00	0.00	0.00	0.00
48.00	2.00	0.65	5.00	0.00	0.00	0.00
48.05	2.00	0.65	5.00	0.00	0.00	0.00
48.10	2.00	0.65	5.00	0.00	0.00	0.00
48.15	2.00	0.65	5.00	0.00	0.00	0.00
48.20	2.00	0.65	5.00	0.00	0.00	0.00
48.25	2.00	0.65	5.00	0.00	0.00	0.00
48.30	2.00	0.65	5.00	0.00	0.00	0.00
48.35	2.00	0.65	5.00	0.00	0.00	0.00
48.40	2.00	0.65	5.00	0.00	0.00	0.00
48.45	2.00	0.65	5.00	0.00	0.00	0.00
48.50	2.00	0.65	5.00	0.00	0.00	0.00
48.55	2.00	0.65	5.00	0.00	0.00	0.00
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48.65	2.00	0.65	5.00	0.00	0.00	0.00
48.70	2.00	0.65	5.00	0.00	0.00	0.00
48.75	2.00	0.65	5.00	0.00	0.00	0.00
48.80	2.00	0.65	5.00	0.00	0.00	0.00
48.85	2.00	0.65	5.00	0.00	0.00	0.00
48.90	2.00	0.65	5.00	0.00	0.00	0.00
48.95	2.00	0.65	5.00	0.00	0.00	0.00
49.00	2.00	0.65	5.00	0.00	0.00	0.00
49.05	2.00	0.65	5.00	0.00	0.00	0.00
49.10	2.00	0.65	5.00	0.00	0.00	0.00
49.15	2.00	0.65	5.00	0.00	0.00	0.00
49.20	2.00	0.65	5.00	0.00	0.00	0.00
49.25	2.00	0.65	5.00	0.00	0.00	0.00
49.30	2.00	0.65	5.00	0.00	0.00	0.00
49.35	2.00	0.65	5.00	0.00	0.00	0.00
49.40	2.00	0.65	5.00	0.00	0.00	0.00
49.45	2.00	0.65	5.00	0.00	0.00	0.00
49.50	2.00	0.65	5.00	0.00	0.00	0.00
49.55	2.00	0.65	5.00	0.00	0.00	0.00
49.60	2.00	0.65	5.00	0.00	0.00	0.00
49.65	2.00	0.65	5.00	0.00	0.00	0.00
49.70	2.00	0.65	5.00	0.00	0.00	0.00
49.75	2.00	0.65	5.00	0.00	0.00	0.00
49.80	2.00	0.65	5.00	0.00	0.00	0.00
49.85	2.00	0.65	5.00	0.00	0.00	0.00
49.90	2.00	0.65	5.00	0.00	0.00	0.00
49.95	2.00	0.65	5.00	0.00	0.00	0.00
50.00	2.00	0.65	5.00	0.00	0.00	0.00
50.05	2.00	0.65	5.00	0.00	0.00	0.00
50.10	2.00	0.65	5.00	0.00	0.00	0.00
50.15	2.00	0.65	5.00	0.00	0.00	0.00
50.20	2.00	0.65	5.00	0.00	0.00	0.00
50.25	2.00	0.65	5.00	0.00	0.00	0.00
50.30	2.00	0.65	5.00	0.00	0.00	0.00
50.35	2.00	0.65	5.00	0.00	0.00	0.00
50.40	2.00	0.65	5.00	0.00	0.00	0.00
50.45	2.00	0.65	5.00	0.00	0.00	0.00
50.50	2.00	0.65	5.00	0.00	0.00	0.00
50.55	2.00	0.65	5.00	0.00	0.00	0.00
50.60	2.00	0.65	5.00	0.00	0.00	0.00
50.65	2.00	0.65	5.00	0.00	0.00	0.00
50.70	2.00	0.65	5.00	0.00	0.00	0.00
50.75	2.00	0.65	5.00	0.00	0.00	0.00
50.80	2.00	0.65	5.00	0.00	0.00	0.00
50.85	2.00	0.65	5.00	0.00	0.00	0.00
50.90	2.00	0.65	5.00	0.00	0.00	0.00
50.95	2.00	0.65	5.00	0.00	0.00	0.00
51.00	2.00	0.65	5.00	0.00	0.00	0.00
51.05	2.00	0.65	5.00	0.00	0.00	0.00
51.10	2.00	0.65	5.00	0.00	0.00	0.00

51.15	2.00	0.65	5.00	0.00	0.00	0.00
51.20	2.00	0.65	5.00	0.00	0.00	0.00
51.25	2.00	0.65	5.00	0.00	0.00	0.00
51.30	2.00	0.65	5.00	0.00	0.00	0.00
51.35	2.00	0.65	5.00	0.00	0.00	0.00
51.40	2.00	0.65	5.00	0.00	0.00	0.00
51.45	2.00	0.65	5.00	0.00	0.00	0.00
51.50	2.00	0.65	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

APPENDIX D

<u>Scale of Acceptable Risks from Geologic Hazards</u>

APPENDIX D SCALE OF ACCEPTABLE RISKS FROM NON-SEISMIC GEOLOGIC HAZARDS*		
RISK LEVEL	**STRUCTURE TYPE**	**RISK CHARACTERISTICS**
EXTREMELY LOW RISKS	Structures whose continued functioning is critical, or whose failure might be catastrophic: nuclear reactors, large dams, power intently systems, plants manufacturing or storing explosive or toxic materials.	Failure affects substantial populations risk equals nearly zero.
VERY LOW RISKS	Structures whose use is critically needed after a disaster: important utility centers: hospitals: fire, police, and emergency communication facilities; fire stations; and critical transportation elements such as bridges and overpasses; also smaller dams.	Failure affects substantial populations.
LOW RISKS	Structures of high occupancy, or whose use after a disaster: important utility centers; hospitals; fire, police, and emergency communication facilities; fire stations; and critical transportation elements such as bridges and overpasses; also smaller dams.	Failure of a single structure would affect primary only the occupants.
"ORDINARY RISKS"	The vast majority of structures: most commercial and industrial buildings; small hotels and apartment buildings, and single-family residences.	Failure only affects owners/occupants of a structure rather than a substantial population. No significant potential for loss of life of serious physical injury. Risk level is similar or comparable to other ordinary risks (including seismic risks) to citizens of coastal California. No collapse of structures; structural damage limited to repairable damage in most cases. This degree of damage is unlikely as a result of storms with a repeat time of 50 years or less.
MODERATE RISKS	fences, driveways, non-habitable structures, detached retaining walls, sanitary landfills, recreation areas and open space.	Structure is not occupied or occupied infrequently. Low probability of physical injury. Moderate probability of collapse.

***Non-seismic geologic hazards include flooding, landslides, erosion, wave run-up and sinkhole collapse.**

Figure 1

APPENDIX D SCALES OF ACCEPTABLE RISKS FROM SEISMIC GEOLOGIC HAZARDS		
LEVEL OF ACCEPTABLE RISK	**KINDS OF STRUCTURES**	**EXTRA PROJECT COST PROBABLY REQUIRED TO REDUCE RISK TO AN ACCEPTABLE LEVEL**
Extremely Low	Structures whose continued functioning is critical, or whose failure might be catastrophic nuclear reactors, large dams, power intently systems, plants manufacturing or storing explosives to toxic materials.	No set percentage (whatever is required for maximum attainable safety).
Slightly higher than under level 1[1]	Structures whose use is critically needed after a disaster; important utility centers; hospitals; fire, police, and emergency communication facilities; fire station; and critical transportation elements such as bridges and overpasses; also smaller dams.	5 to 25 percent of project cost.
Lowest possible risk to occupants of the structure [3]	Structures of high occupancy or whose use after a disaster would be particularly convenient; schools, churches, theaters, large hotels, and other high-rise buildings housing large numbers of people, other places normally attracting large concentrations of people civic buildings such as fire stations, secondary utility structures, extremely large commercial enterprises, most roads,alternative or non-critical bridges and overpasses.	5 to 15 percent of project cost.
An "ordinary" level or risk to occupants of the structure [3.5]	The vast majority of structures; most commercial and industrial buildings, small hotels and apartment buildings and single-family residences.	1 to 2 percent of project cost in most cases (2 to 10 percent of project cost in a minority of cases)[4]

1. Failure of a single structure may affect substantial populations.

2. These additional percentages are based on the assumption that the base cost is the total cost of the building or other facility when ready for occupancy. In addition, it is assumed that the structure would have been designed and built in accordance with current California practice. Moreover, the estimated additional cost presumes that structures in this acceptable-risk category are to embody sufficient safety to remain functional following an earthquake.

3. Failure of single structure would affect primarily only the occupants.

4. These additional percentages are based on the assumption that the base cost is the total cost of the building or facility when ready for occupancy. In addition, it is assumed that the structures would have been designed and built in accordance with current California Practice. Moreover, the estimated additional cost presumes that structures in this acceptable-risk category are to be sufficiently safe to give reasonable assurance of preventing injury or loss of life during and following an earthquake, but otherwise not necessarily to remain functional.

5. "Ordinary Risk": Resist minor earthquakes without damage; resist moderate earthquakes without structural damage but with some non-structural damage; resist major earthquakes of the intensity or severity of the strongest experienced in California, without collapse, but with some structural, as well as non-structural damage. In most structures, it is expected that structural damage, even in a major earthquake, could be limited to repairable damage. (Structural Engineers Association of California).

Source:Meeting The Earthquake Challenge, Joint Committee on Seismic Safety of the California Legislature, January 1974, p.9.

Figure 2

APPENDIX E

Feasibility Level Geotechnical Investigation and Geology Report for Atkinson Lane Development, Watsonville CA dated March 2009 by Pacific Crest Engineering

FEASIBILITY LEVEL
GEOTECHNICAL INVESTIGATION
&
ENGINEERING GEOLOGY REPORT
FOR
ATKINSON LANE DEVELOPMENT
WATSONVILLE, CALIFORNIA

FOR
RBF CONSULTING
MARINA, CALIFORNIA

BY
PACIFIC CREST ENGINEERING INC.
CONSULTING GEOTECHNICAL ENGINEERS
0829-SZ77-H62
MARCH 2009
www.4pacific-crest.com

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APPENDIX D

Feasibility Level Engineering Geology Report

Pacific Crest Engineering Inc. www.4pacific-crest.com

444 Airport Blvd, Suite 106
Watsonville, CA 95076
Phone: 831-722-9446
Fax: 831-722-9158

March 2, 2009 Project No. 0829-SZ77-H62

RBF Consulting
3180 Imjin Road, Suite 110
Marina, California 93933

Attention: Ms. Elizabeth Caraker, Senior Associate

Subject: Feasibility Level Geotechnical Investigation and Engineering Geology Report
Atkinson Lane Future Growth Area
Watsonville, California

Dear Ms. Caraker,

In accordance with your authorization, we have performed a feasibility level geotechnical investigation and engineering geology report for the Atkinson Lane future growth area located in Watsonville, California. The feasibility level engineering geology report was prepared by Zinn Geology, and is included within Appendix D of this report.

The accompanying report presents our conclusions and recommendations as well as the results of the geotechnical investigation on which they are based. If you have any questions concerning the data, conclusions or recommendations presented in this report, please call our office.

Very truly yours,

PACIFIC CREST ENGINEERING INC.

REGISTERED PROFESSIONAL ENGINEER
MICHAEL D. KLEAMES
No. GE 2204
Exp. 3-31-10
GEOTECHNICAL
STATE OF CALIFORNIA

Cara L. Russo
Staff Geologist

Michael D. Kleames, G.E.
President\Principal Geotechnical Engineer
G.E. 2204
Exp. 3/31/10

Copies: 4 to Client

FEASIBILITY LEVEL GEOTECHNICAL INVESTIGATION

PURPOSE AND SCOPE

This report describes the feasibility level geotechnical investigation and presents results, including recommendations, for the future residential growth project located at the terminus of Atkinson Lane in Watsonville, California. Our scope of services for this project has consisted of:

1. Discussions with project team members.

2. Review of the pertinent published material concerning the site including County planning maps, preliminary site plans, geologic and topographic maps, and other available literature.

3. The drilling and logging of 26 test borings and 16 Cone Penetrometer Test (CPT) soundings.

4. Laboratory analysis of retrieved soil samples.

5. Engineering analysis of the field and laboratory results. This included a quantitative liquefaction analysis of the subsurface soils.

6. Preparation of this feasibility level report documenting our investigation and presenting preliminary recommendations for design of the project.

LOCATION AND DESCRIPTION

The County of Santa Cruz and the City of Watsonville are in the process of preparing a joint Specific Plan/Master Plan for the Atkinson Lane future growth area. Please refer to Figure No. 1, Regional Site Map, for the approximate location. The central portion of the site is located at the following coordinates:

Latitude = 36.931214 degrees
Longitude = -121.759820 degrees

The project area is planned for affordable market rate housing and neighborhood services along with parks and recreation space to serve the residents of Pajaro Valley. The total gross area of the site is approximately 68 acres. The proposed Specific Plan/Master Plan includes approximately 34 acres designated for residential uses, including 11 acres for "Residential-High Density" and 23 acres for "Residential-Medium Density." An additional 3.9 acres is planned for expansion of the adjacent Crestview Park. The proposed project also includes 4.0 acres of a designated riparian area and a 1.9 acre riparian buffer adjacent to Corralitos Creek, the preservation of a 3.9 acre existing wetland and incorporation of a 2.7 acre wetland buffer. Additionally, 1.3 acres are designated for storm water swales, 2.2 acres are reserved for a PG&E substation, and 14.9 acres are allocated for a 200 foot agricultural buffer located on the eastern boundary of the project site adjacent to the existing agricultural fields. The entire 68 acres of the project site falls within the County of Santa Cruz.

At the time of our site visits, the 68 acre project site was comprised of 11 parcels. Three of the parcels consisted of strawberry fields and apple orchards (approximately 45.1 acres). The strawberry fields and apple orchards were well maintained and groomed while the remainder of the subject site was either overgrown or plowed and tilled and unused. Five of the parcels (4.6 acres) were used for residential purposes; these parcels, located along Atkinson Lane, include one that was vacant and four that were comprised of single family residences. Two parcels consisted of open fields; one parcel (2.5 acres) included a flat, plowed dirt area that was possibly used for farming purposes. The other parcel was comprised of weeds and native plants that sloped to the south to a slough (14.4 acres). This site was eventually plowed and tilled. The last parcel consisted of a Pacific Gas and Electric sub-station (2.2 acres). It was not maintained and sloped easterly towards the slough. The site is bound by Corralitos Creek and Atkinson Lane to the north, apple orchards to the east, and residential subdivisions to the south and west.

A pond was noted on the southwestern portion of the site in the vicinity of Borings 16, 17, 18, 19 and 26. The pond was roughly 4 acres and covered with vegetation although standing water was visible as well. The pond is south of Boring No. 18, west of Boring No. 19 and east of Boring No. 16 , 17 and 26. Please refer to Figure No. 2, Site Map Showing Test Boring Locations for the approximate location of the pond.

Based upon our review of the preliminary site plan it is our understanding that the County has identified 34 acres designated as affordable housing. A total of 200 units are initially planned while the remaining parcels may have an additional 400 units. The plan includes an expansion of Wagner Street to connect with Crestview Drive to serve as the primary arterial between Freedom Boulevard and East Lake Avenue. Secondary access routes will be analyzed and include Atkinson Lane and Brewington Avenue. This plan will also analyze additional infrastructure necessary to serve the area. This includes: sewer lines, water lines, storm drains, electrical, cable, as well as other public utilities.

We assume the structures will be one and/or two-stories in height, of wood frame and masonry construction, combined with some concrete slab- on-grade. Structural loading conditions are not known at this time, but are expected to be typical of residential-type construction. We also presume the project will require exterior flatwork, landscaping and attendant utility improvements.

FIELD INVESTIGATION

Soil Borings

Eleven 8-inch diameter test borings were drilled on the site on April 21st and 22nd, 2008 and February 6th and 9th, 2009 using hollow-stem drill augers. Fifteen 6-inch diameter test borings were drilled on the site on May 5th, 6th, and 7th, 2008 using solid-stem drill augers. The location of the test borings are shown on Figure No. 2, Site Map Showing Test Borings. The drilling method used was hydraulically operated continuous flight augers. A geologist from Pacific Crest Engineering Inc., was present during the drilling operations to log the soil encountered and to choose soil sampling type and locations.

Relatively undisturbed soil samples were obtained at various depths by driving a split spoon sampler 18 inches into the ground. This was achieved by dropping a 140 pound down hole safety hammer through a vertical height of 30 inches. The number of blows needed to drive the sampler for each 6 inch portion is recorded and the total number of blows needed to drive the last 12 inches is reported as the Standard Penetration Test (SPT) value. The outside diameter of the samplers used in this investigation was either 3 inches or 2 inches, and is noted respectively as "L" or "T" on the boring logs. All standard penetration test data has been normalized to a 2 inch O.D. sampler so as to be the SPT "N" value.

The soils encountered in the borings were continuously logged in the field and visually described in accordance with the Unified Soil Classification System (ASTM D2488 (Modified), Figure No. 3). The soil classification was verified and or modified upon completion of laboratory testing.

Appendix A contains the site plan showing the locations of the test borings and the Log of Test Borings presenting the soil profile explored in each boring, the sample locations, and the SPT "N" values for each sample. Stratification lines on the boring logs are approximate as the actual transition between soil types may be gradual.

Cone Penetrometer Soundings

Four cone Penetrometer (CPT) soundings with pore pressure measurements were advanced on May 1, 2008. Another twelve CPT soundings were performed on February 12th and 13th, 2009. The CPT soundings were located next to hollow stem test borings that were advanced to a depth of 51 ½ feet. The CPT soundings were also extended to a depth of 50 feet, to match the depth of the hollow-stem test borings. A geologist and/or engineer from Pacific Crest Engineering Inc., was present to supervise the field operations. The locations of the Cone Penetrometer Soundings are shown on Figure No. 2, Site Map Showing Test Borings and CPT Soundings.

The Cone Penetrometer soundings with Pore Pressure Measurements were advanced using a hydraulically operated Hogentogler H0322 electronic cone with an apex angle of 60 degrees, a diameter of 35.7 mm, and a friction sleeve with a surface area of 150 square cm. A saturated piezo element was placed between the cone and the friction sleeve to obtain dynamic pore pressure parameters. Continuous measurements were made of the tip resistance, the friction sleeve resistance, and the dynamic pore pressure. Correlations between these measurements and many soil properties were made using charts developed by Robertson (1990).

Appendix A contains the site plan showing the locations of the CPT soundings and Appendix B contains the logs presenting the CPT resistance to penetration as a function of depth, the sleeve friction as a function of depth, and interpretations of the soil behavior types interpreted from the CPT sounding data. Please note that the classification of soil *"behavior type"* shown on the sounding logs is exactly that and should not be misidentified as a specific soil type based upon any classification system. This is because no soil samples were extracted from the soundings advanced by the CPT rig; the interpretations are soil "*behavior types*" derived from calculations and interpolations that are performed by the CPT vendor's software.

LABORATORY INVESTIGATION

The laboratory testing program was developed to help in evaluating the engineering properties of the materials encountered on the site. Laboratory tests performed include:

a. Moisture Density relationships in accordance with ASTM test D2937.

b. Direct Shear tests in accordance with ASTM test D3080.

c. Unconfined Compression tests in accordance with ASTM test D2166.

d. Atterberg Limits tests in accordance with ASTM test D4318.

e. Consolidation tests in accordance with ASTM test D2435.

f. "R" Value tests in accordance with California test 301.

g. Gradation tests in accordance with ASTM test D1140 and D422.

h. Expansion Potential tests in accordance with ASTM test D4829 and the UBC 29-2.

i. Corrosivity testing including pH, resistivity, chloride concentration, and sulfate concentration.

The results of the laboratory tests are presented on the boring logs opposite the sample tested. Selected test results are also presented graphically in Appendix A.

SOIL CONDITIONS

Regional Geologic Maps

The surficial geology in the area of the project site is mapped as Fluvial Facies, Younger Flood Plain Deposits, and Older Flood Plain Deposits (Brabb, 1997; Dupre and Tinsley, 1991). The Fluvial Facies are described as partially consolidated, moderately to well graded silt, sand, silty clay and gravel. The Younger Flood Plain Deposits are described as unconsolidated deposits of fine-grained sand and silt with thin discontinuous layers of clay. The Older Flood Plain Deposits are described as unconsolidated sand, silt, and clay that are fine-grained. The native soils encountered in the test borings and interpreted from the CPT soundings are consistent with these descriptions. Please refer to Appendix D, Feasibility Level Engineering Geology Report, for a more detailed discussion of the regional geologic setting of the site.

Soil Borings

The twenty-six test borings on the project site encountered a range of soils including sandy clay, silty sand, sandy silt, clayey sand, sand, silt, silty clay/silt, clay, and fat clay. Most of the borings exhibited inter-layered sands, silty sands, clays, and fat clays. Nineteen of the twenty-six explored borings contained lenses of fat clay. Please refer to the graphical depiction of the underlying stratigraphy portrayed on the cross sections shown of Plate 2 of the Zinn Geology report appended to this report. The cross sections were developed on the basis of boring and CPT data.

Boring No.'s 4, 6, 8, 10, 11, and 16 were evaluated quantitatively for liquefaction, and most encountered potentially loose and liquefiable sandy soils. Boring No. 2 and Boring No. 5 were not specifically analyzed for liquefaction for this preliminary study due to the shallow nature of the test borings; however it should be noted that these borings did encounter potentially loose and liquefiable soils. The CPT soundings were also evaluated for liquefaction as well as lateral spreading potential.

Turning to the cross section provided to us by Zinn Geology for the site (Plate 2 – appended to this report), we note that the site is predominantly underlain by three stratigraphic subunits, a sand package, underlain by a clay package, with silt package appearing to underlie everything across the site to the depths explored for this project. As may be noted on the geological cross sections, the lateral and vertical variations are extremely complex within the generalized subunits, as is typically found in dynamic fluvial environments. Additionally, it should be noted that the complexity of the stratigraphy drawn by Zinn Geology appears to be directly correlative to the spacing and array between the borings and the soundings. In our opinion, a plausible assumption is that the site stratigraphy is very complex, with very few, if any specific stratigraphic beds being continuous across the site.

Groundwater

Groundwater was encountered in 17 test borings. The depth to water varied within each test boring; Boring No. 2 encountered groundwater at 26 ½ feet; Boring No. 4 encountered groundwater at 36 ½ feet; Boring No. 5 encountered groundwater at 20 feet; Boring No. 8 encountered groundwater at 27 feet; Boring No. 10 encountered groundwater at 28 feet; Boring No. 11 encountered groundwater at 20 ½ feet; Boring No. 12 encountered groundwater at 24 feet, 3 inches; Boring No. 13 encountered groundwater at 23 feet; Boring No. 14 encountered groundwater at 25 feet; Boring No. 15 encountered groundwater at 24 feet; Boring No. 16 encountered groundwater at 13 feet; Boring No. 18 encountered groundwater at 6 feet; Boring No. 19 encountered groundwater at 27 feet; and Boring No. 20 encountered groundwater at 12 ½ feet. Boring No. 23 encountered groundwater at 35 feet, Boring No. 24 encountered groundwater at 35 feet and Boring No. 25 encountered groundwater at 20 feet. It should be noted that the groundwater level was not allowed to stabilize for more than a few hours, therefore, the actual groundwater level may be higher or lower than initially encountered.

Groundwater levels used in our analysis were estimated on the basis of available groundwater data from adjacent borings. Where a groundwater table was encountered, we assumed a rise of 10 feet for seismic conditions. Where no groundwater was encountered to a depth of 50 feet, a minimum groundwater elevation of 25 feet below the existing ground surface was assumed.

Based upon our observation of short-term groundwater levels in our test borings, and due to the abundance of clay lenses throughout all of our test borings, it is our opinion that groundwater elevations do not radiate laterally from Corralitos Creek but tend to seasonally collect within discontinuous, more permeable soil layers.

Cone Penetrometer Soundings

The soils encountered in our CPT soundings, as interpreted based on charts developed by Robertson (1990), consisted of a variety of soil types very similar to those encountered in the adjacent test borings. Please note that the interpretations for the CPT soundings are merely interpretations. As discussed above, the classification of soil *"behavior type"* shown on the sounding logs should not be misidentified as a specific soil type based upon any classification system. This is because no soil samples were extracted from the soundings advanced by the CPT rig; the interpretations are soil *"behavior types"* derived from calculations and interpolations that are performed by the CPT vendor's software. Please refer to Appendix B for the results of CPT testing and the resulting interpretations of soil behavior type (SBT). Ten of the CPT soundings were accompanied by drilled borings to provide visual interpretation and identify soil classifications for selected samples.

The continuity of the soundings lends further credence to the hypothesis that the overall site stratigraphy is fairly complex, with many interfingering and intercalated beds of different soils and soil behavior types, as would be expected in a dynamic fluvial depositional environment. Considering the fact that the complexity of the geometry of the stratigraphy portrayed upon the cross sections issued by Zinn Geology, it is our opinion that the stratigraphy across the entire site is probably at least as complex as that shown on the Zinn Geology cross sections. The importance and implication of this hypothesis will be noted in later sections of this report, where the hazards of liquefaction and lateral spreading are analyzed, since the potential of those hazards relies upon the overall site stratigraphy.

REGIONAL SEISMIC SETTING

The seismic setting of the site is one in which it is reasonable to assume that the site will experience significant seismic shaking during the lifetime of the project.

Based upon our review of the fault maps for the Santa Cruz area (Greene et al. 1973, Hall et al. 1974), and the Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada (CDMG, 1998), active or potentially active faults which may significantly affect the site include those listed in the Table No. 1, below.

TABLE No. 1, Faults in the Santa Cruz County Area

Fault Name	Distance (miles)	Distance (km.)	Direction	Slip Rate* (mm/yr)	M_w Max.*
San Andreas – 1906 Segment	3.9	6.3	Northeast	24	7.9
Zayante – Vergeles	0.9	1.5	Northeast	0.1	7.0
Monterey Bay – Tularcitos	15.6	25.3	Southwest	0.5	7.3

*Source: CDMG, February, 1998

Please refer to Appendix D, Feasibility Level Engineering Geology Report, for a more thorough discussion of the regional geologic setting.

SEISMIC HAZARDS

This section provides a general summary of the seismic hazards associated with the project site. For a more complete review of this issue, please refer to the Feasibility Level Geology Report prepared by Zinn Geology within Appendix D.

In general, seismic hazards which may affect project sites in the Monterey Bay area include ground shaking, ground surface fault rupture, liquefaction and lateral spreading, and seismically induced slope instabilities. Geotechnical aspects of these issues are discussed below:

Ground Shaking

Intense ground shaking generated by earthquakes from nearby local faults will likely occur on the site within the design life of any structure proposed for this project. Structures founded on thick soft soil deposits, such as those encountered on the subject site, are more likely to experience more destructive shaking, with higher amplitude and lower frequency, than structures founded on bedrock. The intensity of ground shaking is generally commensurate with distance to the earthquake epicenters. However, it should be noted that significantly higher ground accelerations may occur in thick soft soil deposits large distances from earthquake epicenters than bedrock at a comparative distance. Structures built in accordance with the latest edition of the California Building Code may have an increased potential for experiencing relatively minor damage which could be repairable. The seismic design of the project should be based on the 2007 California Building Code (CBC) as it has incorporated the most recent seismic design parameters. The following values for the seismic design of the project site were derived or taken from the 2007 CBC:

TABLE No. 2, The 2007 CBC Seismic Design Parameters

Design Parameter	Specific to Site	Reference (See Note 1)
Site Class	E, Soft Soil	Table 1613.5.2
Mapped Spectral Acceleration for Short Periods	Ss = 1.941 g	Fig. 22-3, ASCE 7-05
Mapped Spectral Acceleration for 1-second Period	S_1 = 0.856 g	Fig. 22-4, ASCE 7-05
Short Period Site Coefficient	Fa = 0.9	Table 1613.5.3(1)
1-Second Period Site Coefficient	Fv = 2.4	Table 1613.5.3(2)
MCE Spectral Response Acceleration for Short Period	S_{MS} = 1.747 g	Section 1613.5.3
MCE Spectral Response Acceleration for 1-Second Period	S_{M1} = 2.053 g	Section 1613.5.3
5% Damped Spectral Response Acceleration for Short Period	S_{DS} = 1.165 g	Section 1613.5.4
5% Damped Spectral Response Acceleration for 1-Second Period	S_{D1} = 1.369 g	Section 1613.5.4
Seismic Design Category **(See Notes 2 and 3)**	E	Section 1613.5.6

Note 1: Design values may also have been obtained by using the Ground Motion Parameter Calculator available on the USGS website at http://earthquake.usgs.gov/research/hazmaps/design/index.php. Refer to the "Liquefaction" section for further information on how the Site Class may have been derived.

Note 2: Seismic Design Category assumes Class II occupancy per 2007 CBC Table 1604.5. Pacific Crest Engineering Inc. should be contacted for revised Table 2 seismic design parameters if the building has a different occupancy rating from the one assumed.

Note 3: Based on Section 1613.5.6 of the 2007 CBC, the S_1 value exceeds 0.75g. Therefore, the appropriate Seismic Design Category is E rather than D assuming this development will consist primarily of Category II structures.

Please note that the above minimum prescriptive building code values are appropriate for structures of specific stories, material types and occupancy ratings outlined by the CBC. The above values do not preclude the use of more conservative site-specific values that could conceivably be generated by an engineer or geologist, nor should they be inappropriately applied to structures excluded from those by the CBC.

Seismic Accelerations

It should be noted that the seismic design values in Table No.2 above are based on values derived from the 2007 California Building Code. For the purpose of evaluating peak ground accelerations, Zinn Geology performed a site-specific deterministic seismic hazard analysis.

Deterministic analysis for the site using a deep soil site attenuation relationship yields a mean peak ground acceleration of 0.63g and mean peak ground acceleration plus one dispersion of 0.94g (based on the closest seismic shaking source, the Zayante-Vergeles Fault). The Zinn Geology report also provides the "maximum considered earthquake ground motion" as defined by FEMA (1998). Refer to Table No. 2 within the Zinn Geology Report for more information (Appendix D).

It should be noted that if the deterministically derived values listed in the Zinn Geology report are used for project design, that we recommend utilizing the attenuation relationships developed by Sidigh, et al. Please refer to Appendix D for further details of the analysis.

Ground Surface Fault Rupture
Ground surface fault rupture occurs along the surficial trace(s) of active faults during significant seismic events. Pacific Crest Engineering Inc. has not performed a specific investigation for the presence of active faults on the project site. Since the nearest known active or potentially active fault is mapped approximately 1.5 km from the site (Hall et al, 1974), the potential for ground surface fault rupture to occur within the stipulated design life of any structure at this site is considered low.

Liquefaction
Liquefaction tends to occur in loose, saturated fine grained sands, coarse silts or clays with a low plasticity. In order for liquefaction to occur there must be the proper soil type, soil saturation, and cyclic accelerations of sufficient magnitude to progressively increase the water pressures within the soil mass. Non-cohesive soil shear strength is developed by the point to point contact of the soil grains. As the water pressures increase in the void spaces surrounding the soil grains the soil particles become supported more by the water than the point to point contact. When the water pressures increase sufficiently, the soil grains begin to lose contact with each other resulting in the loss of shear strength and continuous deformation of the soil where the soil appears to liquefy.

Based upon our review of the regional liquefaction maps (Dupre', 1975; Dupre' and Tinsley, 1980) the site is located in an area classified as having a moderately high potential for liquefaction.

The potential for liquefaction was evaluated quantitatively for this project, based upon the data obtained from our exploratory borings. For the borings, our analysis utilized the software program LiquefyPro Version 5, which is based upon the most recent recommendations of the NCEER Workshop and SP117 Implementation. The program calculates a factor of safety against liquefaction and also estimates seismically-induced settlement due to both liquefaction and dynamic compaction of loose, dry sands above the design water table. The data from the CPT soundings was evaluated for liquefaction and lateral spreading potential using the software program by CLiq by GeoLogismiki. Please refer to Appendix C for the model parameters and results we obtained.

The analysis included a peak ground acceleration value of 0.63g. This value is the deterministically derived value for estimated peak ground acceleration as noted in Table 2 of the Zinn Geology Report (refer to Appendix D).

It should be noted that the peak ground acceleration value of 0.63g is somewhat higher than the procedure outlined within the 2007 California Building Code (CBC). Section 1802.2.7 of the 2007 CBC allows for determination of the peak ground acceleration value by first determining the S_{DS} value as outlined in Section 1613 of the 2007 CBC (the S_{DS} value is the 5% damped spectral response acceleration for short periods). The S_{DS} value is then divided by 2.5 to determine the peak ground acceleration, as defined in Section 1802.2.7 of the 2007 CBC. Using this method, the peak ground acceleration value would be 0.47g.

Our liquefaction analysis included seven test borings, all drilled to a depth of at least 50 feet. This included Boring No.'s 4, 6, 8, 10, 11, 12, and 16. Boring No.'s 8, 10, 11 and 12 were located adjacent to southern embankment of Corralitos Creek. Boring No. 16 was located near the pond in the western section of the proposed development. Boring No.'s 4 and 6 were located in the southern and central portions of the proposed development, respectively. Our analysis conservatively assumed the ground water level during above-average rainfall years could rise an additional 10 feet from the level first encountered in the test borings for our study. We believe this is a conservative assumption at present.

The results of our liquefaction analysis indicate that the area near Boring No.'s 6, 8, and 10 were most susceptible to liquefaction and to a lesser extent the area near Boring No.'s 12 and 16. Boring No.'s 8, 10 and 12 are located along the southern embankment of Corralitos Creek, in an area where liquefaction would be considered likely. Boring No.6 was located in the central area of the property, and Boring No.16 was located near the pond in the western area of the property. Boring No.'s 4 and 11 did not exhibit any significant potential for liquefaction, based on our analysis. The areas of Boring No. 2 and Boring No. 5 may also be susceptible to liquefaction, although neither boring was specifically analyzed for this preliminary study due to the shallow nature of the test borings.

Estimated settlements due to liquefaction-induced settlement and dynamic compaction of loose, dry sands were also calculated using LiquefyPro, based upon the work by Ishihara and Yoshimine and Seed. On the basis of our analysis, we estimate the magnitude of possible seismically-induced ground surface settlement could range from 0.5 to 10 inches. The recommendations of this report are intended to reduce the potential for structural damage to an acceptable risk level, however strong seismic shaking could result in architectural damage and the need for post-earthquake repairs. It should be assumed that exterior improvements around the building such as pavements, slabs, sidewalks or patios will need to be repaired or replaced following strong seismic shaking. An increased depth of subgrade compaction below exterior improvements will assist in minimizing the damage to these elements.

Estimated settlements due to liquefaction (dry settlement excluded) for CPT's 1 through 4 and CPT 6 (which were advanced adjacent to B11, B10 B8, B12 and B6, respectively), were also evaluated using the CLiq software. The following table provides a comparison of results between the two methods:

TABLE No. 3, Comparison of *Liquefaction Induced* Settlement
(Dry Settlement Excluded)

CPT Sounding	CLiq Vertical Settlement (Inches)	Liquefy Pro at Adjacent Boring (Inches)
CPT-1	1.35	0.02 (B-11)
CPT-2	2.74	3.08 (B10)
CPT-3	3.26	7.89 (B8)
CPT-4	1.24	1.18 (B12)
CPT-6	0	1.94 (B6)

Please refer to Appendix C for a summary of results from our quantitative liquefaction analyses of boring and CPT data.

The determination that the site has liquefiable soils would generally trigger a special Site Class F designation, per Table 1613.5.2 of the 2007 CBC. However, Site Coefficients F_a and F_v are determined by Tables 1613.5.3(1) and 1613.5.3(2) of the 2007 CBC. Note b for Site Class F refers to Section 11.4.7 of ASCE 7-05. This section states "*The site-specific ground motion procedures set forth in Chapter 21 are permitted to be used to determine ground motions for any structure. A site response analysis shall be performed in accordance with Section 21.1 for structures on Site Class F sites, unless the exception to Section 20.3.1 is applicable.*" Section 20.3.1.1 of ASCE 7-05 states the following under "Exception": "*For structures having fundamental periods of vibration equal to or less than 0.5 s, site-response analysis is not required to determine spectral accelerations for liquefiable soils. Rather, a site class is permitted to be determined in accordance with Section 20.3 and the corresponding values of Fa and Fv determined from tables 11.4-1 and 11.4-2.*" These are the same tables as Tables 1613.5.3(1) and 1613.5.3(2) from the 2007 CBC.

Based on the above discussion, it is our opinion that a Site Class F designation is not appropriate for the project site. This is based on the assumption that the proposed development will likely consist of one to three-story buildings that should have a fundamental period less than 0.5 seconds. **The Project Structural Engineer should confirm that building heights of one to three stories in vertical height have a fundamental period less than 0.5 seconds. If this assumption is not correct, a detailed site response analysis may be required for the project site.** Based on the SPT blow count procedure outlined in Section 1613.5.5 of the 2007 CBC, we have determined the appropriate Site Class is E with a Seismic Design Category of E.

Please note: The Site Class designation does not eliminate the potential for settlement and structural damage due to liquefaction of the subsurface soils. This must be considered in the project design, and is described in more detail within the "Discussions, Conclusions and Recommendations" section of this report. Furthermore, if the fundamental period of any proposed structures will exceed 0.5 seconds, than the Site Class F procedure must be utilized to derive seismic design values.

Liquefaction Induced Lateral Spreading

Liquefaction induced lateral spreading occurs when a liquefied soil mass fails toward an open slope face, or fails on an inclined topographic slope. Our analysis of the project site indicates that the potential for liquefaction to occur is high, and consequently the potential for lateral spreading is also high.

We performed a quantitative lateral spreading analysis for the 16 CPT locations shown in Figure 2. This analysis was performed using CLiq v.1.3 software which was developed under the close guidance of Dr. Peter Robertson, having in mind specific features of the CPT that can be used to provide a more advanced analysis. Such features include the transition layer detection algorithm and evaluation of cyclic softening in clays. The liquefaction assessment method used in CLiq is the one recommended by NCEER 1998 (also known as the Youd et al. 2000 method) which provides concise results regarding the estimation of vertical settlements and lateral displacements.

Lateral displacements were not calculated below a depth of 2H below the toe of the creek bank or the bottom of the pond. A summary of calculated lateral displacements are presented in Appendix C. Total lateral displacements ranged from 0 to 65 inches.

As shown in Appendix C, predicted lateral displacement is significant within the soundings closest to the creek bank. Predicted lateral displacements dropped rapidly with increasing distance from the creek. The analysis for CPT-7, located about 475 feet from the creek, predicted displacements on the order of 2 inches; however this movement is occurring at a depth of 26 to 28 feet which is nearly twice the depth of the present creek channel.

For the pond area to the southwest of the project site, please refer to our liquefaction analysis from Boring No.16 within Appendix C (which was extended to a depth of 50 feet). We also performed liquefaction and lateral spread calculations with CLiq software at CPT-14 (B18) located on the northeast side of the pond, and CPT-16 (B26) located on the west side of the pond. The results of our analysis indicate a significant lateral spreading hazard within the confines of the pond boundary, with calculated displacements of more than 16 inches at CPT-14 and 5 inches at CPT-16.

It is apparent that lateral spreading potential is high in the near vicinity of Corralitos Creek and the pond, with calculated displacements on the order of 5 to 65 inches. Based on a recent paper titled *"Zero-Displacement Lateral Spreads, 1999 Kocaeli, Turkey Earthquake"* (Journal of Geotechnical and Geoenvironmental Engineering, January 2009), some fine-grained sediments, although liquefiable by current criteria, may not be susceptible to significant shear deformation or lateral spreading due to their dilative nature or an inherent undrained shear strength of liquefied plastic silts. The research noted that while discontinuous layers of saturated sands liquefied during an earthquake, lateral spreading did not occur. This may be due to sufficient shear resistance within the discontinuities to prevent these sediments from laterally spreading. Lateral spreading within dilative, fine grained sand-like sediments or plastic clay-like sediments also did not occur. It is believed that these deposits may be too dense or dilative to allow shallow lateral spreads to develop at shallow depths, at least for earthquakes less than $M_w = 8$. *Laboratory results from samples obtained from our study indicate clay soils with predominant intermediate to highly plasticity. The JGGE paper suggests that, although some of these materials may be liquefiable, they may not be subjected to lateral spreading (although our calculations may suggest otherwise).*

In consideration of the CPT data and test borings we have analyzed to date, as well as the conclusions of the JGGE paper, it is our opinion that a minimum setback distance 150 feet from the top of the creek channel bank is required to mitigate the risk due to the lateral spreading hazard to an ordinary level for the proposed residential development.

For similar reasons in the pond area we recommend a prescribed minimum setback of 50 feet from the existing riparian/wetlands area, or 50 feet from the high water mark, whichever is greater, to achieve the objective of mitigating the risk due to lateral spreading to an ordinary level.

Please refer to Appendix C for a graphical summary presenting the results of our lateral spreading analysis results.

It should be noted that we believe the basis of our liquefaction and lateral spreading analysis is extremely conservative, assuming both extremely high groundwater elevations combined with a major 7.9 magnitude earthquake. However, it must be cautioned that liquefaction and lateral spreading analysis is an inexact science and the mathematical models of the liquefaction and liquefiable soils contain many simplifying assumptions, not the least of which are isotropy and homogeneity. An analysis of ground water hydrology for this site was outside the scope of our study, therefore actual ground water conditions which differ from those assumed in our analysis could result in a lower factor of safety and higher displacements. Liquefaction/lateral spreading analyses and the generated factors of safety should be used as indicating trend lines. A soil deposit with a safety factor less than one will not necessarily fail, but the probability of slope movement will be greater than a soil deposit with a higher safety factor. Conversely, a soil deposit with a safety factor greater than one may fail, but the probability of stability is higher than a soil deposit with a lower safety factor.

Landsliding

Seismically-induced landsliding is a hazard with low potential for affecting most of the site since the majority of the area studied is gently sloping. However, it should be noted that slope failures are possible along the steep embankments of Corralitos Creek during strong seismic shaking, which could present a risk to development located atop the creek embankment. This risk can be adequately mitigated to an ordinary level, in our opinion, if the lateral spread hazard and risk set-back distances from the embankment for future development on the site recommended herein are closely followed.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The results of our feasibility level investigation indicate that from a geotechnical engineering standpoint the property may be developed for residential purposes. This study is considered a feasibility level study and therefore should not be used for final project design. *We recommend a final geotechnical report be prepared for the development after the site layout plans are more complete, with residential and street areas and utilities identified in greater detail. The final geotechnical report should include additional test borings and analysis to confirm the results of these preliminary findings and provide final, detailed recommendations for all aspects of the project design.*

Our laboratory testing indicates that the near surface soils consist primarily of silty sands in many areas, with low expansive properties. However, clay soils were identified in the upper five feet in 9 of the 20 test borings (Boring No.'s 1, 6, 11, 12, 13, 16, 17, 18, and 19). The areas where clay soil was present in the upper five feet were found to possess low to high expansive properties. This analysis was based on Atterberg Limits tests per ASTM D4318 and Expansion Index tests per ASTM D4829 and UBC 29-2. Of the six Expansion Index tests performed on the upper clay soils, four had low expansion potential, while two had high expansion potential. The high expansion potential samples were taken near Boring No.1 and No. 17 (refer to Appendix A for the laboratory test results). Mitigation measures for dealing with areas of expansive soil are discussed further within this report.

Liquefaction and lateral spreading of the subsurface soils is a hazard along Corralitos Creek and at other locations across the proposed development. Given the high potential and the attendant risks to proposed developments from liquefaction and lateral spreading along Corralitos Creek, we are recommending a prescriptive minimum development set-back of 150 feet from the southern "top of bank" for Corralitos Creek. We also recommend a minimum set-back of 50 feet from the pond located in the western property area (the 50 foot set-back should apply to the high water mark for the pond, or the existing riparian/wetlands boundary, whichever is greater). If this setback is adhered to for the layout of the residential developments, the attendant risk due to the aforementioned hazards will be ordinary.

The upper 20 feet of soils in general are considered loose to very loose across the project site. In addition, the upper 1 to 2 feet of the on-site soils are ripped and disked on a frequent basis for farming purposes. The loose nature of the upper soils make the proposed residential buildings susceptible to settlement and associated foundation and building distress.

The project site is located within a seismically active area and strong seismic shaking is expected to occur within the design lifetime of the project. Improvements should be designed and constructed in accordance with the most current CBC and the recommendations of this report to minimize reaction to seismic shaking. Structures built in accordance with the latest edition of the California Building Code have an increased potential for experiencing relatively minor damage, which should be repairable, however strong seismic shaking could result in architectural damage and the need for post-earthquake repairs.

SUMMARY OF GEOTECHNICAL ISSUES

The on-site soils were found to have the following geotechnical issues with respect to the proposed residential development:

1. Liquefaction and lateral spreading hazard: This issue appears to be worst along the southern embankment of Corralitos Creek and within the pond area at the western portion of the site. An area of potentially liquefiable soil was also identified in the area of Boring No.'s 6 in the central area of the proposed development. The loss of soil support due to liquefaction can cause damage to building foundations and structures placed over these areas. We would also recommend deeper test borings and additional liquefaction analysis in the area surrounding Boring No. 2 and Boring No. 5, which may also be susceptible to liquefaction hazard. We recommend that these potential liquefaction areas be addressed in the future as part of the final design-level Geotechnical Investigation to be completed for the project site.

2. Expansive soils were identified in the area of Boring No.'s 1 and 17. Boring No.1 is located on the eastern side of the development, and Boring No.17 is located on the western side of the development. Expansive soils can be damaging to building foundations as they tend to "expand" or swell during the winter months, and "shrink" or settle during summer months. This shrink\swell cycle can cause damage to building foundations and structures placed over these areas. Expansive soil conditions for new roadway pavements can be mitigated to an acceptable risk if the pavement sections are properly designed according to the appropriate R-value for the subgrade soils and the soil properly moisture conditioned and compacted per the "Site Grading Issues" and "Pavement Design" sections of this report.

3. The soils across the project site are relatively loose for the upper 20 to 30 feet. These soils are prone to settlement due to surcharge loads from new fills and buildings. This settlement can also cause damage to building foundations and structures placed over these areas.

PRELIMINARY MITIGATION MEASURES

Based upon our review of the geotechnical issues, we believe the most appropriate method to address all of the geotechnical issues outlined in Items 1 to 3 above would be to construct the residential developments upon a structural mat foundation system. The structural mat would likely consist of a 12-inch thick concrete slab (approximate), with one or two layers of reinforcing steel placed within the mat. The mat would be designed to "float" the residence above soft or liquefiable soil areas, and also resist the effect of expansive soils which may tend to lift the structural mat. These mats are also sometimes designed as post-tensioned slabs, which are quite common in many residential developments.

Other options to mitigate the geotechnical issues outlined in Items 1 to 3 above could include: 1) vibro-replacement (stone columns), 2) dynamic deep compaction, or 3) Rammed Aggregate Piers®. These options could be further explored in the final design-level geotechnical report to be prepared in the future for the proposed development.

Given the potential for liquefaction and lateral spreading to occur along Corralitos Creek, we are recommending a minimum development set-back of 150 feet from the southern "top of bank" for Corralitos Creek. We also recommend a minimum set-back of 50 feet from the pond located in the western property area, in the vicinity of Borings No. 16, 17, 18, and 19 (the 50 foot set-back should apply to the high water mark for the pond, or the existing riparian/wetlands boundary, whichever is greater).

Please note: The final geotechnical report may identify significant areas of the property which are clearly not susceptible to liquefaction, expansive soils, or loose upper soils. In this case, it is possible that these areas of the development will not require a structural mat foundation system (or other special geotechnical mitigation measures), based on future studies to be performed at the project site. If this occurs, standard shallow footings may be found acceptable for the project site.

SITE GRADING ISSUES

Site grading should include adequate removal of trees, row crops, surface vegetation, tree roots and organically contaminated topsoil.

It is possible that there are areas of man-made fill on the project site that our field investigation did not detect. Areas of man-made fill, if encountered on the project site will need to be completely excavated to undisturbed native material. The excavation process should be observed and the extent designated by the Geotechnical Engineer. Any voids created by fill removal must be backfilled with properly compacted approved native soils that are free of organic and other deleterious materials, or with approved imported fill.
Given the loose nature of the upper soils, we recommend road and pavement areas include a zone of recompacted soil which extends at least 18 inches below proposed pavement sections (the 18 inch zone should extend below asphaltic concrete, aggregate base and subbase sections).

Note: On-site grading work performed during or soon after the rainy season may encounter on-site soils which are too wet to use as engineered fill. These materials may require a diligent and active drying and/or mixing operation to reduce the moisture content to the levels required to obtain adequate compaction as an engineered fill. If the on-site soils or other materials are too dry, water may need to be added. In some cases the time and effort to dry the on-site soil may be considered excessive, and the import of aggregate base may be required.

The soil on the project site should be compacted as follows:

a. In pavement areas the upper 8 inches of subgrade, and all aggregate subbase and aggregate base, should be compacted to a minimum of 95% of its maximum dry density,
b. In pavement areas all utility trench backfill should be compacted to 95% of its maximum dry density,
c. All remaining soil on the project site should be compacted to a minimum of 90% of its maximum dry density.

Native or imported soil used as engineered fill on this project should meet the following requirements:

a. free of organics, debris, and other deleterious materials,
b. free of "recycled" materials such as asphaltic concrete, concrete, brick, etc.,
c. granular in nature, well graded, and contain sufficient binder to allow utility trenches to stand open,
d. free of rocks in excess of 2 inches in size.

In addition to the above requirements, import fill should have a Plasticity Index between 4 and 12, and a minimum Resistance "R" Value of 30, and be non-expansive.

CUT AND FILL SLOPES

All fill slopes should be constructed with engineered fill meeting the minimum density requirements of this report and have a gradient no steeper than 3:1 (horizontal to vertical). Fill slopes should not exceed 15 feet in vertical height unless specifically reviewed by Pacific Crest Engineering Inc. Where the vertical height exceeds 15 feet, intermediate benches must be provided. These benches should be at least 6 feet wide and sloped to control surface drainage. A lined ditch should be used on the bench.

Fill slopes should be keyed into the native slopes by providing a 10 foot wide base keyway sloped negatively at least 2% into the bank. The depth of the keyways will vary, depending on the materials encountered. It is anticipated that the depth of the keyways may be 3 to 6 feet, but at all locations shall be at least 2 feet into firm material.

Subsequent keys may be required as the fill section progress upslope. Keys will be designated in the field by the Geotechnical Engineer. See Figure No. 96 for general details.

Cut slopes should not exceed a 3:1 (horizontal to vertical) gradient and a 15 foot vertical height unless specifically reviewed by the Geotechnical Engineer. Where the vertical height exceeds 15 feet, intermediate benches must be provided. These benches should be at least 6 feet wide and sloped to control surface drainage. A lined ditch should be used on the bench.

The above slope gradients are based on the strength characteristics of the materials under conditions of normal moisture content that would result from rainfall falling directly on the slope, and do not take into account the additional activating forces applied by seepage from spring areas. Therefore, in order to maintain stable slopes at the recommended gradients, it is important that any seepage forces and accompanying hydrostatic pressure encountered be relieved by adequate drainage. Drainage facilities may include subdrains, gravel blankets, rock fill surface trenches or horizontally drilled drains. Configurations and type of drainage will be determined by the Geotechnical Engineer during the grading operations.

If a fill slope is to be placed above a cut slope, the toe of the fill slope should be set back at least 8 feet horizontally from the top of the cut slope. A lateral surface drain should be placed in the area between the cut and fill slopes.

EROSION CONTROL

The surface soils are classified as having a low to high potential for erosion (low potential in areas where clay is predominant at the surface, and high potential where sandy or silty sands are predominant at the surface). Therefore, the finished ground surface should be planted with ground cover and continually maintained to minimize surface erosion. For specific and detailed recommendations regarding erosion control on and surrounding the project site, you should consult with the project civil engineer or an erosion control specialist.

The surfaces of all cut and fill slopes should be prepared and maintained to reduce erosion. This work, at a minimum, should include track rolling of the slope and effective planting. The protection of the slopes should be installed as soon as practicable so that a sufficient growth will be established prior to inclement weather conditions. It is vital that no slope be left standing through a winter season without the erosion control measures having been provided

UTILITY TRENCHES

Utility trenches that are parallel to the sides of the building should be placed so that they do not extend below a line sloping down and away at a 2:1 (horizontal to vertical) slope from the bottom outside edge of the building slab or footing.

Utility pipes should be designed and constructed so that the top of pipe is a minimum of 36 inches below the finish subgrade elevation of any road or pavement areas. Any pipes within the top 24 inches of finish subgrade should be concrete encased, per design by the Project Civil Engineer.

All utility trenches which enter beneath perimeter areas of the buildings should be backfilled with controlled density fill (such as 2-sack sand\cement slurry) to help minimize potential moisture intrusion below interior floors. The width of the plug should be at least <u>three times</u> the width of the footing or grade beam at the building perimeter, but not less than 36 inches. The Geotechnical Engineer of Record for the development should be contacted to observe the placement of slurry plugs. In addition, all utility pipes which penetrate through the footings, stemwalls or grade beams (below the exterior soil grade) should also be sealed water-tight, as determined by the Project Engineer or Architect.

SURFACE DRAINAGE

Following completion of the project we recommend that storm drainage provisions and performance of permanent erosion control measures be closely observed through the first season of significant rainfall, to determine if these systems are performing adequately and, if necessary, resolve any unforeseen issues.

Surface water must not be allowed to pond or be trapped adjacent to the building foundations nor on the building pad nor in the parking areas.

All roof eaves should be guttered, with the outlets from the downspouts provided with adequate capacity to carry the storm water from the structures to reduce the possibility of soil saturation and erosion. The connection should be in a closed conduit which discharges at an approved location away from the structures and the graded area. The discharge location should not be located at the top of, or on the face of any topographic slopes. We would recommend a discharge point which is at least 10 feet down slope of any foundation or fill areas.

Final grades should be provided with a positive gradient away from all foundations in order to provide for rapid removal of the surface water from the foundations to an adequate discharge point. Soil grades should slope away from foundation areas at least 5 percent for the first 10 feet. Impervious surface areas should slope away from foundations at least 2 percent for the first 10 feet. The Project Civil Engineer or Architect should refer to 2007 CBC Section 1803.3 for further information. Concentrations of surface water runoff should be handled by providing necessary structures, such as paved ditches, catch basins, etc.

Cut and fill slopes should be constructed so that surface water will not be allowed to drain over the top of the slope face. This may require berms along the top of fill slopes and surface drainage ditches above cut slopes. All cut, fill and disturbed native slope areas should be hydro-seeded or other means of erosion control provided, as determined by the Project Civil Engineer.

Irrigation activities at the site should not be done in an uncontrolled or unreasonable manner.

The building and surface drainage facilities must not be altered nor any filling or excavation work performed in the area without first consulting the Geotechnical Engineer of Record for the development. Surface drainage improvements developed by the project civil engineer must be maintained by the property owner at all times, as improper drainage provisions can produce undesirable affects.

PAVEMENT DESIGN

The upper soils vary considerably across the development for pavement design purposes. The "R" Values of the subgrade soils varied from a low of 5 to a high of 74. Although subgrade soil R-values ranged as high as 74, these values exceed the maximum R-value of 50 as recommended by Caltrans in Section 614.3 of the 2006 Highway Design Manual. Therefore, our preliminary pavement design is limited to a maximum assumed R-value of 50 for the subgrade soils.

For preliminary planning purposes, we assumed three main R-values for pavement design. This included an R-value less than 5, an R-value of 25, and an R-value of 50. The final geotechnical report should include follow-up R-value sampling to confirm soil R-values along proposed street areas of the project development.

Pacific Crest Engineering Inc. has not performed a site specific traffic study to determine the actual traffic indices associated with this project. These values are for general design purposes only and the values may need modification. Traffic volume and equivalent axle loads that exceed the assumed TI could be destructive to the pavement, resulting in an accelerated rate of deterioration and the need for increased maintenance.

The following three tables provide a preliminary flexible pavement design which is based on the Caltrans Highway Design Manual – Chapter 600 (last updated September 1, 2006).

The following pavement sections are suggested:

TABLE No. 4
Recommended Pavement Sections for assumed **R-Value less than 5**

Material	Traffic Index			
	5	6	7	8
Asphalt Concrete	3.0 inches	3.5 inches	4.0 inches	4.5 inches
Class 2 Aggregate Base, R=78 min.	4.0 inches	6.0 inches	7.0 inches	8.0 inches
Class 2 Aggregate Sub-base, R=50 min.	7.0 inches	8.0 inches	10.0 inches	12.0 inches

TABLE No. 5
Recommended Pavement Sections for assumed **R-Value of 25**

Material	Traffic Index			
	5	6	7	8
Asphalt Concrete	3.0 inches	3.5 inches	4.0 inches	4.5 inches
Class 2 Aggregate Base, R=78 min.	7.0 inches	9.0 inches	11.0 inches	8.0 inches
Class 2 Aggregate Sub-base, R=50 min.	-- inches	-- inches	-- inches	6.0 inches

TABLE No. 6
Recommended Pavement Sections for assumed **R-Value of 50**

Material	Traffic Index			
	5	6	7	8
Asphalt Concrete	3.0 inches	3.5 inches	4.0 inches	4.5 inches
Class 2 Aggregate Base, R=78 min.	4.0 inches	6.0 inches	7.0 inches	8.0 inches
Class 2 Aggregate Sub-base, R=50 min.	-- inches	-- inches	-- inches	-- inches

To have the selected pavement sections perform to their greatest efficiency, it is very important that the following items be considered:

a. Properly scarify and moisture condition the upper 8 inches of the subgrade soil and compact it to a minimum of 95% of its maximum dry density, at a moisture content 1 to 3% over the optimum moisture content for the soil.

b. Provide sufficient gradient to prevent ponding of water.

c. Use only quality materials of the type and thickness (minimum) specified. All aggregate base and subbase must meet Caltrans Standard Specifications for Class 2 materials, and be angular in shape. All Class 2 aggregate base should be ¾ inch maximum in aggregate size.

d. Compact the base and subbase uniformly to a minimum of 95% of its maximum dry density.

e. Use ½ inch maximum, Type "A" medium graded asphaltic concrete. Place the asphaltic concrete only during periods of fair weather when the free air temperature is within prescribed limits by Cal Trans Specifications.

f. Place ¼ gallon per square yard of SG-70 prime coat over the aggregate base section, prior to placement of the asphaltic concrete.

g. Porous pavement systems which consist of porous paving blocks, asphaltic concrete or concrete are generally not recommended due to the potential for saturation of the subgrade soils and resulting increased potential for a shorter pavement life. At a minimum, porous pavement systems should include a layer of Mirafi HP370 geotextile fabric placed on the subgrade soil beneath the porous paving section. These pavement systems should only be used with the understanding by the Owner of the increased potential for pavement cracking, rutting, potholes, etc.

h. Maintenance should be undertaken on a routine basis.

SOIL CORROSIVITY

Corrosivity tests were run on two representative surface soil samples collected on the project site. These results are summarized as follows:

TABLE No. 7, Corrosivity Test Summary

Sample	Soil Resistivity	Chloride	Sulfate (water soluble)	pH
	Ohm-cm	mg/kg	mg/kg	
1-1-1	1254	3	431	6.5
2-1-1	4736	4	<5	6.3
6-1-1	1198	18	13	6.2
13-1-1	1637	14	<5	6.6
15-1-1	6306	6	<5	6.7

Cal Trans considers a site to be corrosive to foundation elements if one or more of the following conditions exist at the site:

a. Minimum soil resistivity is less than 1,000 ohm-cm
b. Chloride concentration is greater than or equal to 500 mg/Kg (ppm)
c. Sulfate concentration is greater than or equal to 2000 mg/Kg (ppm)
d. The soil pH is 5.5 or less

Refer to Cal Trans Corrosion Guidelines, version 1.0 (September, 2003) for additional information.

Based on the results of the soil resistivity, chloride, sulfate and pH, it appears that the conditions in the shallow existing soil may be assumed to be non-corrosive based on Cal Trans guidelines. The corrosion potential for any imported select fill should also be checked for corrosivity. The Project Civil Engineer should be made aware of the corrosive soil issues so that appropriate subsurface piping can be designed for the project site.

Please refer to Appendix A for the specific results of the corrosivity testing by the analytical laboratory.

SUMMARY

This report provides a feasibility level study of our findings, conclusions and recommendations concerning the geotechnical issues associated with developing the project site. The geotechnical issues outlined herein present serious challenges, but are regularly addressed and mitigated on many residential, commercial and industrial projects throughout the Watsonville area.

The main geotechnical issues include liquefaction of subsurface soils, lateral spreading potential near Corralitos Creek, loose soils within the upper 20 to 30 feet, and expansive soils. It is believed all of these issues can be mitigated by the use of a structural mat foundation system combined with appropriate set-backs from Corralitos Creek and the pond area.

This report is not intended for project level design. A final geotechnical report should be prepared for the development once the initial grading plans and layout of residential and street areas is determined.

Please note that this report includes four appendices. Appendix A provides a summary of our laboratory test results, Appendix B provides a summary of the CPT testing and data analysis, Appendix C provides a summary of our liquefaction analysis, and Appendix D includes the Feasibility Level Engineering Geology Report prepared by Zinn Geology.

Please refer to the Zinn Geology report within Appendix D for a more complete discussion of the geologic hazards and seismic shaking issues associated with the project site.

LIMTATIONS AND UNIFORMITY OF CONDITIONS

1. This Feasibility Level Geotechnical Investigation was prepared specifically for you and for the specific project and location described in the body of this report. This report and the recommendations included herein should be utilized for this specific project and location exclusively. This Geotechnical Investigation should not be applied to nor utilized on any other project or project site. Please refer to the ASFE "Important Information about Your Geotechnical Engineering Report" attached with this report.

2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the time, our firm should be notified so that supplemental recommendations can be provided.

3. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are called to the attention of the Architects and Engineers for the project and incorporated into the plans, and that the necessary steps are taken to ensure that the Contractors and Subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural process or the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or partially, by changes outside of our control. This report should therefore be reviewed in light of future planned construction and then current applicable codes. This report should not be considered valid after a period of two (2) years without our review.

5. This report was prepared upon your request for our services in accordance with currently accepted standards of professional geotechnical engineering practice. No warranty as to the contents of this report is intended, and none shall be inferred from the statements or opinions expressed.

6. The scope of our services mutually agreed upon for this project did not include any environmental assessment or study for the presence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site.

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

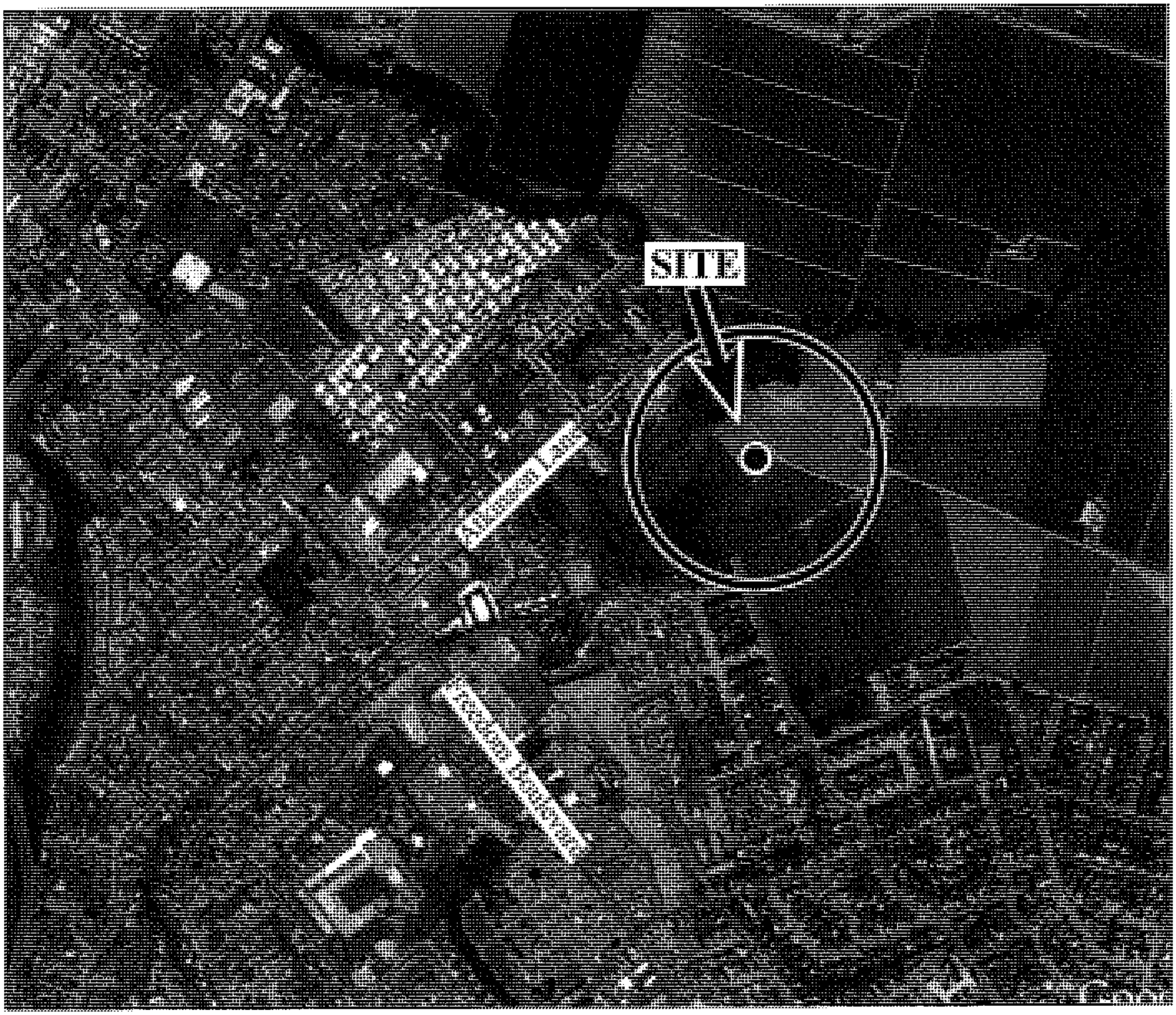
Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

APPENDIX A



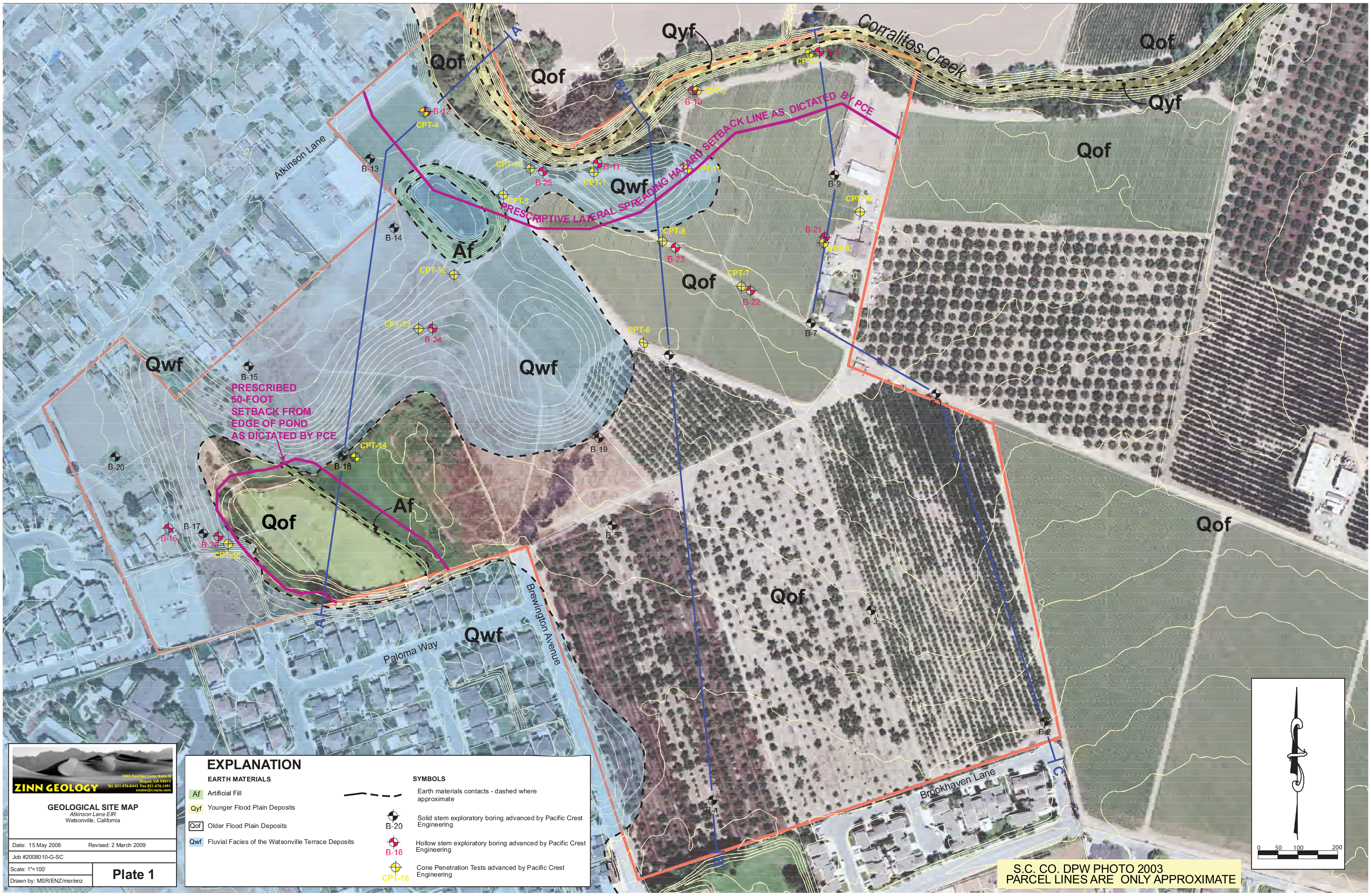
0 939 ft.

Approximate Scale

N

Base Map from Google Maps

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Regional Site Map** Atkinson Lane Development Watsonville, California	Figure No. 1 Project No. 0829 Date: 3/2/09



Corralitos Creek
Qyf
Qof
Qwf
Af
Atkinson Lane
Paloma Way
Brewington Avenue
Brookhaven Lane
PRESCRIPTIVE LATERAL SPREADING HAZARD SETBACK LINE AS DICTATED BY PCE
PRESCRIBED 50-FOOT SETBACK FROM EDGE OF POND AS DICTATED BY PCE
A
B
C
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-9
B-10
B-11
B-12
B-13
B-14
B-15
B-16
B-17
B-18
B-19
B-20
B-21
B-22
B-23
B-24
B-25
CPT-1
CPT-2
CPT-4
CPT-5
CPT-6
CPT-7
CPT-8
CPT-9
CPT-11
CPT-12
CPT-13
CPT-14
CPT-15
CPT-16
S.C. CO. DPW PHOTO 2003
PARCEL LINES ARE ONLY APPROXIMATE
0 50 100 200
ZINN GEOLOGY
3085 Carriker Lane, Suite B
Soquel, CA 95073
Tel. 831.476.8443 Fax 831.476.1491
enzinn@cruzio.com
GEOLOGICAL SITE MAP
Atkinson Lane EIR
Watsonville, California
Date: 15 May 2008
Revised: 2 March 2009
Job #2008010-G-SC
Scale: 1"=100'
Drawn by: MSR/ENZ/msr/enz
Plate 1
EXPLANATION
EARTH MATERIALS
Af Artificial Fill
Qyf Younger Flood Plain Deposits
Qof Older Flood Plain Deposits
Qwf Fluvial Facies of the Watsonville Terrace Deposits
SYMBOLS
Earth materials contacts - dashed where approximate
B-20 Solid stem exploratory boring advanced by Pacific Crest Engineering
B-16 Hollow stem exploratory boring advanced by Pacific Crest Engineering
CPT-16 Cone Penetration Tests advanced by Pacific Crest Engineering

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488 (Modified)

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	**GRAVELS** MORE THAN HALF OF COARSE FRACTION IS LARGER THAN #4 SIEVE	**CLEAN GRAVELS** (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels or gravels-sand mixtures, little or no fines
		GRAVELS (MORE THAN 12% FINES)	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN #4 SIEVE	**CLEAN SANDS** (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		SANDS (MORE THAN 12% FINES)	SM	Silty sands, sand-silt mixtures, non-plastic fines
			SC	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE	**SILTS AND CLAYS** LIQUID LIMIT IS LESS THAN 35%		ML	Inorganic silts and very fine clayey sand silty sands, with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly, sand, silty or lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT IS BETWEEN 35% AND 50%		MI	Inorganic silts, clayey silts and silty fine sands of intermediate plasticity
			CI	Inorganic clays, gravelly/sandy clays and silty clays of intermediate plasticity
			OI	Organic clays and silty clays of intermediate plasticity
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Organic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

BORING LOG EXPLANATION

LOGGED BY______ DATE DRILLED____________ BORING DIAMETER_______ BORING NO.____

Depth, ft.	Sample No. and Type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density, p.c.f.	Moisture % of Dry Wt.	MISC. LAB RESULTS
1			← Ground water elevation	NOTE: All blows/foot are normalized to 2" outside diameter sampler size					
2	1-1 L	▮	← Soil Sample Number ← Soil Sampler Size/Type L = 3" Outside Diameter M = 2.5" Outside Diameter T = 2" Outside Diameter ST = Shelby Tube BAG = Bag Sample						
3									
4									
5									

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	BLOWS/FOOT
VERY SOFT	0-2
SOFT	2-4
FIRM	4-8
STIFF	8-16
VERY STIFF	16-32
HARD	OVER 32

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 1

Depth (feet)	Sample No. and Type	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1 2 3 4	1-1 L	Brown Sandy CLAY, very fine to fine grained, coarse rounded pebbles scattered throughout the sample, small mica flakes scattered throughout the sample, medium plasticity, damp, stiff	CL	9				
5 6 7 8 9	1-2 L	Brown Sandy SILT, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, medium plasticity, damp, stiff	ML	7		97.2	18.5	Gravel = 0.0% Sand = 34.1% Fines = 65.9%
10 11 12 13 14	1-3 L	Brown SAND, fine to coarse grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, coarsens with depth, coarse rounded pebbles near 11 1/2 feet, black staining near 11 feet, damp, loose	SP	8		93.7	27.5	
15 16	1-4 L	Brown Clayey SAND, very fine to medium grained, sub-rounded shaped, sticky texture, very small mica flakes scattered throughout the sample, damp, loose	SC	8		106.6	18.3	
17 18 19		Brown SAND, poorly graded, very fine to medium grained, sub-rounded shaped, small mica flakes scattered throughout the sample, damp, loose	SP					
20 21 22 23 24	1-5 T	Color change to reddish brown, slight increase in fines content, damp, loose		8			12.3	

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 1

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	1-6 T		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace rounded coarse pebbles, damp, medium dense	SP					
26			Mottled brown and gray Silty CLAY/ SILT, smooth texture, very fine grained, low to medium plasticity, damp, stiff	CL-ML	14			9.2	
27									
28			Boring Terminated at 26 and 1/2 feet. No Groundwater was encountered.						
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 2

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	2-1 L		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace coarse rounded pebbles/gravels scattered throughout the sample, damp, loose	SP	7				
5–6	2-2 L		Decrease in coarseness of sand, very fine to fine grained, fining downward, trace medium rounded pebbles near 6 1/2 feet, damp, loose		6		99.5	9.7	
10–11	2-3 L		Increase in coarseness of sand, very fine to medium grained with trace of coarse grains, medium to coarse rounded pebbles scattered throughout the sample, damp, loose		8		97.4	26.4	
11			Brown SILT, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp, stiff	ML					
15–16	2-4 L		Mottled brown and reddish brown Silty CLAY/SILT, very fine grained, smooth texture, small mica flakes scattered throughout the sample, low to medium plasticity, damp, stiff	CL-ML	11		91.7	32.0	
20	2-5 T		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SP					
21			Brown Silty CLAY/SILT, very fine grained, smooth texture, mica flakes scattered throughout the sample, low to medium plasticity, damp, stiff	CL-ML	12			10.7	

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Watsonville, CA 95076

Log of Test Borings
Atkinson Lane Development
Watsonville, California

Figure No. 6
Project No.0829
Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 2

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–31	2-6 T; 2-7 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, trace medium to coarse rounded pebbles, moist to slightly wet, loose	SM	8			20.2	35.8% Passing #200 Sieve
31–32			Brown Silty CLAY/SILT, smooth texture, very fine grained, small mica flakes scattered throughout the sample, low to medium plasticity, damp, firm	CL-ML	6	19		32.9	
33			Boring Terminated at 31 and 1/2 feet. Ground water encountered at 26 and 1/2 feet.						

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 3

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	3-1 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, very small mica flakes scattered throughout the sample, poorly graded, damp, loose	SM	5		108.5	10.3	Gravel = 0.5% Sand = 71.9% Fines = 27.6%
4.5–11.25	3-2 L		Brown SAND, quartz rich, fine to medium grained, sub-angular to sub-rounded shaped, mica flakes scattered throughout the sample, poorly graded, damp, loose	SP	8		104.4	6.7	
	3-3 L		Decrease in coarseness of sand, fining downward, damp, loose		7		101.7	10.7	
11.25–14.5			Brown Silty SAND, very fine to fine grained, trace angular to sub-angular medium to coarse grains, mica flakes scattered throughout the sample, poorly graded, damp, loose	SM					
14.5–19.5	3-4 L		Mottled dark brown, brown, and reddish brown CLAY, smooth texture, medium plasticity, mica flakes scattered throughout the sample, damp, stiff	CL	11		102.8	23.4	Qu = 665 psf
19.5–21.5	3-5 T		Brown SAND, fine to coarse grained, sub-angular to sub-rounded shaped, poorly graded, trace very coarse rounded pebbles, mica flakes scattered throughout the sample, damp, medium dense	SP	18			7.0	
21.5–24			Boring Terminated at 21 and 1/2 feet. No groundwater encountered.						

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 4

Depth (feet)	Sample No. and Type	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	4-1 L	Brown Gravelly SAND with Silt, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, rounded very coarse river pebbles scattered throughout the sample, damp, medium dense	SG	12				Direct Shear: C = 525 psf $\phi = 44^o$ Gravel = 31.0% Sand = 62.6% Fines = 6.4%
5	4-2 L	Lack of pebbles, damp, loose						
6		Dark gray CLAY, smooth texture, very fine grained, intermediate plasticity, damp, stiff	CL-CI	10	19	95.8	27.7	Qu = 994 psf
10–11	4-3 L	Mottled tan and brown CLAY with Sand, clay is very fine grained, smooth texture, and exhibits medium plastic characteristics, sand is medium to coarse grained, sub-angular to sub-rounded shaped, and poorly graded, very coarse rounded pebbles scattered throughout the sample, silt pocket near 11 1/2 feet, damp, firm	CL	8	20	108.7	13.9	
15–16	4-4 L	Mottled light brown, gray, and reddish brown Fat CLAY, very fine grained, smooth texture, high plasticity, damp, very stiff	CH	26				
20–21	4-5 L	Damp, very stiff		17	41	82.7	35.9	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 4

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	4-6 L		Mottled grayish brown, gray, and reddish brown Fat CLAY, very fine grained, smooth texture, thin oxidized lines and veins scattered throughout the sample, high plasticity, damp, very stiff	CH	28	55	86.5	35.1	
30–31	4-7 L		Color change to brownish gray, increase in amount of oxidized veins scattered throughout the sample, damp, very stiff		28				
35–36	4-8 L		Damp, very stiff (groundwater symbol)		28		89.2	33.8	100% Passing #200 Sieve
40–41	4-9 L		Mottled yellowish brown and reddish brown patches near 41 1/2 feet, high plastic characteristics, damp near 41 1/2 feet, wet near 41 feet, very stiff		20	37	84.5	38.5	
45–46	4-10 L		Color change to gray, oxidized patches and veins scattered throughout the sample, damp near 46 1/2 feet wet near 46 feet, damp, hard		36	31	90.0	32.0	

Depth scale: 25 – 48 feet

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 4

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	4-11 L		Gray Silty CLAY/SILT, very fine grained, smooth texture, oxidation patches and oxidized veins scattered throughout the sample, intermediate plasticity, damp, hard	CI					
51–53			Grayish brown SILT, very fine to fine grained, smooth texture, very small mica flakes and oxidation patches scattered throughout the sample, intermediate plasticity, damp, near 51 1/2 feet wet near 51 feet, hard	ML	39	18	95.4	29.4	
			Boring Terminated at 51and 1/2 feet. Ground water encountered at 44 feet and stabilized at 36 and 1/2 feet.						

Depth scale: 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 5

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	5-1 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SM	5		112.8	12.5	27.7% Passing #200 Sieve
5–6	5-2 L		Increase in fine grained sand, decrease in fines content, slight coarsening downward, color change to tannish brown, sub-angular medium to coarse grains near 6 1/2 feet, damp, loose		6		98.3	13.1	
10–11	5-3 L		Brown SAND very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SP	8		96.9	14.7	
15–16	5-4 L		Mottled reddish brown, brown and gray Clayey SAND, very fine to fine grained, slight sticky texture, small mica flakes scattered throughout the sample, poorly graded, damp, loose	SC	9		113.3	12.3	21.2% Passing #200 Sieve Qu = 487 psf
20–21	5-5 T		▼ (water level) Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, moist to slightly wet, loose	SM	10			22.2	Gravel = 0.0% Sand = 63.1% Fines = 36.9%

Depth scale: 1 through 24 feet.

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 5

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	5-6 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace sub-angular medium grains, wet, medium dense	SP	11			24.9	13.8% Passing #200 Sieve
30–31	5-7 T		Increase in fines content, slight fining downward, wet, loose		8			33.0	26.6% Passing #200 Sieve
32			Boring Terminated at 31 and 1/2 feet. Groundwater was encountered at 21 and 1/2 feet, then rose to 20 feet prior to backfilling.						

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 6

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	6-1 L		Mottled light brown and dark brown Sandy CLAY, very fine to fine grained, small mica flakes scattered throughout the sample, medium to high plasticity, damp, stiff	CL	12				Direct Shear: C = 700 psf $\phi = 28^{o}$
4.5–9.5	6-2 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, very coarse rounded pebbles scattered throughout the sample, damp, loose	SM	7		107.7	13.0	
9.5–14.5	6-3 L		Brown Silty SAND, poorly graded, very fine to medium grained, sub-rounded shaped, mica flakes scattered throughout the sample, coarse rounded pebbles scattered throughout the sample, trace sub-angular coarse grains, damp, medium dense		14		104.3	4.4	Gravel = 0.0% Sand = 93.9% Fines = 6.1%
14.5–16.5	6-4 L		Brown Sandy SILT, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, damp, stiff	ML	10		111.6	18.4	32.3% Passing #200 Sieve
16.5–19.5			Brown Clayey SAND, very fine to medium grained, sub-angular to sub-rounded shaped, sticky texture, low plasticity, trace sub-angular coarse grains and mica flakes scattered throughout the sample, damp, loose	SC					
19.5–24	6-5 L		Brown CLAY with Sand, very fine to fine grained smooth texture, low plasticity, sub-rounded shaped, oxidation patches scattered throughout the sample, damp, very stiff	CL	16	15			

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 6

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	6-6 L		Mottled light gray and reddish tan Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, dark brown/black veins scattered throughout the sample, damp, very stiff	CH	23	50	92.1	31.6	
30–31	6-7 L		Mottled brown, gray, and reddish brown SILT, smooth texture, very fine grained, very small mica flakes scattered throughout the sample, damp, very stiff	ML	20				
35–36	6-8 L		Mottled bluish gray and reddish brown Fat CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, high plasticity,oxidized veins scattered throughout the sample, damp, very stiff	CH	25	46	81.6	39.7	Qu = 3417 psf
40–41	6-9 L		Dark oxidized patches and patches of black clay near 41 feet, damp, very stiff		25		85.5	38.1	
45–46	6-10 L		Dark oxidized patches and patchesof charcoal near 45 1/2 feet, damp, very stiff		25	56	86.5	35.8	

Depth scale: 25 to 48 feet.

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 6

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	6-11 L		Mottled bluish gray, reddish brown, and gray Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	27	40	93.2	32.1	
52–72			Boring Terminated at 51 and 1/2 feet. No ground water encountered.						

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 7

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–6.5			Brown SAND with Silt, very fine to fine grained, poorly graided, sub-rounded shaped, very small mica flakes scattered throughout the sample, trace sub-angular grains near 3 1/2 feet, rounded pebbles near 3 feet, damp, loose	SM					
2–3.5	7-1 L				7		108.3	10.6	
5–6.5	7-2 L		Increase in fines content, very coarse rounded shaped, pebbles scattered throughout the sample, damp, loose		7		105.0	11.2	
6.5–11.5			Brown SAND, fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace sub-angular to sub-rounded medium grains, damp, loose	SP					
10–11.5	7-3 L		Slight increase in fines content, very fine grains, damp, loose		10		101.4	20.6	
11.5–16			Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, trace sub-angular coarse grains, small mica flakes scattered throughout the sample, poorly graded, damp, loose	SM					
15–16.5	7-4 L		Lack of medium and coarse grains, increase in fines content, fining downward, damp, loose		5		109.5	18.6	
16–19.5			Brown SAND with Clay, slight sticky texture, very fine to coarse grained, sub-angular to sub-rounded shaped, small mica flakes scattered throughout the sample, trace coarse rounded pebbles near 16 1/2 feet, damp, loose	SC					
19.5–24			Light brown Silty SAND, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, trace medium and coarse sub-angular grains scattered throughout the sample, damp, medium dense	SM					
20–21.5	7-5 T				17			15.3	

LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 7

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–29	7-6 T		Brown SAND with Silt, very fine to medium grained, sub-rounded shaped, trace rounded coarse grains scattered throughout the sample, small mica flakes scattered throughout the sample, damp, medium dense	SM	14			10.5	
30–34	7-7 T		Variegated Gravelly SAND, fine to coarse grained, sub-angular to sub-rounded shaped, poorly graded, mica flakes scattered throughout the sample, angular to rounded very coarse pebbles scattered throughout the sample, pockets of silty sand scattered throughout the sample, damp, medium dense	SG	25			7.4	
35–36	7-8 T		Increase in coarseness of sand, predominately medium to coarse grains with few fines, coarsening downward, fractured and broken river rocks scattered throughout the sample, damp, dense		37			6.7	
37–48			Boring Terminated at 36 and 1/2 feet. No groundwater was encountered.						

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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 8

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–1	8-1 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, loose	SM	6		91.0	15.8	42.9% Passing #200 Sieve
4	8-2 L								
4.5–5.5	8-3 T		Brown SAND, fine grained, poorly graded, sub-rounded shaped, small mica flakes scattered throughout the sample, damp, loose	SP	5			9.3	
5.5–8			Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, loose	SM	7			14.8	31.6% Passing #200 Sieve
8–13	8-4 T		Brown Silty SAND, fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, medium dense		13			7.3	6.4% Passing #200 Sieve
13–18	8-5 T		Brown SILT, very fine grained, smooth texture, intermediate plasticity, small mica flakes scattered throughout the sample, moist to wet, soft	MI & OI	4	11		40.0	98.8% Passing #200 Sieve
18–23	8-6 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, very small mica flakes scattered throughout the sample, low plasticity, wet, loose	SM	7			21.7	Gravel = 2.1% Sand = 65.8% Fines = 32.1%
23–24	8-7 T		Brown Silty SAND, very fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, wet, loose	SP					

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 8

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	8-7 T		Brown Silty SAND, very fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, wet, loose	SM	9			16.1	10.5% Passing #200 Sieve
26, 27	8-8 T		Brown CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, intermediate plasticity, moist, stiff	CI	9	26		30.2	
28, 29, 30, 31, 32	8-9 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, very small mica flakes scattered thoughout the sample, wet, very loose	SM	4			24.6	47.6% Passing #200 Sieve
33, 34, 35, 36, 37	8-10 T		Brown Clay, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, low to medium plasticity, moist, firm	CL	8	14		25.4	
38, 39, 40, 41, 42	8-11 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, trace medium grains, wet, loose	SM	10			23.7	36.7% Passing #200 Sieve
43, 44, 45, 46, 47, 48	8-12 T		Moist, medium dense		14			19.2	36.0% Passing #200 Sieve

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 8

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49	8-13 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small micas flakes scatered throughout the sample, wet, medium dense	SM	15			23.8	34.5% Passing #200 Sieve
50			Boring Terminated at 50 feet. Groundwater initially encountered at 15 feet, stabilized at 27 feet.						
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53									
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Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 21 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 9

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	9-1 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, rounded pebbles scattered throughout the sample, damp, loose	SM	5		99.8	10.0	25.5% Passing #200 Sieve
4.5–10	9-2 L		Brown SAND, quartz rich, fine to coarse grained, sub-angular to sub-angular shaped, mica flakes scattered throughout the sample, broken and whole rounded pebbles scattered throughout the sample, poorly graded, damp, medium dense	SP	17				Direct Shear: C = 195 psf $\phi = 24^{o}$
10–15.5	9-3 B		Clayey SAND, very fine to medium grained, low plasticity, sub-rounded shaped, mica flakes scattered throughout the sample, damp, loose No sample was recovered. Spoils are described above. Fining to Sandy CLAY	SC	6			18.8	
15.5–16.5	9-4 L		Brown CLAY, very fine grained, smooth texture, mica flakes scattered throughout the sample, low to medium plasticity, damp, firm	CL	7			29.4	
16.5–24			Boring Terminated at 16 and 1/2 feet. No groundwater was encountered.						

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 22 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 10

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	10-1 L		Brown Silty SAND, very fine to fine grained, trace medium sub-rounded gravels, poorly graded, very small mica flakes scattered throughout the sample, damp, very loose	SM	4		99.8	18.2	49.4% Passing #200 Sieve
4	10-2 L		Bits of charcoal near 4 feet, sub-angular to sub-rounded medium to very coarse gravels near 4 1/2 feet, large rounded river rock near 4 1/2 feet, damp, very loose		2			12.6	
5–6	10-3 T		Lack of pebbles and rocks, increase in coarseness of sand, coarsening downward, very fine to medium grained, damp, very loose		2			10.1	14.4% Passing #200 Sieve
8–9	10-4 T		Brown SAND, fine to medium grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SM	9			9.5	44.3% Passing #200 Sieve
10			Brown Silty SAND, moderately cemented, very fine grained, mica flakes scattered throughout the sample, damp, loose	SM					
14	10-5 T		Brown Silty SAND, very fine to fine grained, there is a significant amount of slough in the sample; the native is the fine grained soil the slough is the sand, several sub-angular to sub-rounded river rocks, damp, loose		7			9.5	16.0% Passing #200 Sieve
19	10-6 T		Color change to mottled brown, gray and reddish brown, trace rounded river pebbles and medium gravels scattered throughout the sample, mica flakes scattered throughout the sample, damp to moist, medium dense		12			13.9	27.7% Passing #200 Sieve
23–24	10-7 T		Color change to brown, trace medium grains, damp, medium dense		16				Gravel = 0.0% Sand = 80.5% Fines = 19.5%

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 10

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	10-7 T		Brown Silty SAND, very fine to fine grained, trace medium grains, poorly graded, mica flakes scattered throughout the sample, damp, medium dense	SM	16			10.6	
28	10-8 T		Brown Sandy CLAY, very fine to medium grained, sub-angular to sub-rounded shaped, low to medium plasticity, very small mica flakes scattered throughout the sample, moist, stiff	CL	14	13		22.7	
33	10-9 T		Mottled brown, grayish brown and reddish brown Fat CLAY, smooth texture, very fine grained, very small mica flakes scattered throughout the sample, high plasticity, damp, stiff	CH	14	43		31.6	
39	10-10 T		Color change to mottled gray and reddish brown, damp, stiff		10	47		35.1	
43	10-11 T		Color change to mottled bluish gray and yellowish brown very smooth texture, damp, stiff		14	42		35.7	

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 10

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49	10-12 T		Bluish gray Fat CLAY, very fine grained, very smooth texture, oxidized patches and veins of decomposed organics scattered throughout the sample, trace charcoal, medium plasticity, damp, stiff	CH	14	45		34.9	
50			Boring Terminated at 50 feet. Groundwater was initially encountered at 29 and 1/2 feet, and stabilized at 28 feet.						
51									
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72									

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" BORING NO. 11

Depth (feet)	Sample No. and Type	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	11-1 L	Yellowish brown Sandy CLAY, very fine to fine grained, very small mica flakes scattered throughout the sample, low plasticity , damp, very stiff	CL	22	17	114.7	15.3	
3–5	11-2 L	Yellowish brown Sandy SILT very fine to fine grained, very small mica flakes scattered throughout the sample, patches of gray near 5 feet, damp, very stiff	ML	25			20.3	56.8% Passing #200 Sieve
8–10	11-3 T	Yellowish brown Silty SAND, very fine to fine grained, trace medium grains, sub-angular to sub-rounded shaped, very small mica flakes scattered throughout the sample, poorly graded, slightly damp, dense	SM	36			7.4	17.9% Passing #200 Sieve
13–15	11-4 T	Mottled grayish brown and brownish red Fat CLAY, smooth texture, very fine grained, low plastic characteristics, very small mica flakes scattered throughout the sample, slightly damp, very stiff	CH	27	47		27.5	
19–20	11-5 T	Damp, very stiff		17	60		31.9	
24	11-6 T	Color change to mottled gray and brownish red, smooth texture, low to medium plasticity, damp to wet, stiff						

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" BORING NO. 11

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	11-6 T		Mottled gray and brownish red Fat CLAY, high plasticity, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp to wet, stiff	CH	12	43		37.4	
26									
27									
28									
29	11-7 T		Damp, stiff						
30					11	35		36.5	
31									
32									
33									
34	11-8 T		Color change to mottled bluish gray and reddish brown, damp, very stiff						
35					18	46		36.2	
36									
37									
38									
39	11-9 T		Color change to bluish gray, trace oxidized patches scattered throughout the sample, damp, stiff						
40					12	36		34.1	
41									
42									
43									
44	11-10 T		Color change to mottled bluish gray and light yellowish brown, damp, very stiff						
45					17	39		36.8	
46									
47									
48									

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" BORING NO. 11

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49	11-11 T		Mottled bluish gray and yellowish brown Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, damp, very stiff	CH	18	34		36.5	
50			Boring Terminated at 50 feet. Groundwater encountered at 24 and 1/2 feet and stabilized at 20 and 1/2 feet.						
51–72									

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LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 12

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–3	12-1 L		Mottled brown, grayish tan and reddish orange Sandy CLAY, very fine to fine grained, intermediate plasticity, very small mica flakes scattered throughout the sample, damp,very stiff	CL-CI	16	19	113.4	18.5	
4–8	12-2 L		Mottled dark brown and reddish brown Clayey SAND, very fine to fine grained, sub-rounded shaped , very small mica flakes scattered throughout the sample, poorly graded, damp, dense	SC	36		120.5	14.5	47.6% Passing #200 Sieve
9–13	12-3 T		Brown CLAY with Sand, very fine to fine grained, low to medium plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CL	13	11		18.1	
13–18	12-4 T		Mottled reddish brown and grayish brown Clayey SAND, very fine to medium grained, sub-rounded shaped, slight sticky texture, poorly graded, very small mica flakes scattered throughout the sample, large fractured river rock in the sample, damp, medium dense	SC	17			16.8	33.2% Passing #200 Sieve
18–23	12-5 T		Mottled gray and reddish brown SILT with Sand, smooth texture, very fine to fine grained, very small mica flakes scattered throughout the sample, intermediate plasticity, damp, stiff Water in the hole, collected sample and waited 17 minutes	MI-OI	9	12		25.4	
24	12-6 T		▼ Mottled gray and reddish brown Fat CLAY, smooth texture, very fine grained, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH	11	56		42.5	

LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 12

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25			Mottled gray and reddish brown Fat CLAY, smooth texture, very fine grained, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH					
26									
27									
28									
29	12-7 T		Color change to brownish gray, damp, stiff						
30					13	57		35.0	
31									
32									
33									
34	12-8 T		Color change to mottled gray and reddish orange, damp, very stiff						
35					16	39		35.0	
36									
37									
38			Damp, stiff						
39	12-9 T								
40					10	27		35.0	
41									
42									
43									
44	12-10 T		Color change to mottled gray and reddish brown, damp, very stiff						
45					16	32		34.2	
46									
47									
48									

LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 12

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–50	12-11 T		Bluish gray Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, medium plasticity, damp, stiff	CH		27		35.5	
50–72			Boring Terminated at 50 feet. Groundwater was encountered at 24 feet and 3 inches.						

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Log of Test Borings
Atkinson Lane Development
Watsonville, California

Figure No. 31
Project No.0829
Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 13

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2.2	13-1 L		Mottled light brown and brownish red Sandy CLAY, very fine to fine grained, low plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CL	13				
2.2–5			Mottled brown, tan and reddish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, medium dense	SM					
5–10	13-2 L		Mottled brown and reddish brown Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, medium to very coarse sub-angular to rounded gravels and pebbles scattered throughout the sample, damp, dense	SC	39				Direct Shear: C = 650 psf $\phi = 36°$
10–15	13-3 L		Increase in coarseness and content of sand, very fine to medium grained, coarsening downward, lack of sub-angular gravels, rounded pebbles scattered throughout the sample, damp, medium dense		20		109.3	17.9	Gravel = 7.1% Sand = 67.8% Fines = 25.1%
15–17	13-4 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, dense	SM	31		97.5	16.7	27.0% Passing #200 Sieve
17–20			Brown SAND, fine to medium grained, sub-rounded shaped, poorly graded, mica flakes scattered throughout the sample, damp, dense	SP					
20–24	13-5 T		Mottled brownish gray and reddish brown CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, intermediate plasticity to non-plastic, damp, stiff (groundwater symbol ▼ at ~23 ft)	ML	14	19		39.3	

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 13

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	13-6 T		Mottled brown and blackish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes and oxidation patches scattered throughout the sample, damp, very stiff	CH	21	64		36.7	
27–48			Boring terminated at 26 and 1/2 feet. Groundwater initially encountered at 25 feet and came up to 23 feet.						

LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 14

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–5	14-1 L		Mottled grayish brown, yellowish tan, brown and reddish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, oxidation patches scattered throughout the sample, thin roots near 1 1/2 feet, coarse to very coarse sub-angular gravels scattered throughout the sample, slightly damp to dry, very dense	SM	50/6				Direct Shear: C = 175 psf Φ = 28°
5–9.9	14-2 L		Yellowish tan Clayey SAND, very fine to fine grained, sub-rounded shaped, oxidation patches scattered throughout the sample, coarse rounded pebbles scattered throughout the sample, veins of black clay scattered throughout the sample, poorly graded, damp, dense	SC	37		113.2	18.6	
9.9–14.9	14-3 L		Yellowish brown Sandy CLAY, very fine to fine grained, low plasticity, fairly high sand content, very small mica flakes scattered throughout the sample, damp, very stiff	CL	22				
14.9–19.9	14-4 L		Mottled brownish red and grayish brown SILT, very fine to fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp, very stiff	ML	18		95.2	29.4	
19.9–24	14-5 T		Brownish gray Fat CLAY, very fine grained, smooth texture, high plasticity, oxidation patches scattered throughout the sample, damp, stiff	CH	14	44		35.7	

LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 14

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	14-6 T		Mottled brownish gray and brownish orange Fat CLAY, very fine grained, smooth texture, high plasticity, patchesof brick orange claynear 26 1/2 feet, damp, stiff	CH	15	55		31.7	
30–31	14-7 T		Lack of brick orangeclay, increase in amount of oxidation patches scattered thoughout the sample, damp, very stiff		18			35.6	
34–36	14-8 T		Mottled gray and reddish brown Silty CLAY, very fine grained, very sticky texture, imtermediate plasticity, damp, very stiff	CI	18	26		33.5	99.9% Passing #200 Sieve
37–48			Boring terminated at 36 and 1/2 feet. Groundwater was initially encountered at 26 and 1/2 feet, but stabilized at 25 feet.						

LOGGED BY CLR DATE DRILLED 5/7/07 BORING DIAMETER 6" BORING NO. 15

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	15-1 L		Mottled light brown, brown and dark brown Sandy SILT, very fine to fine grained, thin roots near 2 feet, yellowish orange oxidation patches scattered throughout the sample, very small mica flakes scattered throughout the sample, black patches near 2 1/2 feet, damp, stiff	ML	14				
5–6	15-2 L		Yellowish brown Silty SAND, very fine to medium grained, sub-rounded shaped, very small mica flakes scattered throughout the sample, very coarse rounded pebbles scattered throughout the sample, poorly graded, damp, dense	SM	34		124.2	12.7	
10–11	15-3 L		Increase in coarseness and content of sand, more medium grains, coarsening downward, increase in content of rounded pebbles, sub-angular coarse gravels scattered throughout the sample, damp, dense		32		113.6	16.7	
15–16	15-4 B		No sample recovered. Spoils from hole were described as yellowish brown Fat CLAY, very fine grained, smooth texture, high plasticity, mica flakes scattered throughout the sample, damp, very stiff	CH	23			27.3	
20–21	15-5 T		Color change to mottled gray and orange, patches of black clay scattered throughout the sample, high plasticity, damp, stiff		14	56		39.0	
24			▼ (groundwater)						

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 15

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	15-6 T		Mottled gray brownish red Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	30			33.6	
27–48			Boring Terminated at 26 and 1/2 feet. Groundwater was encountered at 24 feet.						

LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 16

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	16-1 L		Mottled blackish brown and brown CLAY, thin roots near 2 feet, intermediate plasticity, very fine grained, very small mica flakes and oxidation patches scattered throughout the sample, damp, very stiff	CI					
2–4			Mottled brownish tan and grayish tan Sandy CLAY, very fine to medium grained, sub-rounded shaped, slight sticky texture, very small mica flakes scattered thoughout the sample, poorly graded, damp, stiff	CL	15	22	110.2	18.1	59.6% Passing #200 Sieve
4–5	16-2 L		Mottled grayish tan and reddish orange CLAY, very fine grained, smooth texture, intermediate plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CI	23	25	102.0	15.9	
5–7			Brown SAND with Clay, very fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, coarse to very coarse rounded gravels near 5 feet, damp, medium dense	SC					
7–10	16-3 T		Mottled gray and reddish brown CLAY, intermediate plasticity, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp, stiff	CI	9	21		34.7	89.4% Passing #200 Sieve
10–13			Mottled gray and reddish brown SILT, very fine grained, small mica flakes scattered throughout the sample, damp, stiff	ML					
13–24	16-4 T		▼ Mottled grayish brown and reddish brown Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH	12	62		35.5	
19	16-5 T		Color change to mottled gray and reddish brown, damp, very stiff		19	38		29.3	
23			Encountered groundwater waited 35 minutes for stabilization						
24	16-6 T		Possible maganese oxide staining or organic staining scattered throughout the sample, damp, very stiff		17	45		37.4	

LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 16

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	16-6 T		Mottled gray and reddish brown Fat CLAY, smooth texture,very fine grained, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	17	45		37.4	
26									
27									
28									
29	16-7 T		Color change to mottled gray and reddish brown, damp, very stiff						
30					18	32		36.5	
31									
32									
33									
34	16-8 T		Color change to mottled bluish gray and reddish brown, damp, very stiff						
35					18	51		34.6	
36									
37									
38									
39	16-9 T		Slight silty texture, damp, stiff						
40					15	36		35.4	
41									
42									
43									
44	16-10 T		Damp, very stiff						
45					20	39		20.6	
46									
47									
48									

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LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 16

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49	16-11 T		Mottled bluish gray and light reddish brown Fat CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, high plasticity, slight staining from organics, damp, very stiff	CH	17	53		37.0	
50			Boring Terminated at 50 feet. Groundwater was encountered at 25 feet and stabilized at 13 feet after 35 minutes						
51–72									

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 40 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 17

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	17-1 L (1–2.5)		Black Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, thin root scattered throughout the sample, medium to coarse sub-angular to rounded pebbles scattered throughout the sample, damp, medium dense	SC	23				Direct Shear: C = 300 psf $\phi = 40^{o}$
4.5–9.5	17-2 L (5–6.5)		Brown Clay, very fine grained, smooth texture, low to medium plasticity, oxidation patches scattered throughout the sample, black patches near 6 1/2 feet, very small mica flakes scattered throughout the sample, damp, stiff	CL	11		82.7	38.2	
9.5–14.5	17-3 L (10–11.5)		Mottled brownish gray and reddish brown Clayey SILT, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, low plasticity to non-plastic, damp, very stiff	ML	20		93.3	30.5	
14.5–16.5	17-4 L (15–16.5)		Mottled gray and reddish brown Silty CLAY, very fine grained, smooth texture, low to medium plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CL	16				
16.5			Boring Terminated at 16 and 1/2 feet. No groundwater was encountered, but a slight seep zone was encountered near 16 and 1/2 feet.						

Depth scale: 1 to 24 feet.

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 18

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–4	18-1 L		Dark brown CLAY with Sand, very fine grained, smooth texture, low to medium plasticity, thin roots near 2 feet, rounded pebbles near 2 1/2 feet, trace medium sub-rounded grains scattered throughout the sample, damp, firm	CL	8		113.9	15.2	
5–9	18-2 L		Mottled dark brown and light brown Fat CLAY, very fine grained, smooth texture, high plasticity, small mica flakes scattered throughout the sample, black clay veins near 6 feet, damp, stiff	CH	13	38	102.5	23.2	
10–14	18-3 L		Mottled gray and reddish brown Clayey SILT, very fine grained, smooth texture, low plasticity to non-plastic, very small mica flakes scattered throughout the sample, damp, very stiff	ML	17		83.3	40.3	99.9% Passing #200 Sieve
15–19	18-4 L		Mottled gray and reddish brown Silty CLAY, very fine grained, smooth texture, intermediate plasticity, very small mica flakes scattered throughout the sample, black clayey veins and patches scattered throughout the sample, damp, very stiff	CI	25		86.5	36.7	
20–24	18-5 T		Trace black patches scattered throughout the sample, damp, stiff		14	20		36.0	99.6% Passing #200 Sieve

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 18

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	18-6 T		Mottled bluish gray and reddish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH	14	44		36.0	
30–31	18-7 T		Damp, very stiff		16			38.8	
31.5			Boring Terminated at 31 and 1/2 feet. Groundwater was encountered at 15 feet and stabilized at 6 feet.						

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 19

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	19-1 L (2–3.5)		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, medium to coarse sub-angular to sub-rounded grains and pebbles near 3 1/2 feet, damp, loose	SM	5		109.6	12.6	
4.5–14.5	19-2 L (5–6.5)		Mottled dark brown and light reddish brown CLAY, very fine grained, smooth texture, low to medium plasticity, small oxidized nodes near 6 feet, damp, stiff	CL	14		94.8	31.0	Qu = 3073 psf
	19-3 L (10–11.5)		Color change to mottled gray, brownish red and brown, very small mica flakes scattered throughout the sample, damp, very stiff		21		89.7	36.2	
14.5–24	19-4 L (15–16.5)		Mottled gray and tannish red Fat CLAY, very fine grained, smooth texture, high plasticity, damp, very stiff	CH	20		88.0	36.2	
	19-5 L (20–21.5)		Very small mica flakes scattered throughout the sample, damp, very stiff		16	52	89.3	34.7	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 44 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 19

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	19-6 T		Grayish brown CLAY, very fine grained, smooth texture, intermediate plasticity, small mica flakes and oxidation patches scattered throughout the sample, damp, very stiff	CI	20	17		35.5	95.6% Passing #200 Sieve
27			▼ (groundwater)						
30–31	19-7 T		Mottled grayish brown and reddish brown Silty CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, low to medium plasticity, damp, very stiff	CL-ML	20			39.3	
31.5			Boring Terminated at 31 and 1/2 feet. Groundwater encountered at 27 feet.						

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 45 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 20

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	20-1 L		Mottled light brown, dark brown and reddish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, roots near 2 feet, damp, loose	SM	9		102.6	8.8	
5–6	20-2 L		Color change to mottled brown, tan, and reddish brown, sligh increase in coarseness of sand, fine to medium grained, sub-rounded shaped, some well cemented / hardpan portions, broken and whole rounded pebbles scattered throughout the sample, damp to dry, very hard		50/6		112.7	8.4	20.8% Passing #200 Sieve
10–11	20-3 L		Color change to mottled reddish brown, brown and slight decrease in coarseness of sand, very fine to fine grained, sub-rounded shaped, very coarse sub-angular to sub-rounded gravels, pebbles, damp, medium dense		19		105.9	20.9	
12–14			▼ Brown SAND with Silt, very fine to medium grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, patches of medium and coarse grained sand near 11 feet, wet, medium dense	SP					
15–16	20-4 L		Mottled grayish brown, reddish brown, brownish orange, brown and blackish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp to moist, very stiff	CH	23	36	77.5	46.2	
20–21	20-5 T		Color change to mottled grayish brown and reddish brown, patches of black silty clay scattered throughout the sample, damp, stiff		14			37.8	
22–24									

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 20

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	20-6 T		Mottled grayish brown and reddish brown SILT, very fine to fine grained, smooth texture, mica flakes scattered throughout the sample, low plasticity, wet, stiff	ML	17			28.5	
30–31	20-7 T		Mottled bluish gray and reddish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	17			37.8	
35–36	20-8 T		Damp, very stiff		18	39		34.5	
			Boring Terminated at 36 and 1/2 feet. Groundwater initially encountered at 10 and 1/2 feet, and stabilized at 12 and 1/2 feet.						

Depth scale: 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 21

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2.5	21-1 L		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace rounded pebbles near 2 1/2 feet, rounded rock near 2 1/2 feet, damp, very loose	SM	4				
2.5–5	21-2 T		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded small mica flakes scattered throughout the sample, damp, very loose	SP	2				
5–9.5	21-3 L		Increase in coarseness of sand, medium to coarse grained, sub-angular to sub-rounded shaped, rounded sandstone and cherty pebbles scattered throughout the sample, damp, loose		5				
9.5–14.5	21-4 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp to slightly moist, very loose	SM	2				
14.5–19.5	21-5 L		Brown SAND with Gravels, fine to medium grained with trace coarse grains, sub-angular to sub-rounded shaped, gravels are rounded cherty pebbles, rounded sandstone pebbles, and sub-angular quartz gravels, poorly graded, damp, medium dense	SP	12				
19.5–24	21-6 T		Brown Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, slight sticky texture, very small mica flakes scattered throughout the sample, moist, loose	SC	7				

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 21

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	21-7 L		Brown SAND, fine to medium grained, trace coarse grains, sub-angular to sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp	SP					
26			Mottled brown and gray fat CLAY, very fine grained, very smooth texture, high plasticity, moist, stiff	CH	11				
27, 28, 29			Brown Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, slight sticky texture, very small mica flakes scattered throughout the sample, damp, loose	SC					
30, 31, 32, 33, 34	21-8 T		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, loose	SM	8				
35	21-9 L		Brown Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, wet, soft	CH					
36, 37, 38, 39			Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, saturated, very loose	SM	4				
40, 41, 42, 43, 44	21-10 T		Color change to mottled brown and gray, significant increase in fines content, fining downward, damp to slightly moist, loose		10				
45, 46, 47, 48	21-10 T		Color change to brown, significant increase in sand content, coarsening with depth, predominately medium grained sand, moist, medium dense		12				

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 21

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51 1/2	21-12 T		Mottled gayish brown and brownish red Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, damp, stiff	CH	12				
51 1/2–72			Boring terminated at 51 1/2 feet. No groundwater encountered.						

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 22

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1	22-1 L		Brown Sandy CLAY, very fine to fine grained, smooth texture, low plasticity, very small mica flakes scattered throughout the sample, moist, firm	CL	8				
2									
3	22-2 T		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, poorly graded, very small mica flakes scattered throughout the sample, damp, very loose	SM	4				
4									
5	22-3 L		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, trace coarse grains of sand, damp, loose	SP	8				
6									
7									
8									
9									
10	22-4 T		Increase in coarseness of sand, medium to coarse grained, sub-angular to sub-rounded shaped, damp, loose		7				
11									
12									
13									
14									
15	22-5 L		Mottled brown and gray Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH					
16			Brown SAND, fine to medium grained with trace coarse grains, sub-angular to sub-rounded shaped, trace rounded chert pebbles scattered throughout the sample, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SP	6				
17									
18									
19									
20	22-6 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SM	10				
21									
22									
23									
24									

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 22

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–29	22-7 L		Mottled brown and grayish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SM	6				
30–34	22-8 T		Mottled brown and grayish brown Sandy SILT with pockets of Fat CLAY, very fine to fine grained, smooth texture, very small mica flakes scattered throughout the sample, clay pockets exhibit high plasticity, moist, soft	ML	3				
35–39	22-9 L		Mottled brown and reddish brown Fat CLAY with Sand, very fine to fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, very moist to slightly wet, firm	CH	6				
40–44	22-10 T		Mottled dark tan and reddish tan CLAY with Sand, very fine to fine grained, smooth texture, manganese oxide staining scattered throughout the sample, very small mica flakes and trace rounded chert pebbles scattered throughout the sample, low plasticity, moist, very stiff	CL	20				
45–48	22-11 L		Mottled greenish brown, reddish tan and brown CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, damp, very stiff	CI	17				

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 22

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	22-12 T		Mottled grayish brown and reddish brown Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, wet, firm	CH	7				
52			Boring terminated at 51 1/2 feet. No groundwater encountered.						
53–72									

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 23

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1	23-1 L		Brown Sandy CLAY, very fine grained, smooth texture, low to medium plasticity, trace rootlets scattered throughout the sample, very small mica flakes and trace oxidation patches scattered throughout the sample, moist	CL					69.6% Passing #200 Sieve
2–3	23-2 T		Brown Silty SAND, very fine to fine grained, sub-angular to rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SM	5		104.4	21.3	
4			Color change to medium reddish brown, increase in sand content, very fine to fine grained, trace mdium grained, damp, very loose		4			9.9	
5–6	23-3 L		Increase in fines content, color change to brown, moist, very loose		4		105.9	15.4	37.7% Passing #200 Sieve
10–11	23-4 T		Mottledbrown and reddish brown Sandy CLAY, very fine to fine grained, smooth texture, low to medium plasticity, grades to clay with depth, very moist to wet, firm	CL	6			19.0	61.7% Passing #200 Sieve
15–16	23-5 L		Mottled brown, tan, reddish orange, and brownish black CLAY, very fine grained, smooth texture, intermediate plasticity, small mica flakes scattered throughout the sample, damp, stiff	CI	15		101.4	25.4	93.5% Passing #200 Sieve
20–21	23-6 T		Mottled grayish brown and reddish brown Fat CLAY, very fine grained, very smooth texture, high plasticity, small mica flakes scattered throughout the sample, damp to slightly moist, firm	CH	8	62		39.0	100% Passing #200 Sieve
22–24									

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 23

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	23-7 L		Mottled grayish brown and reddish brown Fat CLAY, very fine grained, smooth texture, small mica flakes scattered throughout the sample, moist, stiff	CH	10	36	89.6	35.0	99.9% Passing #200 Sieve
30–31	23-8 L		Grayish brown Fat CLAY, very fine grained, very smooth texture, high plasticity, small mica flakes scattered throughout the sample, damp, stiff	CH	11		90.1	36.8	
35–36	23-9 T		▼ Moist, stiff		13			35.6	
40–41	23-10 L		Mottled bluish grayand brown Fat CLAY, very fine grained, very smooth and sticky texture, small mica flakes scattered throughout the sample, very moist, stiff	CH	13		83.9	41.9	
45–46	23-11 T		Damp, stiff		9	47		37.1	100% Passing #200 Sieve

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 23

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51 1/2	23-12 L		Grayish brown Fat CLAY, very fine grained, very smooth texture, charcoal staining and other organics near 51 feet, oxidation veins near 51 1/2 feet, high plasticity, very small mica flakes scattered throughout the sample, very moist, stiff	CH	9		78.4	46.0	
52			Boring terminated at 51 1/2 feet. Groundwater encountered at 35 feet.						

Depth scale: 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 24

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1	24-1 L		Brown Sandy CLAY, very fine to fine grained, smooth texture, low to medium plasticity, very small mica flakes scattered throughout the sample, rootlets scattered throughout the sample, moist to slightly wet, firm	CL	5		111.6	17.5	56.3% Passing #200 Sieve
2-3	24-2 T		Color change to mottled medium brown and reddish brown, trace bits of charcoal scattered throughout the sample, moist, firm		6			17.0	
5	24-3 L		Color change to mottled medium grayish brown and reddish brown, very moist, firm		7		86.3	34.6	
10	24-4 T		Lack of charcoal, lack of rootlets, moist, stiff		9			34.2	
15	24-5 L		Color change to mottled brownish gray and orangish tan, moist, stiff		13		91.8	34.7	
20	24-6 T		Moist, firm		7			37.7	
24									

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 24

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	24-7 L		Mottled dark brownish gray and orangish brown FAT CLAY, very fine grained, very smooth texture, slight sticky texture, very small mica flakes scattered throughout the sample, low plasticity, moist, stiff	CH	11	46	89.6	36.4	100% Passing #200 Sieve
30–31	24-8 T		Moist, firm		8			34.5	
34–35			Possible seep zone near 35 feet, rod is wet, auger is dry						
35–36	24-9 L		Mottled bluish gray and orangish brown Fat CLAY, very fine grained, very smooth and sticky texture, very small mica flakes scattered throughout the sample, high plasticity, moist, very stiff	CH	16		87.8	37.1	
40–41	24-10 T		Slightly moist, stiff		12	53		37.3	99.8% Passing #200 Sieve
45–46	24-11 L		Color change to bluish gray, trace dark purplish gray staining near 46 1/2 feet, very damp to slightly moist, very stiff		16		88.6	37.0	
47–48									

LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 24

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	24-12 T		Bluish gray Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, trace dark purplish gray staining and trace oxidation patches scattered throughout the sample, trace organics near 51 feet, damp to slightly moist, stiff	CH	11			36.4	
52–72			Boring terminated at 51 1/2 feet. No groundwater encountered.						

LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 25

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	25-1 L		Mottled brown and yellowish brown Silty SAND, very fine to fine grainedwith trace medium grains, poorly graded rootlets near 2 feet, very small mica flakes scattered throughout the sample, damp, medium dense	SM					
2–3	25-2 T		Mottled brown and yellowish brown Clayey SAND, very fine to fine grained, trace medium grains, sub-angular to sub-rounded shaped, poorly graded, slightly sticky texture, damp, medium dense	SC	15				
3–10	25-3 L		Mottled brown, grayish brown and orangish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, trace rootlets scattered throughout the sample, damp, dense Color change to mottled grayish brown and tannish orange, damp to slightly moist, medium dense	SM	39 17				
10–15	25-4 T		Mottled grayish brown, yellowish brown, and brownish red Silty CLAY, very fine to fine grained, smooth texture, low to medium plasticity, slightly sticky feeling, very small mica flakes scattered throughout the sample, moist, very stiff	CL	17				
15–20	25-5 L		Mottled dark gray and reddish brown CLAY, very fine grained, very smooth texture, low plasticity, very small mica flakes scattered throughout the sample, very damp to slightly moist, very stiff	CL	18				
20–24	25-6 T		▼ Mottled greenish brown and orangish brown SILT, very fine to fine grained, very smooth and sticky texture, very small mica flakes scattered throughout the sample, moist, firm	ML	8				

LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 25

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	25-7 L		Mottled grayish brown and orangish brown Fat CLAY, very fine grained, very smooth and stick texture, high plasticity, very small mica flakes scattered throughout the sample, very moist, stiff	CH	13				
30	25-8 T		Very moist to wet firm		8				
35	25-9 L		Color change to mottled bluish gray and dark orangish brown, very moist to slightly wet, stiff		11				
40	25-10 T		Color change to mottled dark gray, bluish gray, and dark orangish brown, trace organics near 4 1/2 feet, very moist to slightly wet, stiff		9				
45	25-11 L		Color change to mottled bluish gray and greenish gray, very moist, very stiff		16				

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 25

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	25-12 T		Mottled bluish gray and orangish gray Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, trace dark purplish gray staining scattered throughout the sample, moist, stiff	CH	14				
52			Boring terminated at 51 1/2 feet. Groundwater encountered at 20 feet.						
53–72									

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 62 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 26

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	26-1 L		Very dark brown Sandy CLAY, very fine to fine grained, smooth texture, low to medium plasticity, very small mica flakes scattered throughout the sample, rootlets scattered throughout the sample, moist, firm	CL	7		111.1	18.7	52.8% Passing #200 Sieve
	26-2 T		Trace oxidation patches scattered throughout the sample, moist, stiff		9			18.8	
4.5–14.5	26-3 L		Mottled brownish gray and brownish orange CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, low plasticity, moist, stiff	CL	10		86.2	38.4	
	26-4 T		Moist, stiff		9			41.1	
14.5–19.5	26-5 L		Mottled brownish gray and brownish orange SILT, very fine grained, very smooth and sticky texture, very small mica flakes scattered throughout the sample, low plasticity, moist, stiff	ML	11	33	85.5	37.5	100% Passing #200 Sieve
19.5–24	26-6 T		Mottled dark gray and brownish orange CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, intermediate plasticity, moist, firm	CI	6	41		37.1	

LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 26

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	26-7 L		Mottled medium gray and brownish orange Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, moist, very stiff	CH	16		90.7	34.4	100% Passing #200 Sieve
30–31	26-8 T		Moist, stiff		11			35.1	
35–36	26-9 L		Decrease in oxidized content, moist to very moist, very stiff		18		82.7	39.4	
40–41	26-10 T		Color change to dark gray, organics scattered throughout the sample, moist to very moist, stiff		11	53		35.8	100% Passing #200 Sieve
45–46	26-11 L		Trace oxidation patches near 46 1/2 feet, moist, very stiff		17		85.1	39.2	

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 64 Project No.0829 Date: 3/2/09

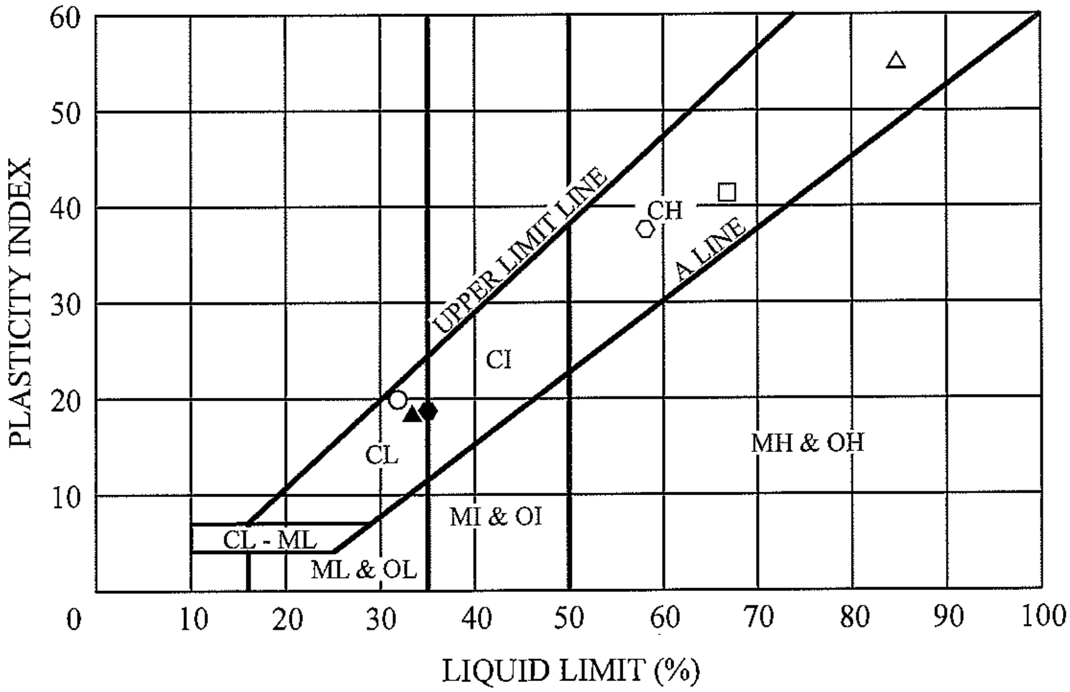
LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 26

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51 1/2	26-12 T		Dark gray Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, trace organics scattered throughout the sample, damp to slightly moist, stiff	CH	10			32.2	
52			Boring terminated at 51 1/2 feet. No groundwater encountered.						

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 65 Project No.0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



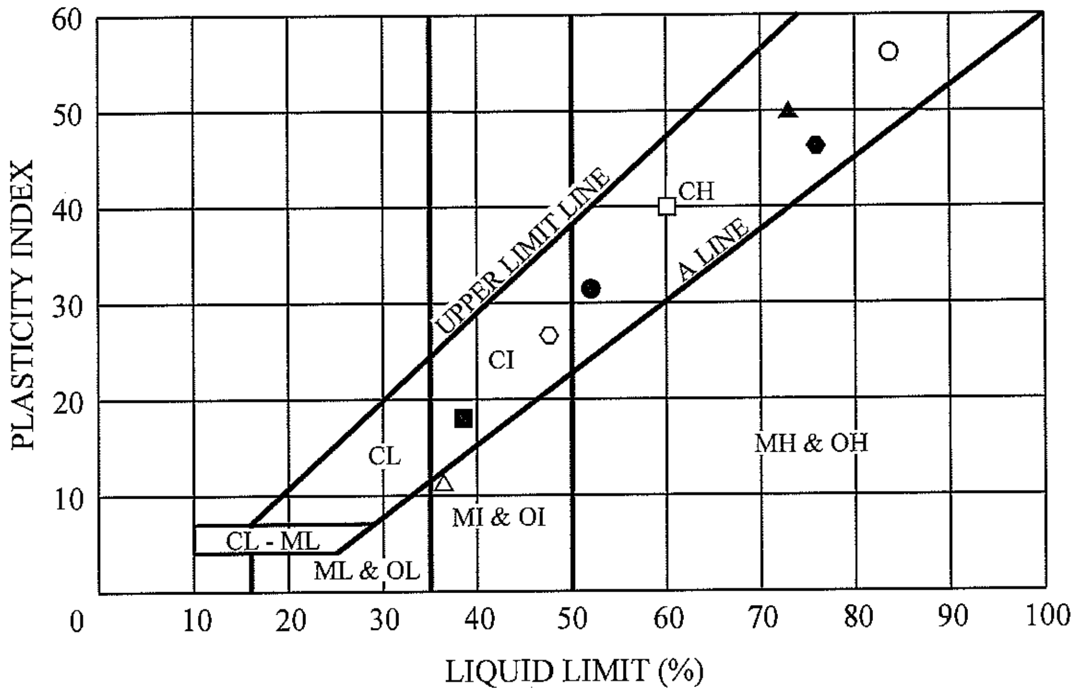
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	2-5	——NON-PLASTIC——		
■	2-6	——NON-PLASTIC——		
▲	2-7	34	15	19
⬢	4-2-1	35	16	19
○	4-3-1	32	12	20
□	4-5-1	66	25	41
△	4-6-1	85	30	55
⬡	4-9-1	59	22	37

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 66 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



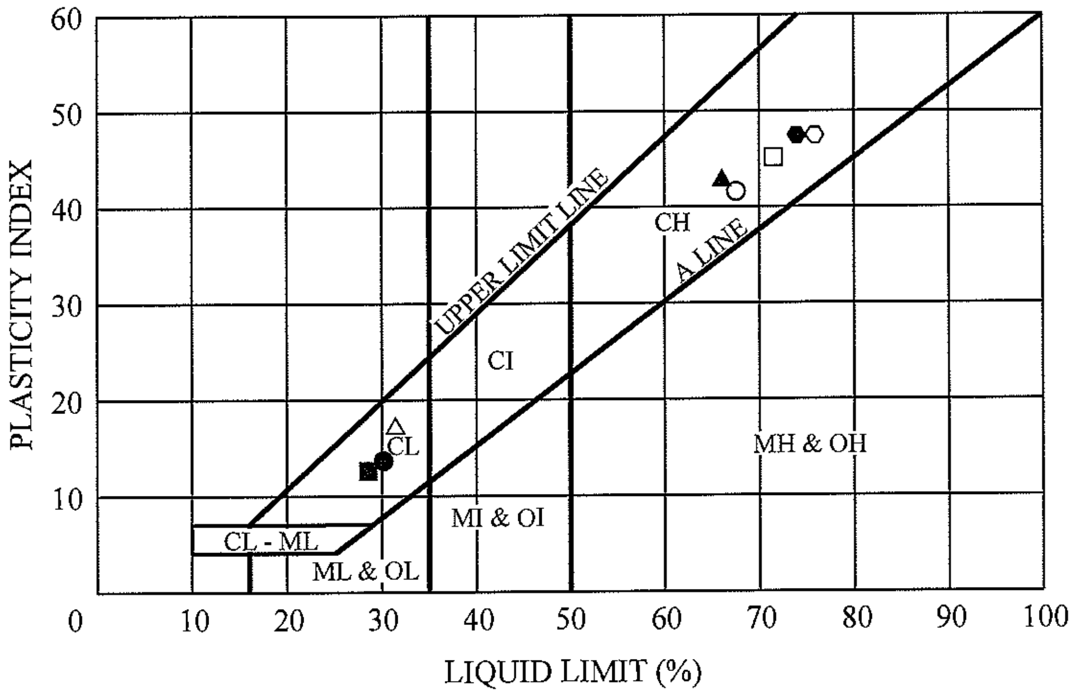
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	4-10-1	52	21	31
■	4-11-1	39	21	18
▲	6-6-1	73	23	50
⬢	6-8-1	76	30	46
○	6-10-2	84	28	56
□	6-11-1	60	20	40
△	8-5	36	25	11
⬡	8-8	48	22	26

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 67 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



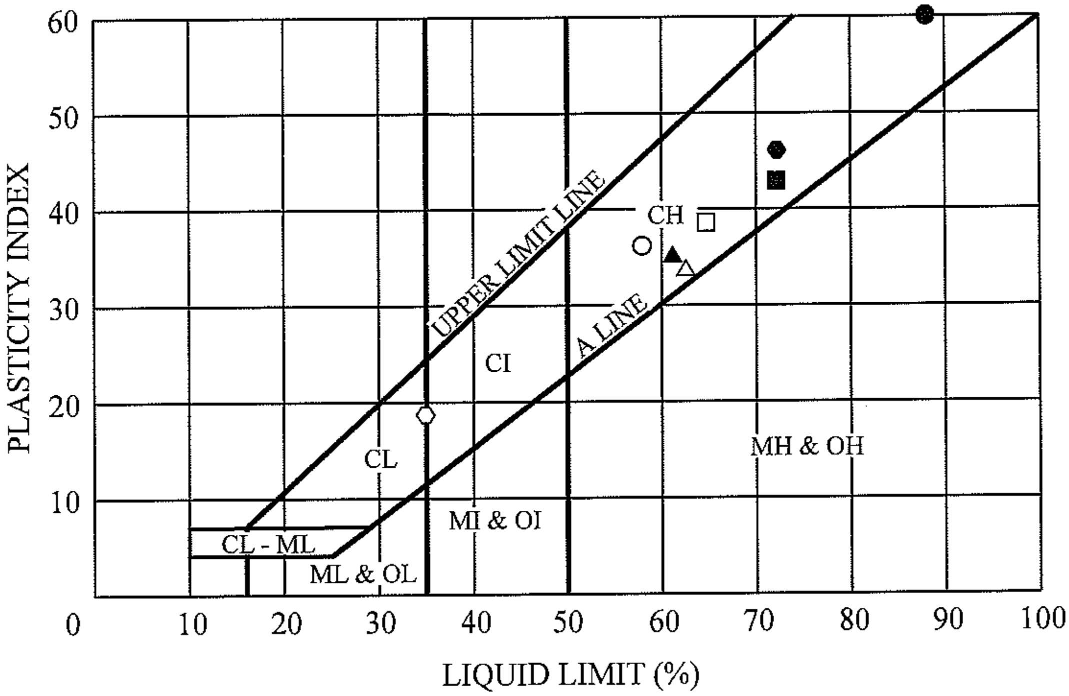
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**8-10**	**30**	**16**	**14**
■	**10-8**	**29**	**16**	**13**
▲	**10-9**	**66**	**23**	**43**
⬢	**10-10**	**75**	**28**	**47**
○	**10-11**	**67**	**25**	**42**
□	**10-12**	**72**	**27**	**45**
△	**11-1-1**	**32**	**15**	**17**
⬡	**11-4**	**75**	**28**	**47**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 68 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



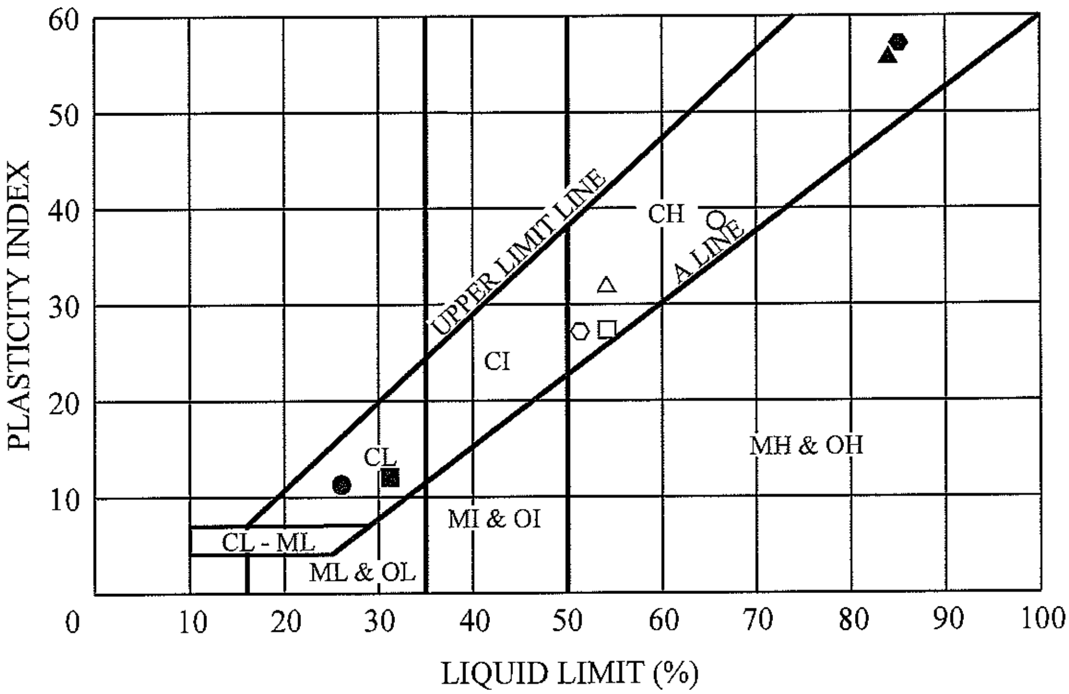
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**11-5**	**88**	**28**	**60**
■	**11-6**	**72**	**29**	**43**
▲	**11-7**	**61**	**26**	**35**
⬢	**11-8**	**72**	**26**	**46**
○	**11-9**	**58**	**22**	**36**
□	**11-10**	**65**	**26**	**39**
△	**11-11**	**62**	**28**	**34**
⬡	**12-1-1**	**35**	**16**	**19**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 69 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART

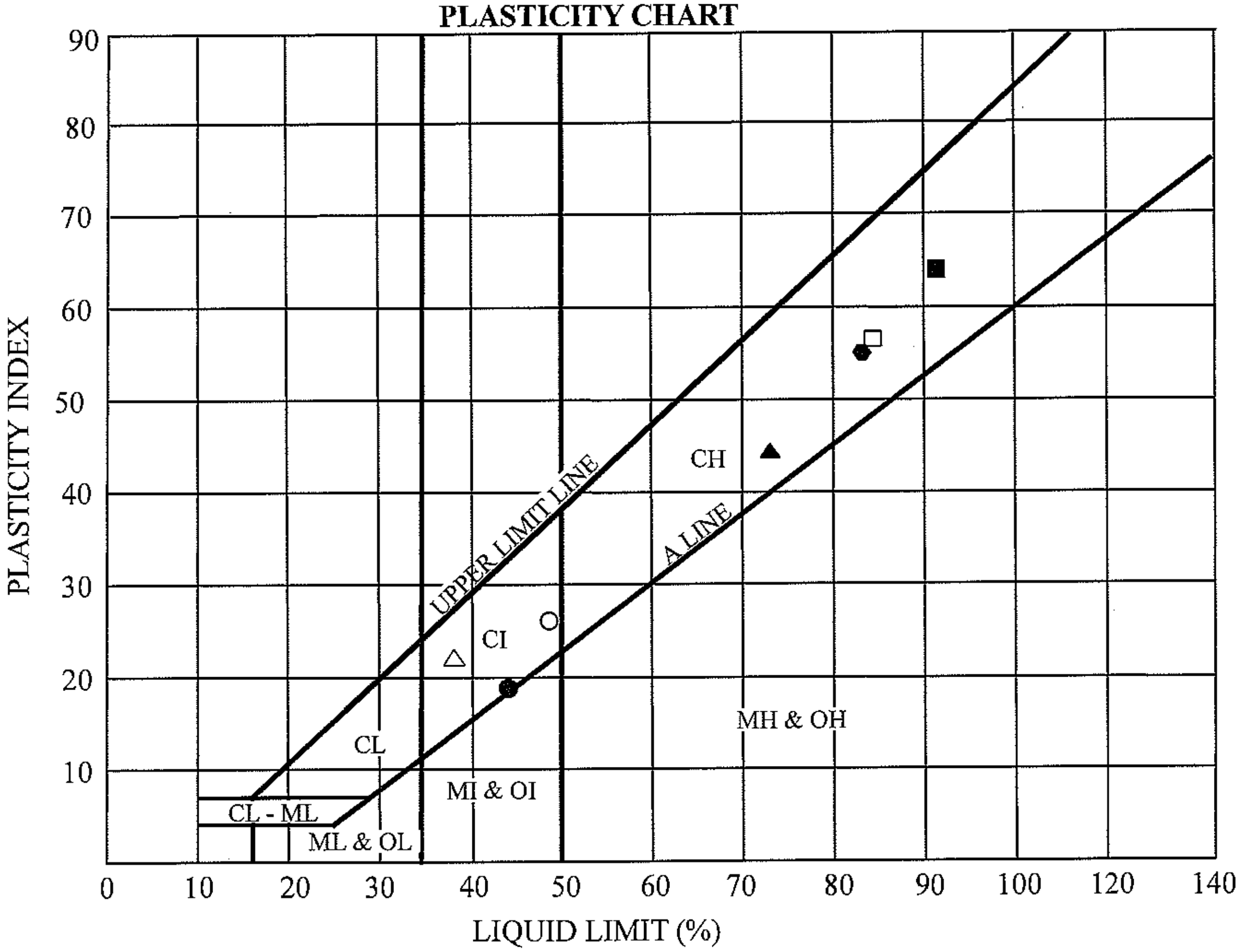


*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**12-3**	**26**	**15**	**11**
■	**12-5**	**31**	**19**	**12**
▲	**12-6**	**84**	**28**	**56**
⬢	**12-7**	**85**	**28**	**57**
○	**12-8**	**66**	**27**	**39**
□	**12-9**	**54**	**27**	**27**
△	**12-10**	**54**	**22**	**32**
⬡	**12-11**	**51**	**24**	**27**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 70 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318



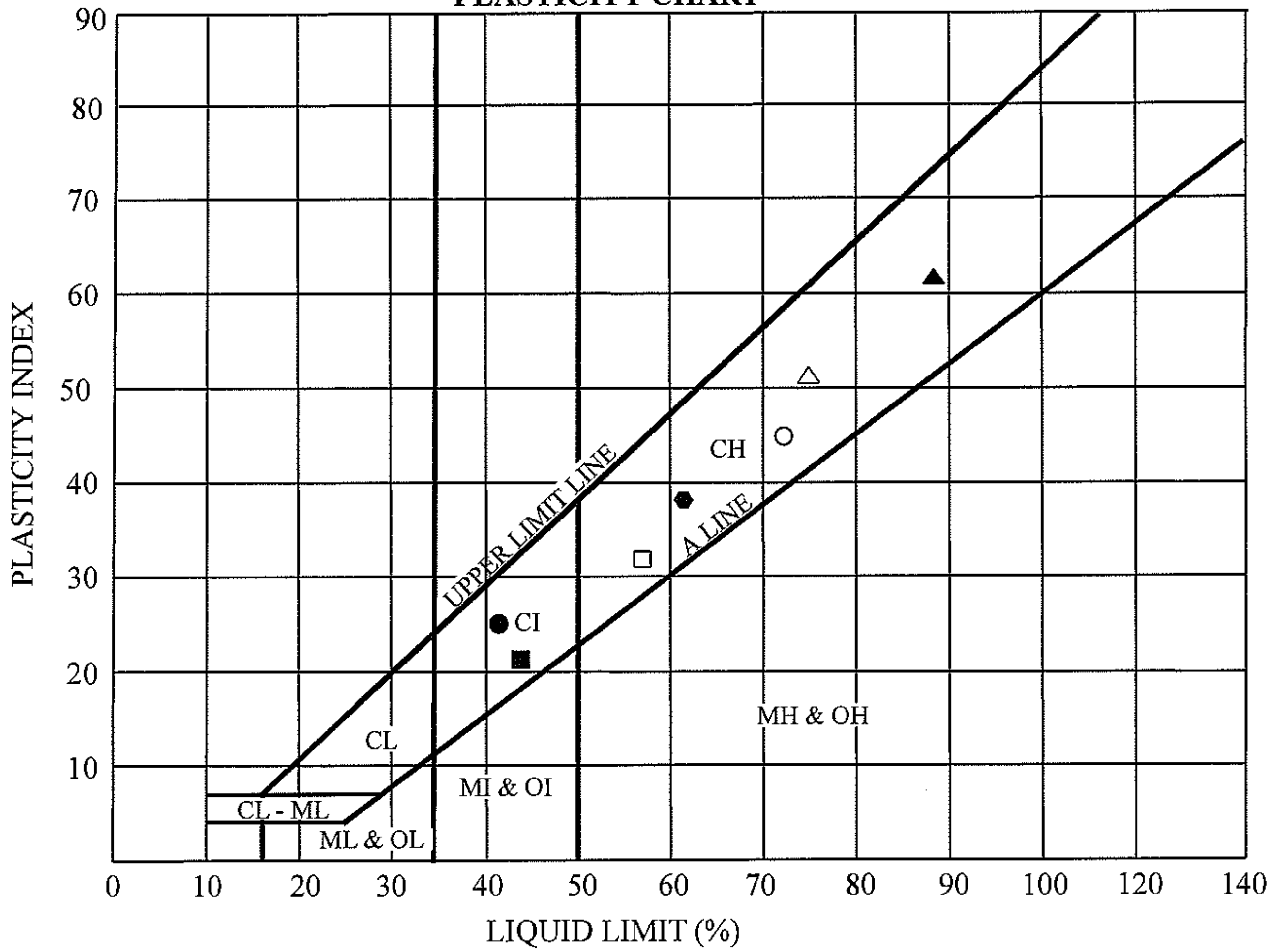
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**13-5**	**44**	**25**	**19**
■	**13-6**	**91**	**27**	**64**
▲	**14-5**	**73**	**29**	**44**
⬢	**14-6**	**83**	**28**	**55**
○	**14-8**	**49**	**23**	**26**
□	**15-5**	**84**	**28**	**56**
△	**16-1-1**	**38**	**16**	**22**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 71 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



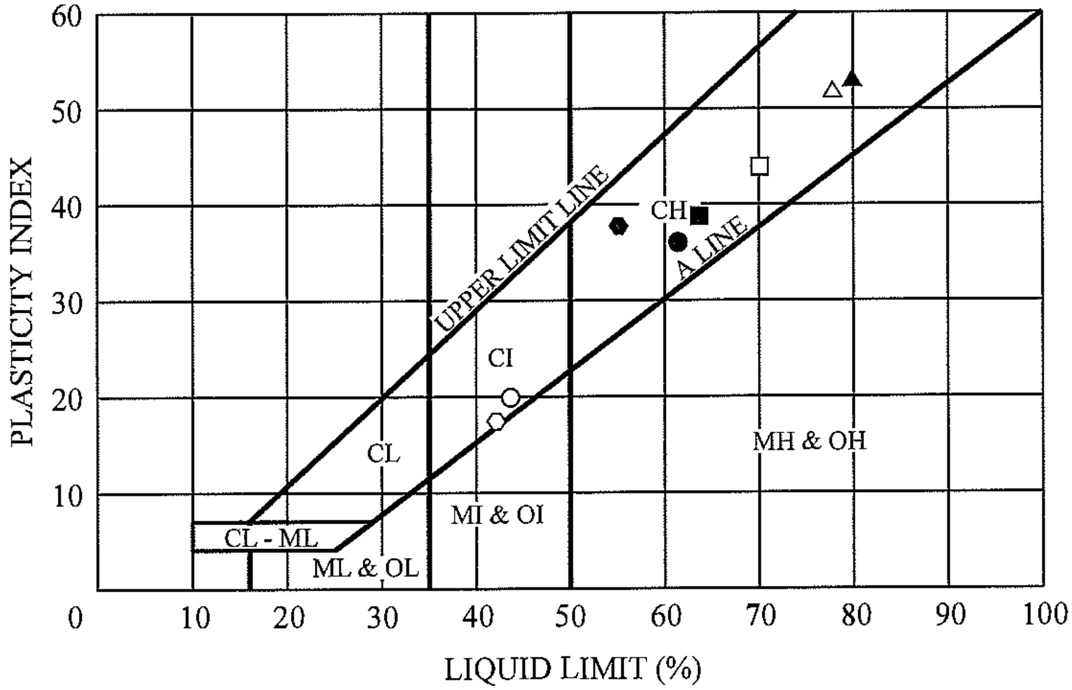
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**16-2-1**	**41**	**16**	**25**
■	**16-3**	**44**	**23**	**21**
▲	**16-4**	**89**	**27**	**62**
⬢	**16-5**	**61**	**23**	**38**
○	**16-6**	**72**	**27**	**45**
□	**16-7**	**57**	**25**	**32**
△	**16-8**	**75**	**24**	**51**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 72 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART

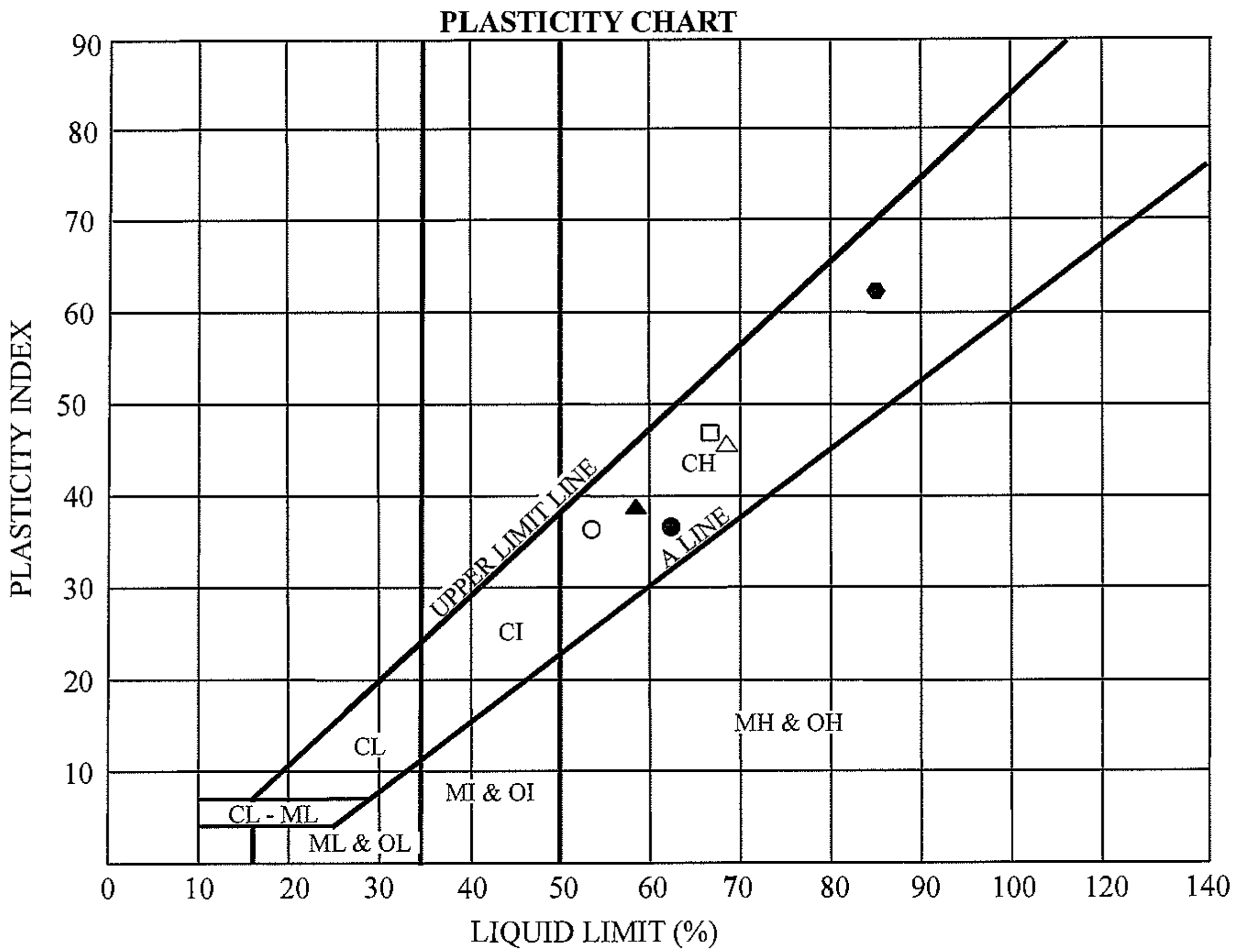


*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**16-9**	**61**	**25**	**36**
■	**16-10**	**64**	**25**	**39**
▲	**16-11**	**80**	**27**	**53**
⬢	**18-2-1**	**55**	**17**	**38**
○	**18-5**	**44**	**24**	**20**
□	**18-6**	**70**	**26**	**44**
△	**19-5-1**	**78**	**26**	**52**
⬡	**19-6**	**42**	**25**	**17**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 73 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

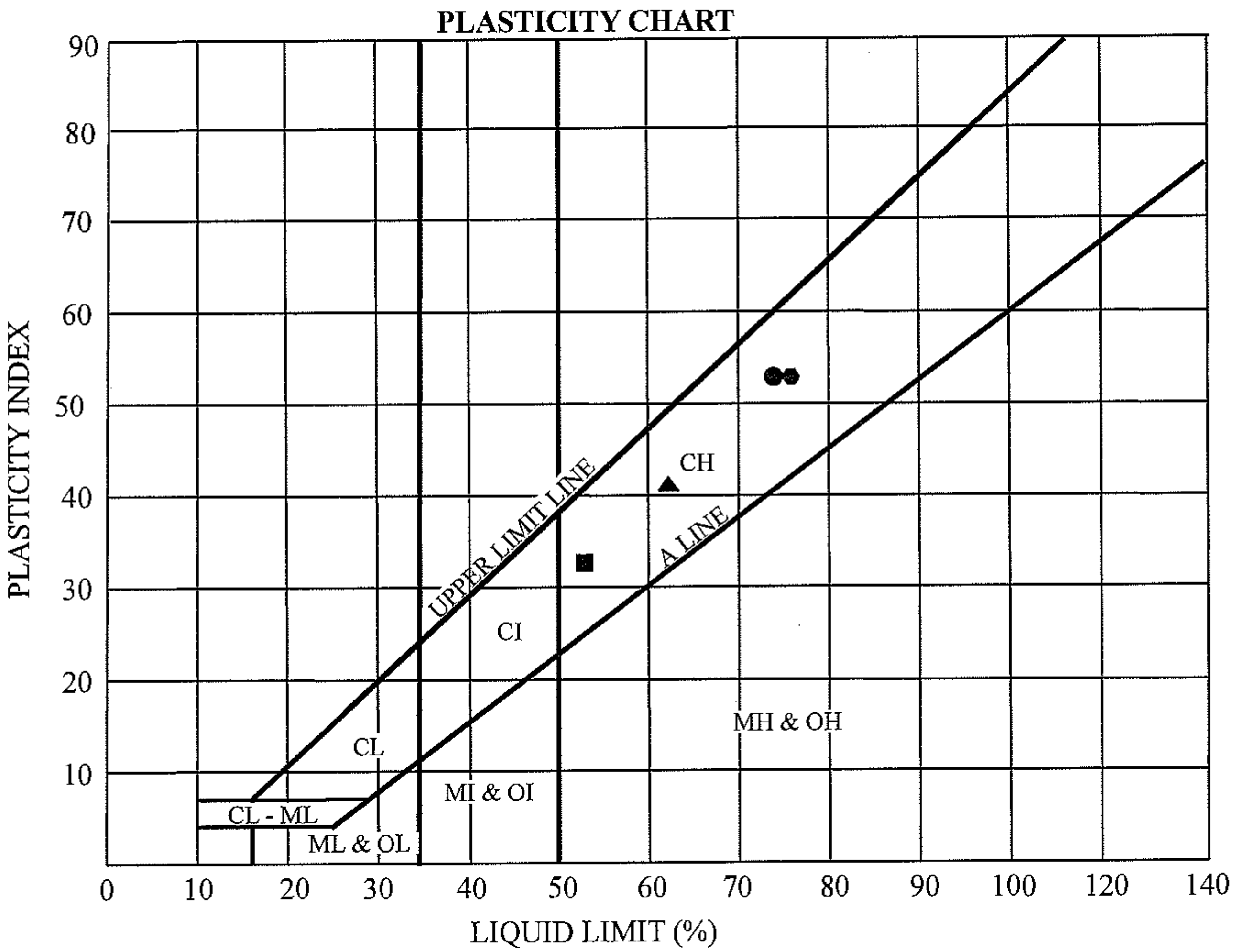


*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**20-4-1**	**62**	**26**	**36**
■	**20-6**	**---------NON-PLASTIC---------**		
▲	**20-8**	**59**	**20**	**39**
⬢	**23-6**	**85**	**23**	**62**
○	**23-7**	**54**	**18**	**36**
□	**23-11**	**67**	**20**	**47**
△	**24-7**	**69**	**23**	**46**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 74 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

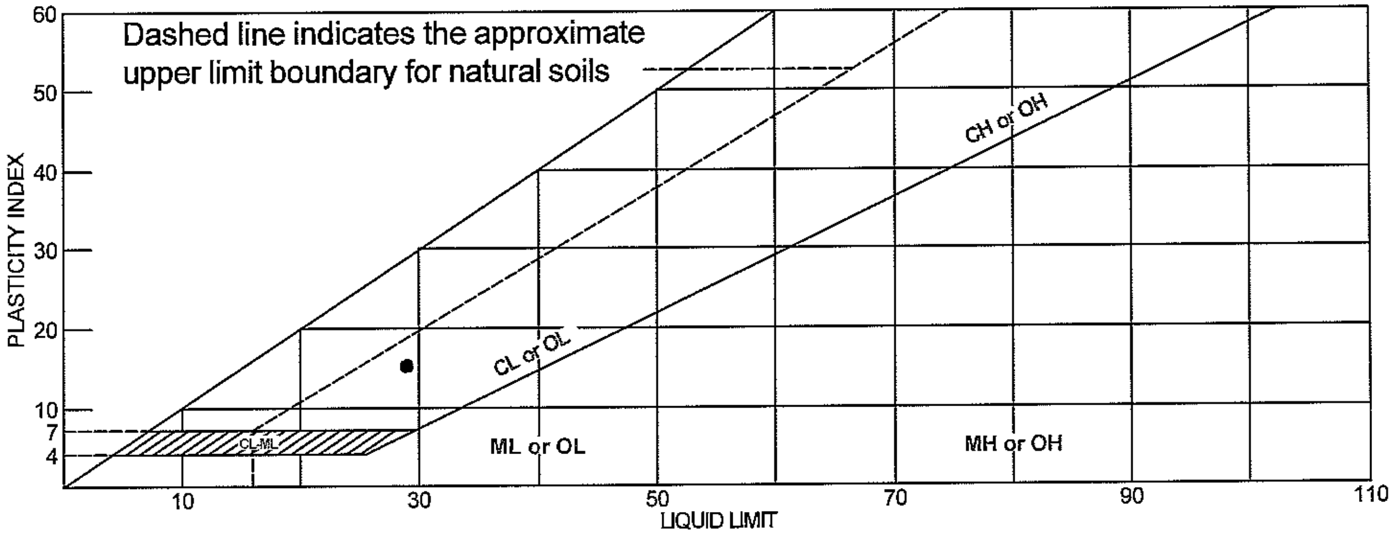


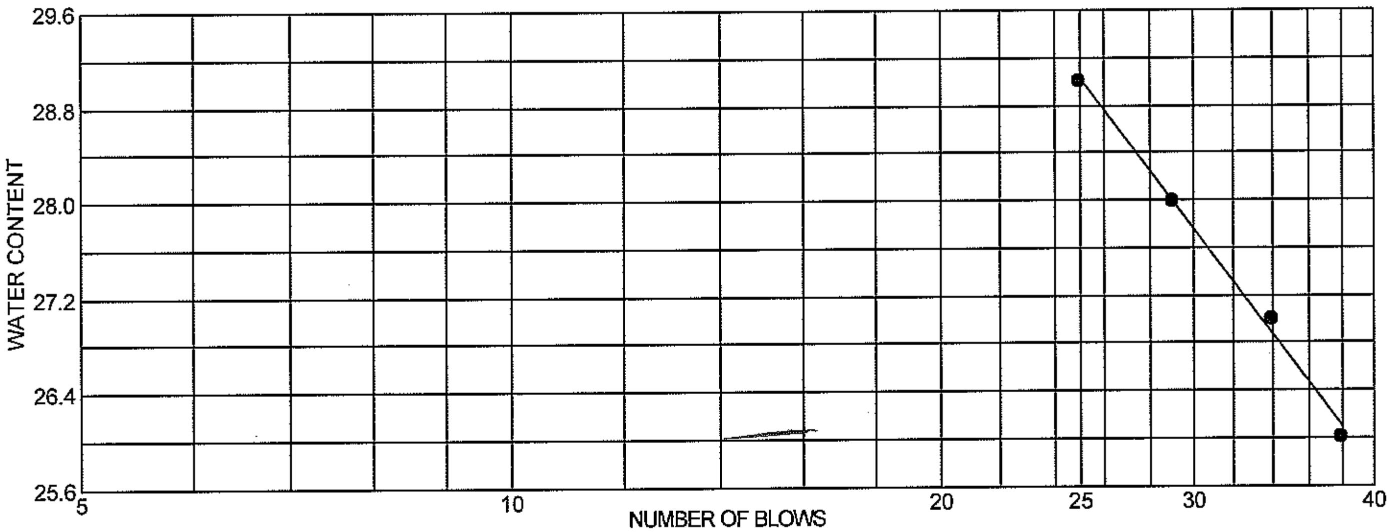
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	**24-10**	**75**	**22**	**53**
■	**26-5**	**53**	**20**	**33**
▲	**26-7**	**62**	**21**	**41**
●	**26-10**	**75**	**22**	**53**

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 75 Project No. 0829 Date: 3/2/09

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Lean Clayey SAND	29	14	15			

Project No. 416-342 **Client:** Pacific Crest Engineering, Inc.

Project: Atkinson Lane - 0829

● **Source:** 6-5-1

Remarks:

●

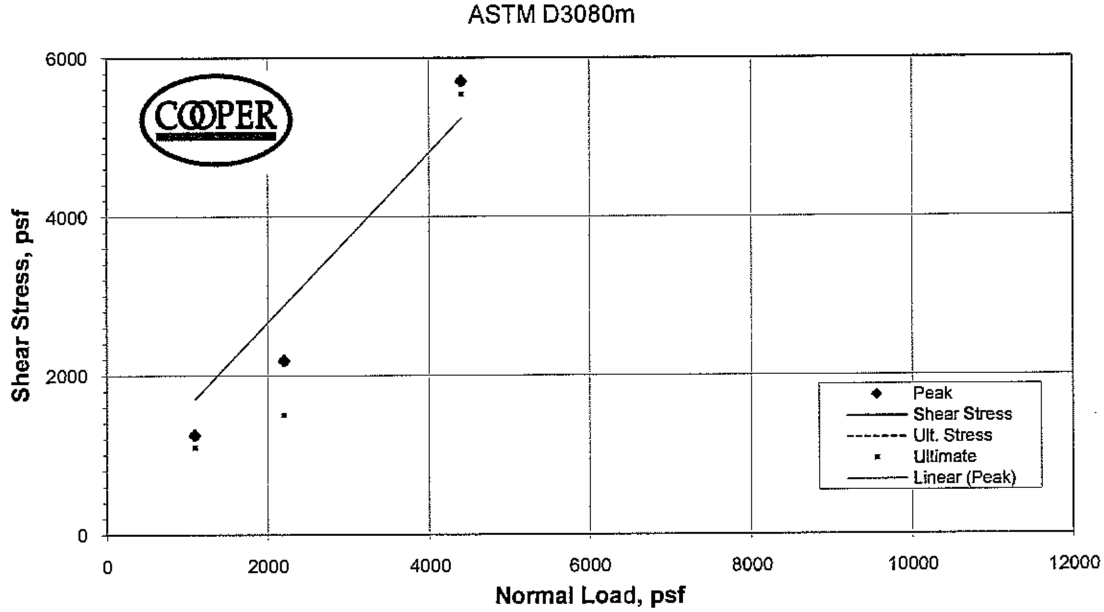
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

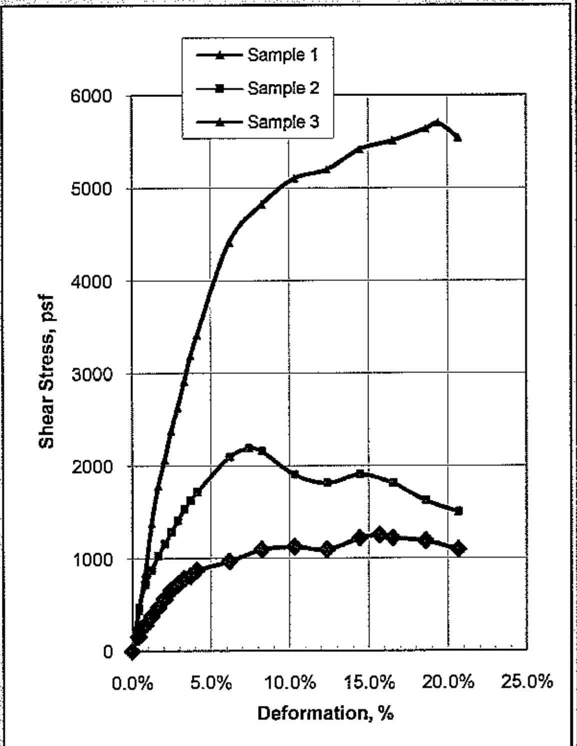
Figure

Figure No. 76
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	44.0	Ult. Phi (degrees)	
P. Cohesion(psf)	525	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	6.4	6.9	7.2	
Dry Dens., pcf	95.5	95.4	97.2	
Void Ratio	0.765	0.767	0.735	
Saturation %	22.7	24.5	26.3	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	19.7	19.9	18.1	
Dry Dens., pcf	99.5	100.8	105.1	
Void Ratio	0.694	0.672	0.603	
Saturation %	76.5	79.9	80.9	
Diameter	2.42	2.42	2.42	
Height	0.96	0.95	0.92	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1252	2191	5698	
Strengths picked at	15.7%	7.4%	19.4%	
Ult. Stress, psf	1096	1503	5541	
Strain Rate, in/min	0.020	0.020	0.020	

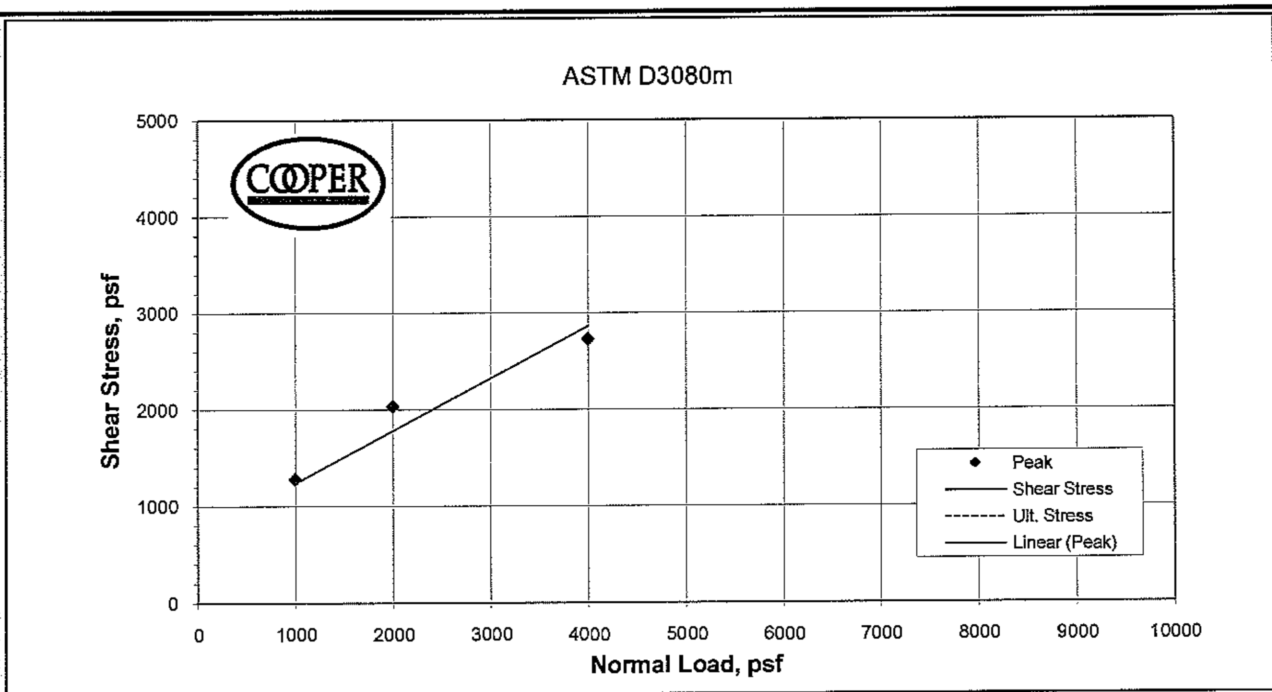
CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/2/2008

Specimen #	Boring:	Sample:	Depth, ft: Visual Soil Classification
1		4-1-1	Brown Poorly Graded SAND w/ Silt & Gravel
2		4-1-1	Brown Poorly Graded SAND w/ Silt & Gravel
3		4-1-1	Brown Poorly Graded SAND w/ Silt & Gravel
4			

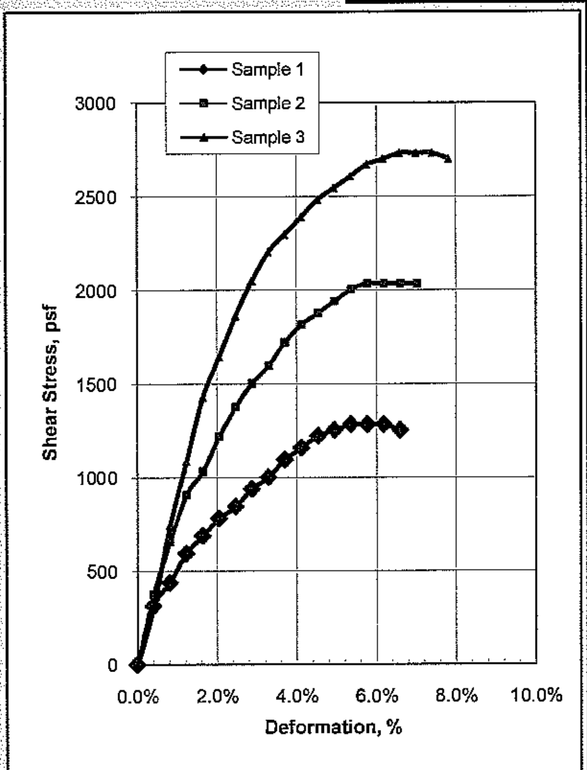
Remarks: *DS-CU* A fully undrained condition may not be attained in this test. Cap tilted during shearing of the second sample. Gravel in shear plane of sample #3.

Figure No. 77
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	28.0	Ult. Phi (degrees)	
P. Cohesion(psf)	700	Ult. Cohesion (psf)	

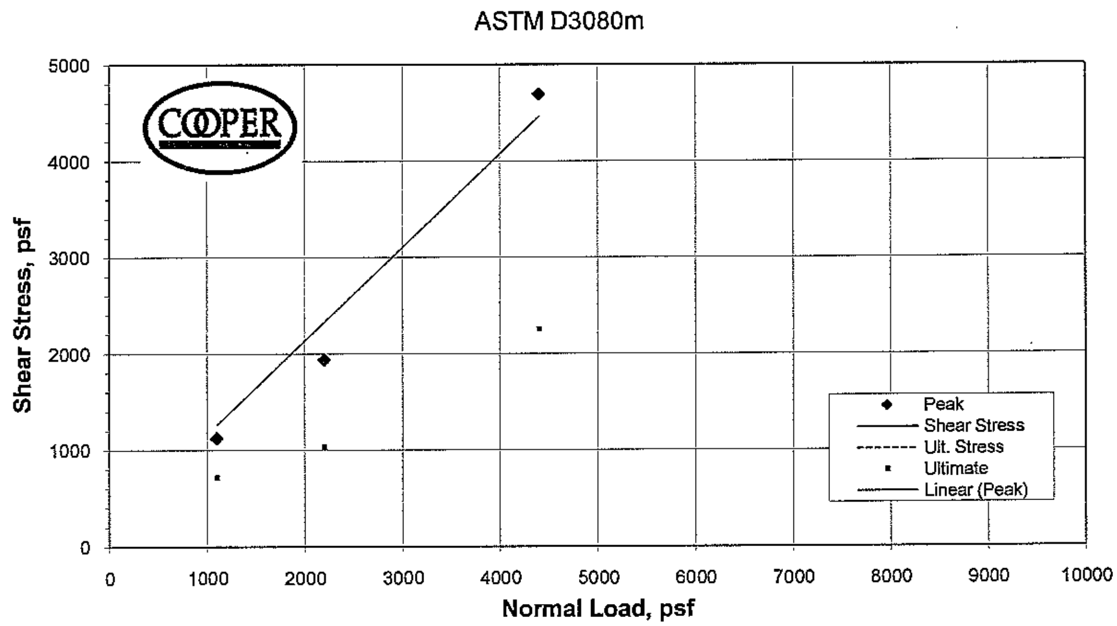


	Sample Data: Initial			
	1	2	3	4
Moisture %	18.4	18.5	19.5	
Dry Dens., pcf	104.2	104.8	102.2	
Void Ratio	0.618	0.608	0.649	
Saturation %	80.6	82.3	81.1	
Diameter	2.42	2.42	2.43	
Height	1.00	1.01	1.01	
	Sample Data: At Test			
Moisture %	20.1	19.8	20.7	
Dry Dens., pcf	105.5	109.5	107.8	
Void Ratio	0.598	0.540	0.563	
Saturation %	90.8	99.0	99.2	
Diameter	2.42	2.42	2.43	
Height	0.99	0.97	0.96	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1284	2035	2732	
Strengths picked at	6.2%	7.0%	7.4%	
Ult. Stress, psf				
Strain Rate, in/min	0.020	0.020	0.020	

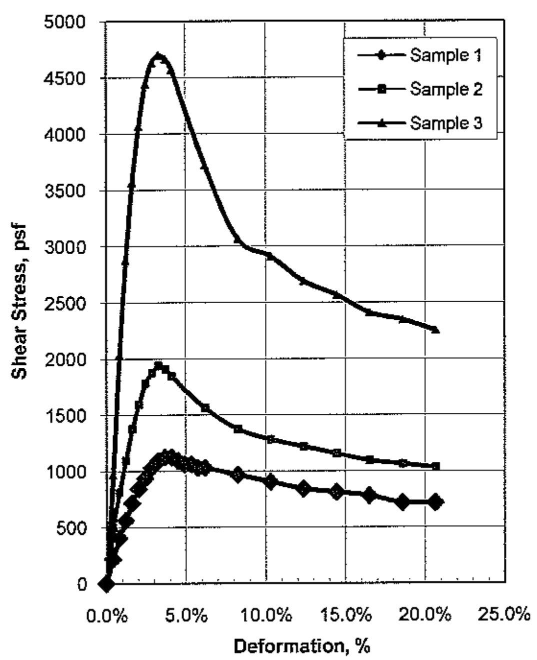
CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	5/30/2008

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		6-1-1		Brown Clayey SAND
2		6-1-1		Brown Clayey SAND
3		6-1-1		Brown Clayey SAND
4				
Remarks:	*DS-CU* A fully undrained condition may not be attained in this test.			

Direct Shear



P. Phi (degrees)	24.0	Ult. Phi (degrees)	
P. Cohesion(psf)	195	Ult. Cohesion (psf)	



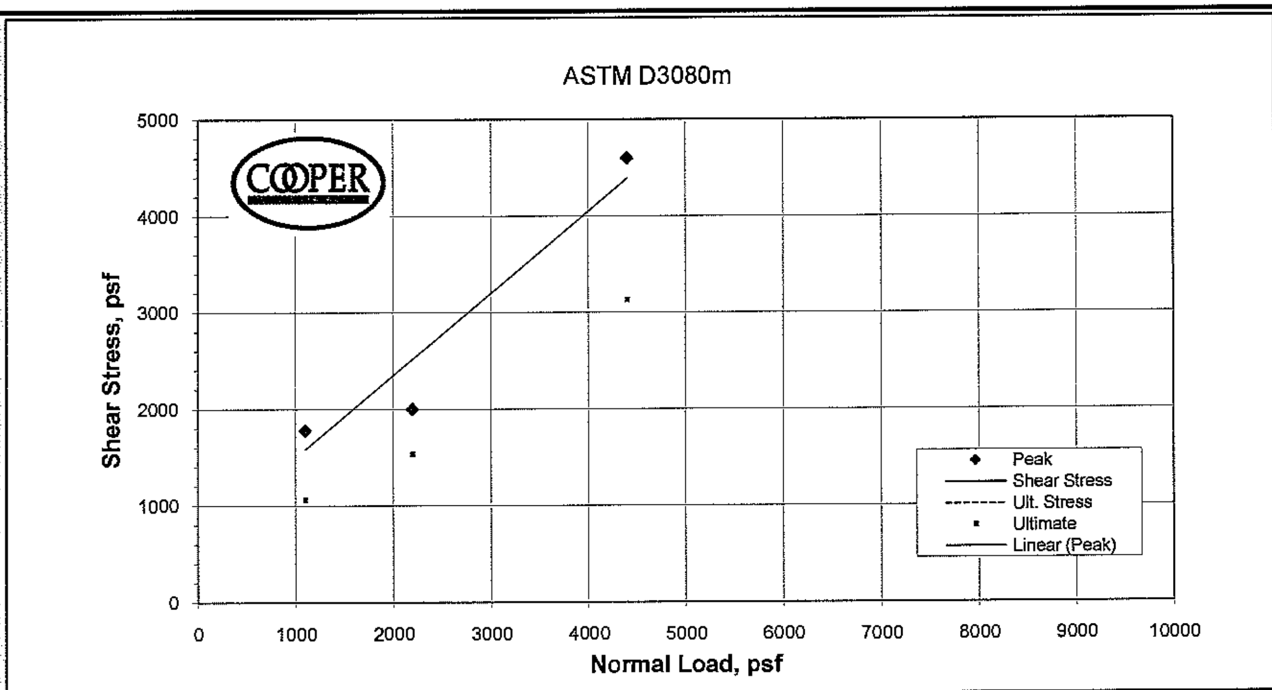
Sample Data: Initial	1	2	3	4
Moisture %	7.9	7.3	9.4	
Dry Dens., pcf	95.9	96.8	100.9	
Void Ratio	0.757	0.741	0.671	
Saturation %	28.0	26.5	38.0	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	21.6	22.1	19.6	
Dry Dens., pcf	94.3	98.8	102.7	
Void Ratio	0.787	0.706	0.642	
Saturation %	74.1	84.4	82.6	
Diameter	2.42	2.42	2.42	
Height	1.02	0.98	0.98	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1127	1941	4696	
Strengths picked at	4.1%	3.3%	3.3%	
Ult. Stress, psf	720	1033	2254	
Strain Rate, in/min	0.020	0.020	0.020	

CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/9/2008

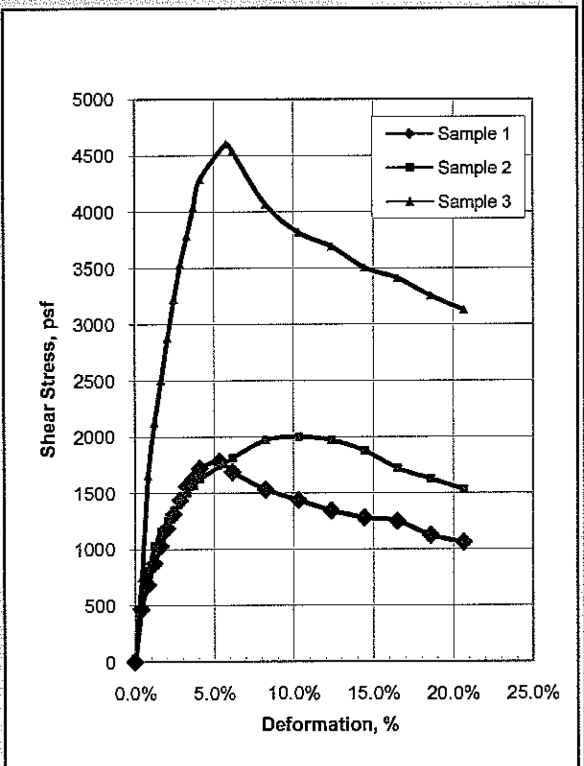
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		9-2-1		Olive SAND
2		9-2-1		Olive SAND
3		9-2-1		Olive SAND
4				

Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

Direct Shear



P. Phi (degrees)	36.0	Ult. Phi (degrees)	
P. Cohesion(psf)	650	Ult. Cohesion (psf)	



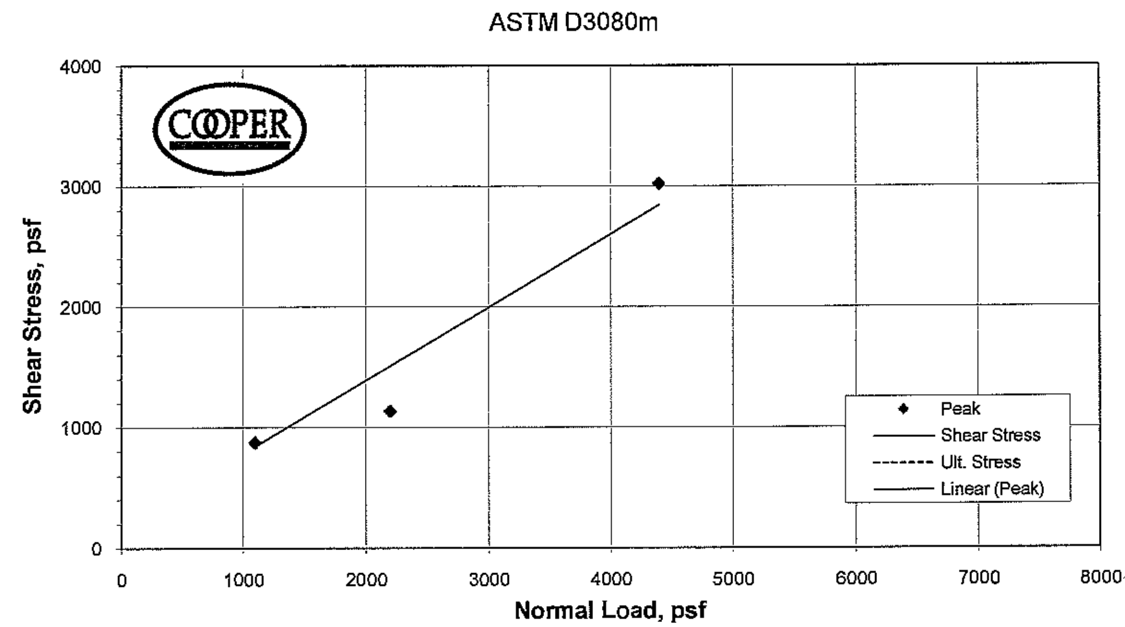
	Sample Data: Initial			
	1	2	3	4
Moisture %	13.7	14.1	15.1	
Dry Dens., pcf	112.7	110.7	114.9	
Void Ratio	0.495	0.523	0.467	
Saturation %	74.9	73.0	87.1	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.01	
	Sample Data: At Test			
Moisture %	14.9	16.0	15.6	
Dry Dens., pcf	114.2	114.7	118.1	
Void Ratio	0.475	0.470	0.427	
Saturation %	84.7	92.1	98.5	
Diameter	2.42	2.42	2.42	
Height	0.99	0.96	0.98	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1785	2004	4602	
Strengths picked at	5.4%	10.3%	5.8%	
Ult. Stress, psf	1064	1534	3131	
Strain Rate, in/min	0.020	0.020	0.020	

CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/4/2008

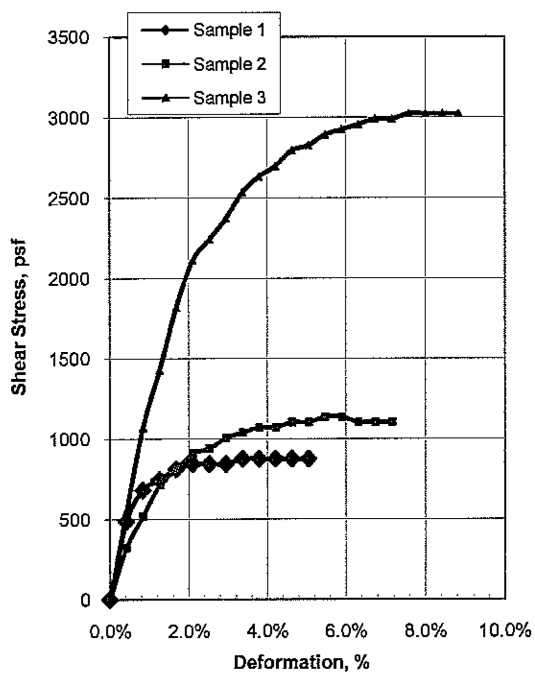
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		13-2-1		Yellowish Brown Clayey SAND
2		13-2-1		Yellowish Brown Clayey SAND
3		13-2-1		Yellowish Brown Clayey SAND
4				
Remarks:	*DS-CU* A fully undrained condition may not be attained in this test.			

Figure No. 80
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	28.0	Ult. Phi (degrees)	
P. Cohesion(psf)	175	Ult. Cohesion (psf)	



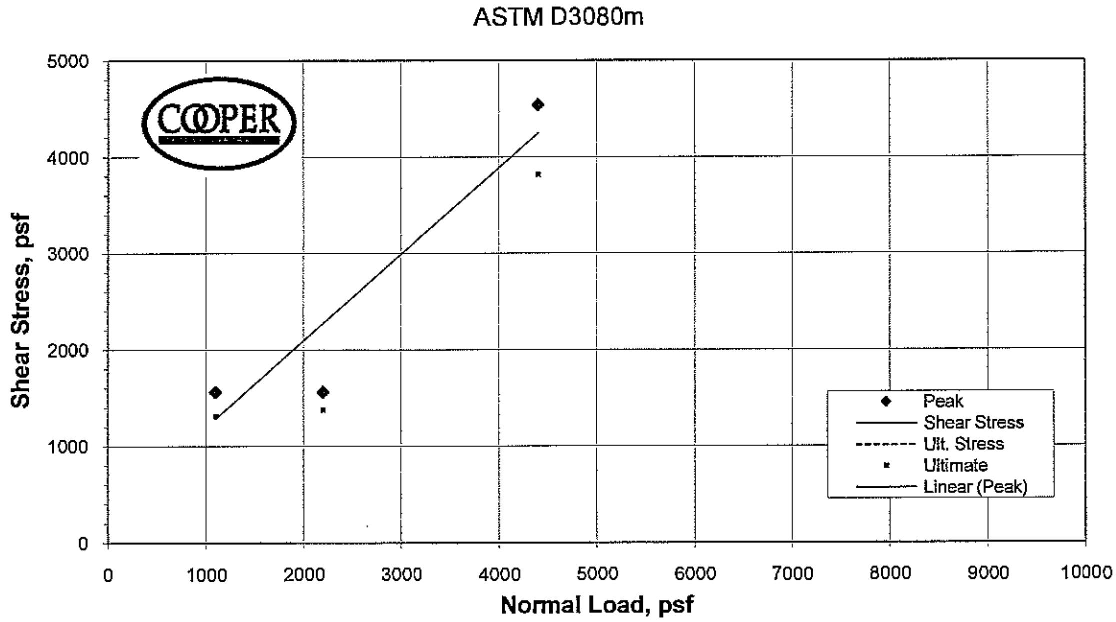
Sample Data: Initial	1	2	3	4
Moisture %	8.6	8.3	9.1	
Dry Dens., pcf	110.9	103.1	114.9	
Void Ratio	0.519	0.635	0.467	
Saturation %	44.7	35.1	52.3	
Diameter	2.38	2.38	2.38	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	17.1	18.5	15.2	
Dry Dens., pcf	111.8	107.2	117.5	
Void Ratio	0.507	0.572	0.434	
Saturation %	90.8	87.4	94.5	
Diameter	2.38	2.38	2.38	
Height	0.99	0.96	0.98	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	878	1138	3023	
Strengths picked at	5.1%	5.9%	8.8%	
Ult. Stress, psf				
Strain Rate, in/min	0.020	0.020	0.020	

CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/5/2008

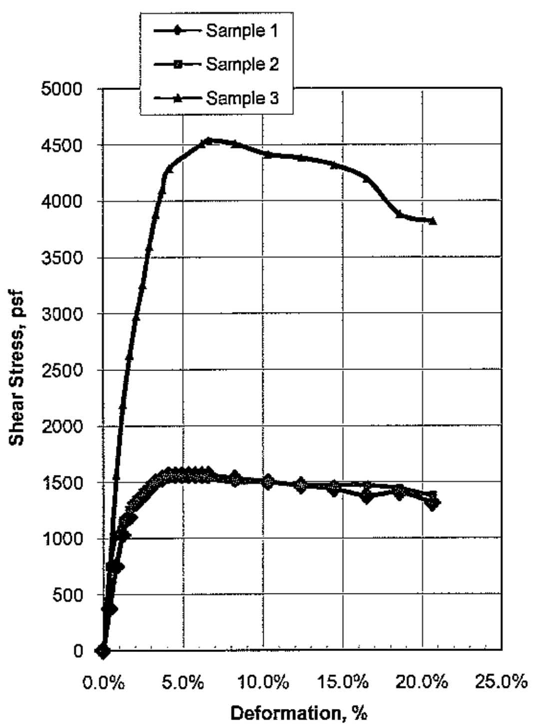
Specimen #	Boring:	Sample: Depth, ft:	Visual Soil Classification
1		14-1-1	Brown Clayey SAND (Cemented)
2		14-1-1	Brown Clayey SAND (Cemented)
3		14-1-1	Brown Clayey SAND (Cemented)
4			
Remarks:	*DS-CU* A fully undrained condition may not be attained in this test.		

Figure No. 81
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	40.0	Ult. Phi (degrees)	
P. Cohesion(psf)	300	Ult. Cohesion (psf)	



	1	2	3	4
Sample Data: Initial				
Moisture %	11.5	11.1	11.7	
Dry Dens., pcf	107.0	103.8	112.1	
Void Ratio	0.575	0.624	0.503	
Saturation %	54.1	48.0	63.0	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	18.6	18.5	16.5	
Dry Dens., pcf	107.9	105.0	113.5	
Void Ratio	0.562	0.606	0.485	
Saturation %	89.2	82.6	91.6	
Diameter	2.42	2.42	2.42	
Height	0.99	0.99	0.99	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1565	1565	4540	
Strengths picked at	6.6%	4.1%	6.6%	
Ult. Stress, psf	1315	1378	3819	
Strain Rate, in/min	0.020	0.020	0.020	

CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/10/2008

Specimen #	Boring:	Sample:	Depth, ft: Visual Soil Classification
1		17-1-1	Black Clayey SAND
2		17-1-1	Black Clayey SAND
3		17-1-1	Black Clayey SAND
4			
Remarks:	*DS-CU* A fully undrained condition may not be attained in this test.		

Figure No. 82
Project No. 0829
Date: 3/2/09

COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	416-343	**Date:**	06/03/08
Client:	Pacific Crest Engineering, Inc.	**Tested**	MD
Project:	Atkinson Lane - 0829	**Reduced**	RU
Sample	R1 from B-4	**Checked**	DC
Soil Type:	Grayish Brown Silty SAND w/ pockets of Clay		

Initial Moisture,	8.1%	
R-value by Stabilometer	30	
Expansion Pressure	20	psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	402	223	733	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	35	55	25	
Weight of Soil & Mold, grams	3141	3269	3128	
Weight of Mold, grams	2120	2111	2080	
Height After Compaction, in.	2.29	2.65	2.33	
Moisture Content, %	11.2	13.0	10.3	
Dry Density, pcf	121.4	117.1	123.5	
Expansion Pressure, psf	17.2	21.5	4.3	
Stabilometer @ 1000				
Stabilometer @ 2000	64	126	35	
Turns Displacement	3.75	3.75	3.9	
R-value	44	17	66	

Remarks:

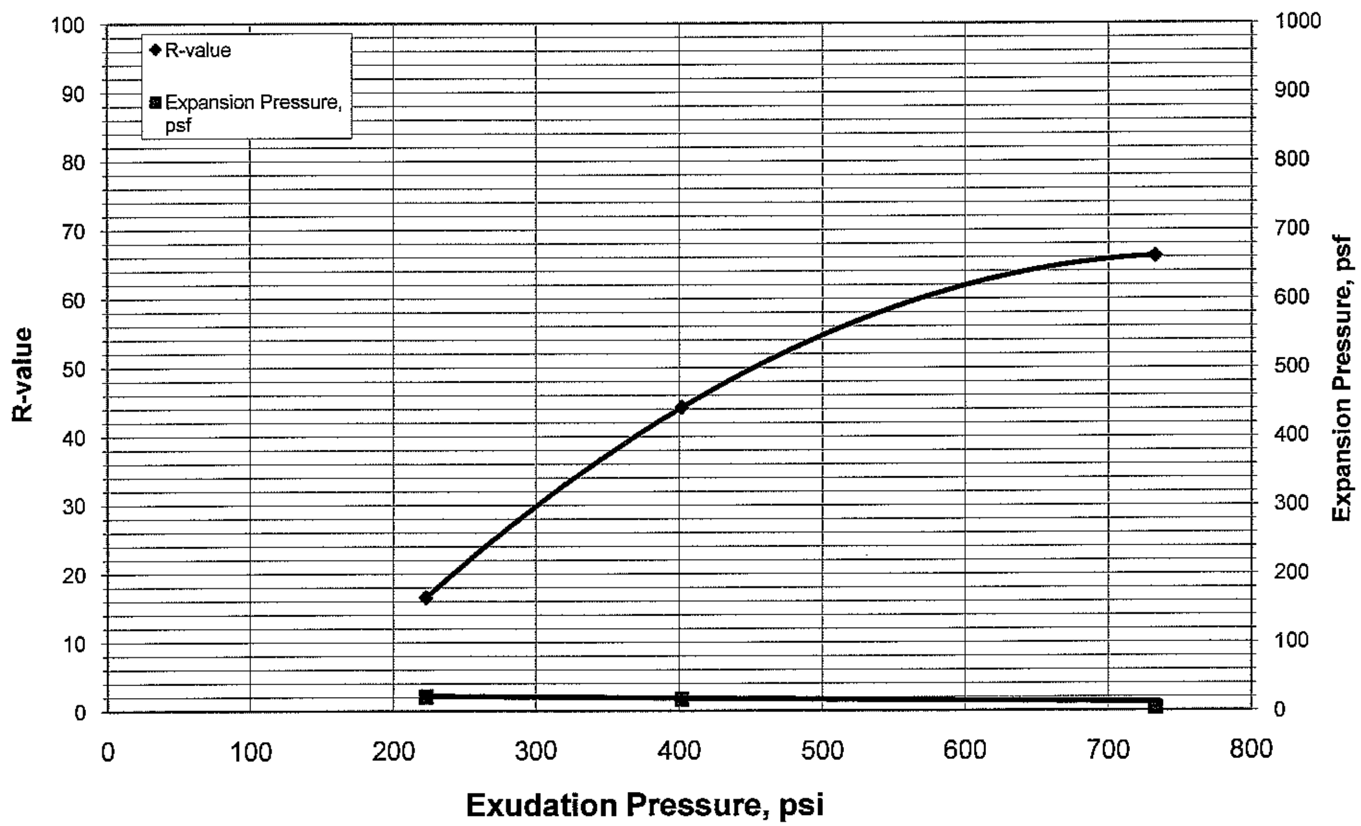


Figure No. 83

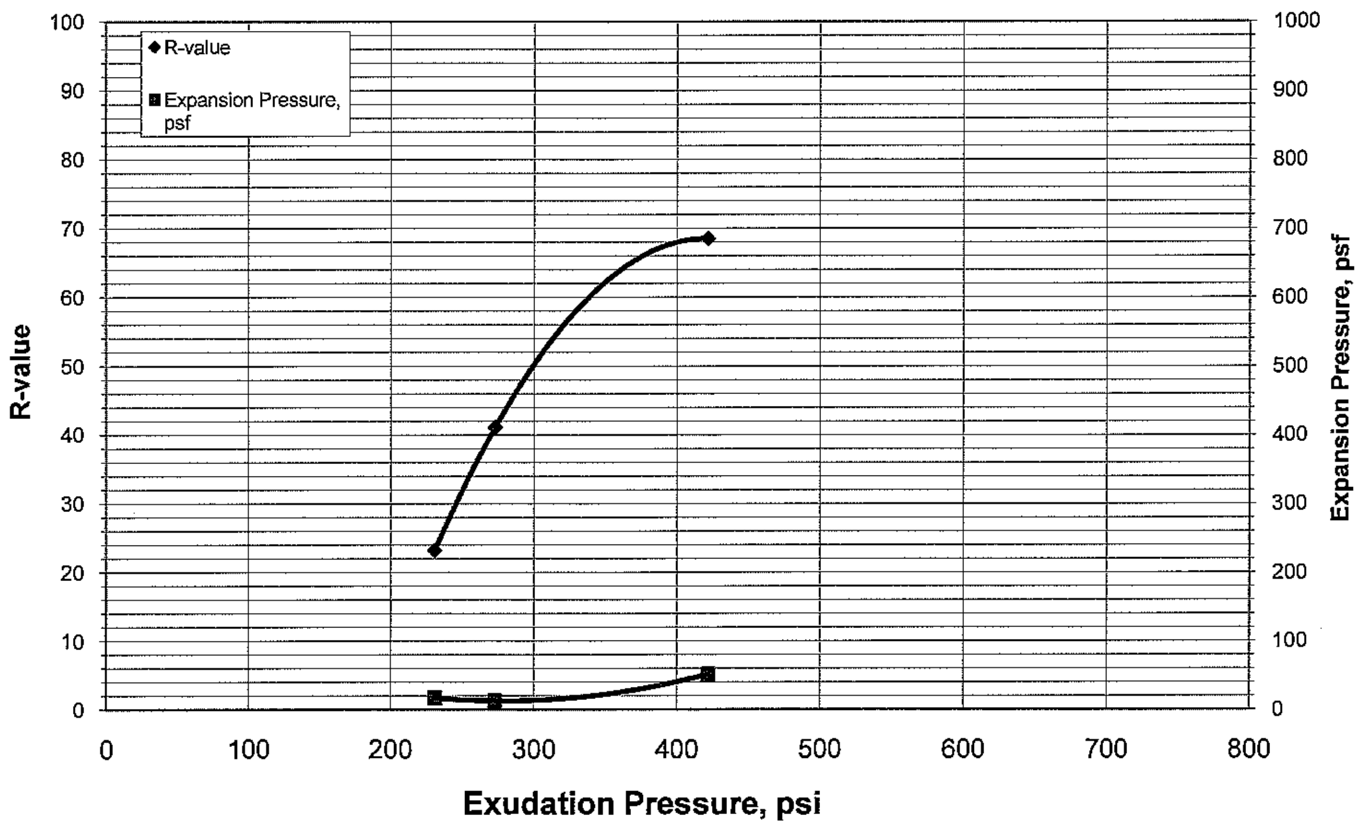
COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	416-343	**Date:**	06/02/08	**Initial Moisture,**	8.6%
Client:	Pacific Crest Engineering, Inc.	**Tested**	MD	**R-value by Stabilometer**	**50**
Project:	Atkinson Lane - 0829	**Reduced**	RU		
Sample	R2 from B-1	**Checked**	DC	**Expansion Pressure**	**20 psf**
Soil Type:	Grayish Brown Clayey SAND (Silty)				

Specimen Number	A	B	C	D
Exudation Pressure, psi	273	422	231	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	46	30	59	
Weight of Soil & Mold, grams	3132	3134	3220	
Weight of Mold, grams	2067	2081	2109	
Height After Compaction, in.	2.44	2.44	2.6	
Moisture Content, %	12.8	11.3	13.9	
Dry Density, pcf	117.2	117.4	113.5	
Expansion Pressure, psf	12.9	51.6	17.2	
Stabilometer @ 1000				
Stabilometer @ 2000	72	32	112	
Turns Displacement	4.1	4.34	3.84	
R-value	41	69	23	

Remarks:



COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	416-343	**Date:**	06/02/08	**Initial Moisture,**	15.3%
Client:	Pacific Crest Engineering, Inc.	**Tested**	MD	**R-value by Stabilometer**	<5
Project:	Atkinson Lane - 0829	**Reduced**	RU		
Sample	R3 from B-18	**Checked**	DC	**Expansion Pressure**	psf
Soil Type:	Mottled Grayish Brown Clayey SAND				

Specimen Number	A	B	C	D
Exudation Pressure, psi	350			
Prepared Weight, grams	1200			
Final Water Added, grams/cc	85			
Weight of Soil & Mold, grams	3070			
Weight of Mold, grams	2085			
Height After Compaction, in.	2.42			
Moisture Content, %	23.5			
Dry Density, pcf	99.8			
Expansion Pressure, psf	159.1			
Stabilometer @ 1000				
Stabilometer @ 2000	140			
Turns Displacement	3.24			
R-value	10			

Remarks:
Soil extruded from the mold giving a false exudation pressure. Per Caltrans, the R-Value test was terminated and an R-Value of less than 5 was reported.

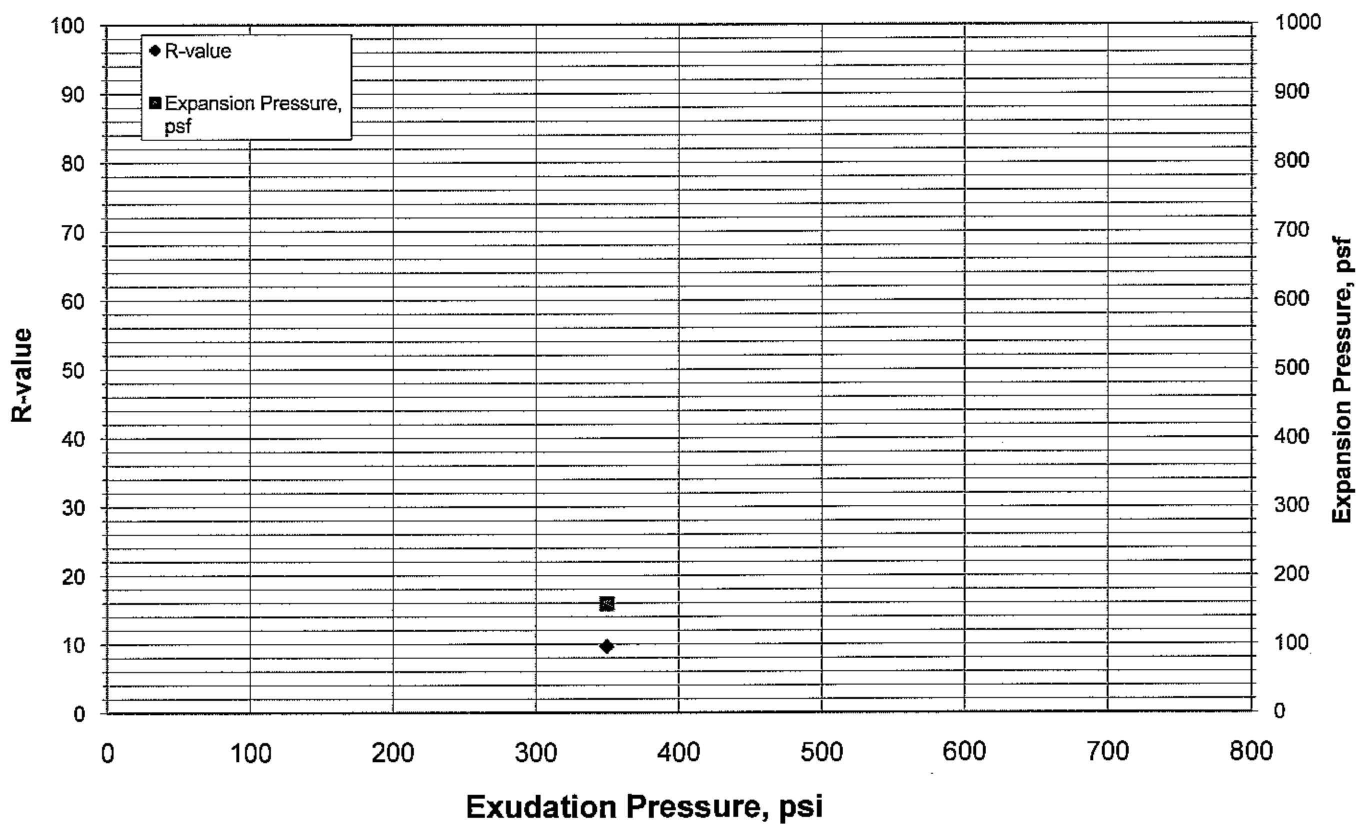


Figure No. 85
Project No. 0829
Date: 3/2/09

COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	416-343	**Date:**	05/27/08	**Initial Moisture,**	8.4%
Client:	Pacific Crest Engineering, Inc.	**Tested**	MD	**R-value by Stabilometer**	74
Project:	Atkinson Lane - 0829	**Reduced**	RU		
Sample	R4 from B-9	**Checked**	DC	**Expansion Pressure**	0 psf
Soil Type:	Grayish Brown Clayey SAND (Silty)				

Specimen Number	A	B	C	D
Exudation Pressure, psi	214	405	800	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	40	26	17	
Weight of Soil & Mold, grams	3184	3198	3152	
Weight of Mold, grams	2190	2089	2109	
Height After Compaction, in.	2.51	2.56	2.46	
Moisture Content, %	12.1	10.8	10.0	
Dry Density, pcf	107.0	118.4	116.7	
Expansion Pressure, psf	0.0	0.0	0.0	
Stabilometer @ 1000				
Stabilometer @ 2000	28	20	18	
Turns Displacement	5.2	5.3	5	
R-value	69	78	80	

Remarks:

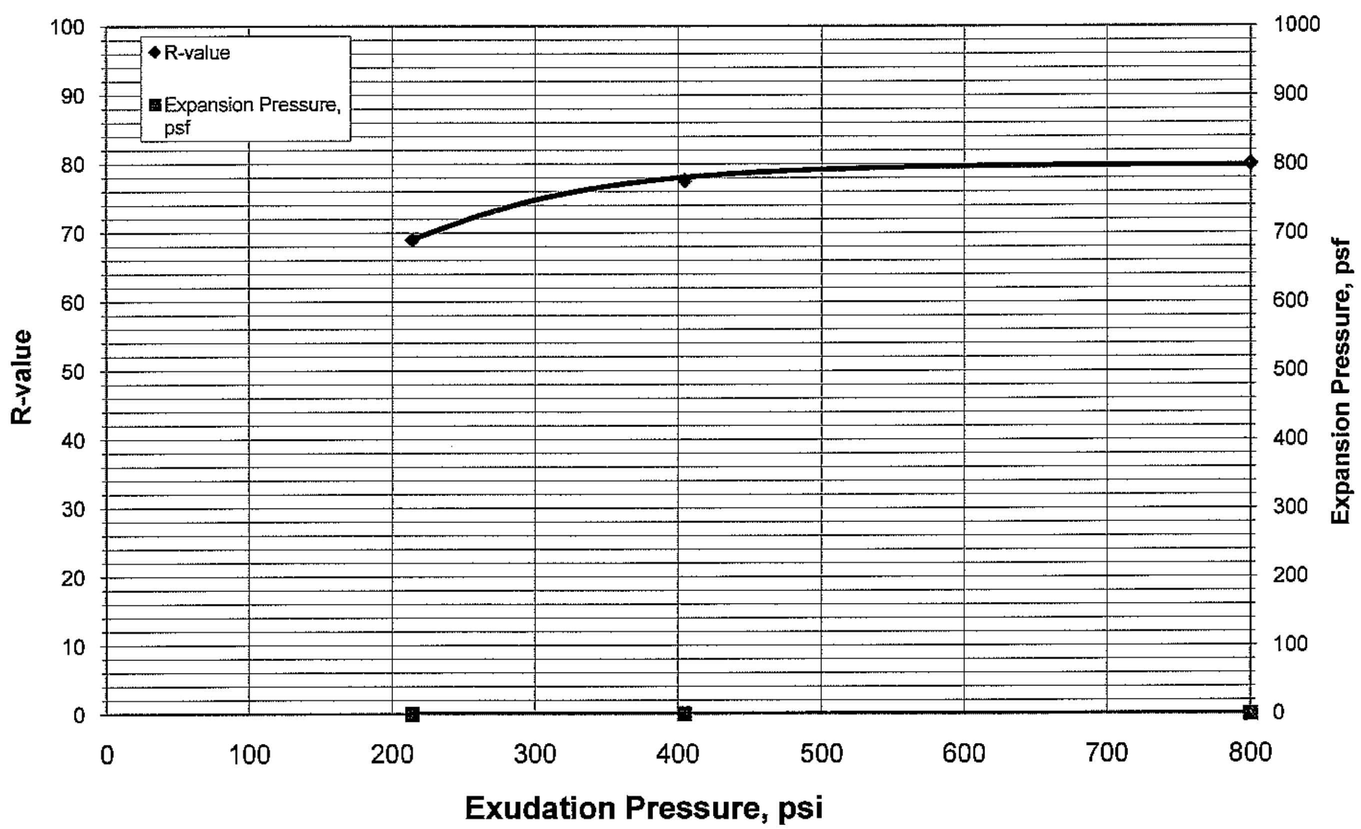


Figure No. 86

R-value Test Report (Caltrans 301)

COOPER TESTING LABORATORY

Job No.:	416-343	Date:	05/30/08
Client:	Pacific Crest Engineering, Inc.	Tested	MD
Project:	Atkinson Lane - 0829	Reduced	RU
Sample	R5 from B-13	Checked	DC
Soil Type:	Brown Clayey SAND		

Initial Moisture,	9.5%
R-value by Stabilometer	16
Expansion Pressure	5 psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	160	237	500	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	66	45	25	
Weight of Soil & Mold, grams	3189	3195	3141	
Weight of Mold, grams	2089	2100	2104	
Height After Compaction, in.	2.68	2.56	2.4	
Moisture Content, %	15.5	13.6	11.8	
Dry Density, pcf	107.6	114.0	117.1	
Expansion Pressure, psf	12.9	8.6	8.6	
Stabilometer @ 1000				
Stabilometer @ 2000	146	132	94	
Turns Displacement	4.4	4.3	4	
R-value	5	11	29	

Remarks:

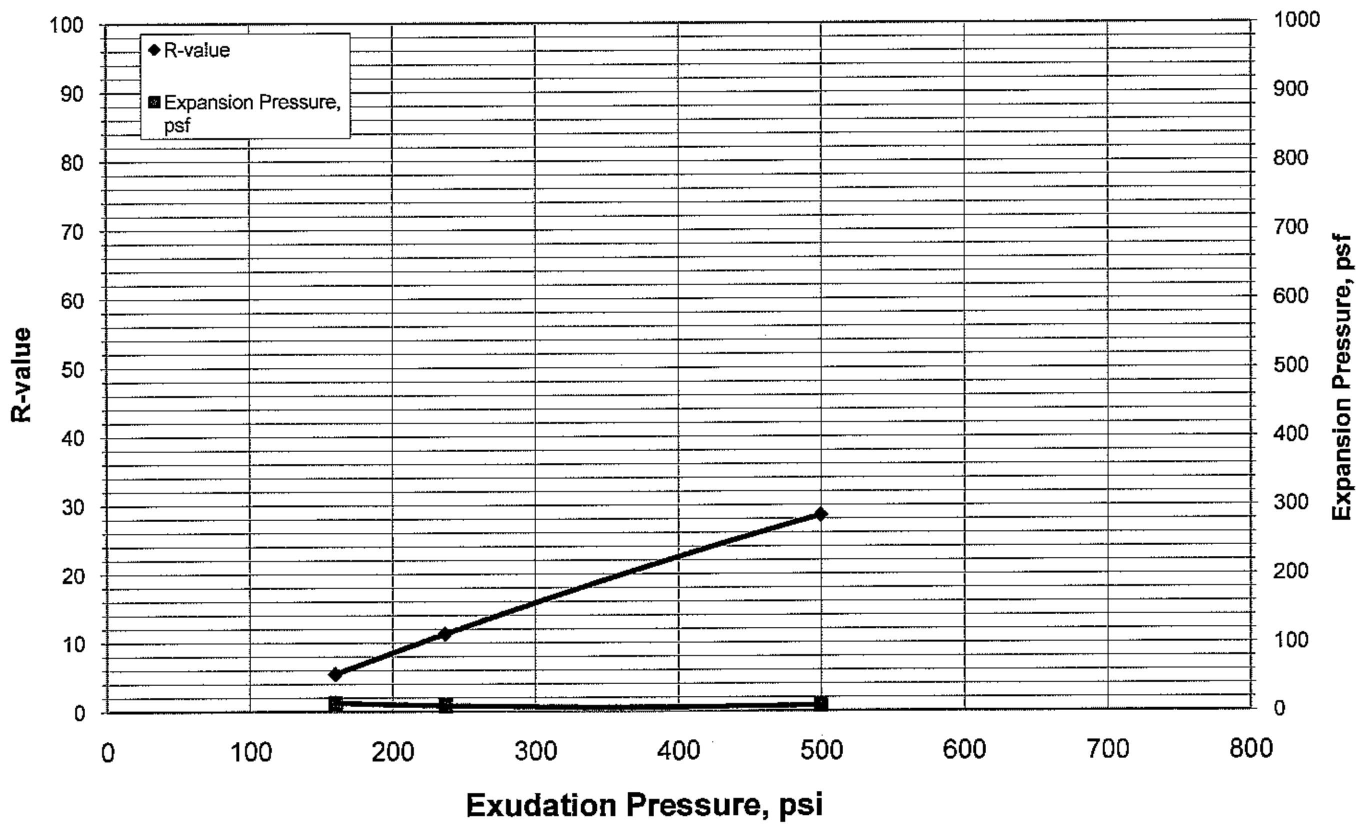


Figure No. 87

COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	416-343	Date:	06/03/08	Initial Moisture,	16.5%
Client:	Pacific Crest Engineering, Inc.	Tested	MD	R-value by Stabilometer	<5
Project:	Atkinson Lane - 0829	Reduced	RU		
Sample	R6 from B-17	Checked	DC	Expansion Pressure	psf
Soil Type:	Brown Sandy CLAY				

Specimen Number	A	B	C	D
Exudation Pressure, psi	580			
Prepared Weight, grams	1200			
Final Water Added, grams/cc	65			
Weight of Soil & Mold, grams	3088			
Weight of Mold, grams	2099			
Height After Compaction, in.	2.44			
Moisture Content, %	22.9			
Dry Density, pcf	99.9			
Expansion Pressure, psf	4.3			
Stabilometer @ 1000				
Stabilometer @ 2000	134			
Turns Displacement	3			
R-value	14			

Remarks:

Soil extruded from the mold giving a false exudation pressure. Per Caltrans, the R-Value test was terminated and an R-Value of less than 5 was reported.

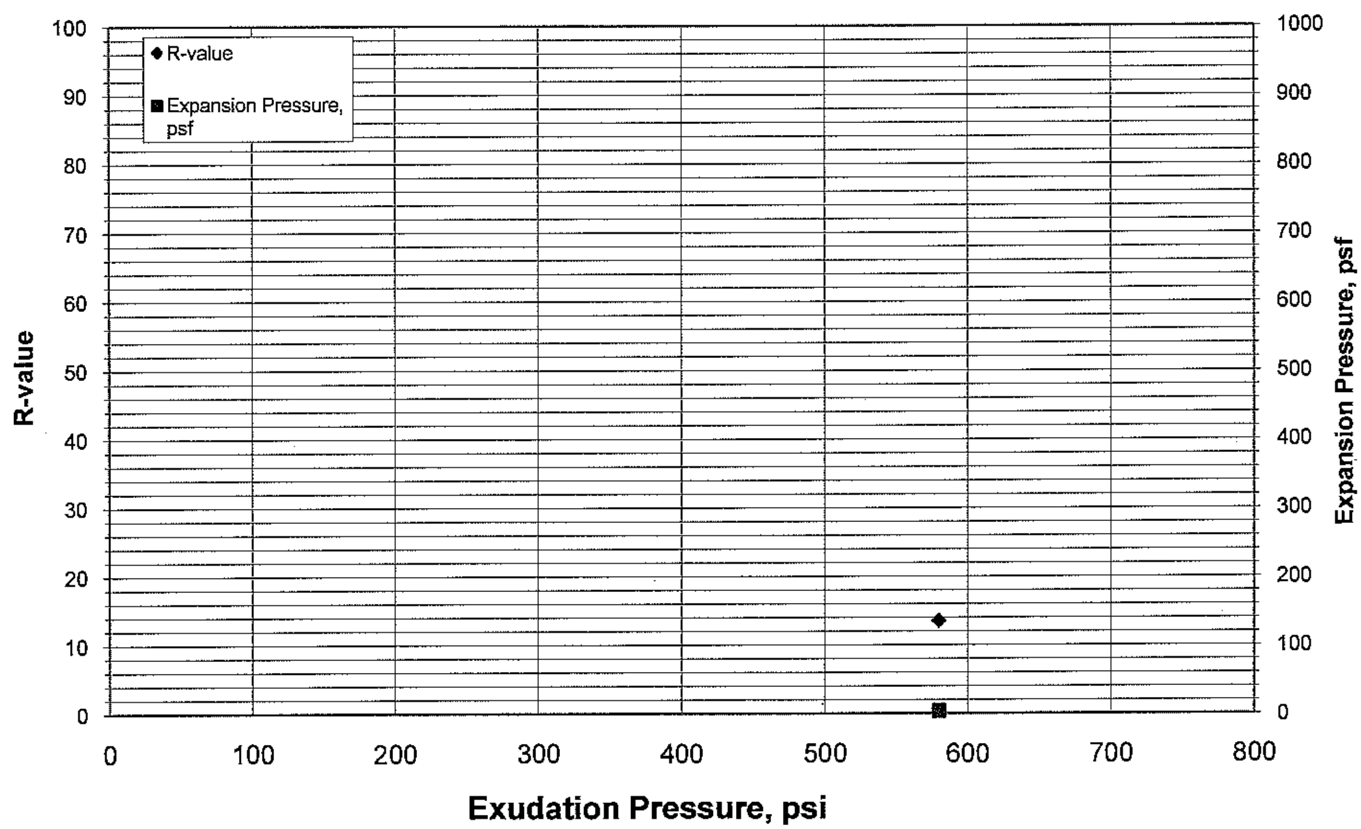


Figure No. 88
Project No. 0829
Date: 3/2/09

COOPER

Expansion Index

UBC 29-2 ___

ASTM D-4829 X

CTL Job No.:	416-345	**Boring:**		**Date:**	6/2/2008
Client:	Pacific Crest	**Sample:**	EXPOT - 1 near B-4	**By:**	PJ
Project Name:		**Depth:**			
Project No:	829				
Visual Description:	Brown SAND w/ Clay				

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	606.6	648
Dry Wt. + Tare, (gm)	571.3	571.3
Tare Wt., (gm)	233.1	233.1
Wt. Of Water, (gm)	35.3	76.7
% Water	10.4	22.7

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	573.1	614.5	grams
Ring:	199.6	199.6	grams
Remolded Wet Wt.:	373.5	414.9	grams
Wet Density	112.2	122.3	pcf
Dry Density	101.6	99.7	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	42.8	88.7	UBC 49<Sat%<51; ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
5/29/2008	15:51	0.0000	0.000
	16:49	-0.0150	1.499
5/30/2008	7:45	-0.0188	1.878
	11:40	-0.0189	1.888
		Total Dial	1.9

Tested with 1 psi Surcharge

Remarks:

Expansion Index **Results**

initial dial - final dial / initial sample height x 1000

uncorrected EI = 19

Corrected EI= 15

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

COOPER

Expansion Index

UBC 29-2 ___
ASTM D-4829 _X_

CTL Job No.:	416-345	**Boring:**		**Date:**	6/2/2008
Client:	Pacific Crest	**Sample:**	EXPOT - 2 near B-1	**By:**	PJ
Project Name:	Atkinson Lane	**Depth:**			
Project No:	829				
Visual Description:	Brown Sandy CLAY				

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	621.3	663.7
Dry Wt. + Tare, (gm)	578.7	578.7
Tare Wt., (gm)	250.9	250.9
Wt. Of Water, (gm)	42.6	85
% Water	13.0	25.9

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	566.1	608.5	grams
Ring:	195.7	195.7	grams
Remolded Wet Wt.:	370.4	412.8	grams
Wet Density	111.2	117.4	pcf
Dry Density	98.4	93.3	pcf
			UBC 49<Sat%<51
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	49.3	86.8	ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
5/23/2008	16:06	0.0000	0.000
	17:10	-0.0335	3.347
5/24/2008	9:31	-0.0505	5.045
	13:12	-0.0511	5.105
5/25/2008	14:06	-0.0528	5.275
5/26/2008	13:30	-0.0539	5.385
5/27/2008	8:41	-0.0547	5.465
	17:31	-0.0551	5.504
28-May	7:49	-0.0556	5.554
		Total Dial	5.6

Tested with 1 psi Surcharge

Remarks:

Expansion Index **Results**

$\frac{\text{initial dial - final dial}}{\text{initial sample height}} \times 1000$

Uncorrected EI = 56

Corrected EI= 55

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

COOPER

Expansion Index

UBC 29-2 __

ASTM D-4829 X

CTL Job No.:	416-345	**Boring:**		**Date:**	6/2/2008
Client:	Pacific Crest	**Sample:**	EXPOT - 3 near B-18	**By:**	PJ
Project Name:		**Depth:**			
Project No:	829				
Visual Description:	Brown SAND w/ Clay				

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	630.9	656.4
Dry Wt. + Tare, (gm)	586.2	586.2
Tare Wt., (gm)	238.1	238.1
Wt. Of Water, (gm)	44.7	70.2
% Water	12.8	20.2

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	588.5	614.0	grams
Ring:	195.7	195.7	grams
Remolded Wet Wt.:	392.8	418.3	grams
Wet Density	118.0	123.7	pcf
Dry Density	104.5	103.0	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	56.7	85.6	UBC 49<Sat%<51; ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
5/29/2008	15:52	0.0000	0.000
	16:49	-0.0113	1.129
5/30/2008	7:45	-0.0151	1.508
	11:40	-0.0151	1.508
		Total Dial	1.5

Tested with 1 psi Surcharge

Remarks:

Expansion Index

Results

initial dial - final dial / initial sample height x 1000

Uncorrected EI = 15

Corrected EI= 18

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$$EI_{50} = EI_{meas} - (50-S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

COOPER

Expansion Index

UBC 29-2 ___
ASTM D-4829 _X_

CTL Job No.:	416-345	**Boring:**		**Date:**	6/9/2008
Client:	Pacific Crest	**Sample:**	EXPOT - 4 near B-9	**By:**	PJ
Project Name:	Atkinson Lane	**Depth:**			
Project No:	829				
Visual Description:	Brown Clayey SAND				

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	901.7	926.0
Dry Wt. + Tare, (gm)	859.3	859.3
Tare Wt., (gm)	511.7	511.7
Wt. Of Water, (gm)	42.4	66.7
% Water	12.2	19.2

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	585.7	610.1	grams
Ring:	195.7	195.7	grams
Remolded Wet Wt.:	390	414.4	grams
Wet Density	117.1	122.6	pcf
Dry Density	104.4	102.9	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	53.6	81.2	UBC 49<Sat%<51 / ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
6/2/2008	17:30	0.0000	0.000
6/2/2008	17:58	-0.0083	0.829
6/4/2008	7:31	-0.0150	1.499
6/4/2008	16:17	-0.0151	1.508
		Total Dial	1.5

Tested with 1 psi Surcharge

Remarks:

Expansion Index

Results

initial dial - final dial / initial sample height x 1000

Uncorrected EI = 15

Corrected EI= 17

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$$EI_{50} = EI_{meas} - (50-S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

COOPER

Expansion Index

UBC 29-2 ___
ASTM D-4829 _X_

CTL Job No.:	416-345	**Boring:**		**Date:**	6/9/2008
Client:	Pacific Crest	**Sample:**	EXPOT - 5 near B-13	**By:**	PJ
Project Name:	Atkinson Lane	**Depth:**			
Project No:	829				
Visual Description:	Brown Clayey SAND				

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.000 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	764.5	789.5
Dry Wt. + Tare, (gm)	729.7	729.7
Tare Wt., (gm)	362.4	362.4
Wt. Of Water, (gm)	34.8	59.8
% Water	9.5	16.3

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	598.6	612.8	grams
Ring:	196.5	196.5	grams
Remolded Wet Wt.:	402.1	416.3	grams
Wet Density	120.9	124.1	pcf
Dry Density	110.4	106.8	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	48.6	76.0	UBC 49<Sat%<51 ASTM (40-60%)

Expansion Test:

Tested with 1 psi Surcharge

Remarks:

Date	Time	Dial	Delta h, %
6/2/2008	17:30	0.0000	0.000
6/2/2008	17:57	-0.0036	0.360
6/4/2008	7:31	-0.0079	0.790
6/4/2008	16:10	-0.0080	0.800
		Total Dial	0.8

Expansion Index

Results

$$\frac{\text{initial dial - final dial}}{\text{initial sample height}} \times 1000$$

Uncorrected EI = 8

Corrected EI= 7

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

COOPER

Expansion Index

UBC 29-2 ___
ASTM D-4829 X

CTL Job No.:	416-345	**Boring:**		**Date:**	6/2/2008
Client:	Pacific Crest	**Sample:**	EXPOT - 6 near B-17	**By:**	PJ
Project Name:	Atkinson Lane	**Depth:**			
Project No:	829				
Visual Description:	Brown Clayey SAND				

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.002 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	597.7	645.9
Dry Wt. + Tare, (gm)	554.0	554.0
Tare Wt., (gm)	230.7	230.7
Wt. Of Water, (gm)	43.7	91.9
% Water	13.5	28.4

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	564.5	612.8	grams
Ring:	197.5	197.5	grams
Remolded Wet Wt.:	367	415.3	grams
Wet Density	110.1	115.6	pcf
Dry Density	97.0	90.0	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	49.5	88.1	UBC 49<Sat%<51 ASTM (40-60%)

Expansion Test:

Tested with 1 psi Surcharge

Remarks:

Date	Time	Dial	Delta h, %
5/23/2008	14:47	0.0000	0.000
	17:07	-0.0651	6.497
5/24/2008	9:30	-0.0730	7.285
	13:12	-0.0736	7.345
5/25/2008	14:05	-0.0755	7.535
5/26/2008	13:30	-0.0765	7.635
5/27/2008	8:42	-0.0768	7.665
	17:31	-0.0771	7.695
28-May	7:49	-0.0776	7.745
		Total Dial	7.7

Expansion Index — **Results**

$$\frac{\text{initial dial - final dial}}{\text{initial sample height}} \times 1000$$

Uncorrected EI = 77

Corrected EI= 77

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

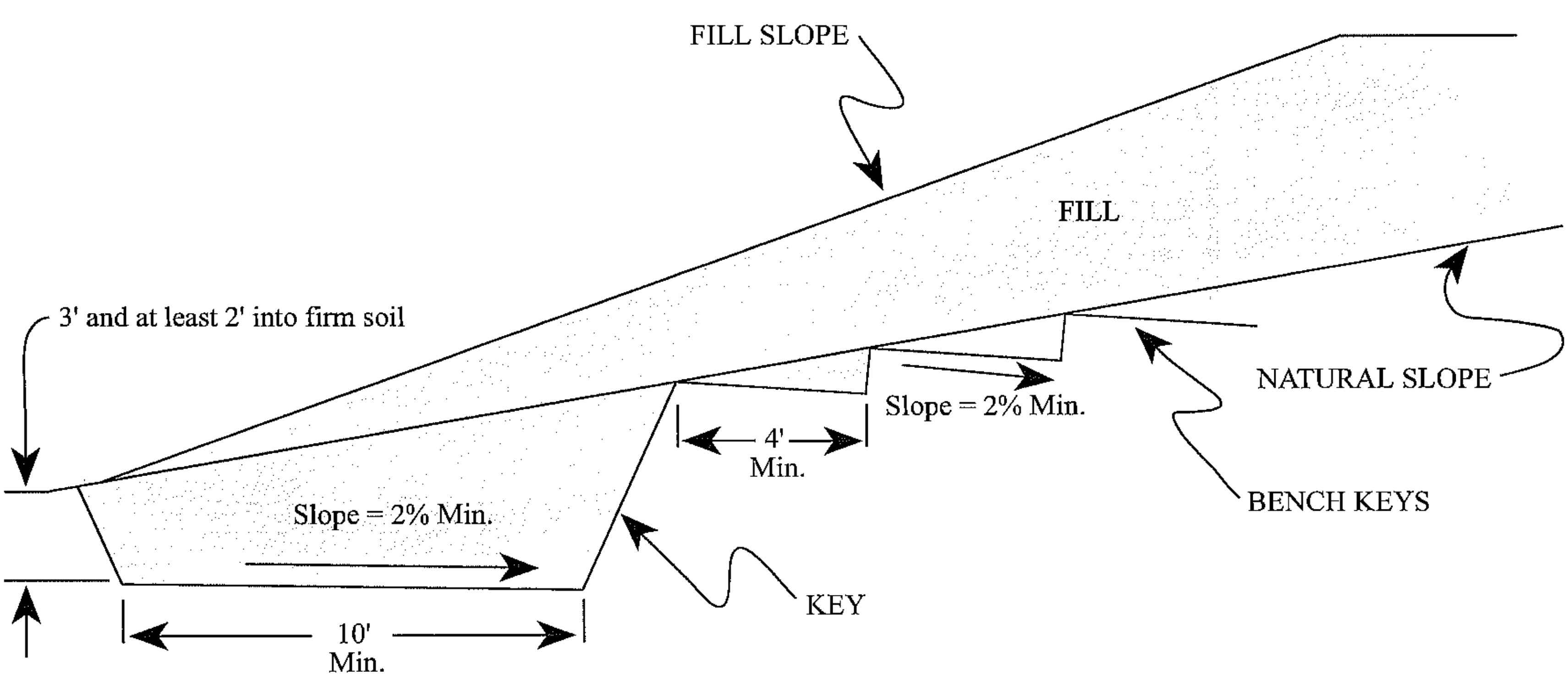
$$EI_{50} = EI_{meas} - (50-S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

COOPER TESTING LABORATORY

Corrosivity Test Summary

CTL # 416-342 **Date:** 6/5/2008 **Tested By:** PJ **Checked:** PJ
Client: Pacific Crest Engineering **Project:** Atkinson Lane **Proj. No:** 0829
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg	mg/kg	%		(Redox)	As Received	
						Dry Wt.	Dry Wt.	Dry Wt.		mv	%	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
-	1-1-1	-	-	1254	-	3	431	0.0431	6.5	-	15.7	Brown Clayey SAND
-	2-1-1	-	-	4736	-	4	<5	<0.0005	6.3	-	8.8	Brown Clayey SAND
-	6-1-1	-	-	1198	-	18	13	0.0013	6.2	-	17.2	Brown Clayey SAND
-	13-1-1	-	-	1637	-	14	<5	<0.0005	6.6	-	16.7	Reddish Brown Sandy CLAY
-	15-1-1	-	-	6306	-	6	<5	<0.0005	6.7	-	14.6	Reddish Brown Clayey SAND



TYPICAL KEY AND BENCHES

not to scale

Pacific Crest Engineering Inc.
444 Airport Blvd., Suite 106
Watsonville, CA 95076

Keyway Detail

Atkinson Lane Development
Watsonville, California

Figure No. 96
Project No. 0829
Date: 3/2/09

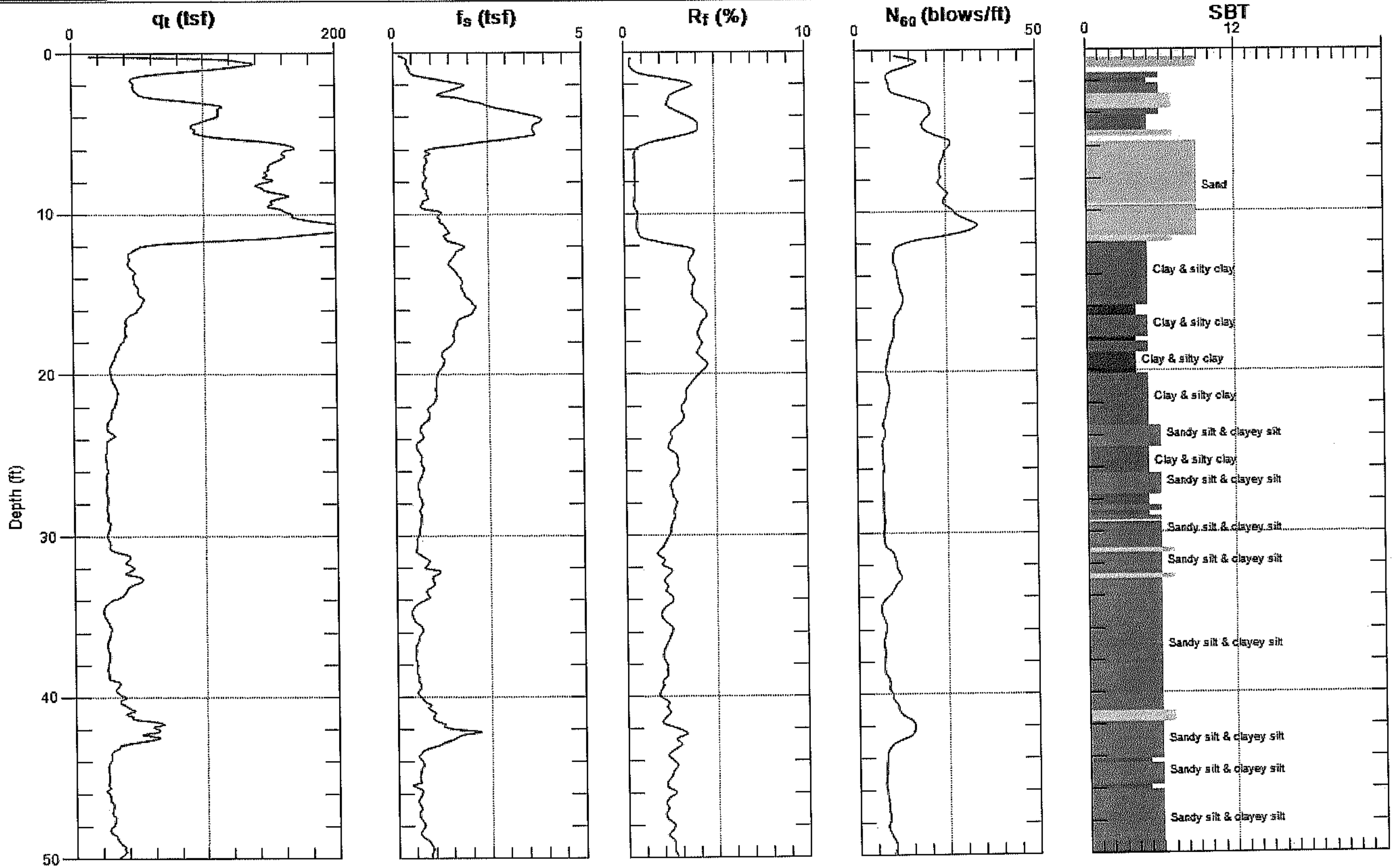
APPENDIX B

CPT Soundings and Data Summary

GREGG **PACIFIC CREST ENG.**

Site: ATKINSON LANE
Sounding: CPT-1

Engineer: M.KLEAMES
Date: 5/1/2008 08:25



Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

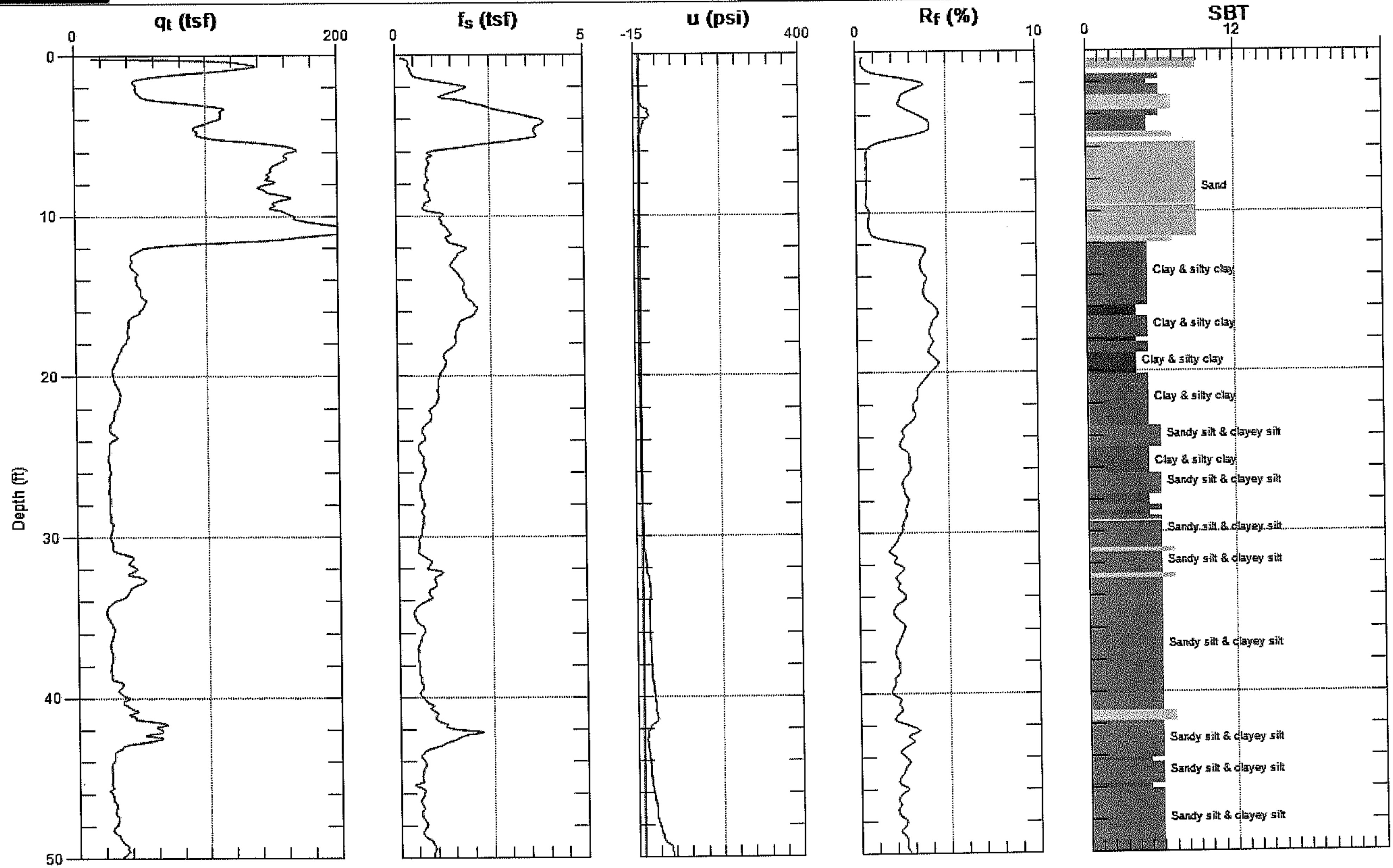
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-1

Engineer: M.KLEAMES
Date: 5/1/2008 08:25



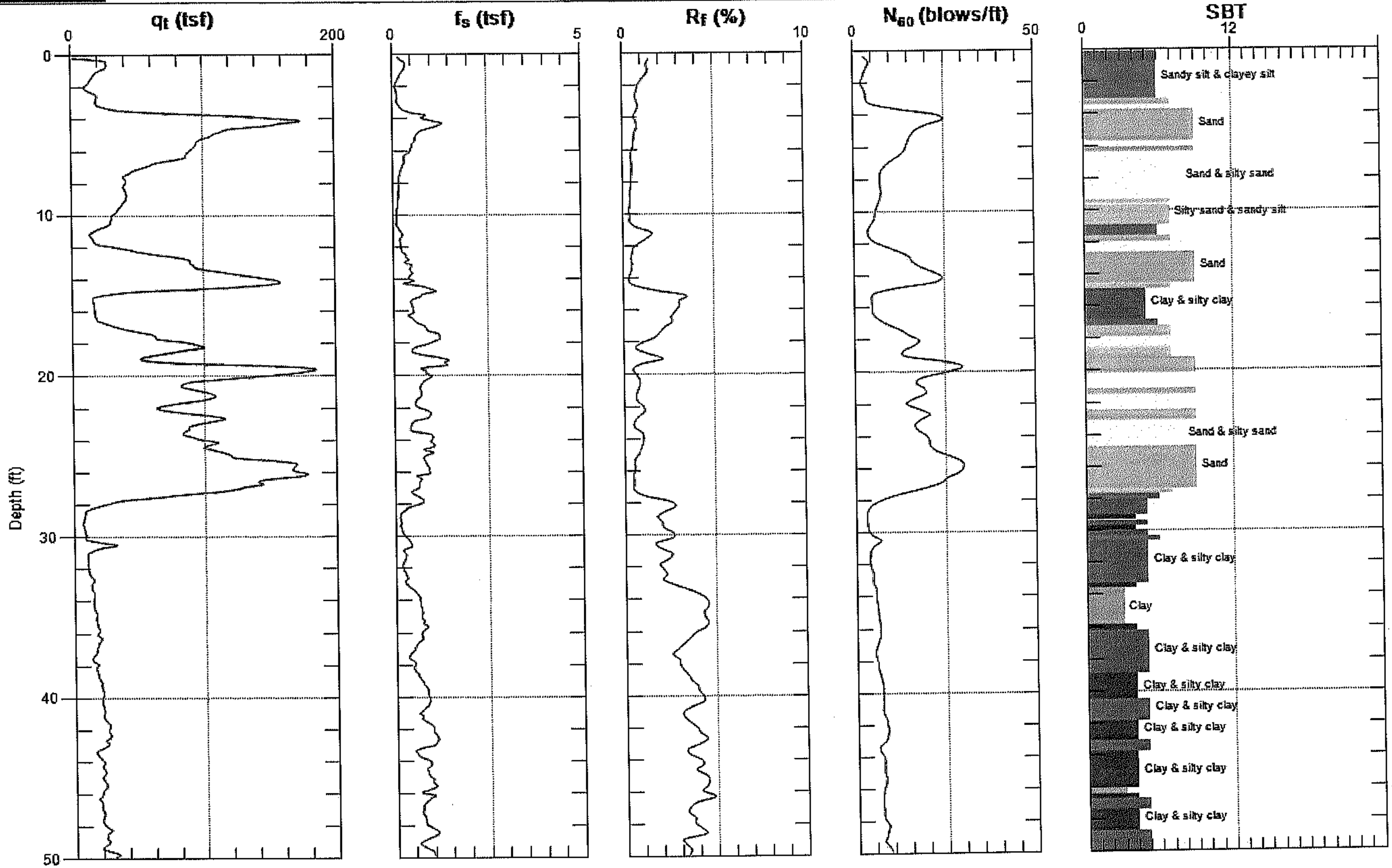
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-2

Engineer: M.KLEAMES
Date: 5/1/2008 10:21



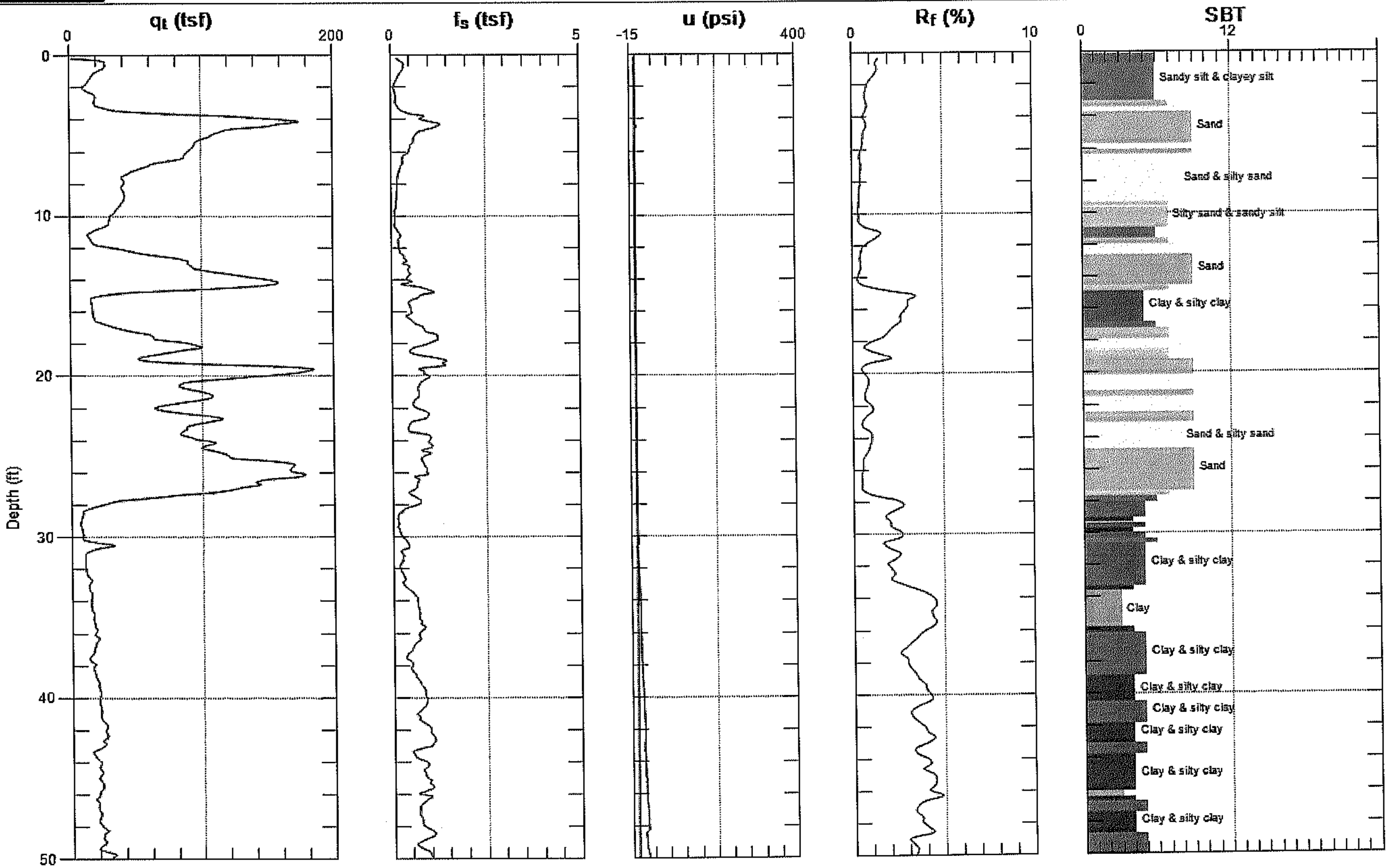
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-2

Engineer: M.KLEAMES
Date: 5/1/2008 10:21



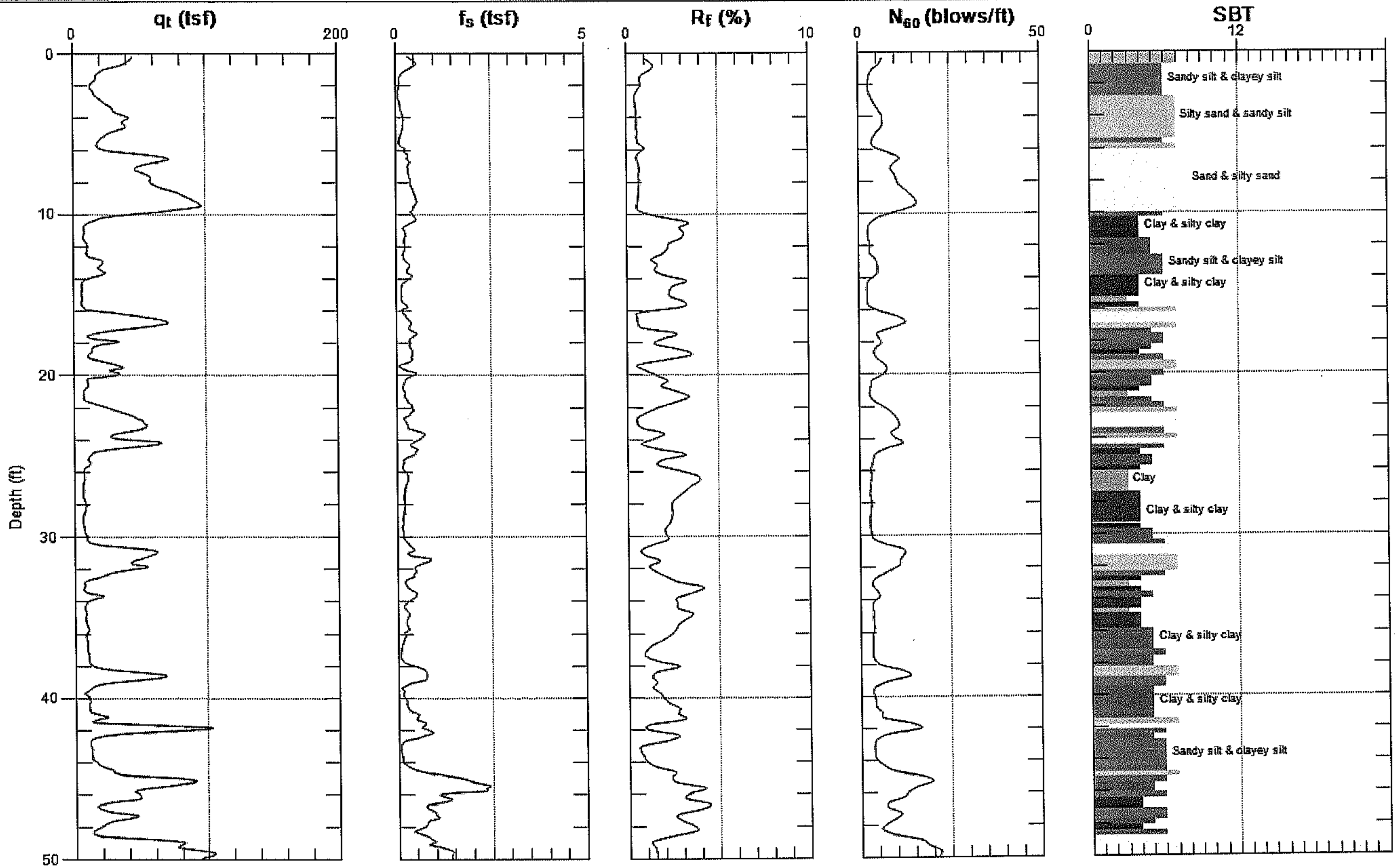
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-3

Engineer: M.KLEAMES
Date: 5/1/2008 11:07



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

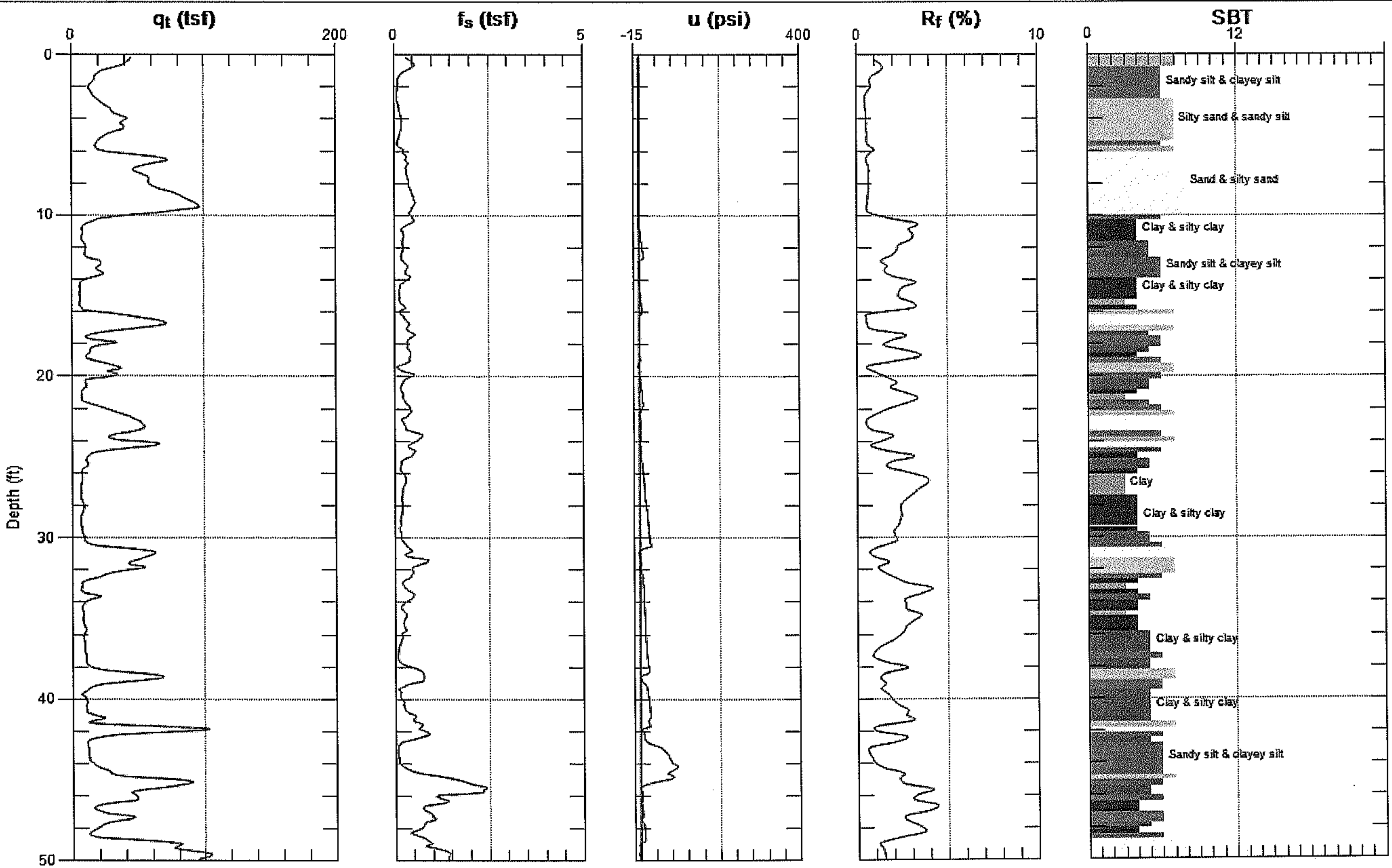
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENG.

Site: ATKINSON LANE **Engineer: M.KLEAMES**

Sounding: CPT-3 **Date: 5/1/2008 11:07**



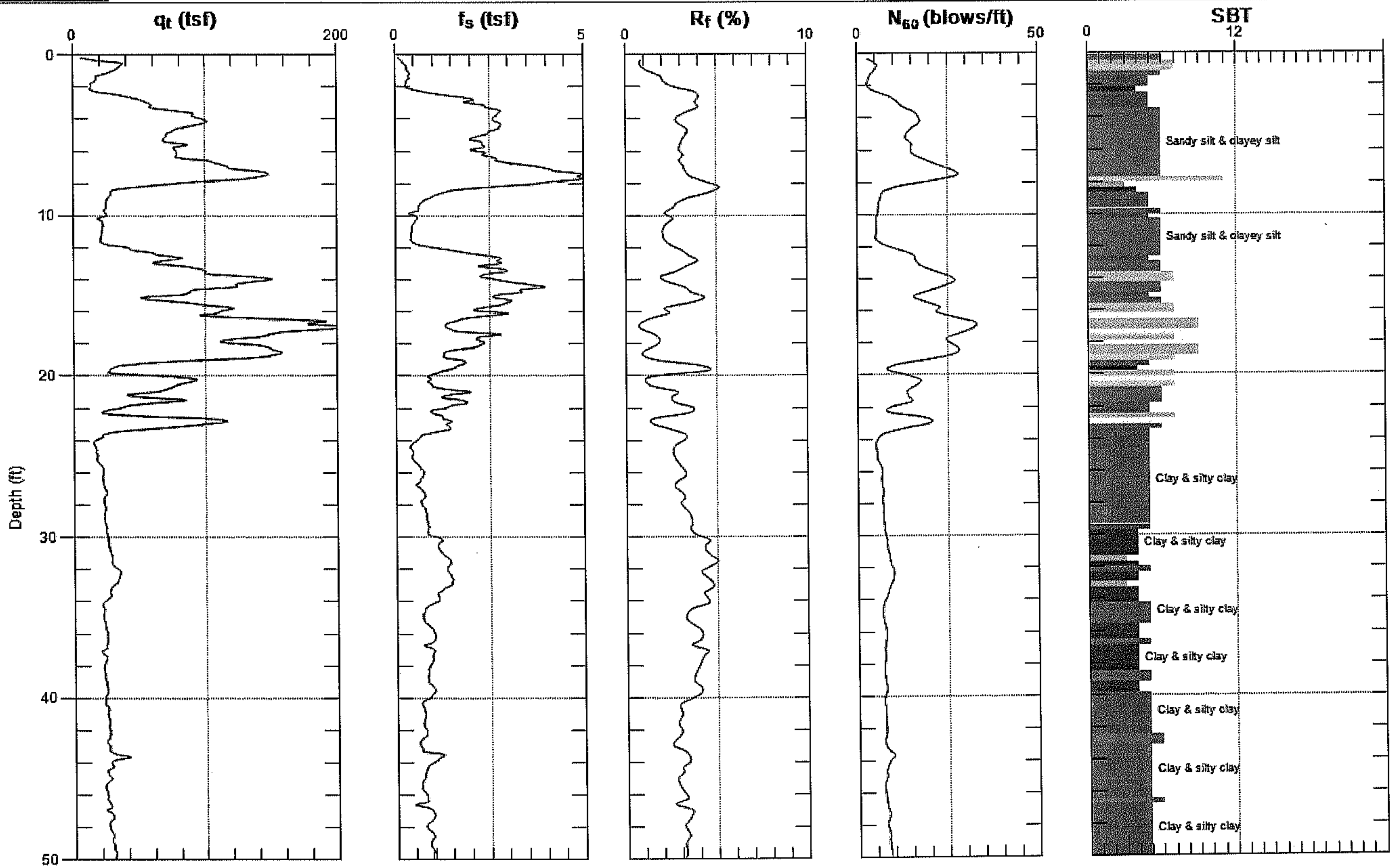
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENG.**

Site: ATKINSON LANE
Sounding: CPT-4

Engineer: M.KLEAMES
Date: 5/1/2008 12:12



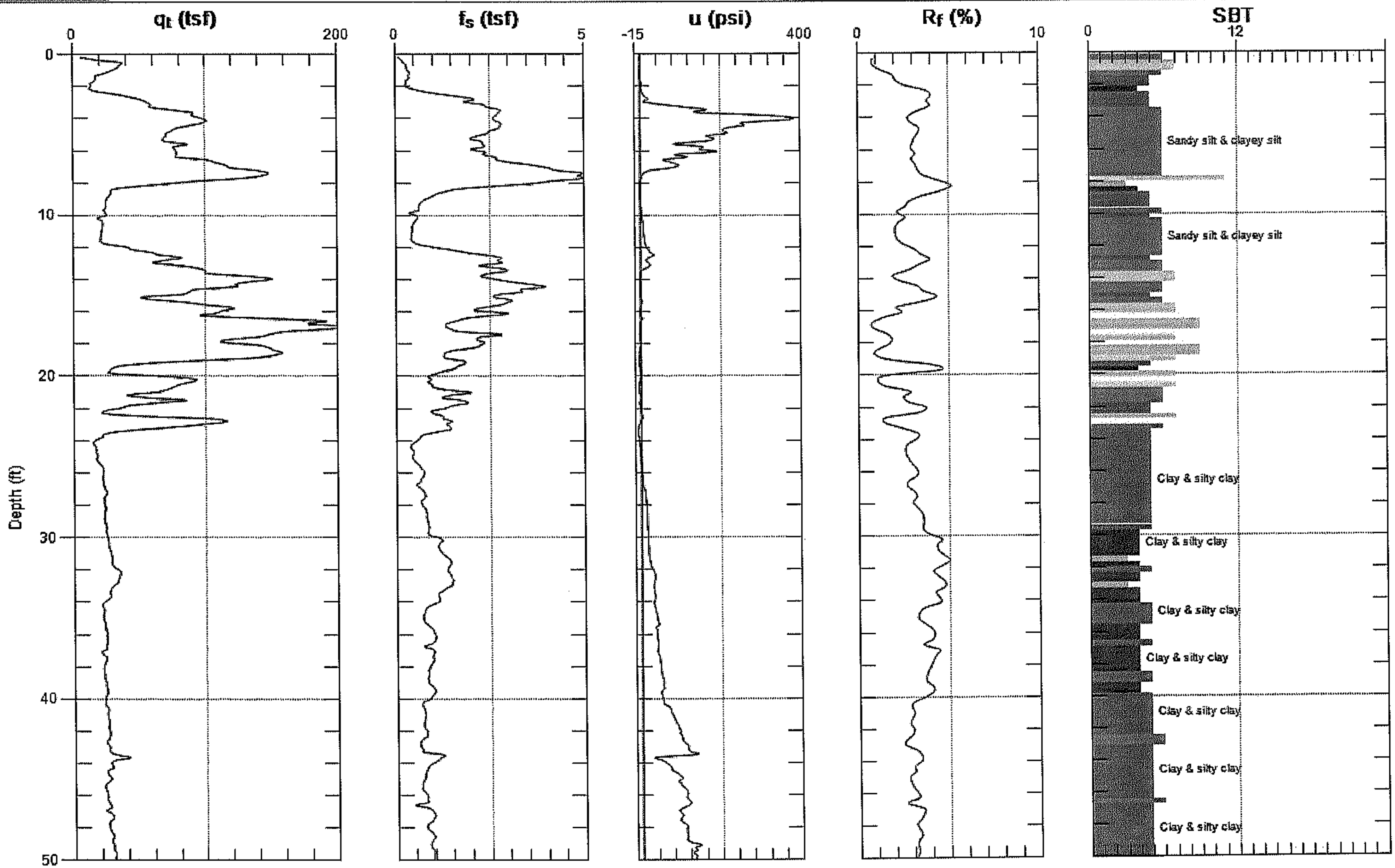
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-4

Engineer: M.KLEAMES
Date: 5/1/2008 12:12



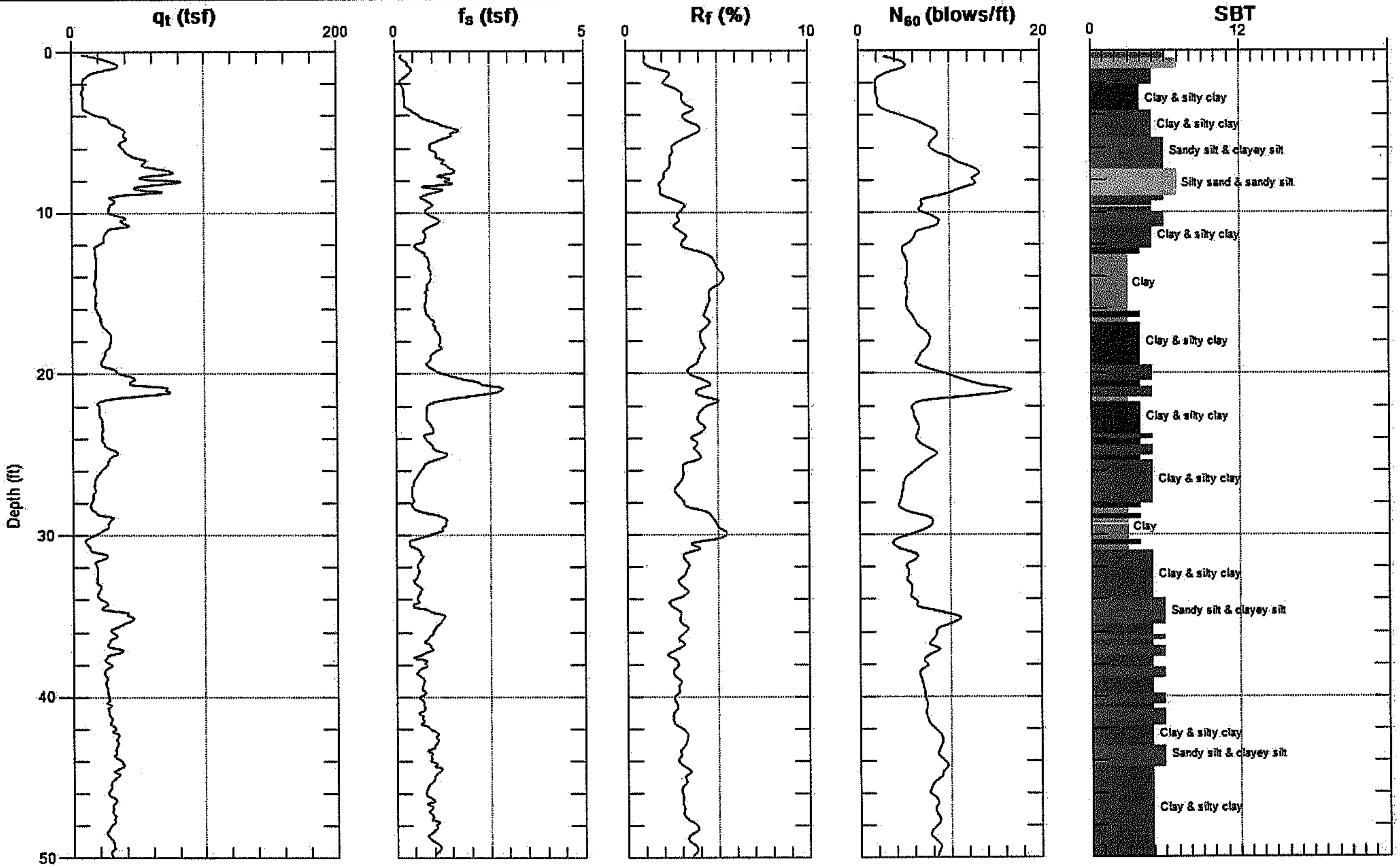
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-5

Engineer: E.MITCHELL
Date: 2/12/2009 09:40



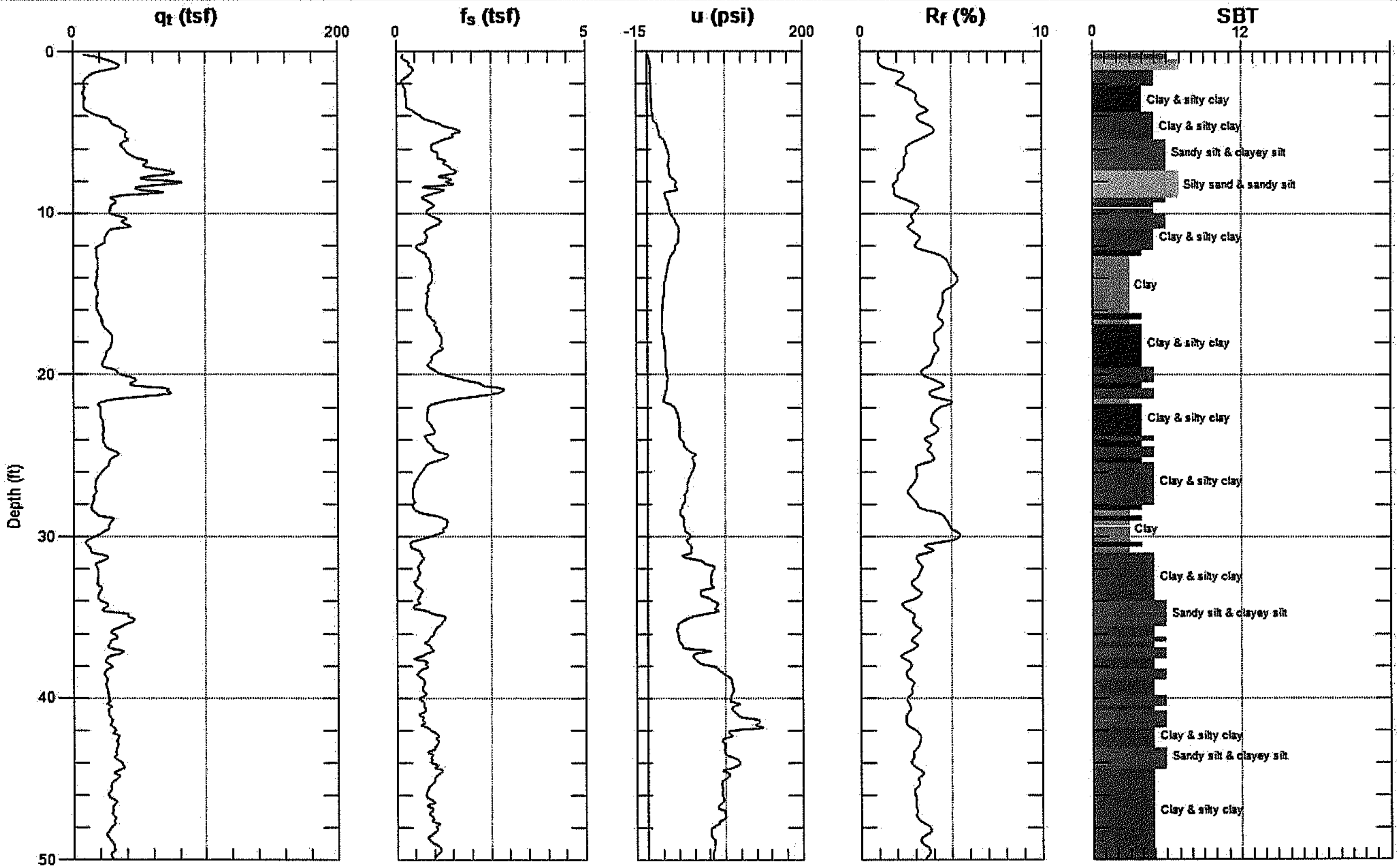
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-5

Engineer: E.MITCHELL
Date: 2/12/2009 09:40



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

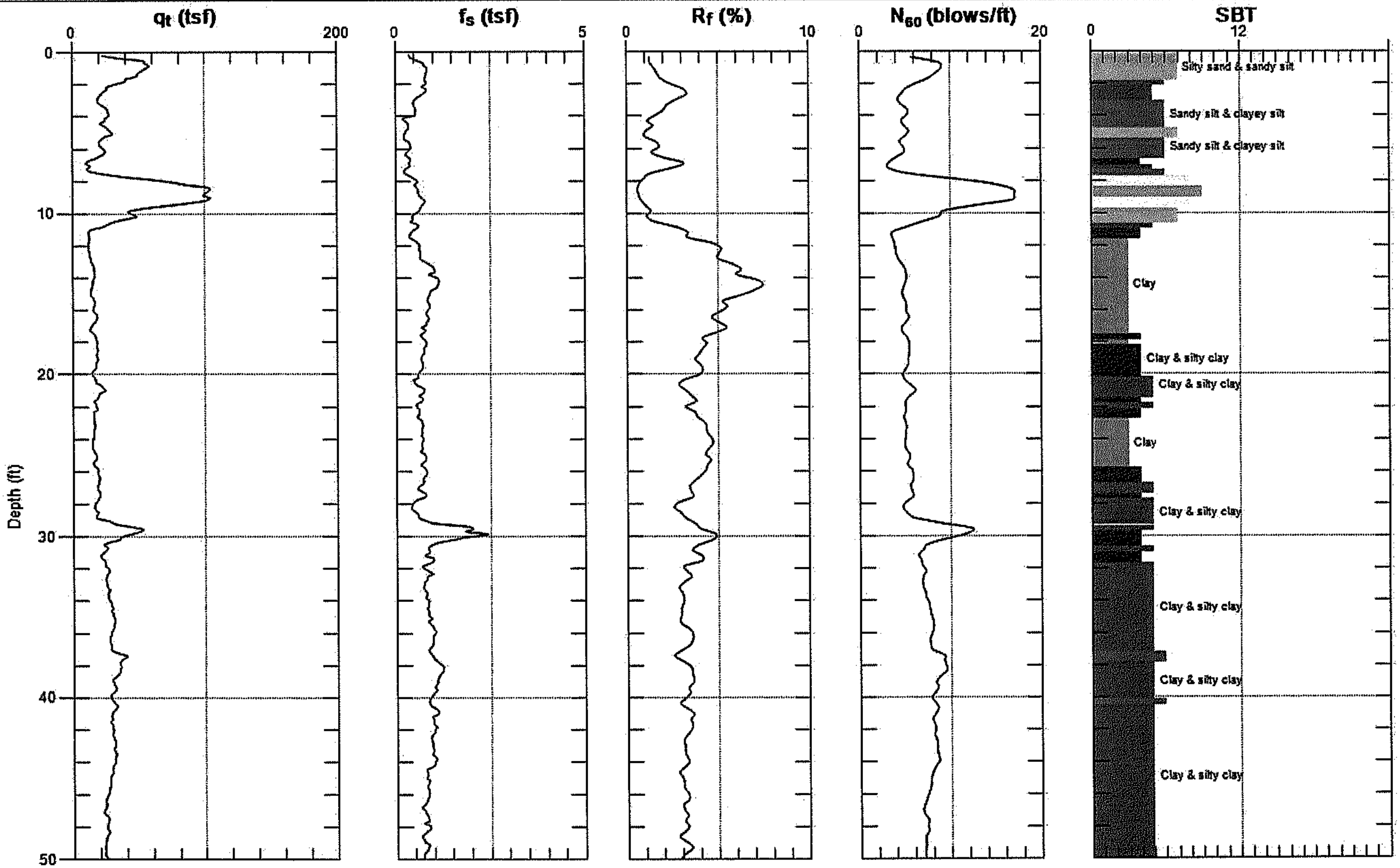
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-6

Engineer: E.MITCHELL
Date: 2/12/2009 10:30



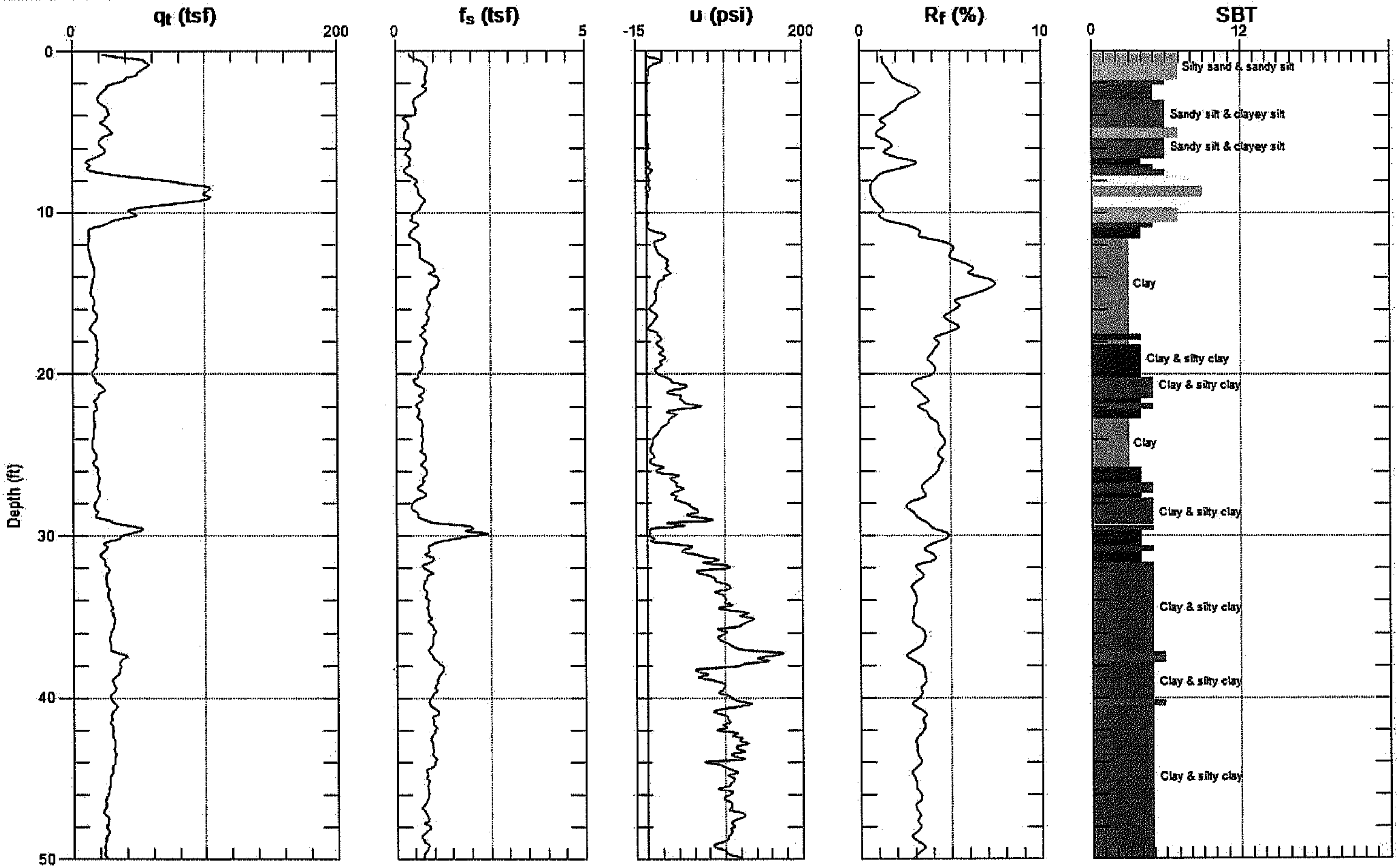
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE **Engineer: E.MITCHELL**

Sounding: CPT-6 **Date: 2/12/2009 10:30**



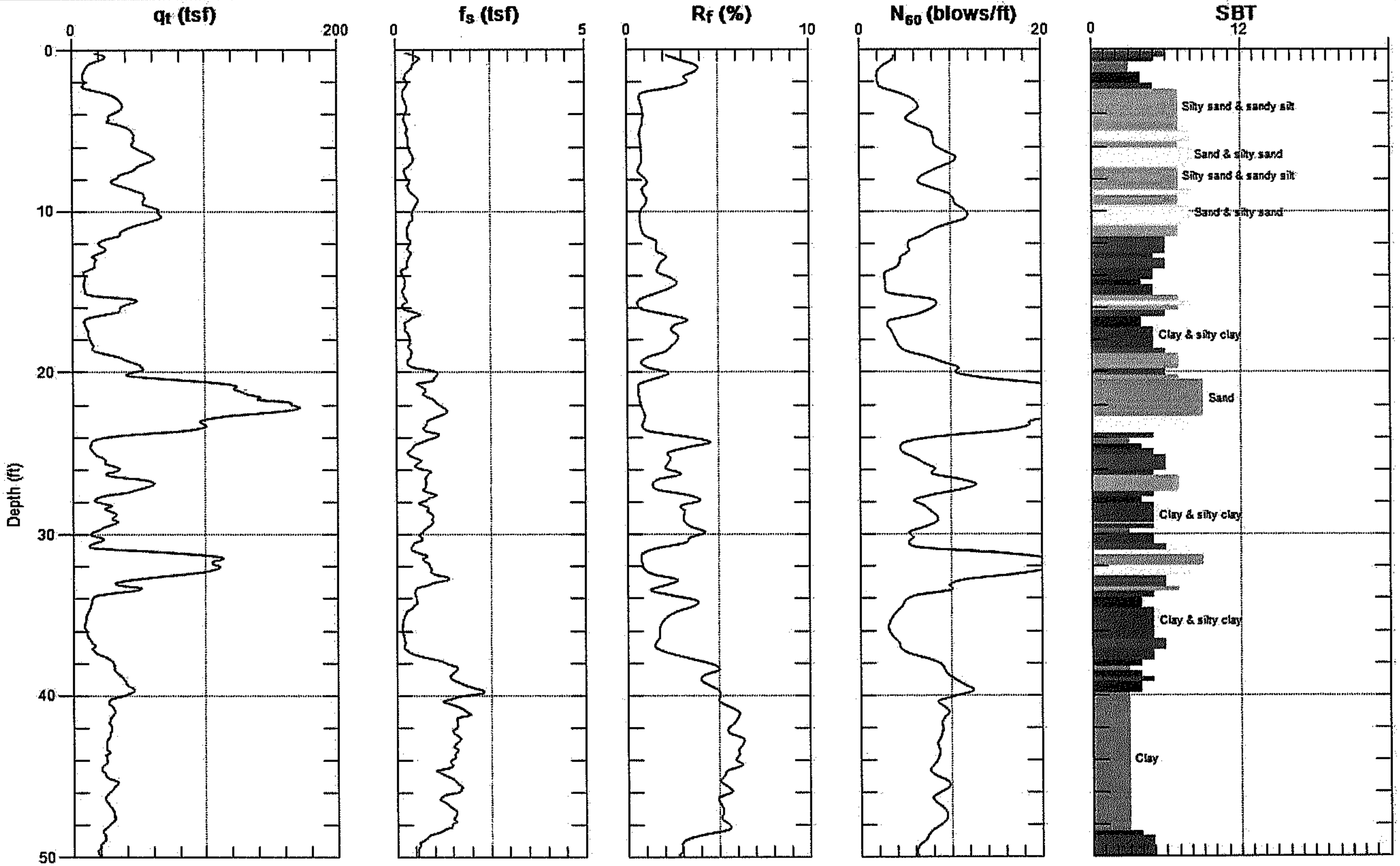
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-7

Engineer: E.MITCHELL
Date: 2/12/2009 11:34



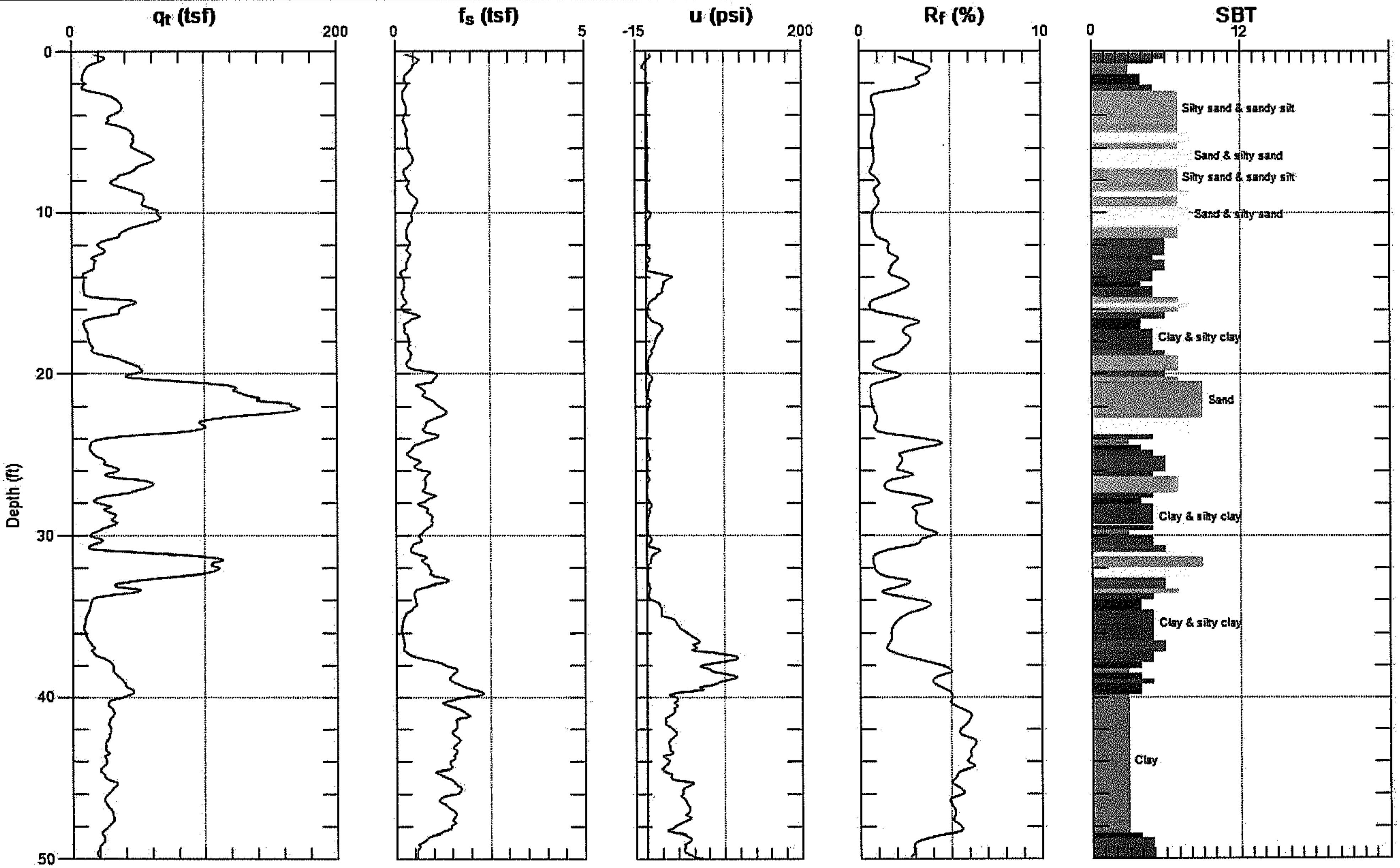
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-7

Engineer: E.MITCHELL
Date: 2/12/2009 11:34



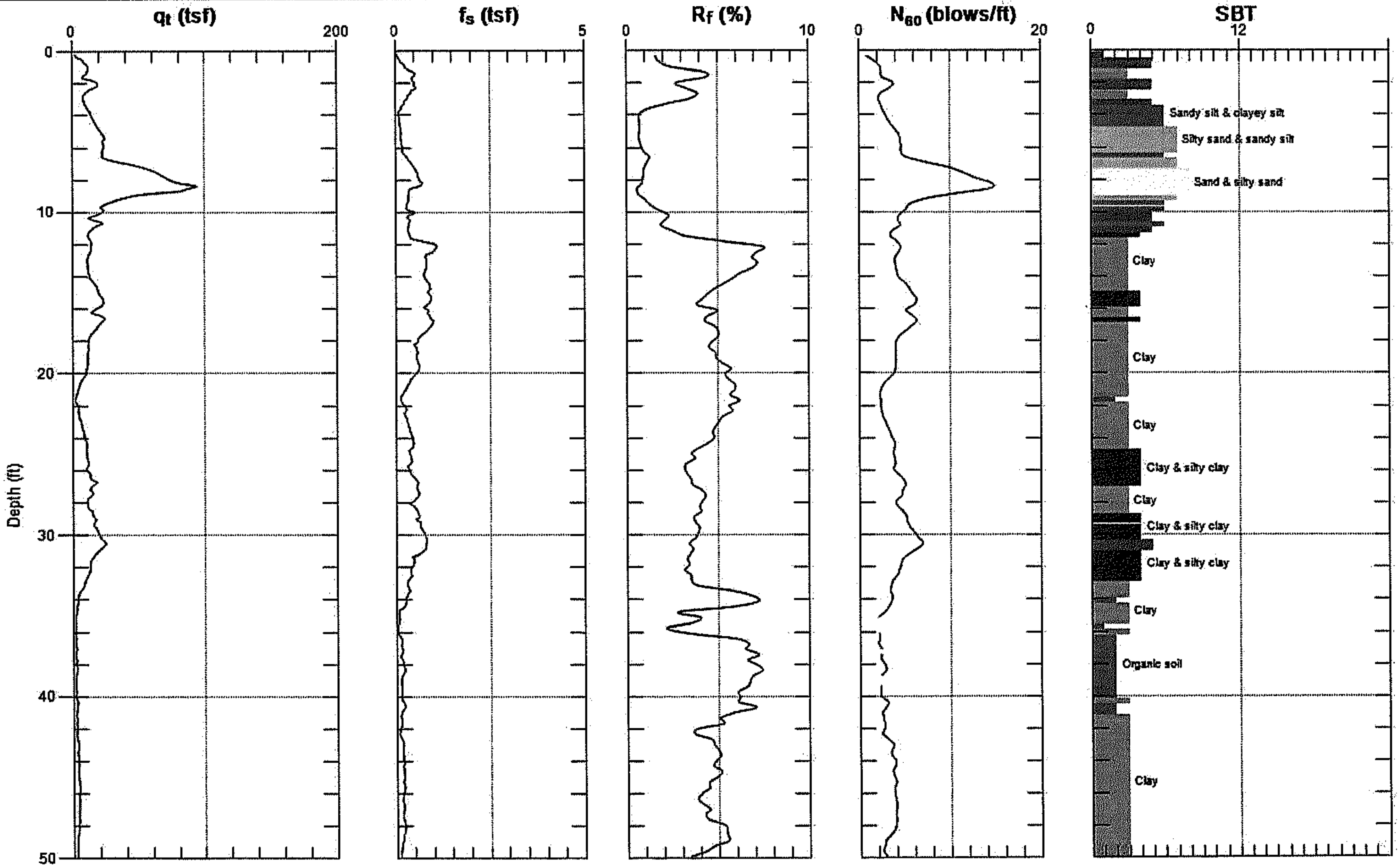
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-8

Engineer: E.MITCHELL
Date: 2/12/2009 12:56



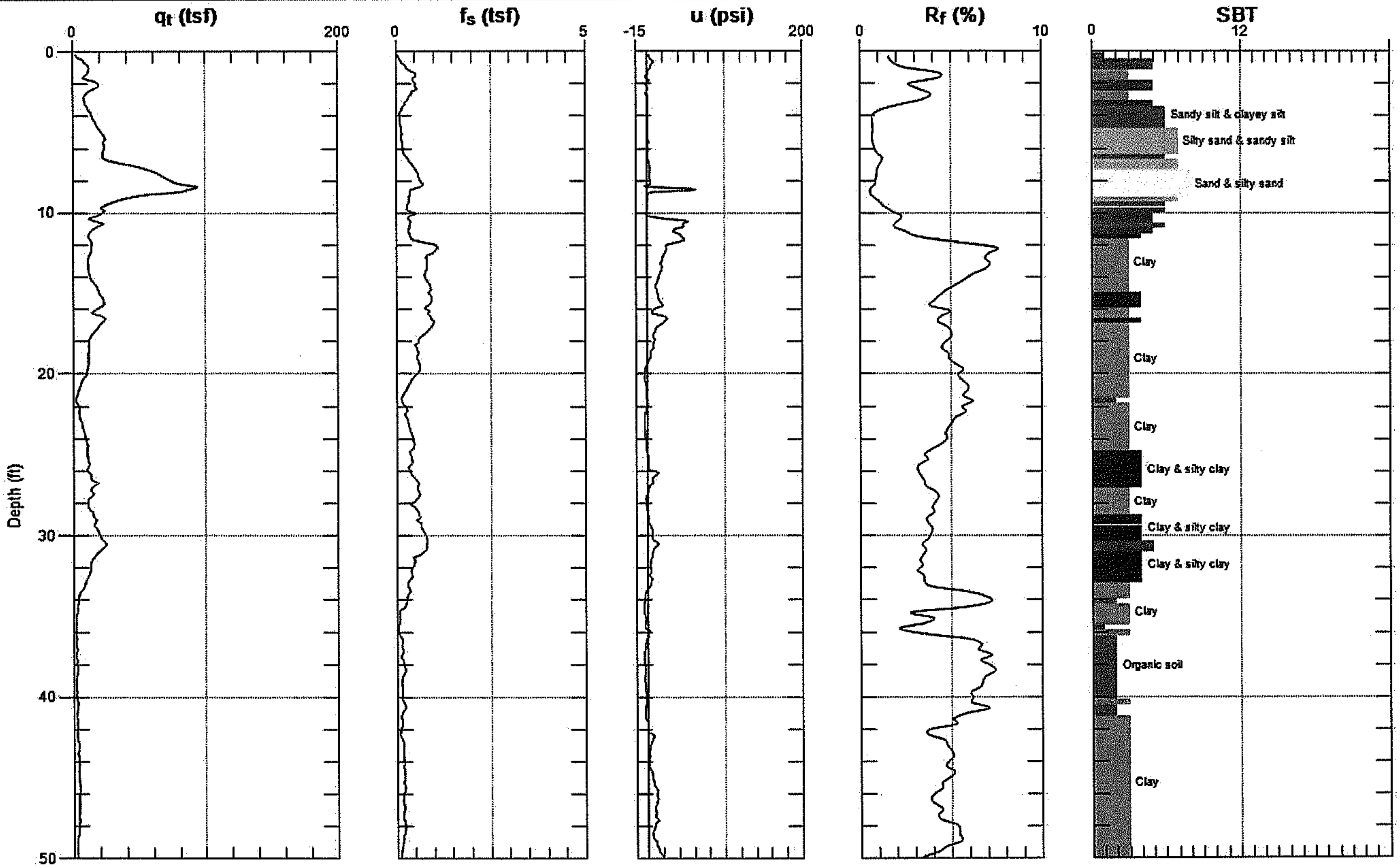
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-8

Engineer: E.MITCHELL
Date: 2/12/2009 12:56



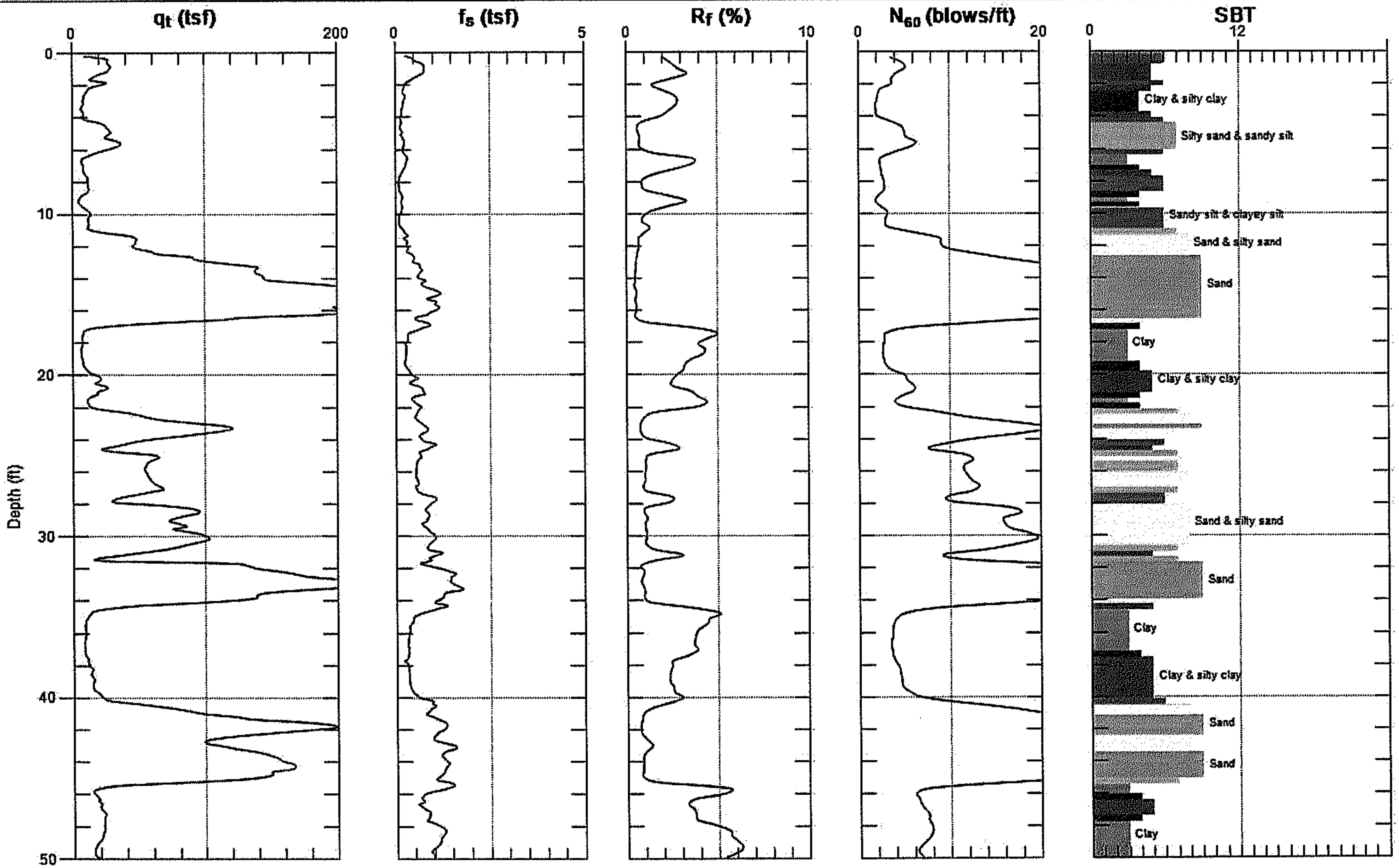
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-9

Engineer: E.MITCHELL
Date: 2/12/2009 01:53

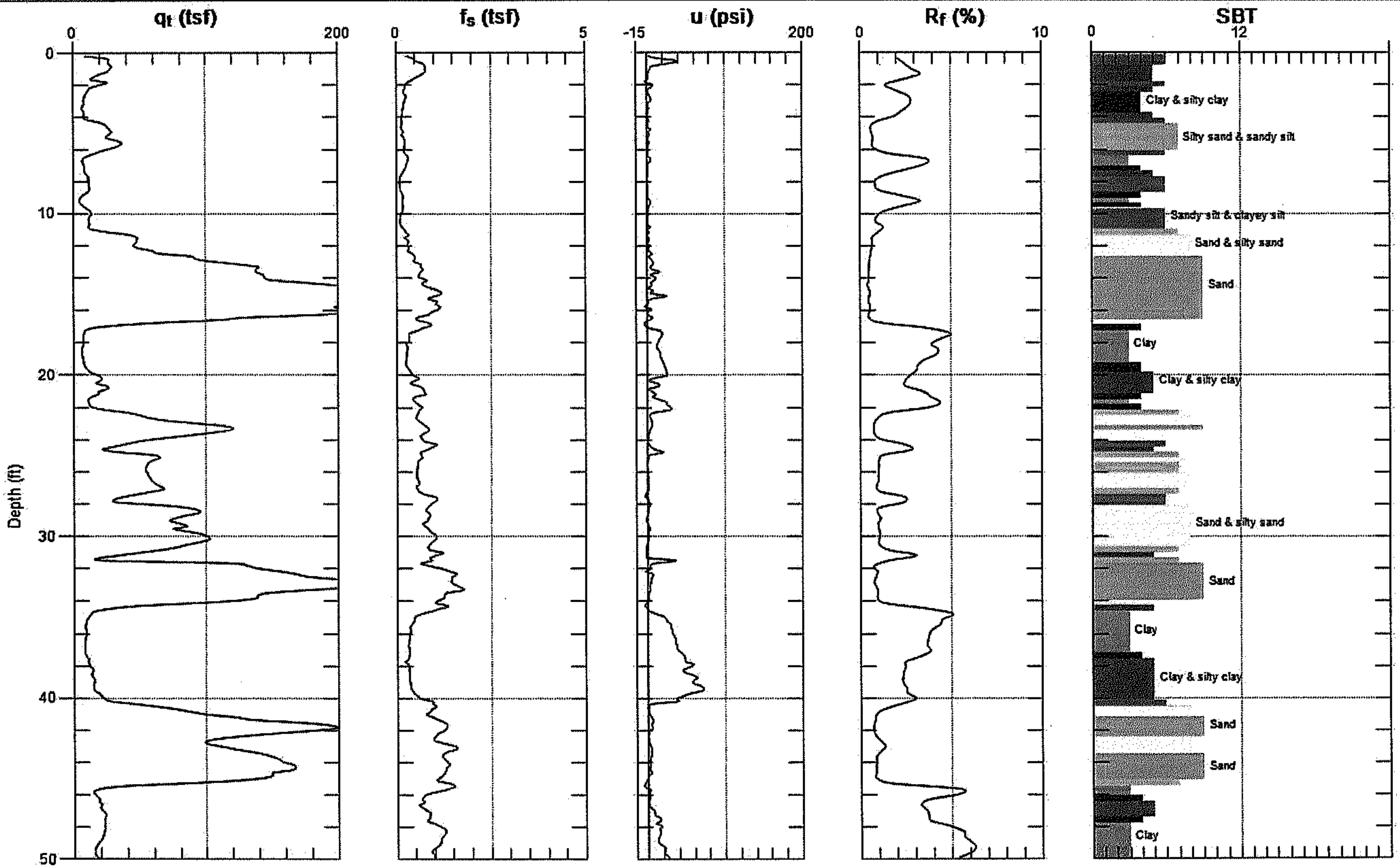


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-9
Engineer: E.MITCHELL
Date: 2/12/2009 01:53

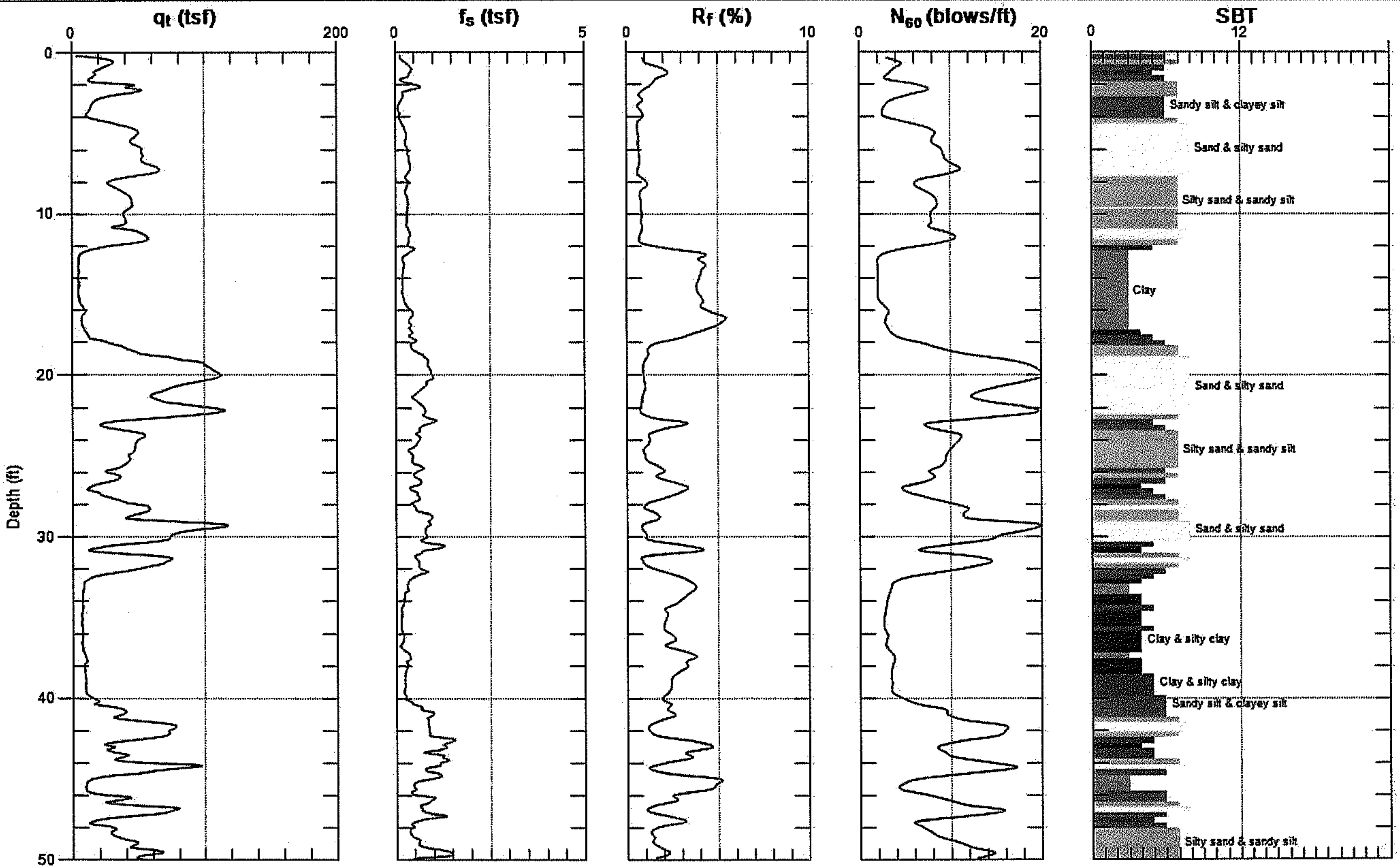


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-10 | Date: 2/12/2009 02:42



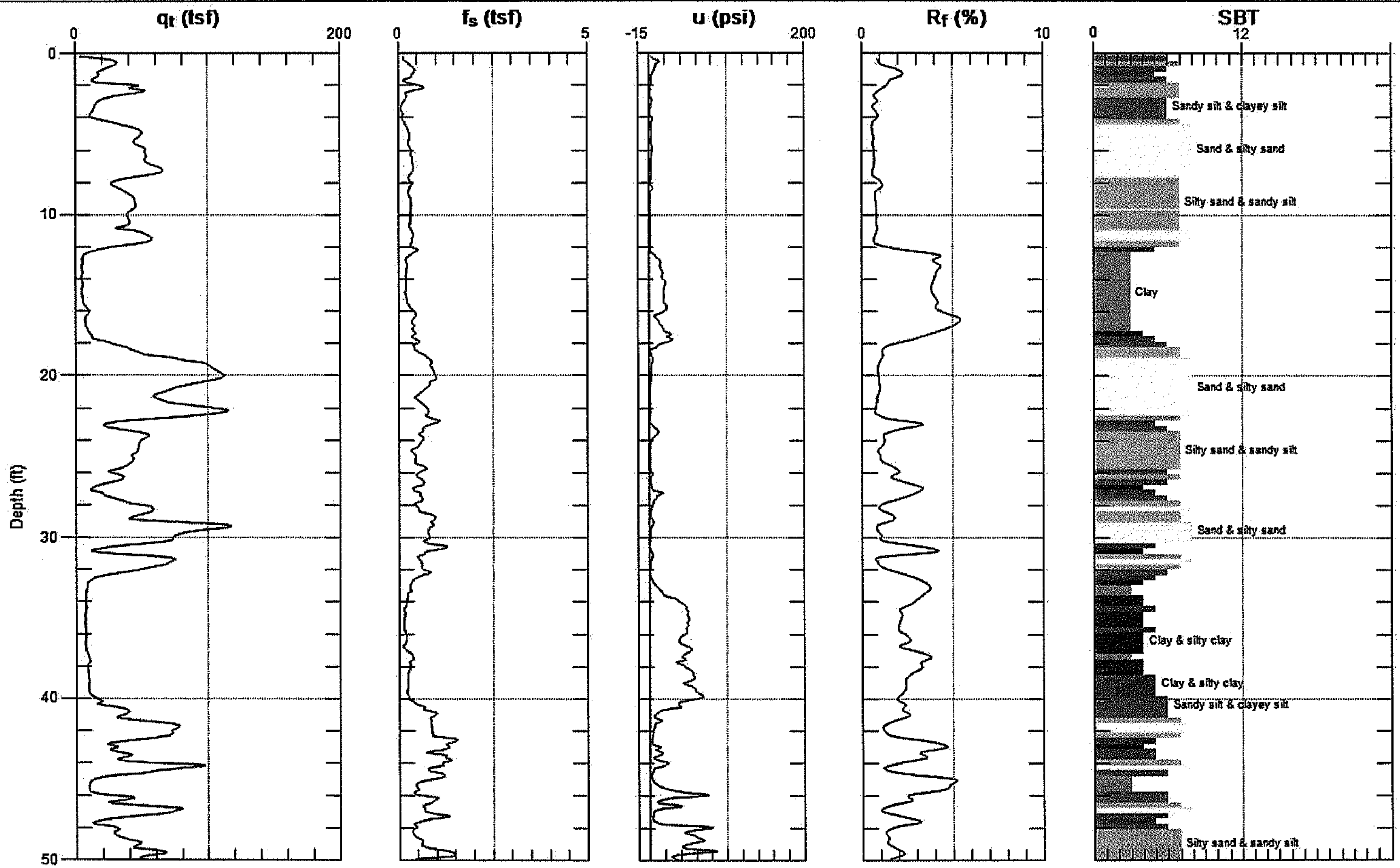
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-10

Engineer: E.MITCHELL
Date: 2/12/2009 02:42



Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

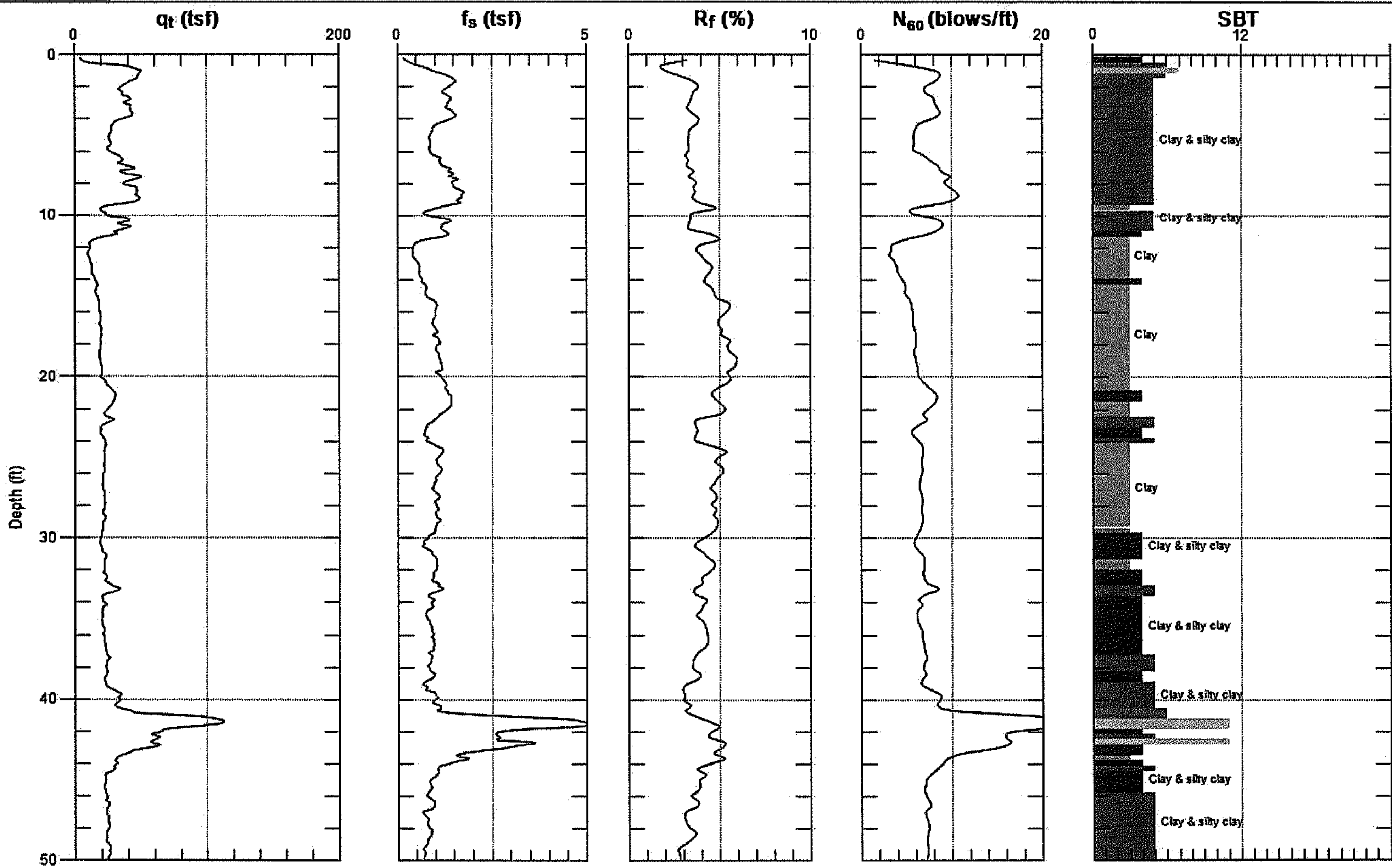
PACIFIC CREST ENGINEERING

Site: ATKINSON LANE

Sounding: CPT-11

Engineer: E.MITCHELL

Date: 2/12/2009 03:42



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

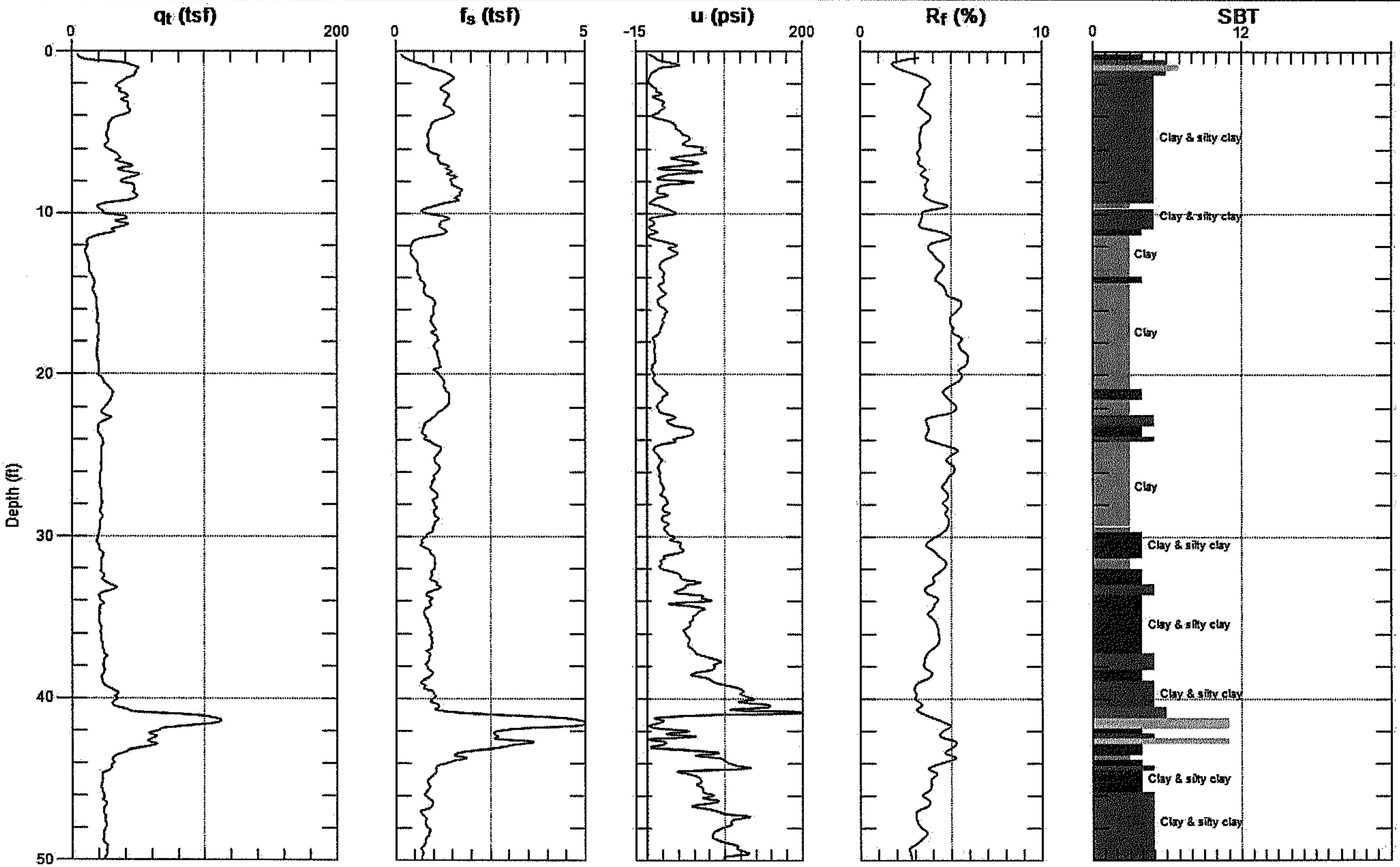
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-11

Engineer: E.MITCHELL
Date: 2/12/2009 03:42



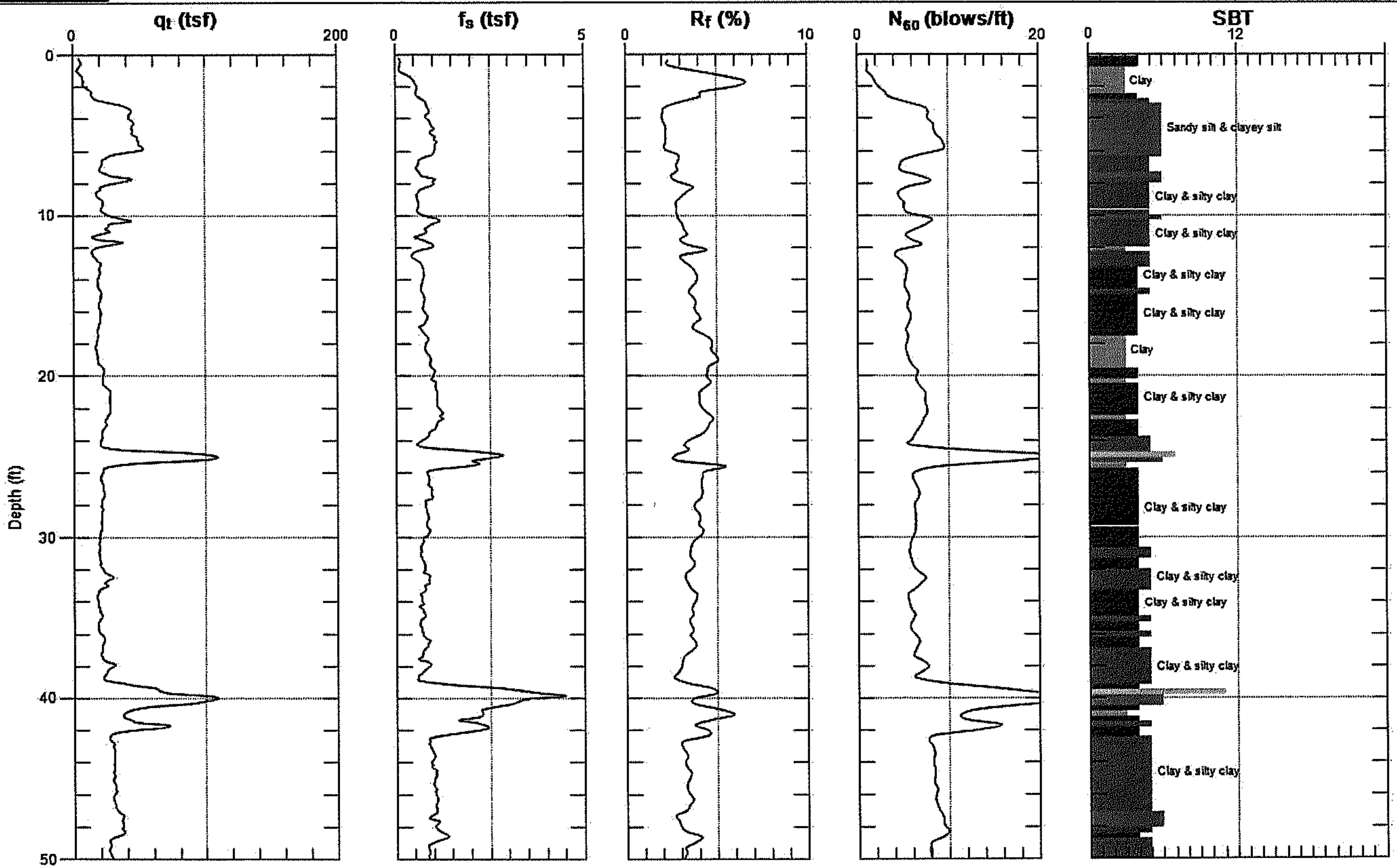
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12

Engineer: E.MITCHELL
Date: 2/12/2009 04:40



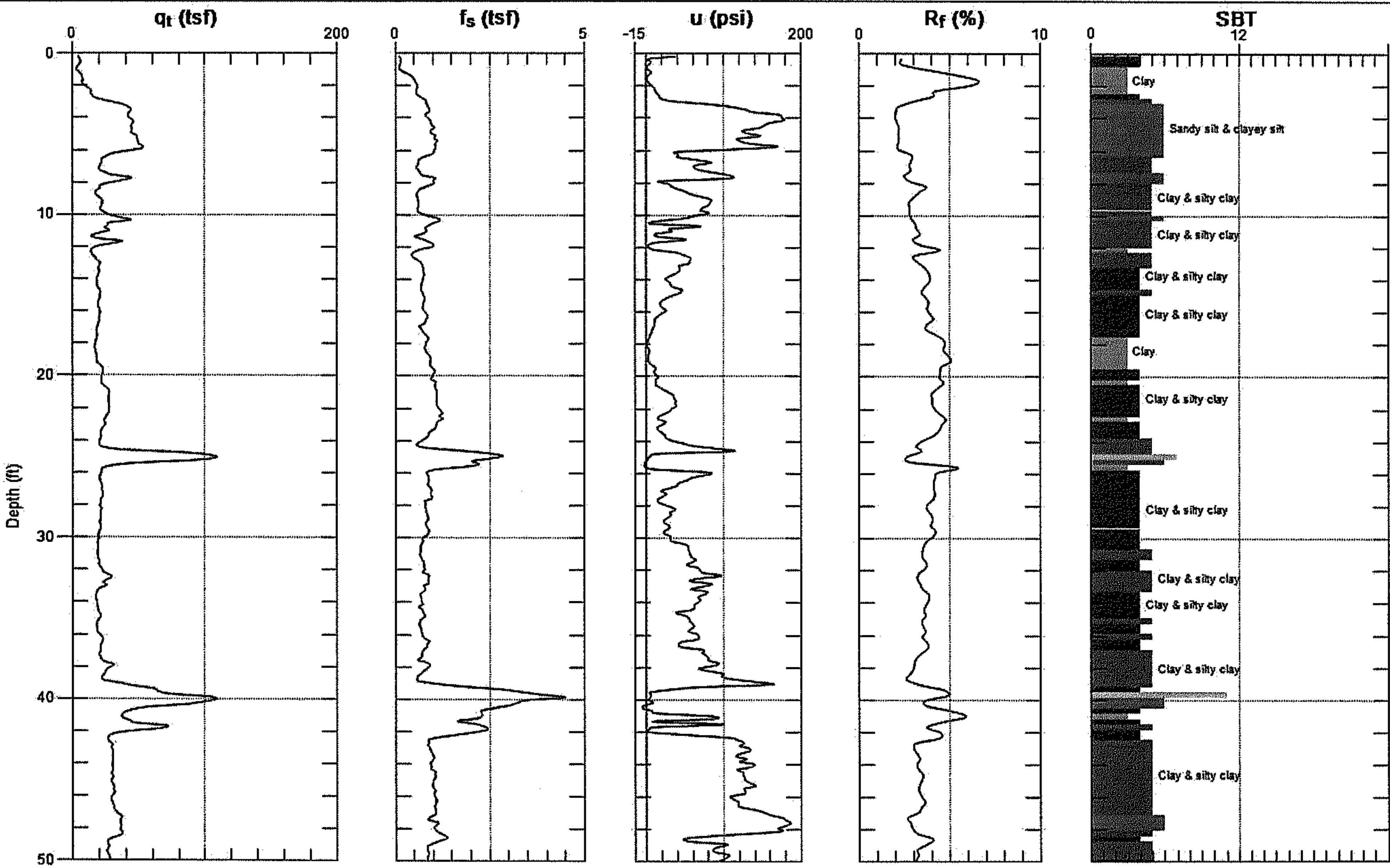
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12

Engineer: E.MITCHELL
Date: 2/12/2009 04:40



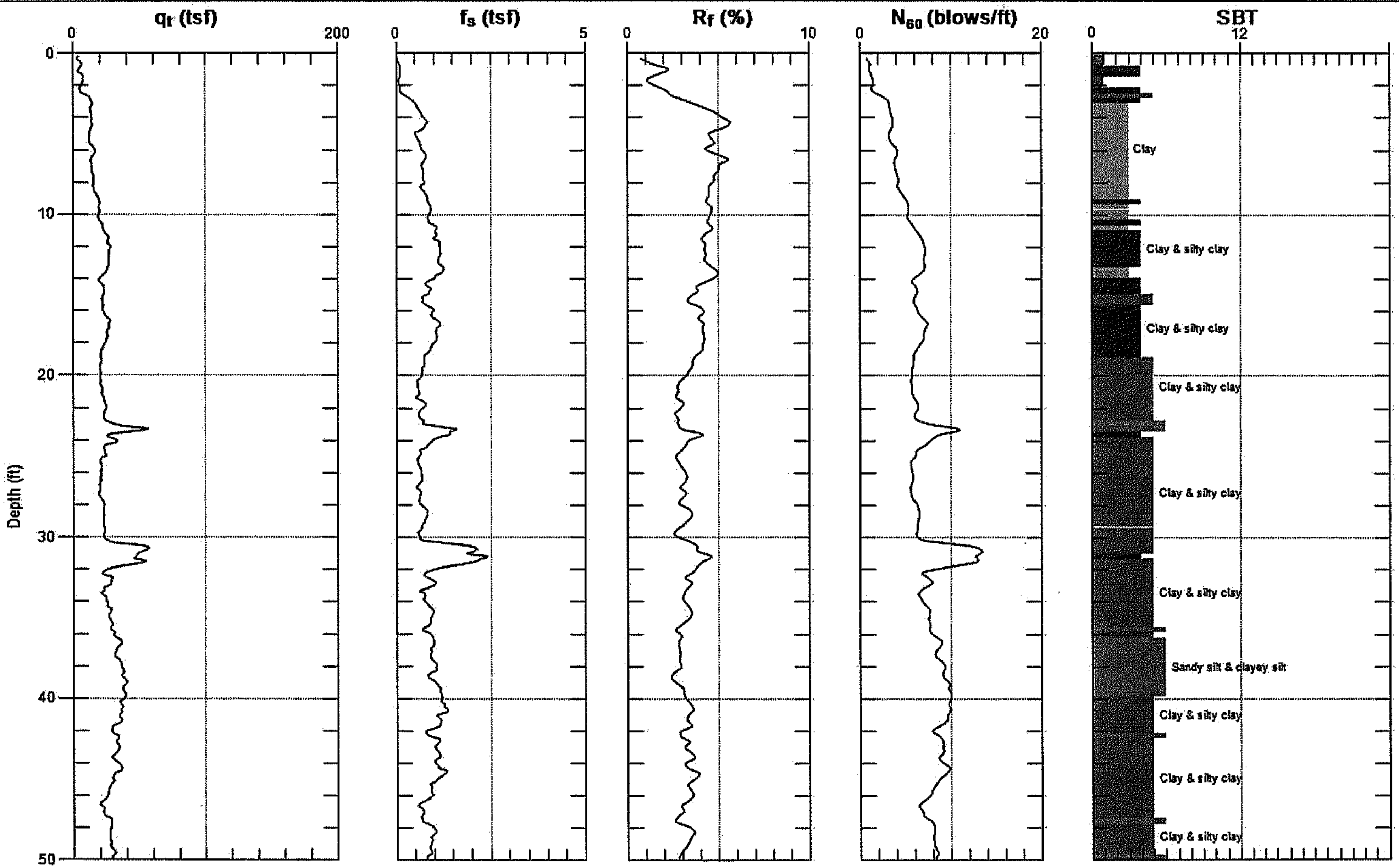
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-13

Engineer: E.MITCHELL
Date: 2/13/2009 08:13



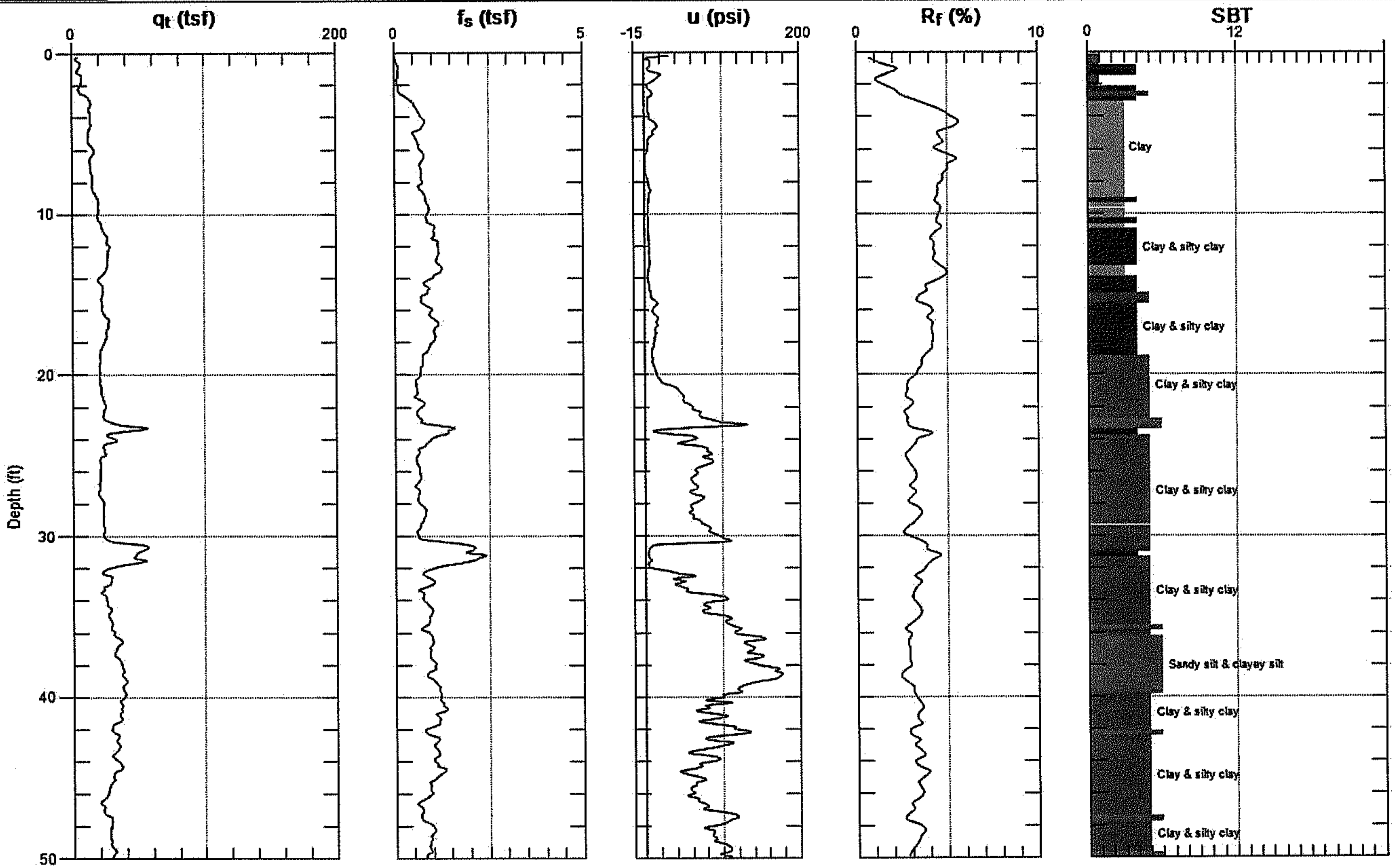
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-13

Engineer: E.MITCHELL
Date: 2/13/2009 08:13



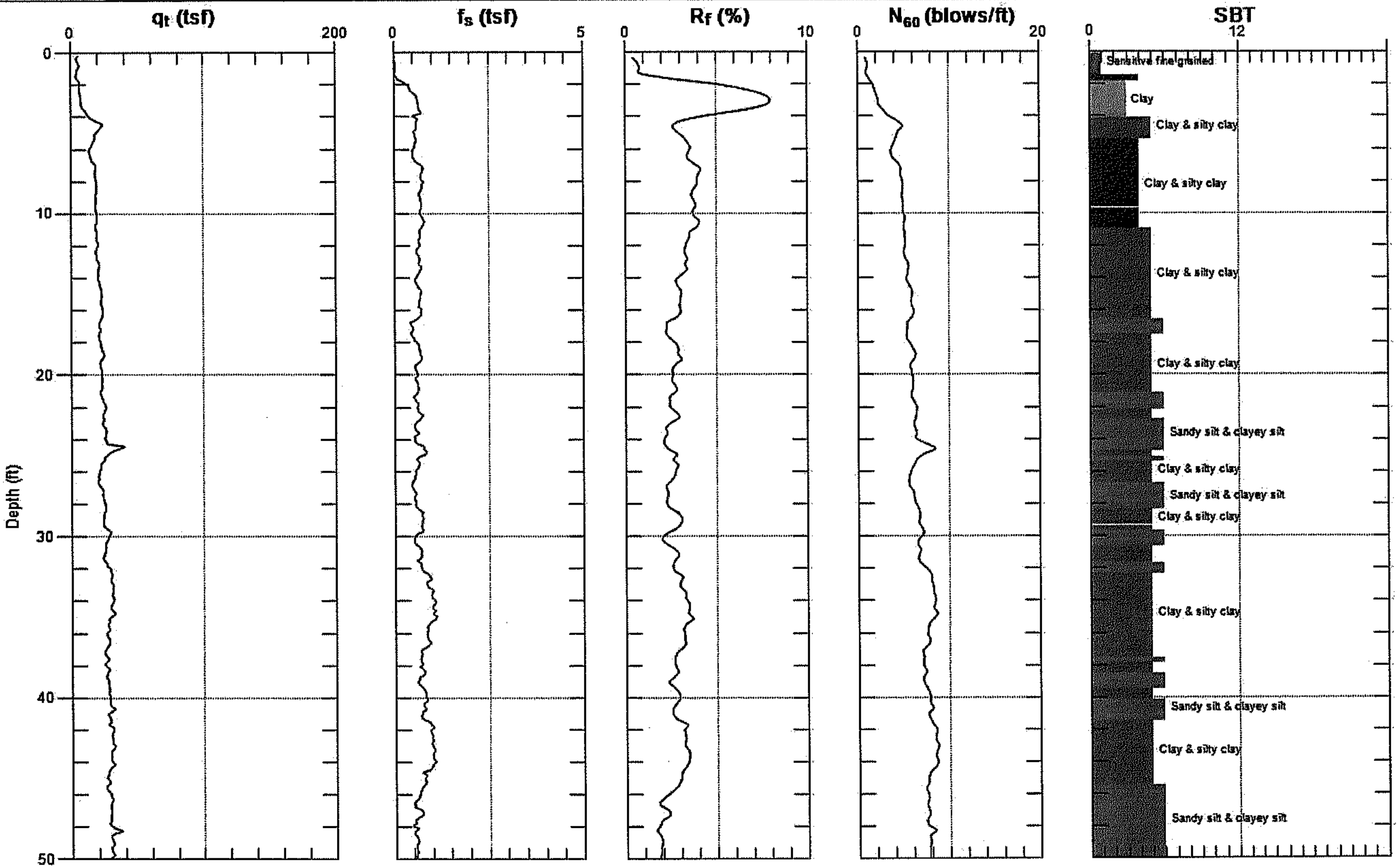
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02



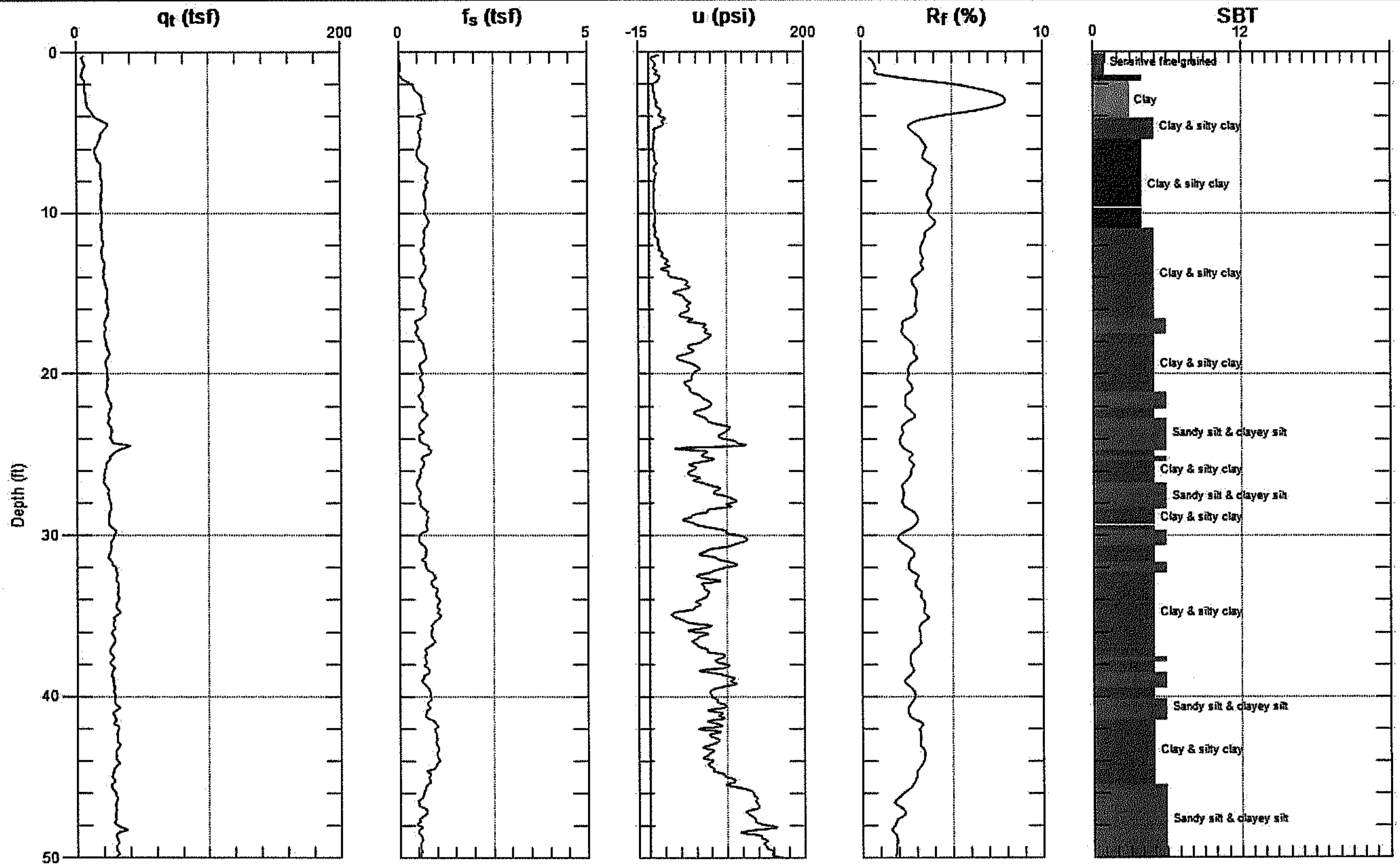
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02



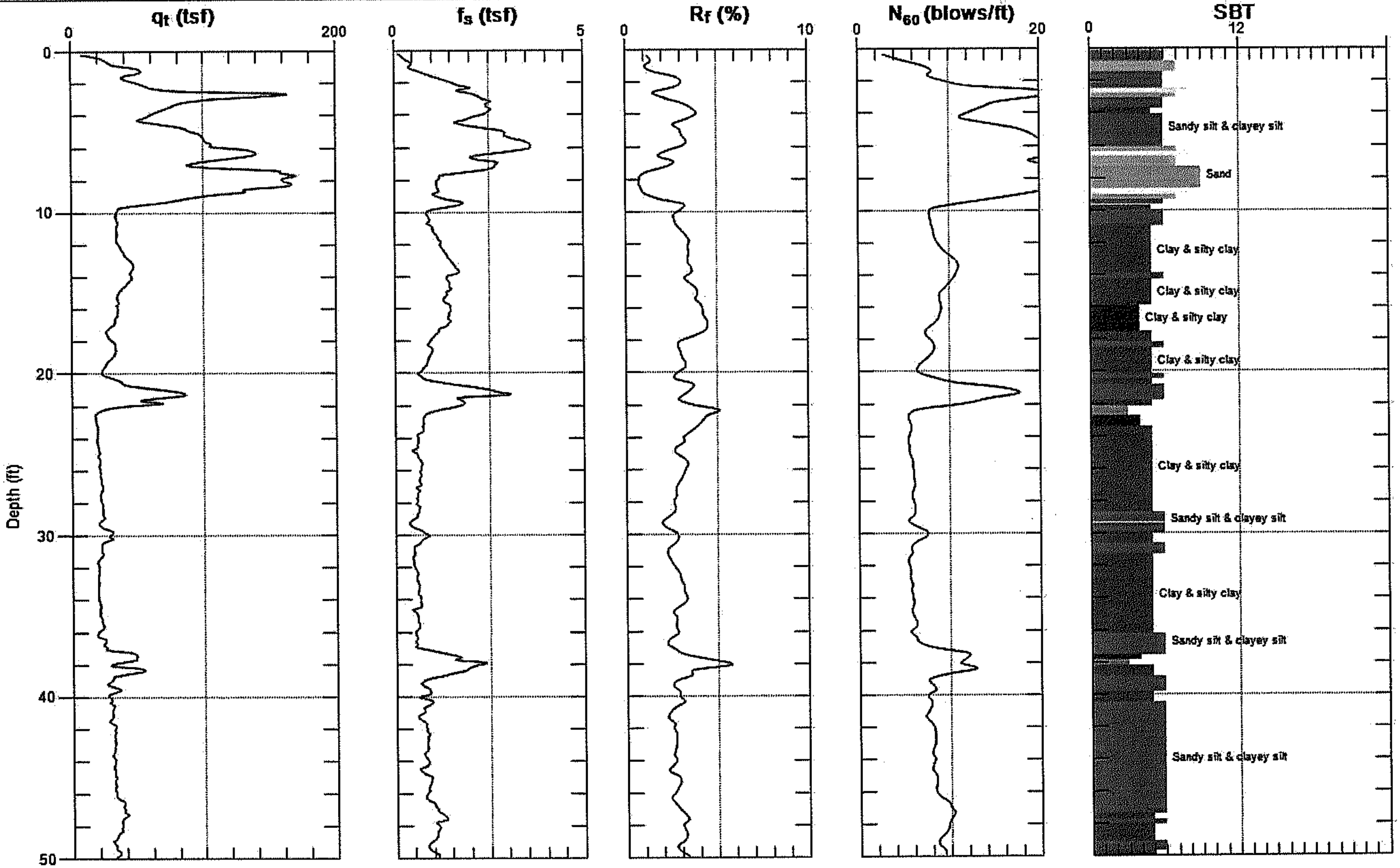
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE **Engineer: E.MITCHELL**

Sounding: CPT-15 **Date: 2/13/2009 09:49**



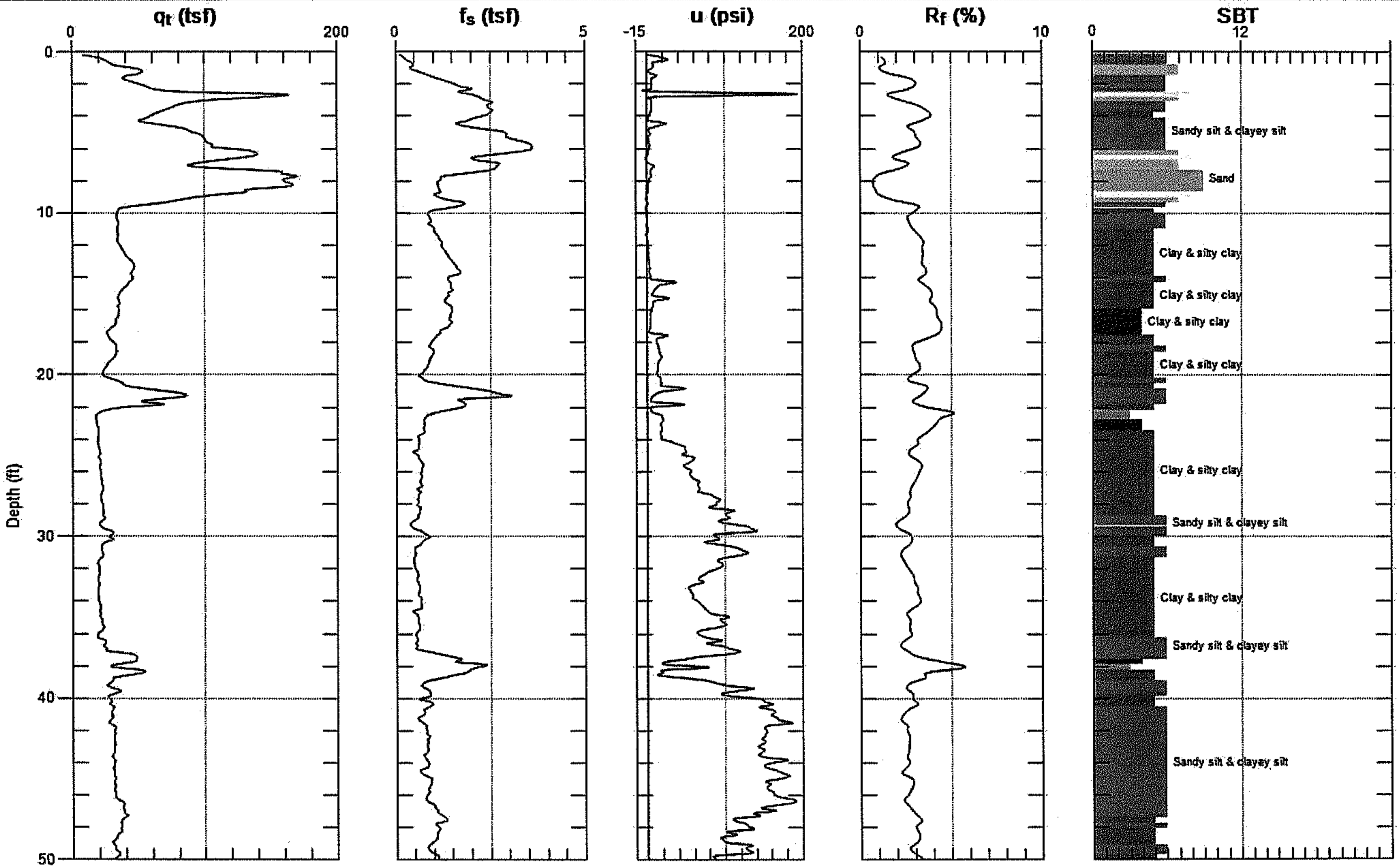
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-15

Engineer: E.MITCHELL
Date: 2/13/2009 09:49



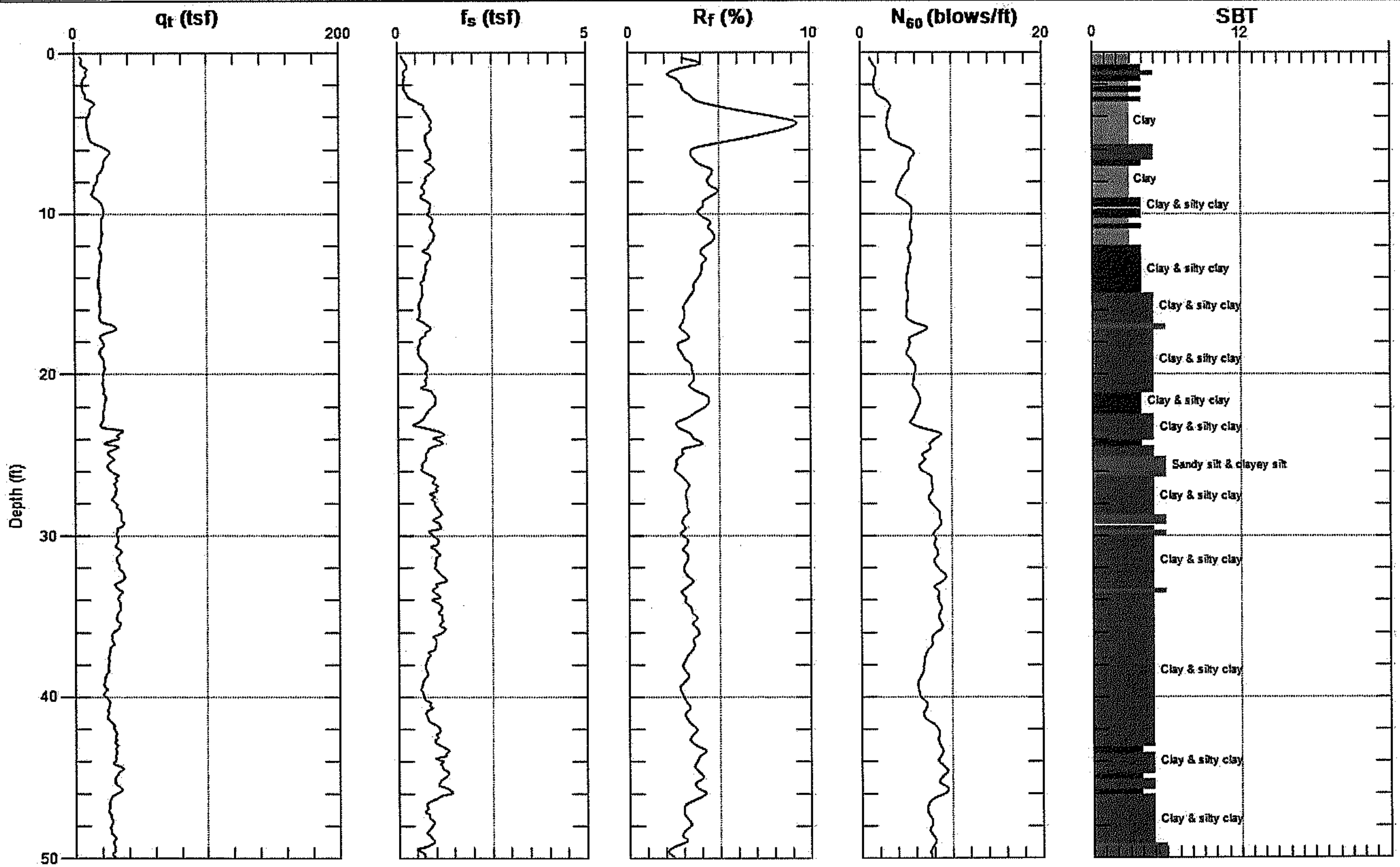
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-16

Engineer: E.MITCHELL
Date: 2/13/2009 11:18



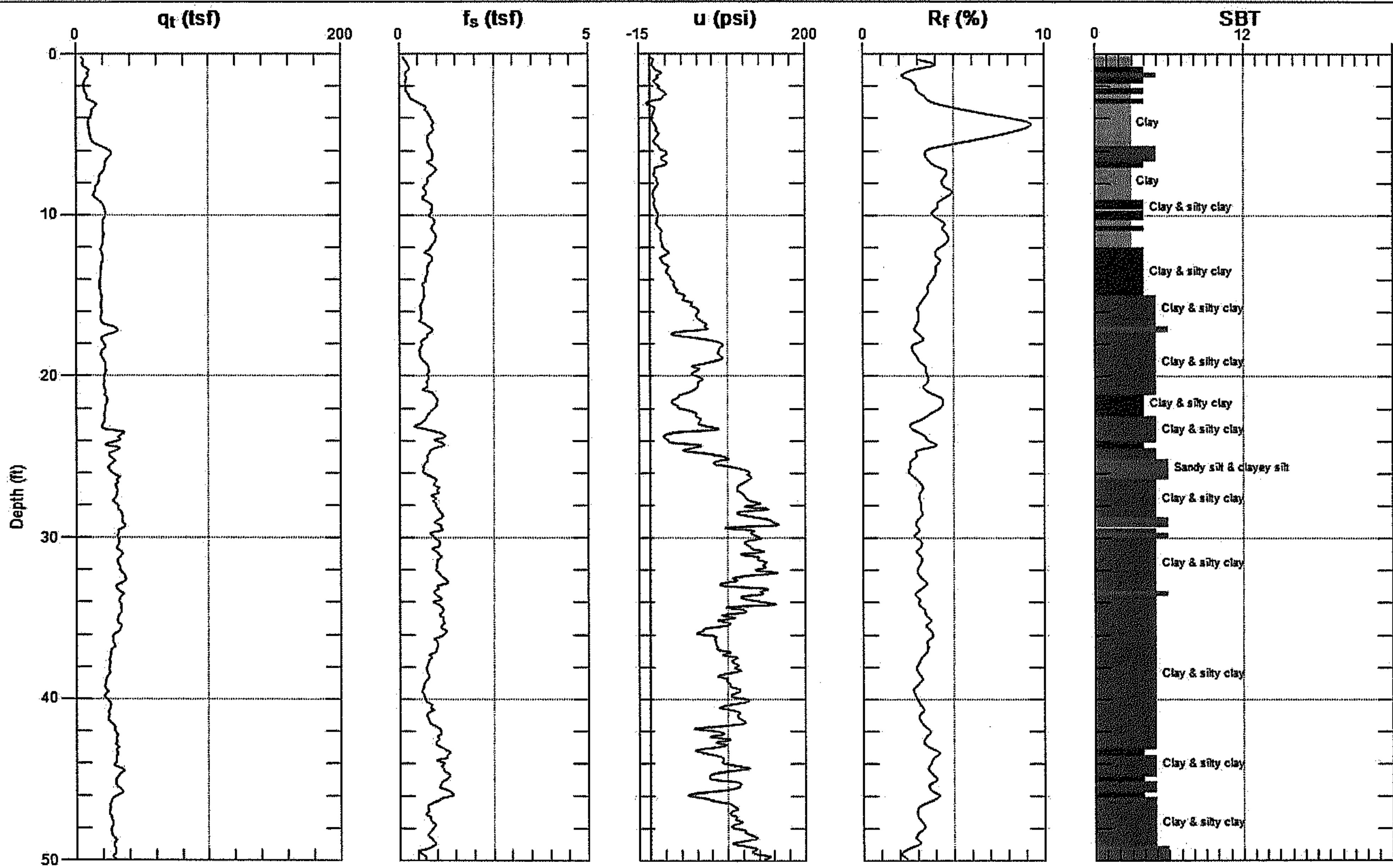
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-16

Engineer: E.MITCHELL
Date: 2/13/2009 11:18



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

February 16, 2009

Pacific Crest Engineering
Attn: Elizabeth Mitchell
444 Airport Blvd., Suite 106
Watsonville, California 95076

Subject: CPT Site Investigation
Atkinson Lane
Watsonville, California
GREGG Project Number: 09-021MA

Dear Ms. Mitchell:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	Resistivity Cone Penetration Tests	(RCPTU)	☐
5	UVOST Laser Induced Fluorescence	(UVOST)	☐
6	Groundwater Sampling	(GWS)	☐
7	Soil Sampling	(SS)	☐
8	Vapor Sampling	(VS)	☐
9	Vane Shear Testing	(VST)	☐
10	SPT Energy Calibration	(SPTE)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (925) 313-5800.

Sincerely,
GREGG Drilling & Testing, Inc.

Mary Walden
Operations Manager

950 Howe Rd • Martinez, California 94553 • (925) 313-5800 • FAX (925) 313-0302
OTHER OFFICES: LOS ANGELES • HOUSTON • SOUTH CAROLINA
www.greggdrilling.com

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)
CPT-05	2/12/09	50	-	-	-
CPT-06	2/12/09	50	-	-	-
CPT-07	2/12/09	50	-	-	15.9, 21.5, 31.7
CPT-08	2/12/09	50	-	-	-
CPT-09	2/12/09	50	-	-	27.1
CPT-10	2/12/09	50	-	-	-
CPT-11	2/12/09	50	-	-	-
CPT-12	2/12/09	50	-	-	-
CPT-13	2/13/09	50	-	-	-
CPT-14	2/13/09	50	-	-	-
CPT-15	2/13/09	50	-	-	-
CPT-16	2/13/09	50	-	-	-

Bibliography

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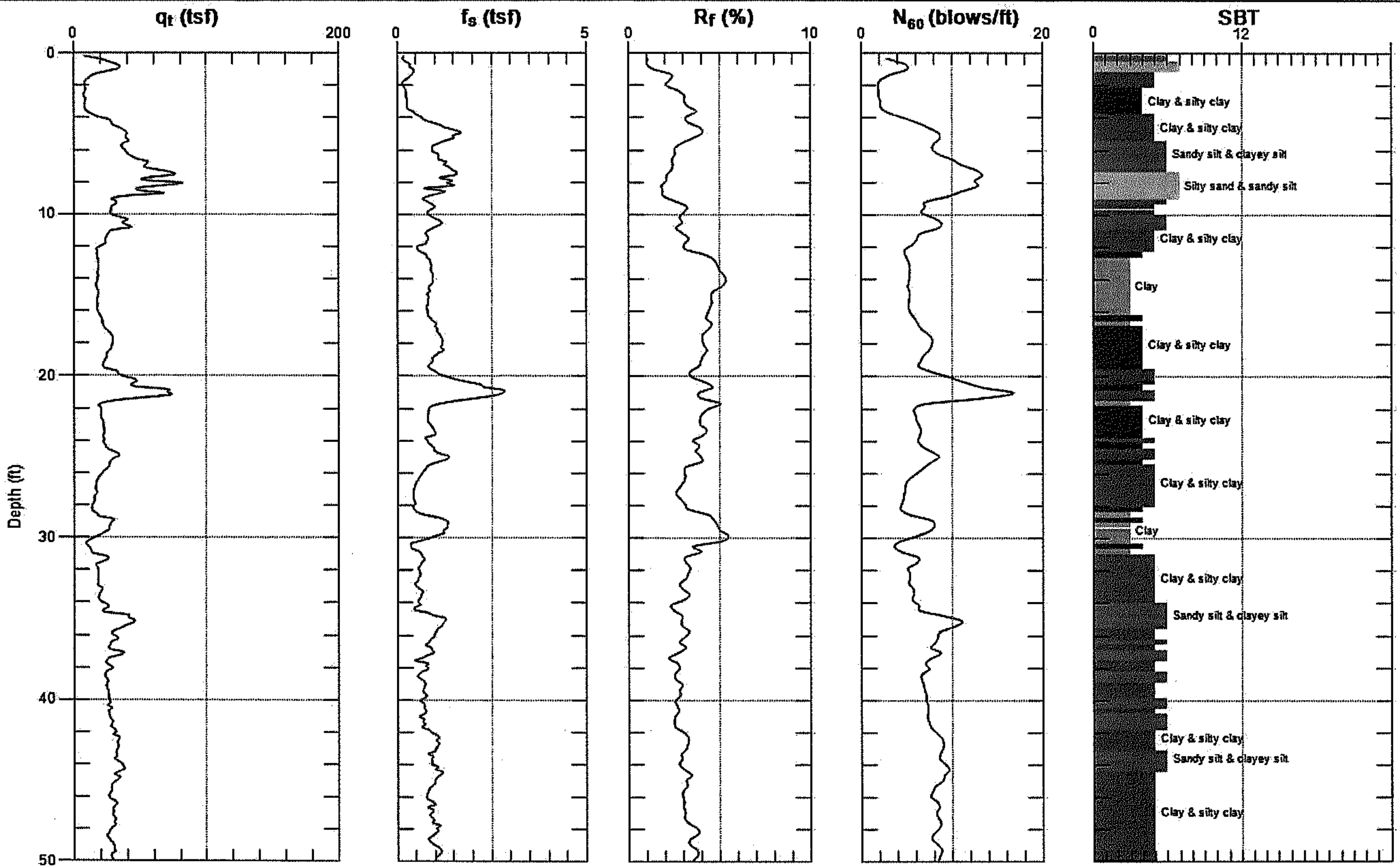
Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

Copies of ASTM Standards are available through www.astm.org

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-5

Engineer: E.MITCHELL
Date: 2/12/2009 09:40



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

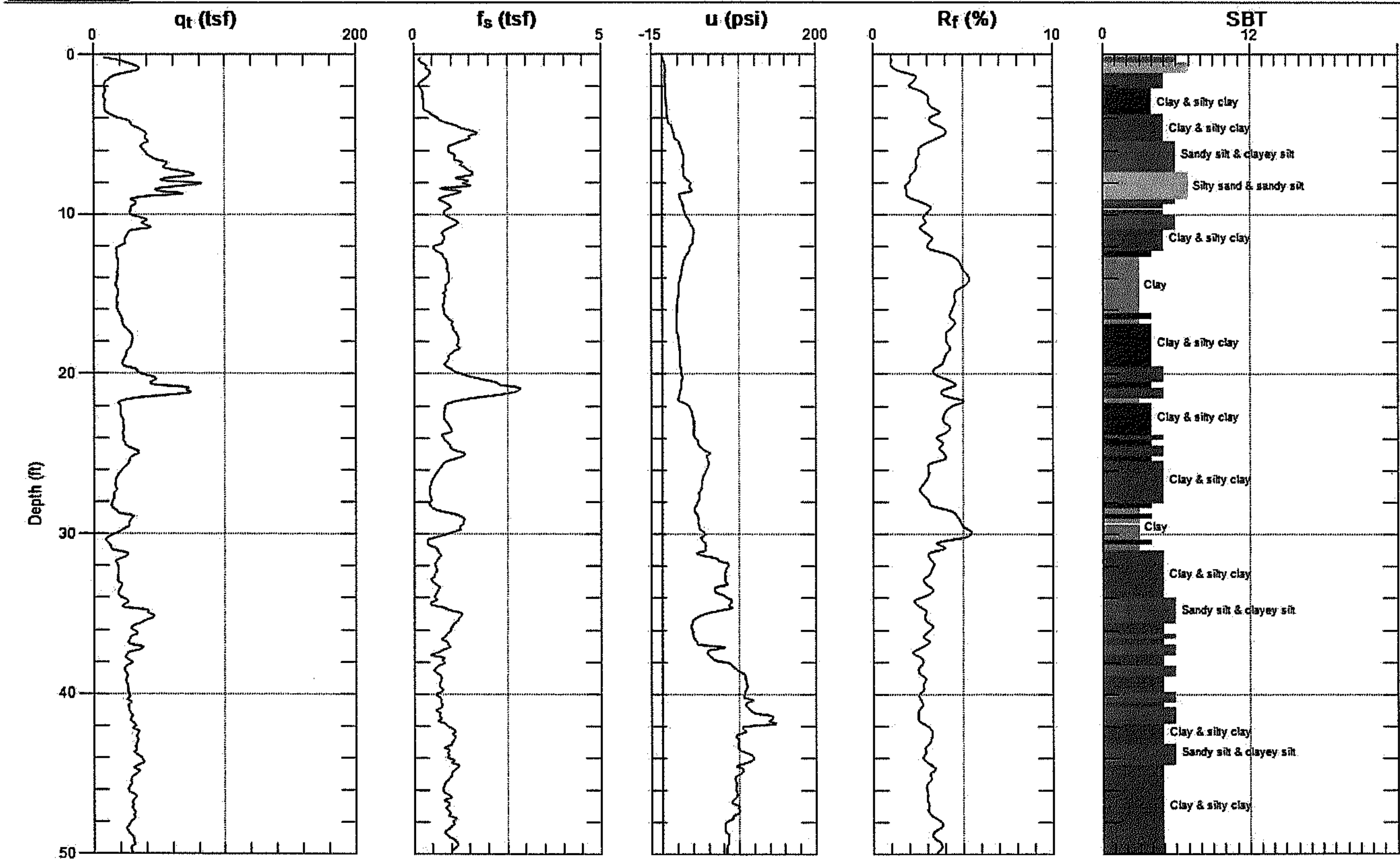
PACIFIC CREST ENGINEERING

Site: ATKINSON LANE

Sounding: CPT-5

Engineer: E.MITCHELL

Date: 2/12/2009 09:40



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

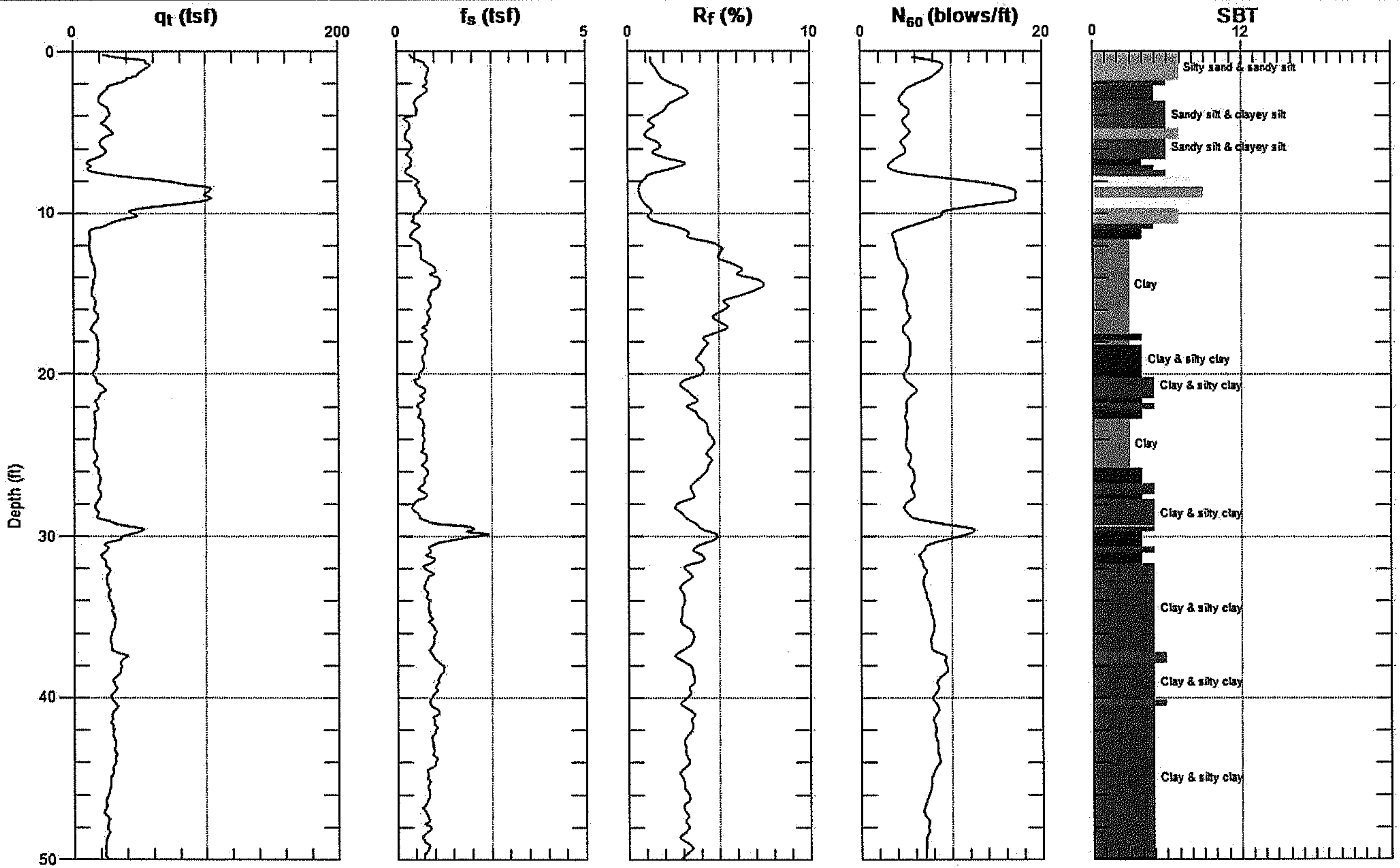
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-6

Engineer: E.MITCHELL
Date: 2/12/2009 10:30



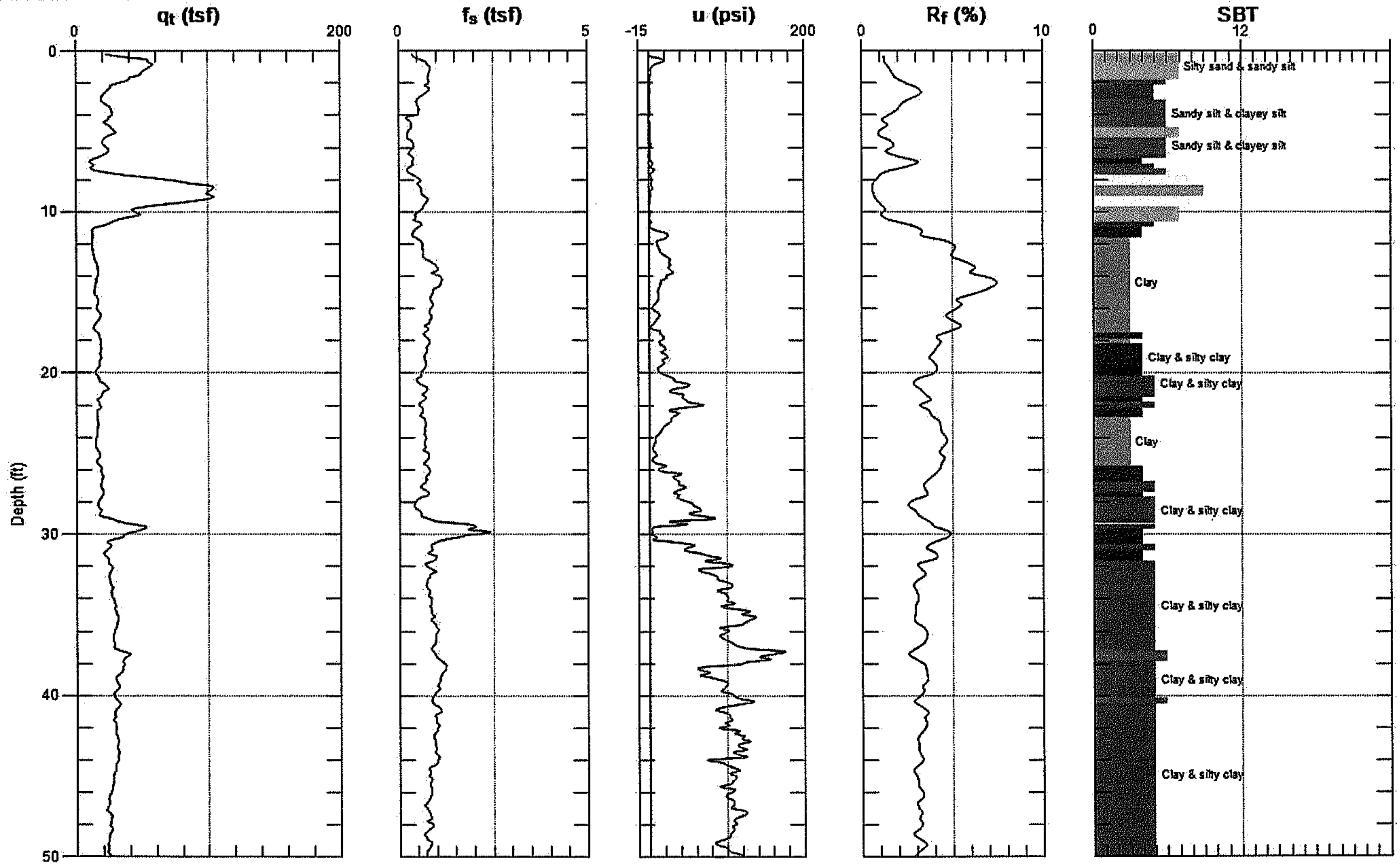
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-6

Engineer: E.MITCHELL
Date: 2/12/2009 10:30



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

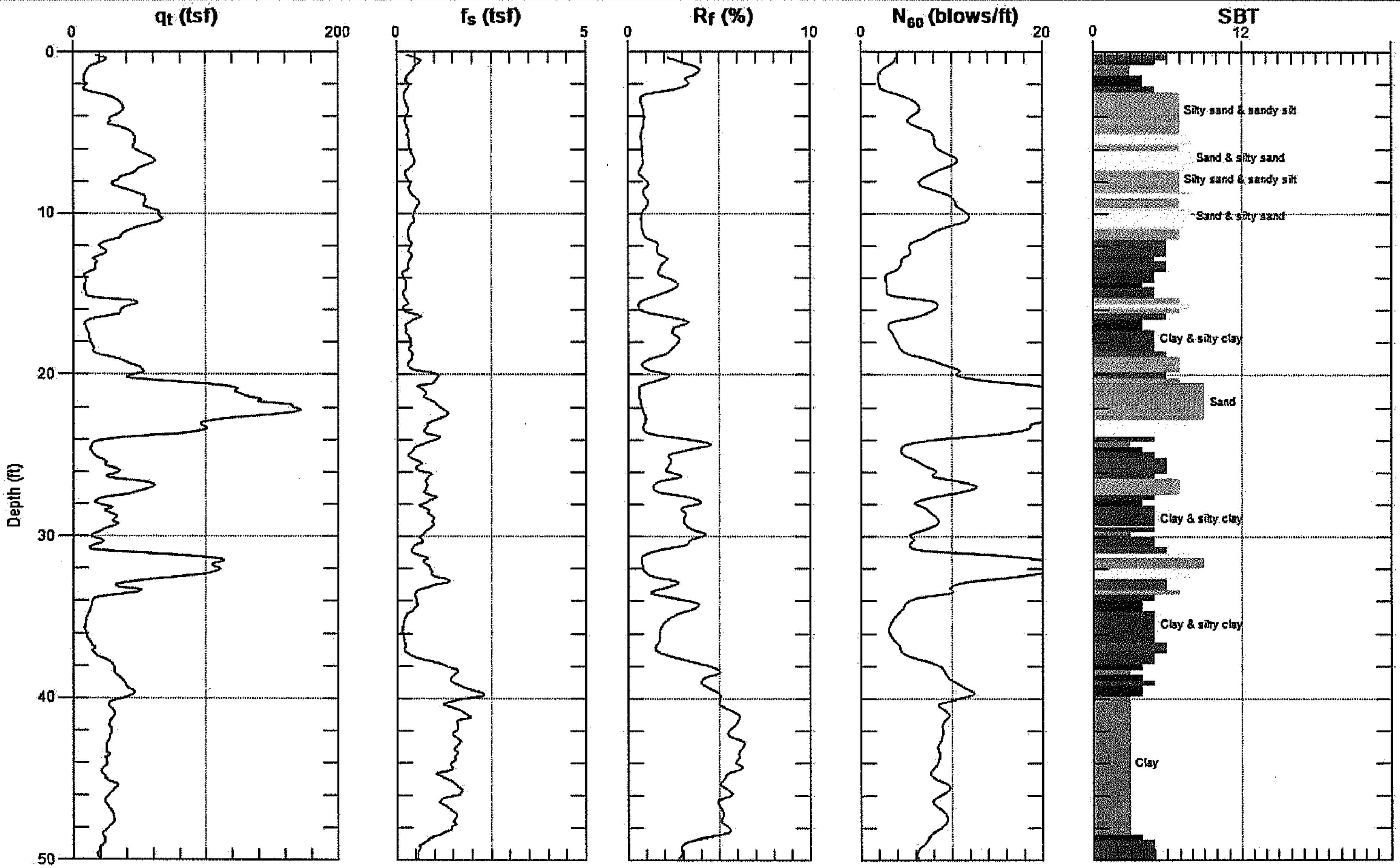
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-7

Engineer: E.MITCHELL
Date: 2/12/2009 11:34



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

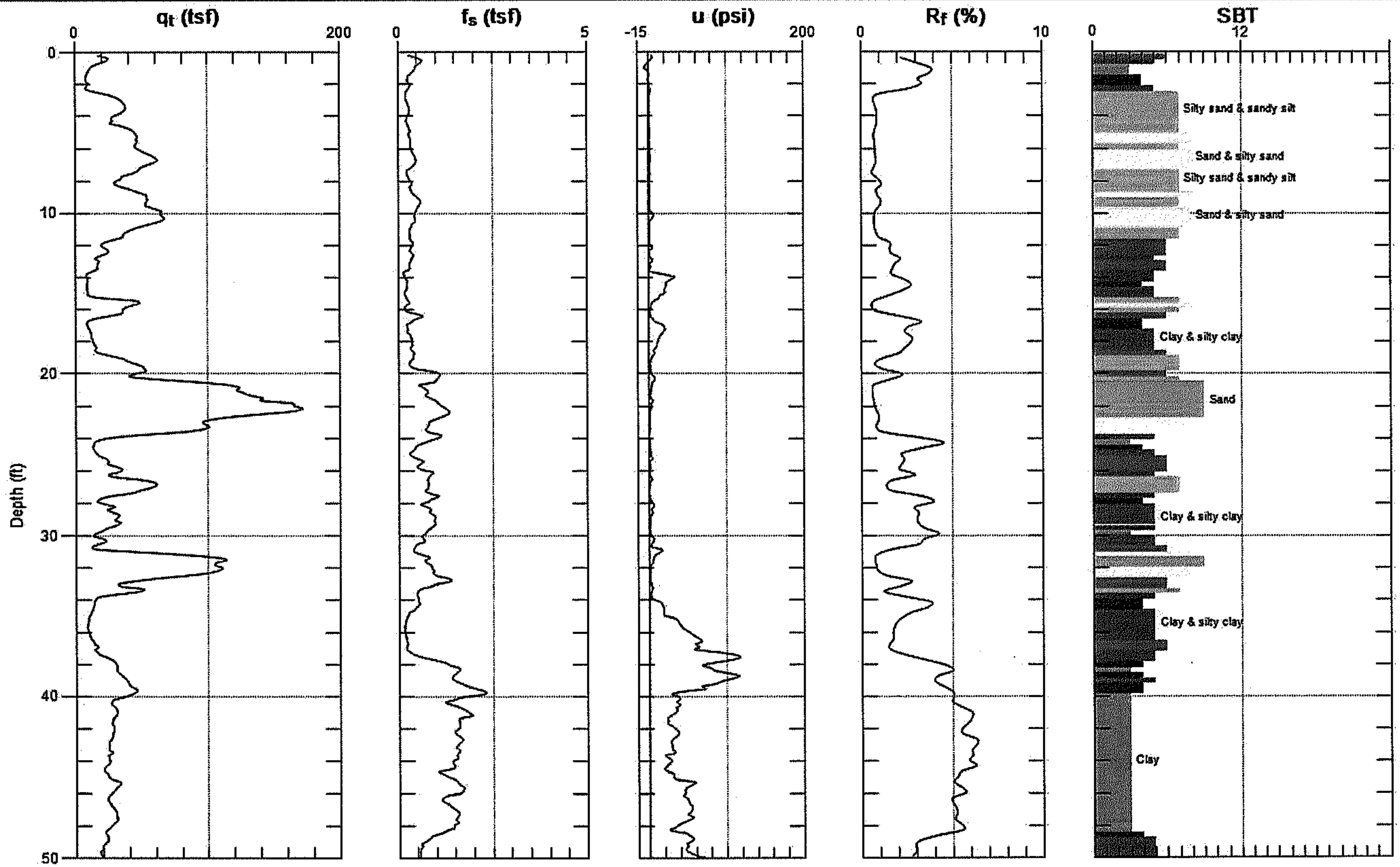
SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

GREGG

Site: ATKINSON LANE
Sounding: CPT-7

Engineer: E.MITCHELL
Date: 2/12/2009 11:34



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

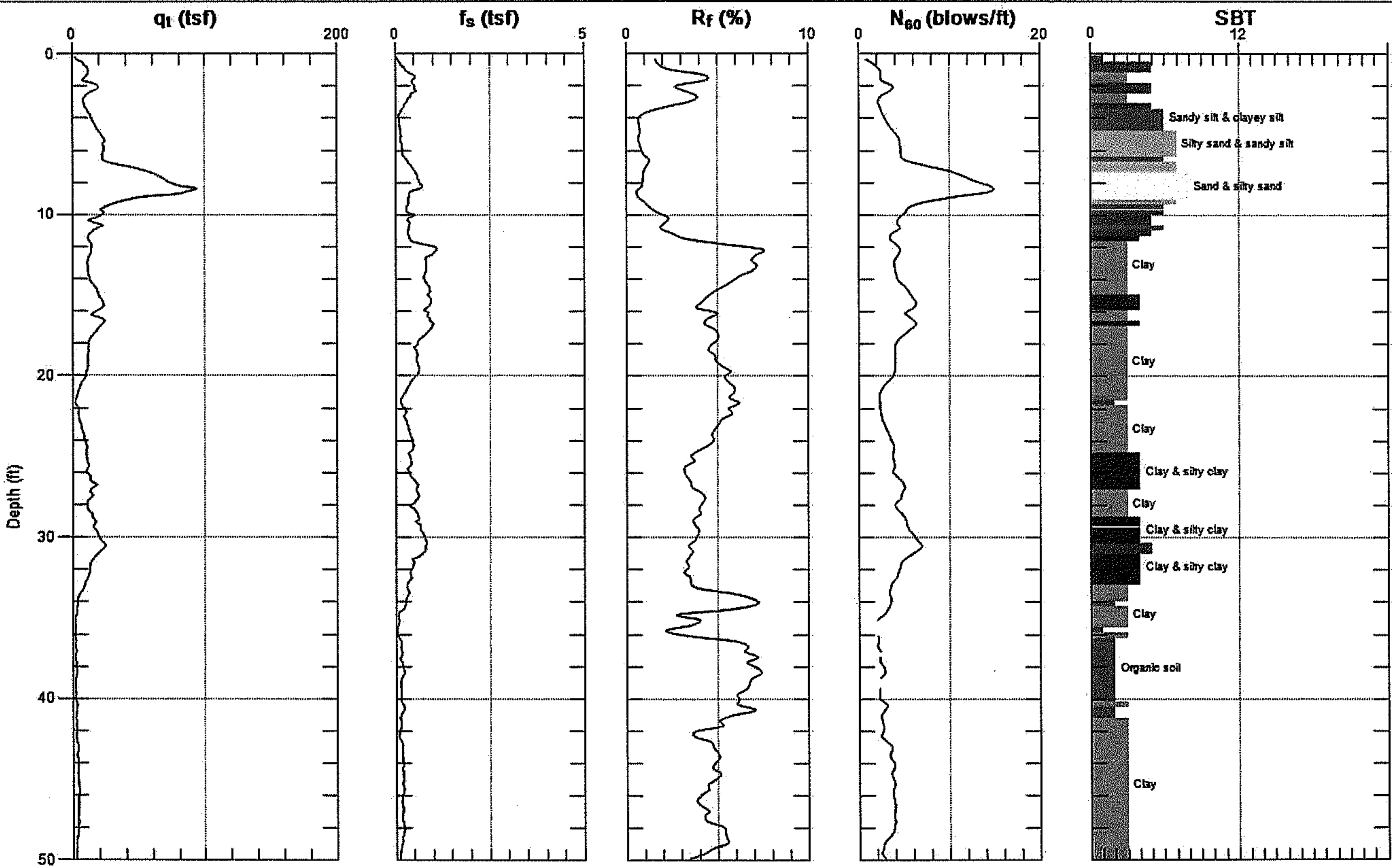
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-8

Engineer: E.MITCHELL
Date: 2/12/2009 12:56



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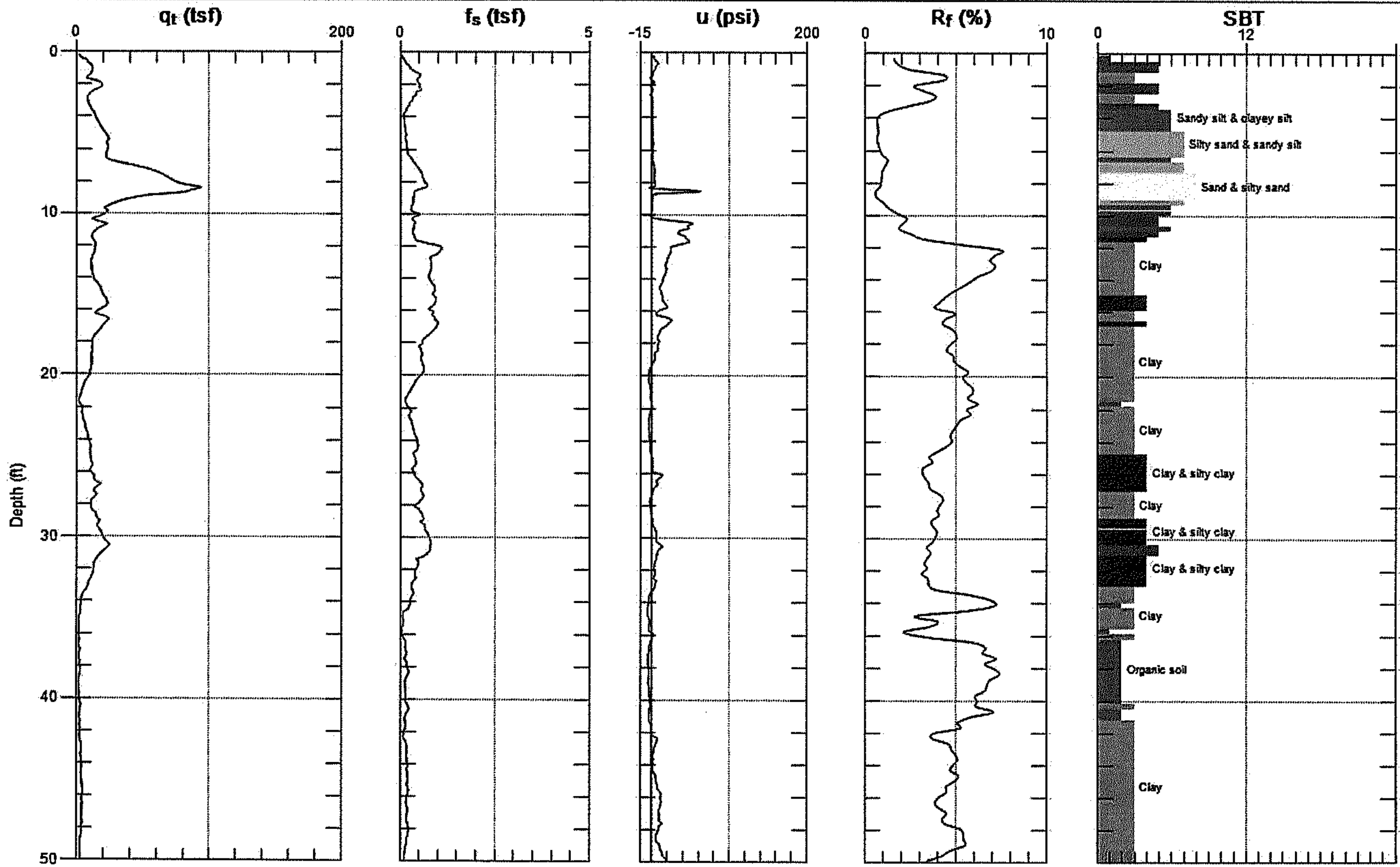
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-8

Engineer: E.MITCHELL
Date: 2/12/2009 12:56



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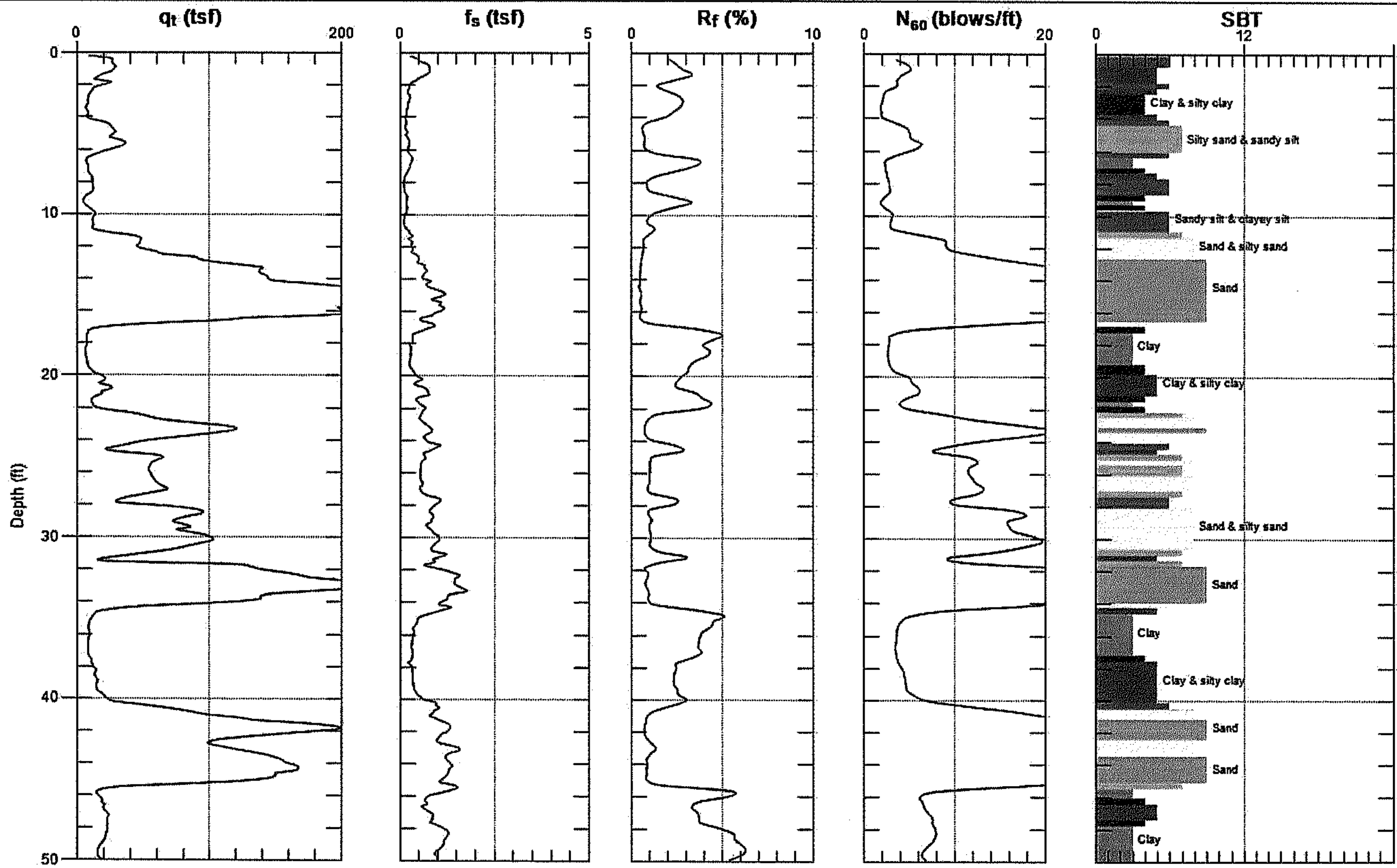
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-9

Engineer: E.MITCHELL
Date: 2/12/2009 01:53



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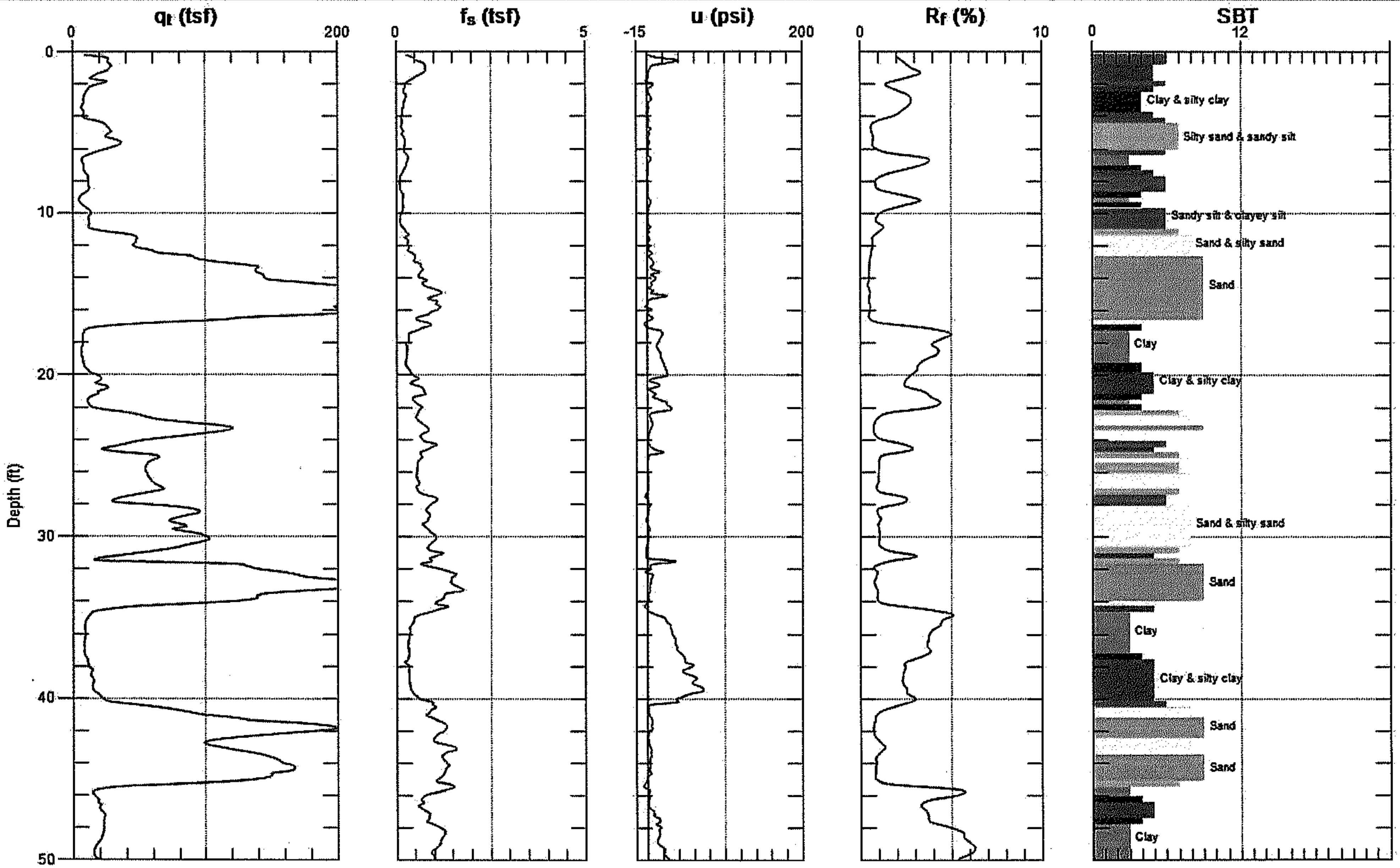
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-9

Engineer: E.MITCHELL
Date: 2/12/2009 01:53



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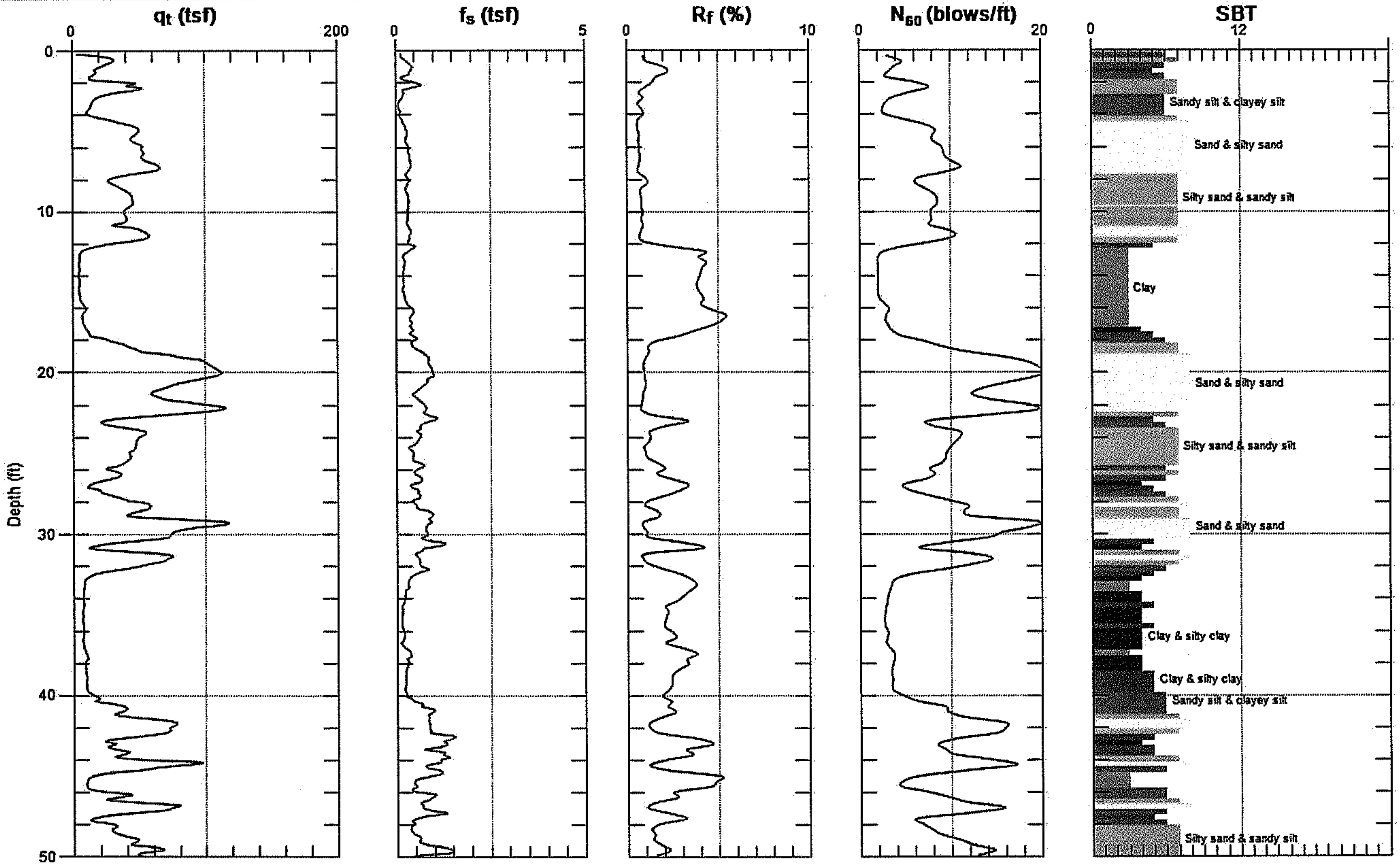
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-10

Engineer: E.MITCHELL
Date: 2/12/2009 02:42



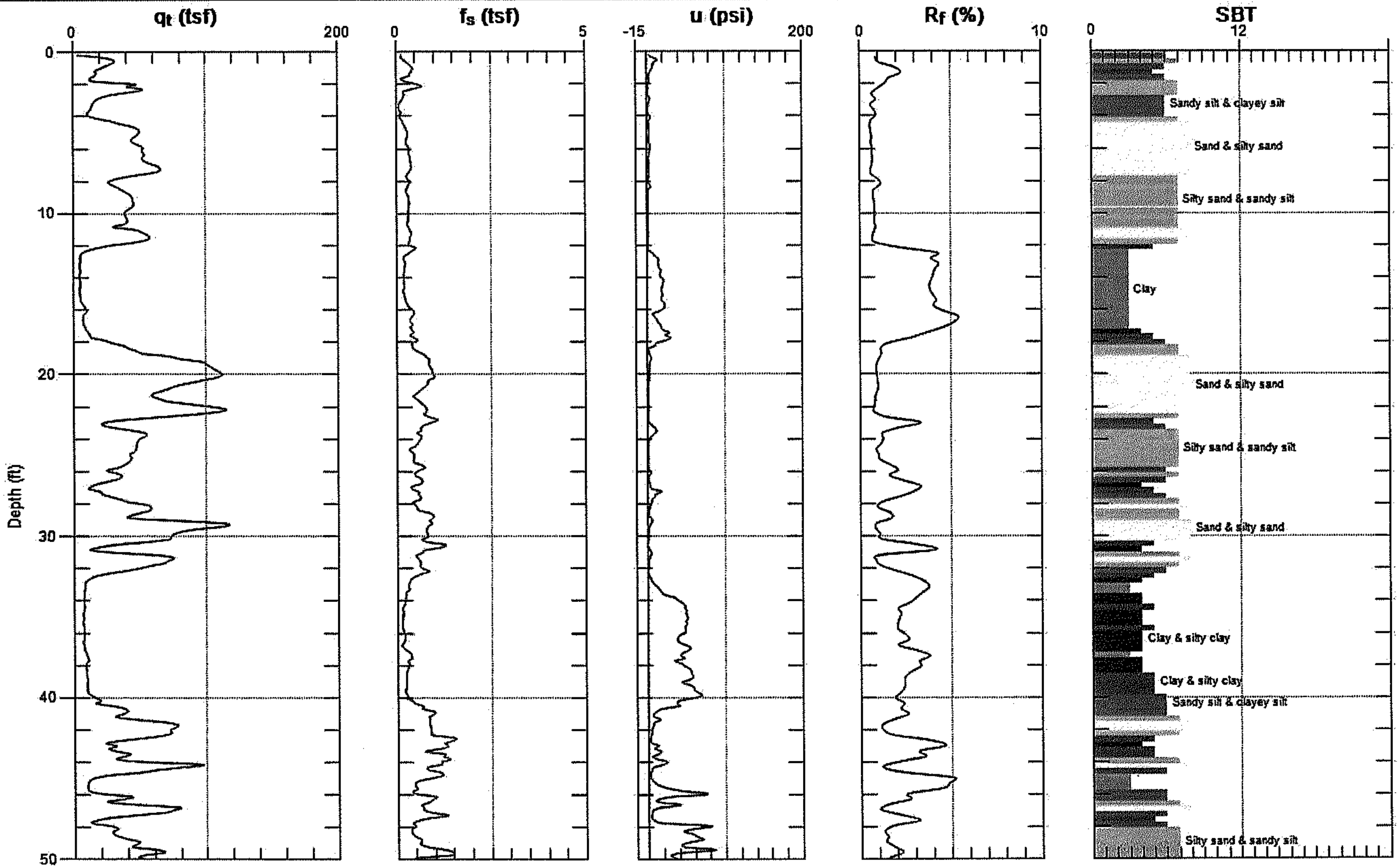
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-10

Engineer: E.MITCHELL
Date: 2/12/2009 02:42



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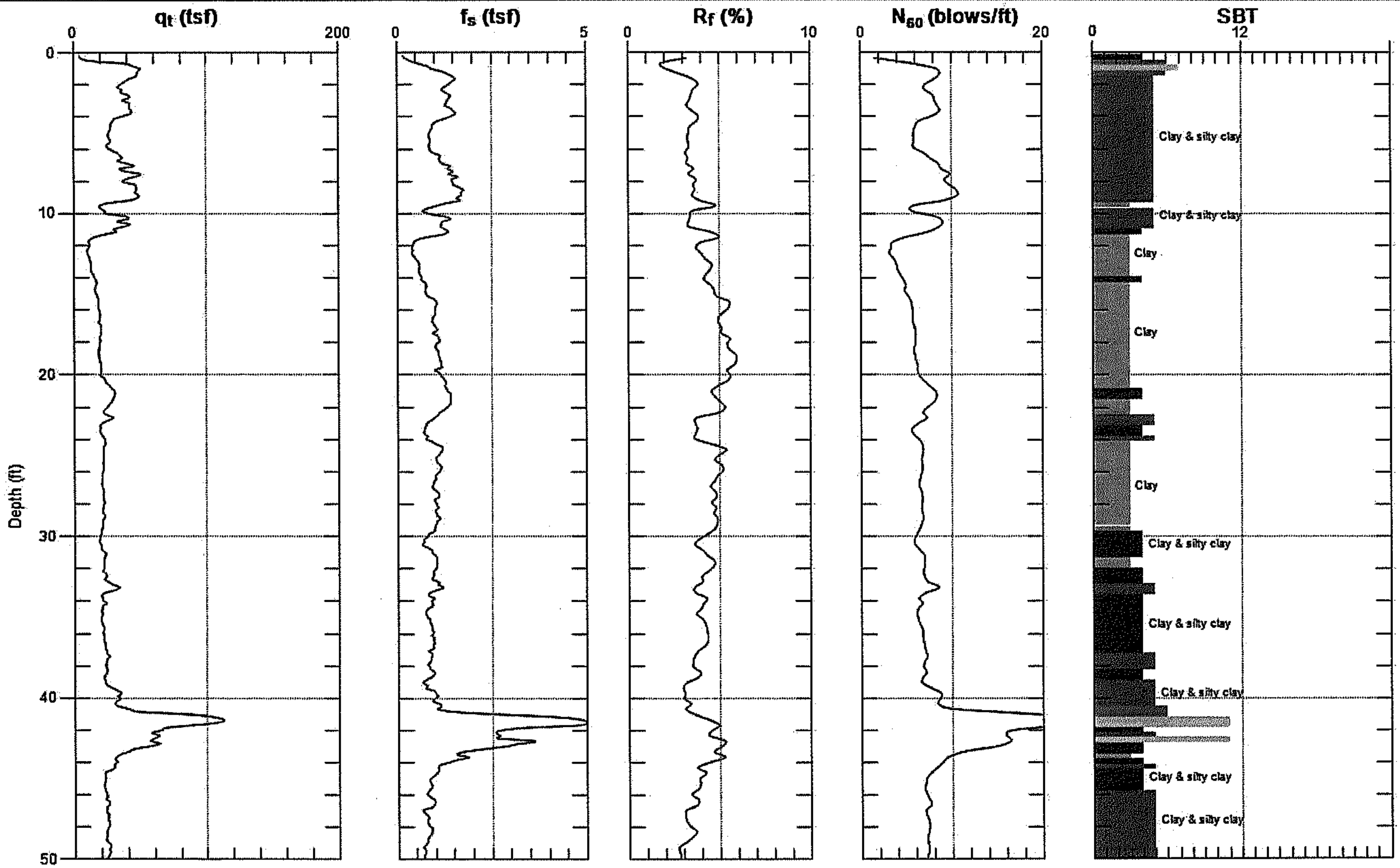
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-11

Engineer: E.MITCHELL
Date: 2/12/2009 03:42



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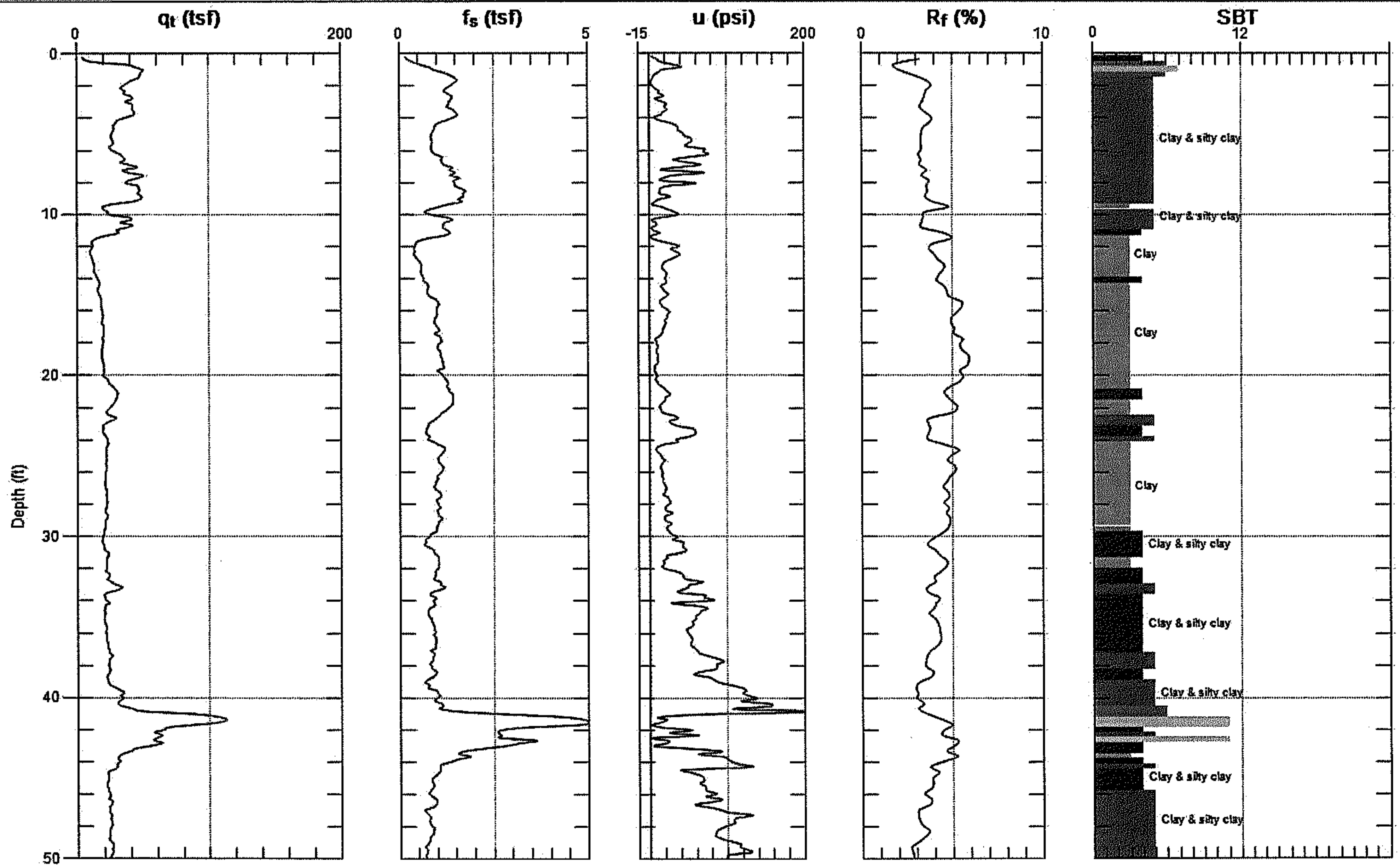
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-11

Engineer: E.MITCHELL
Date: 2/12/2009 03:42



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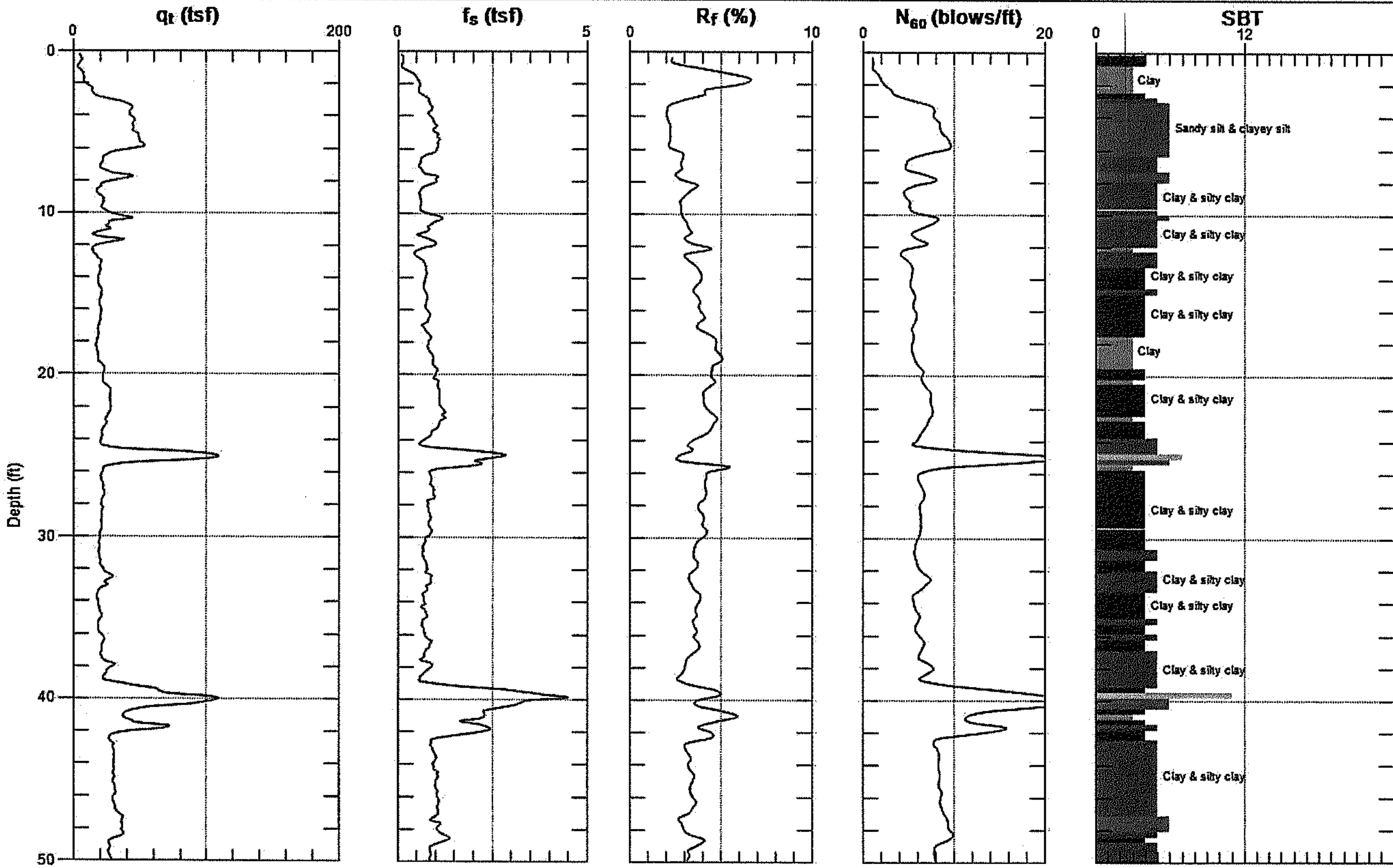
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12

Engineer: E.MITCHELL
Date: 2/12/2009 04:40



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

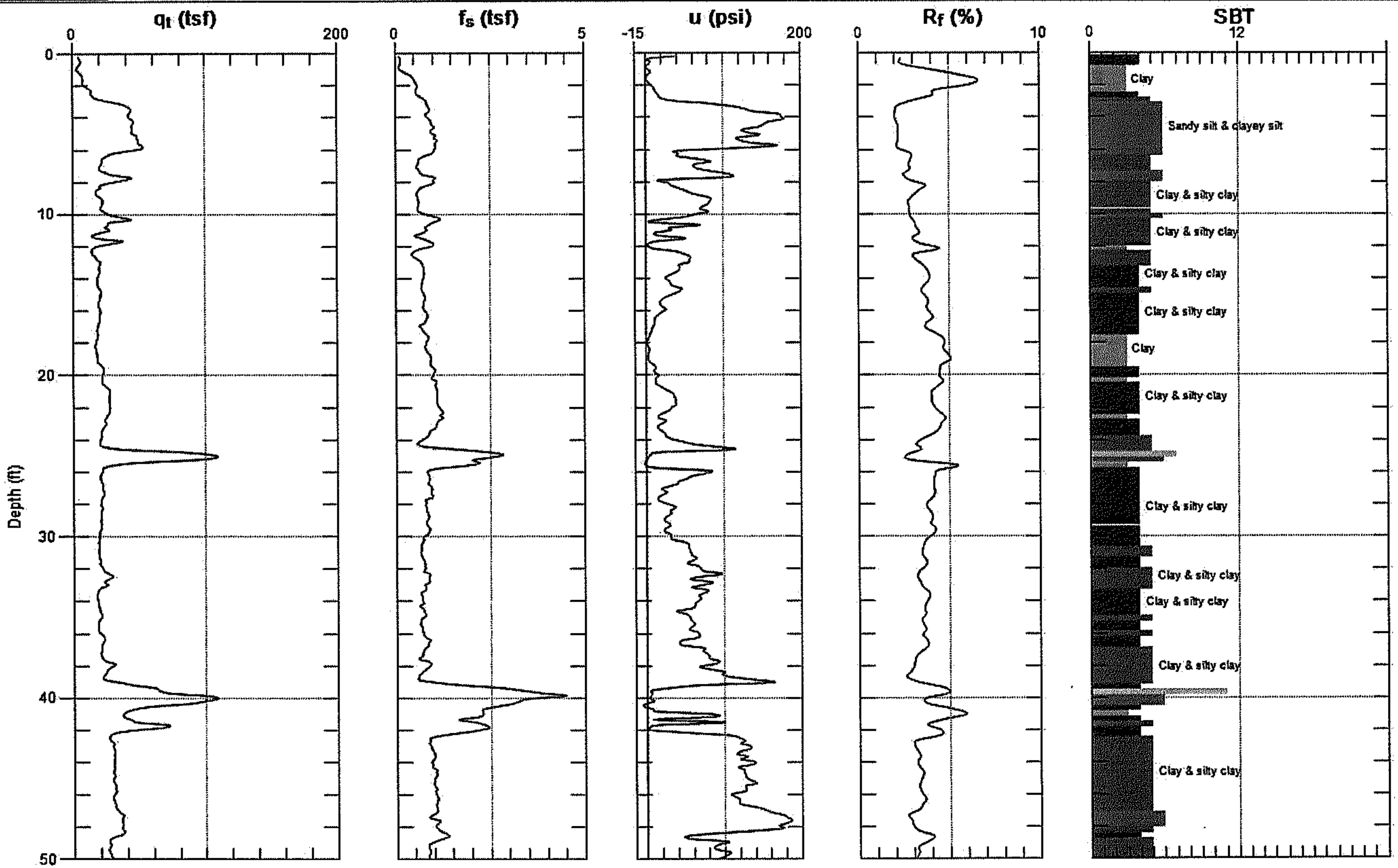
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12

Engineer: E.MITCHELL
Date: 2/12/2009 04:40



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Avg. Interval: 0.328 (ft)

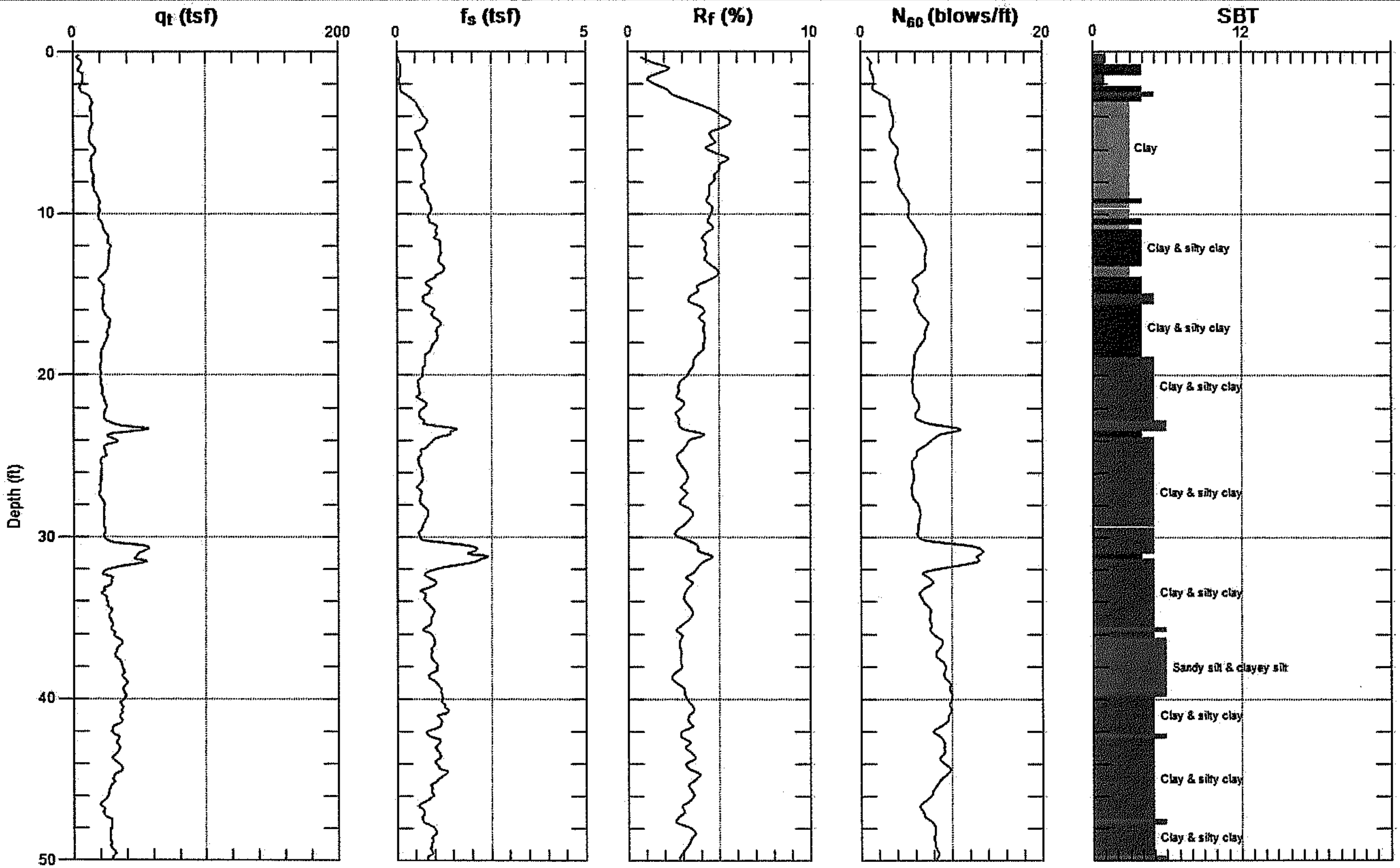
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-13

Engineer: E.MITCHELL
Date: 2/13/2009 08:13



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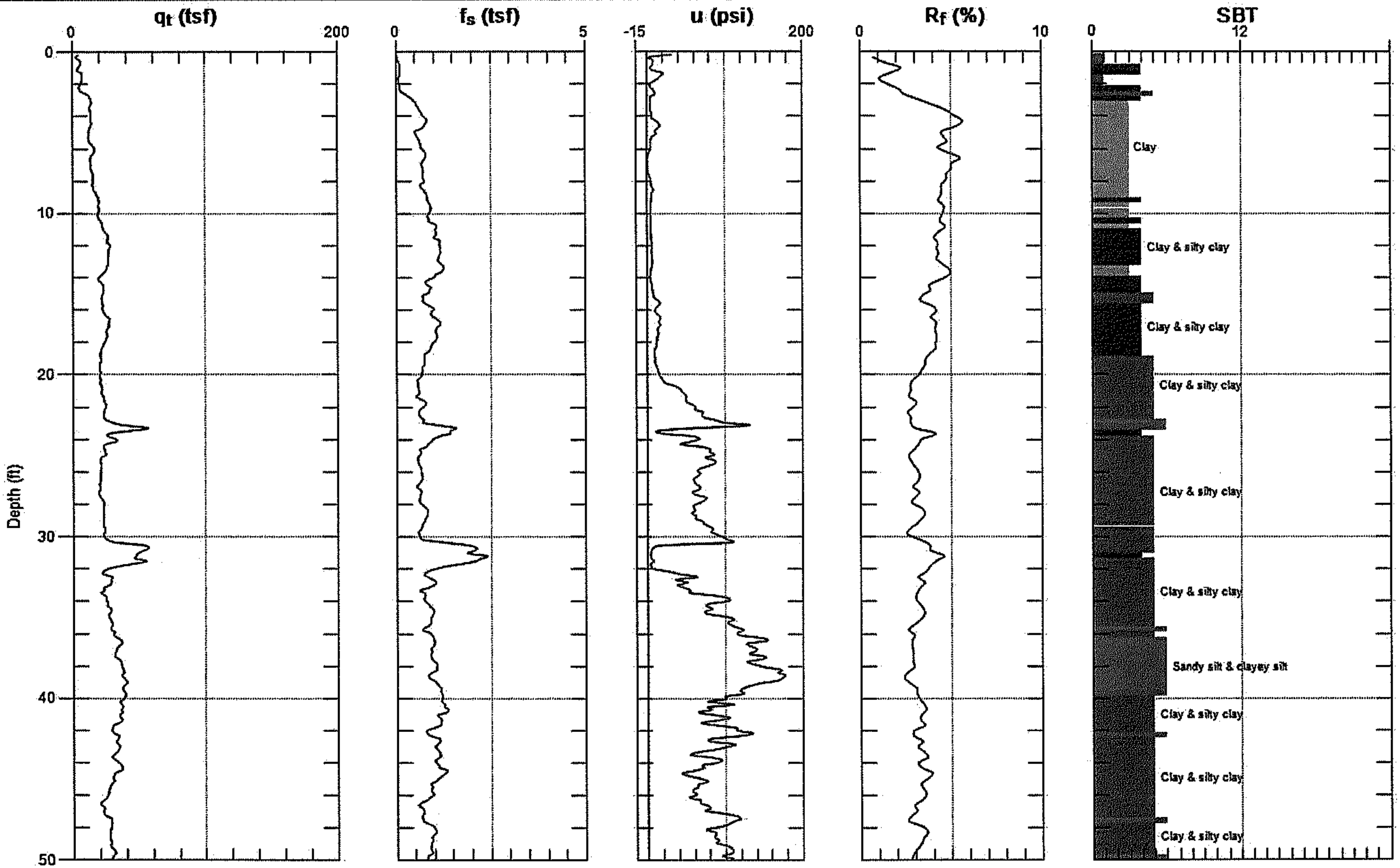
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-13

Engineer: E.MITCHELL
Date: 2/13/2009 08:13



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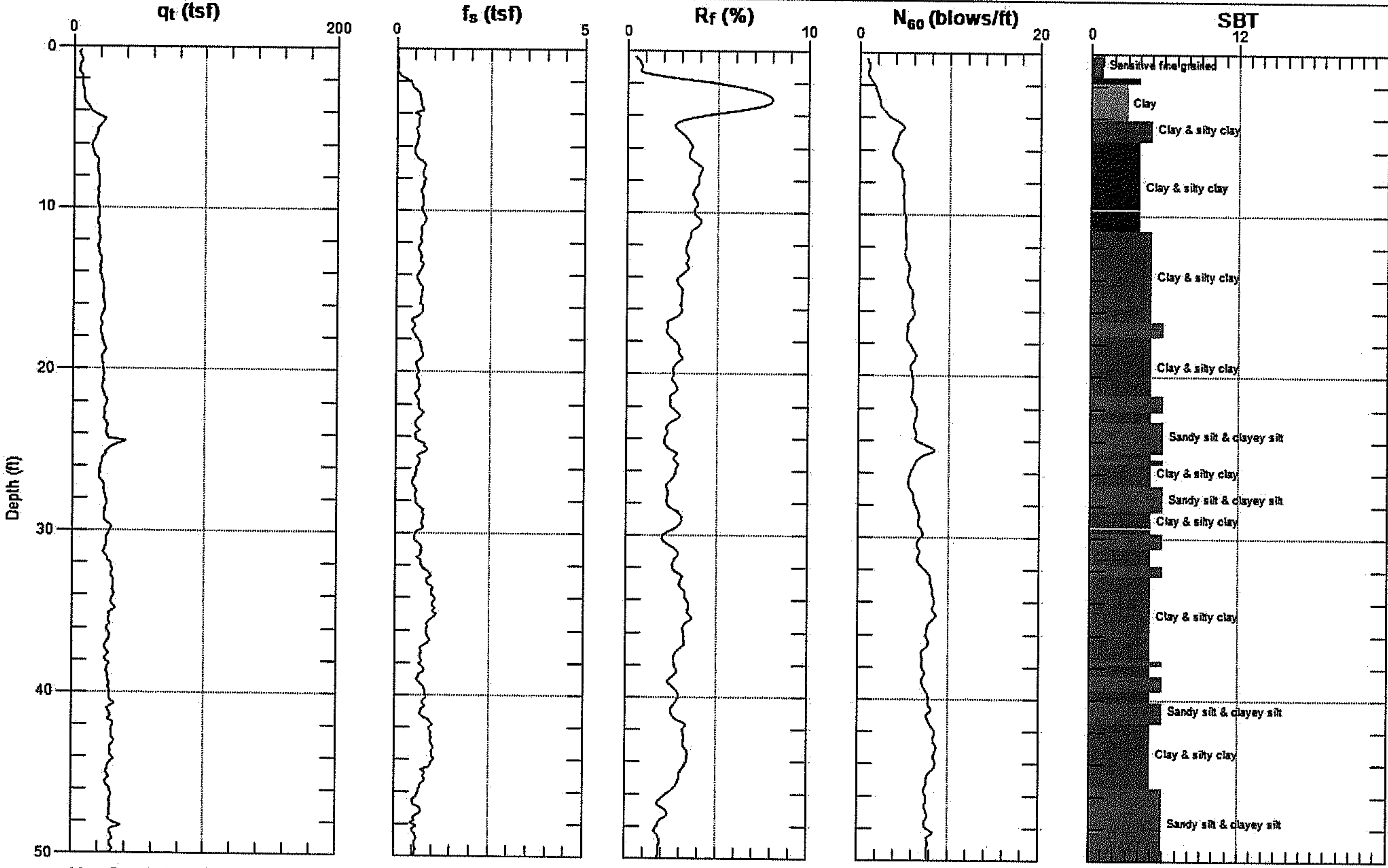
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02



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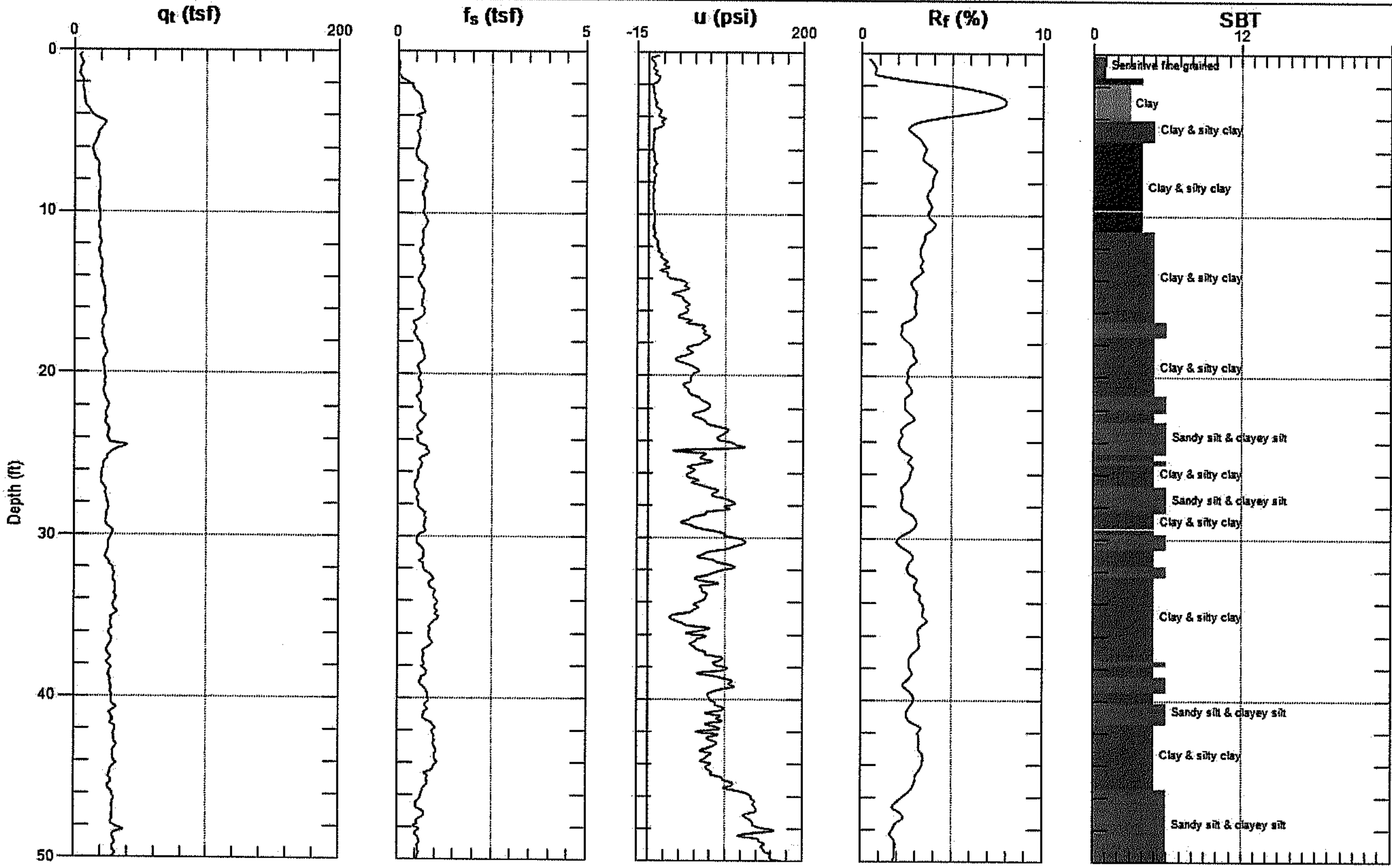
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02



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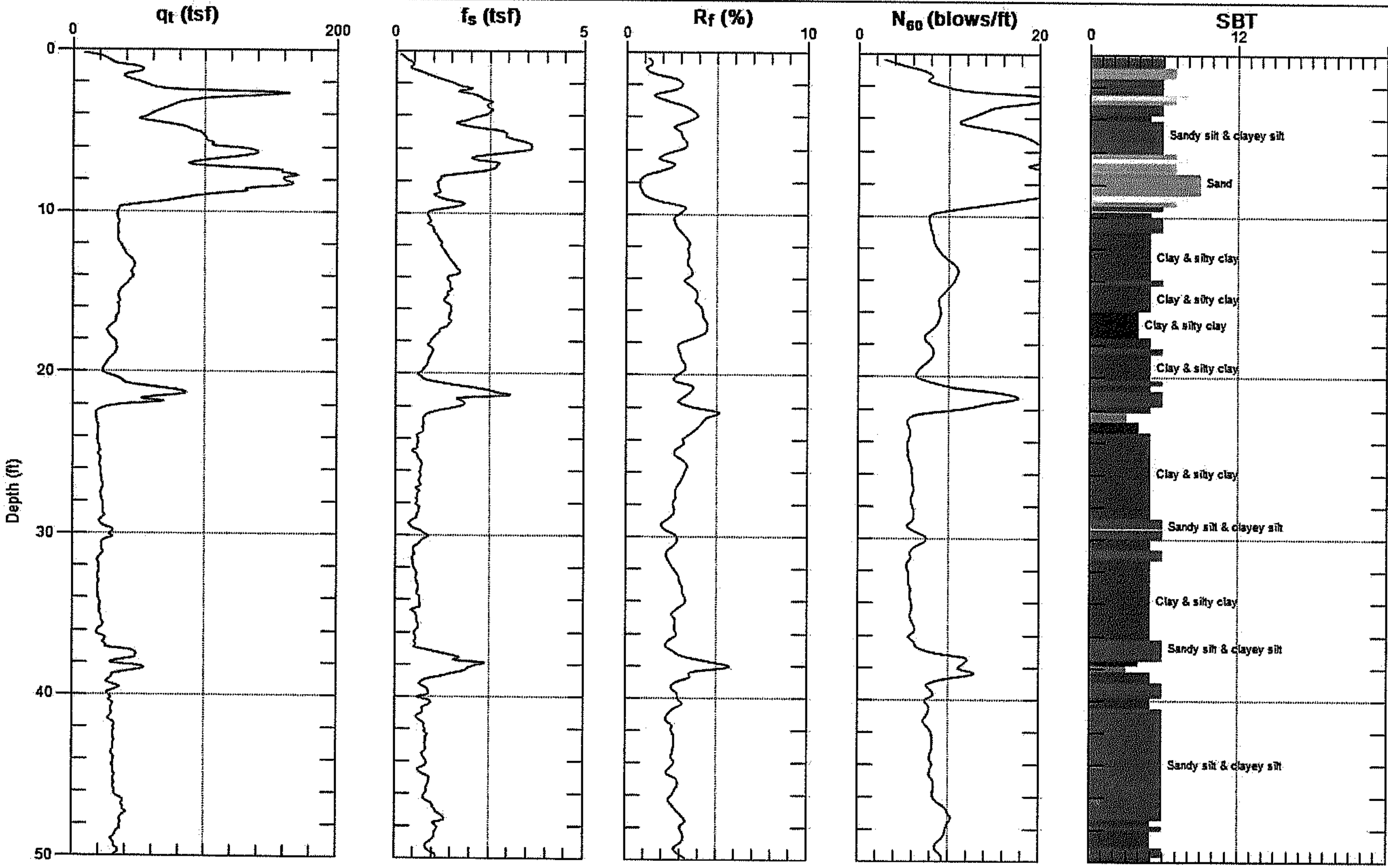
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-15

Engineer: E.MITCHELL
Date: 2/13/2009 09:49



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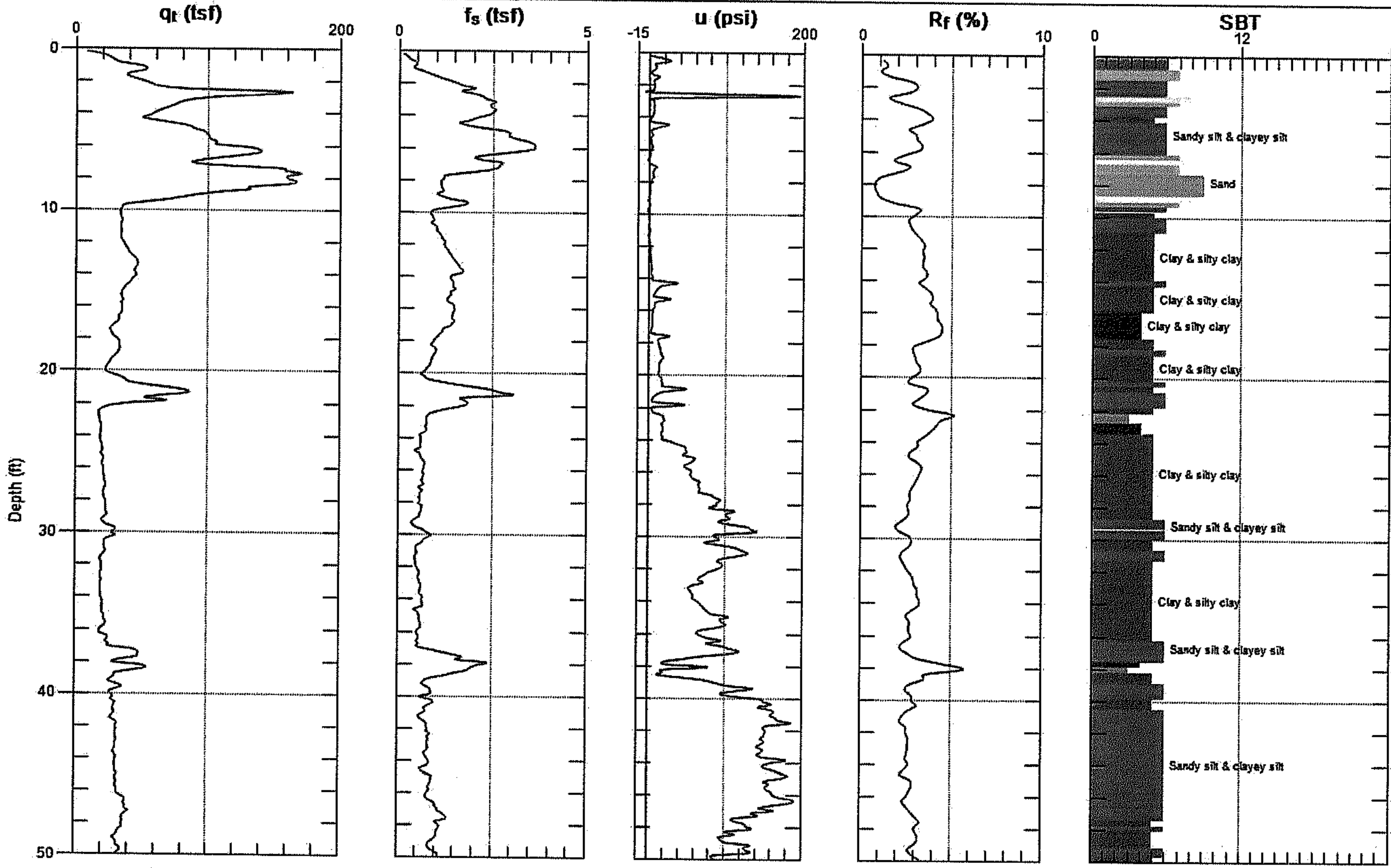
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-15

Engineer: E.MITCHELL
Date: 2/13/2009 09:49

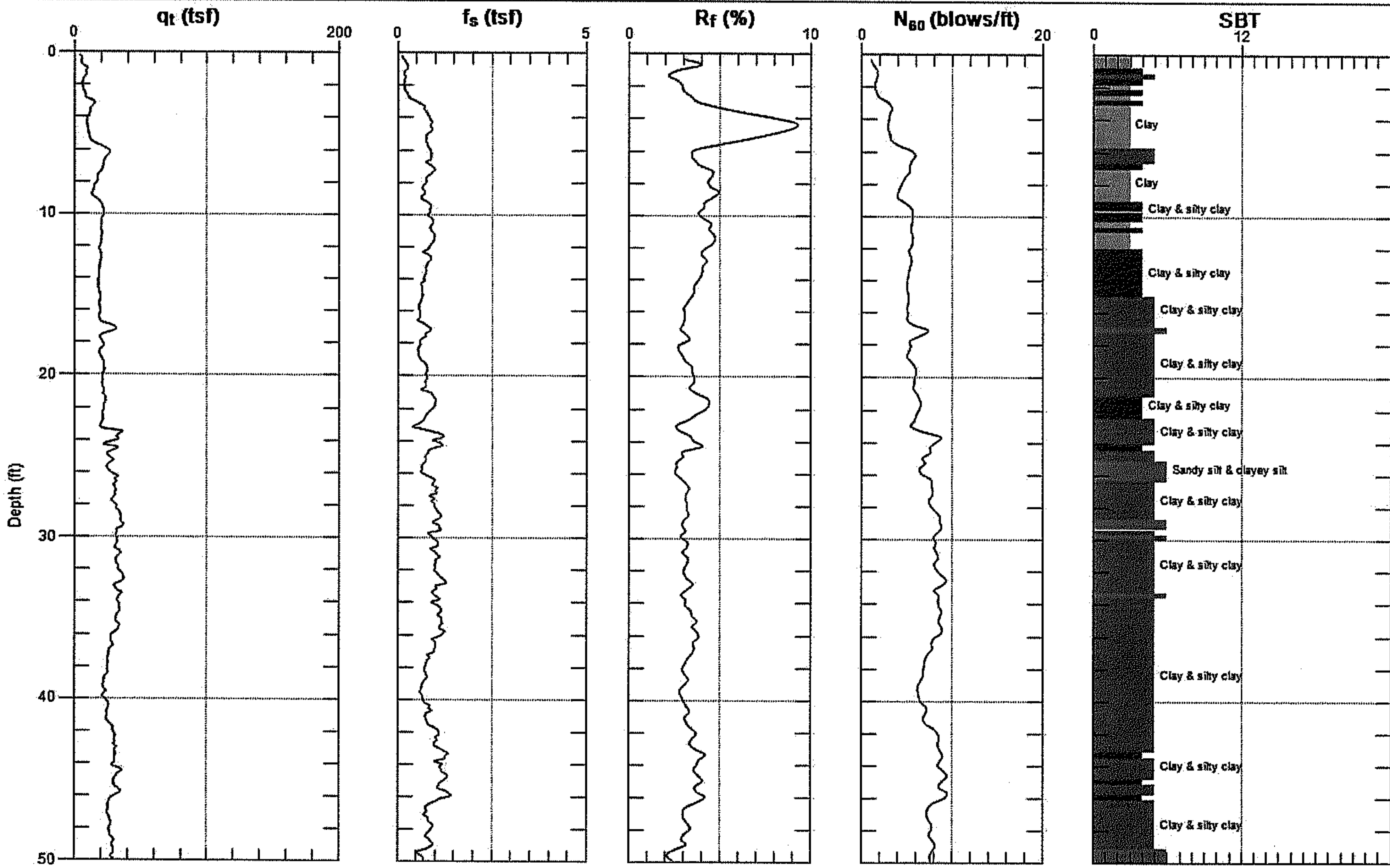


Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-16
Engineer: E.MITCHELL
Date: 2/13/2009 11:18



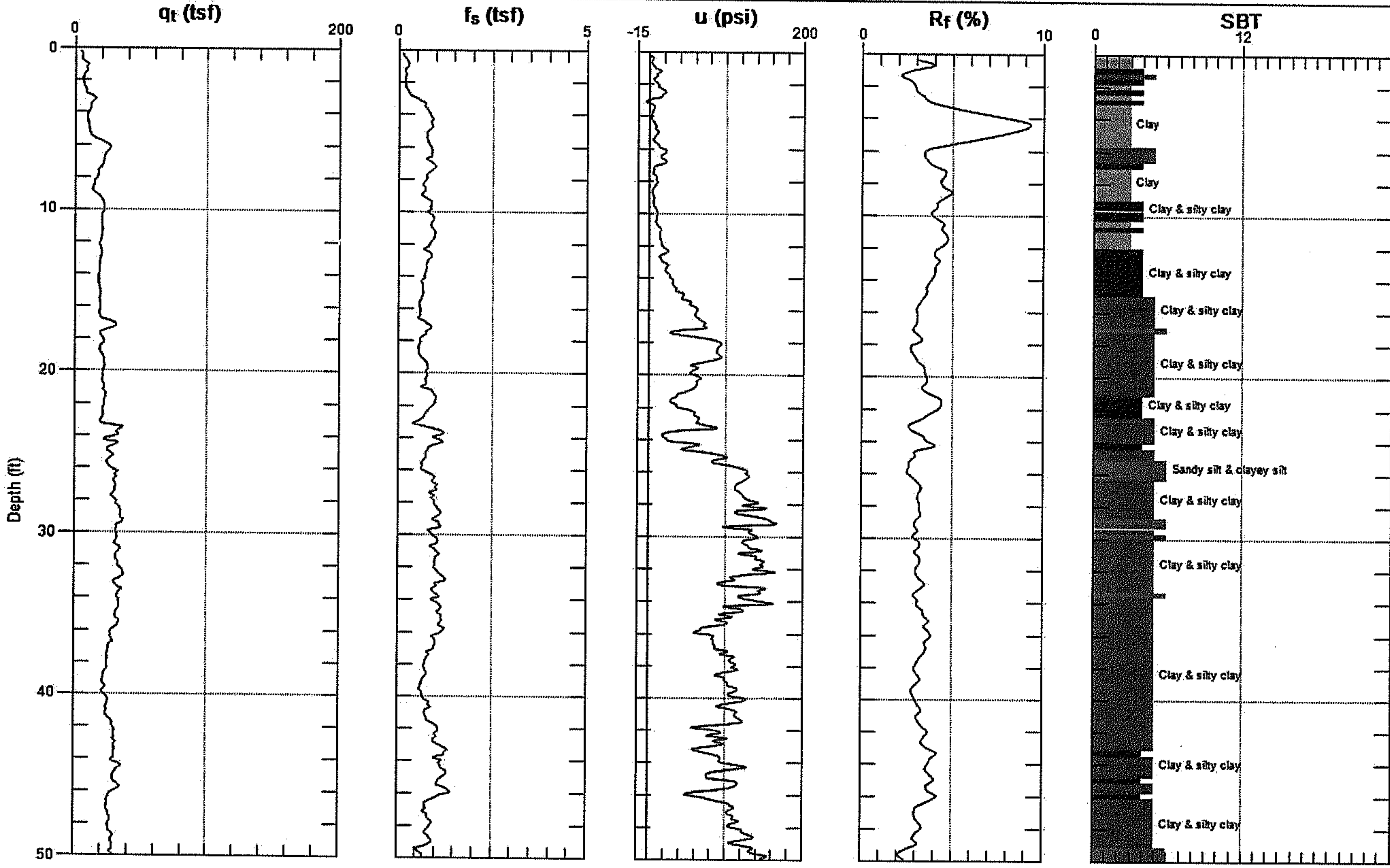
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-16

Engineer: E.MITCHELL
Date: 2/13/2009 11:18



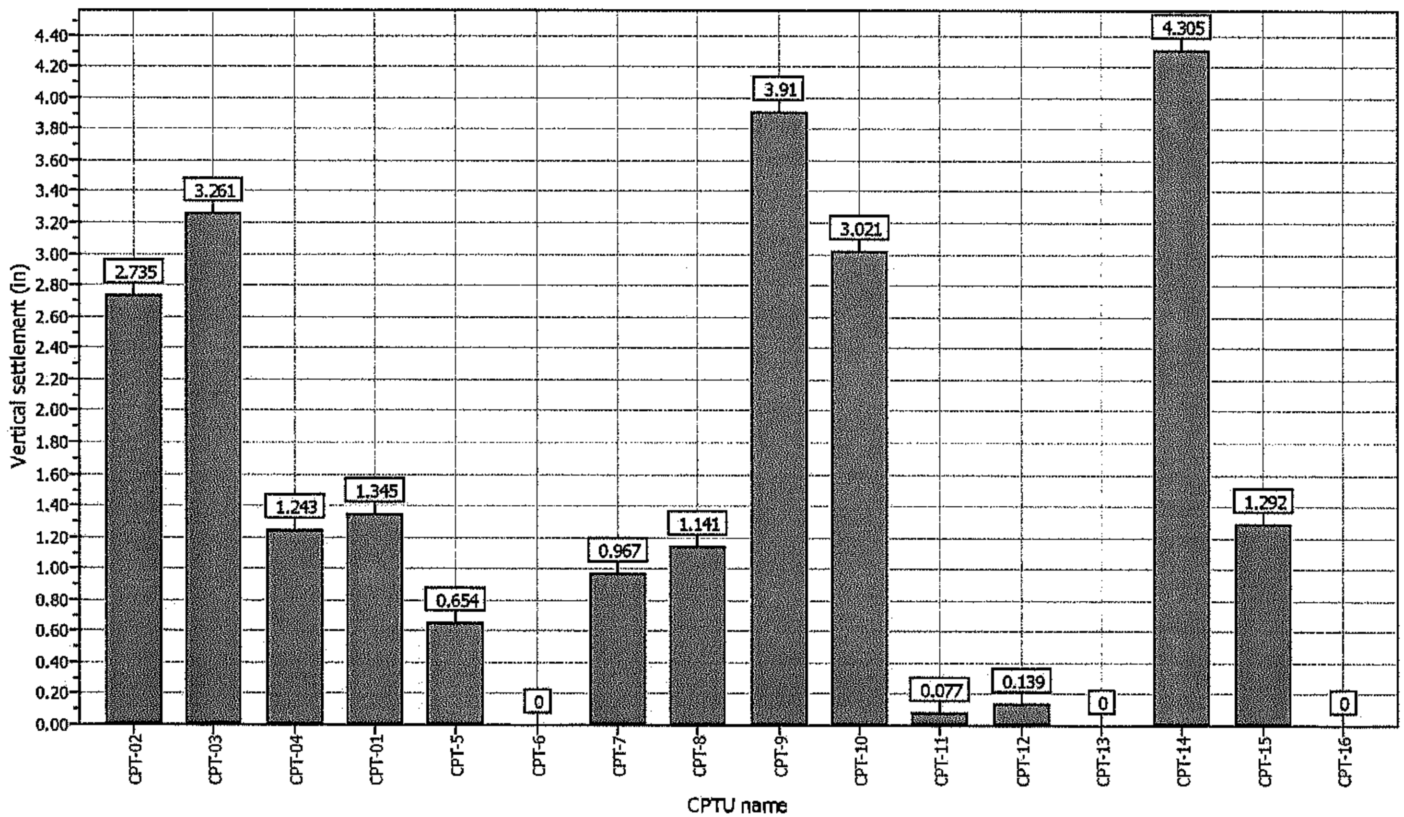
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX C

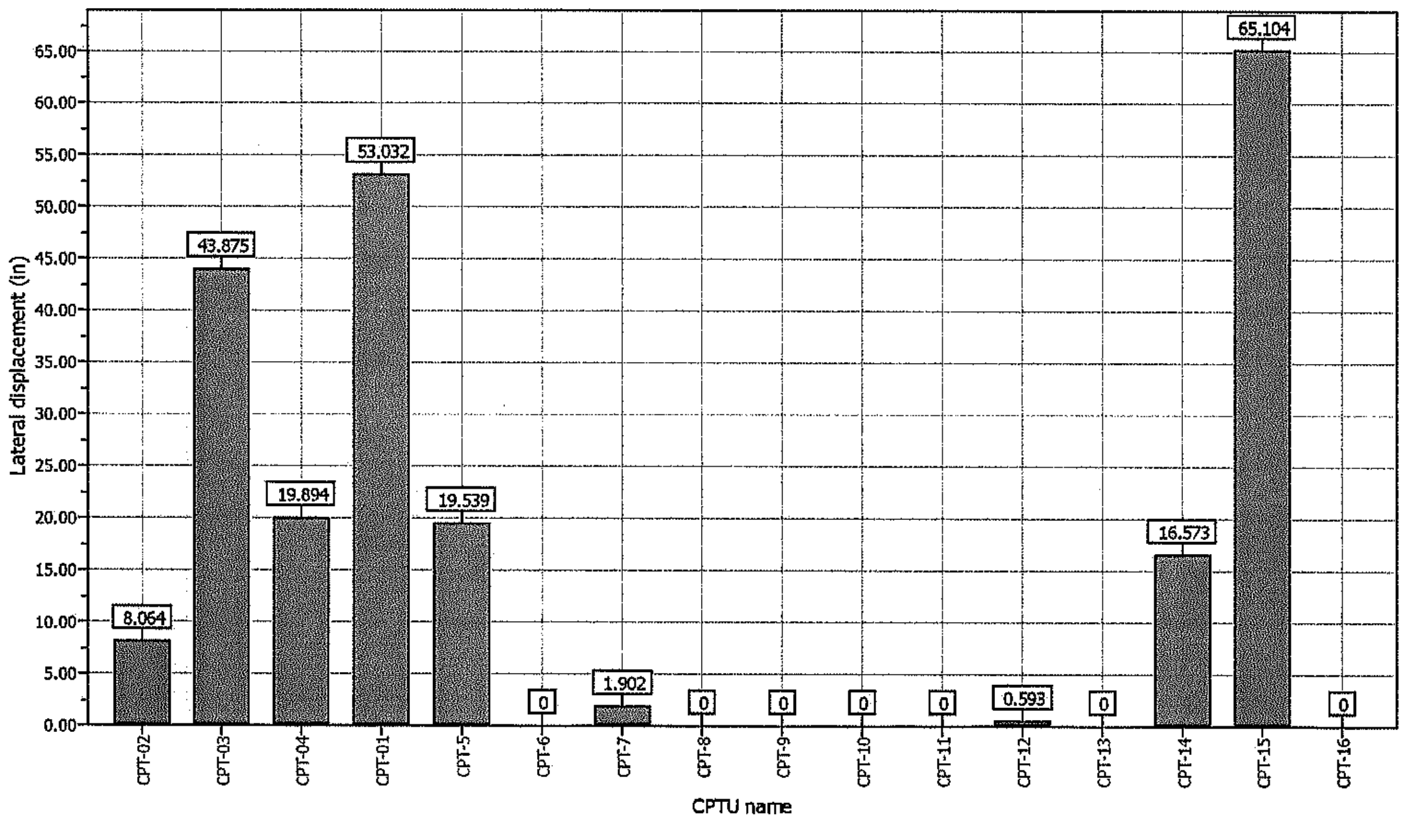
Preliminary Liquefaction and Lateral Spreading Analysis

Overall vertical settlements report



GEOLOGISMIKI
Geotechnical Software

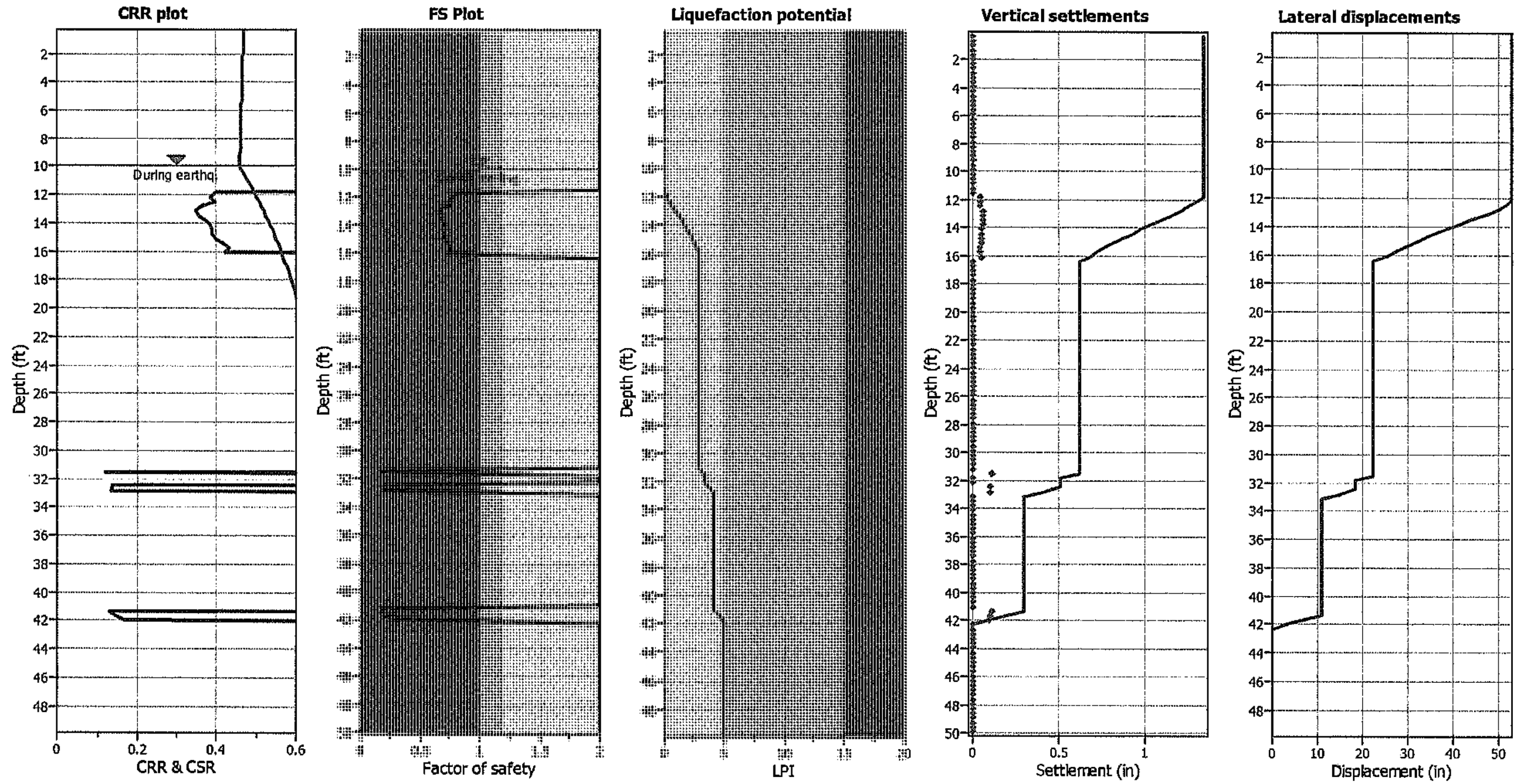
Overall lateral displacements report



This software is licensed to: Pacific Crest Engineering

CPT name: CPT-01

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

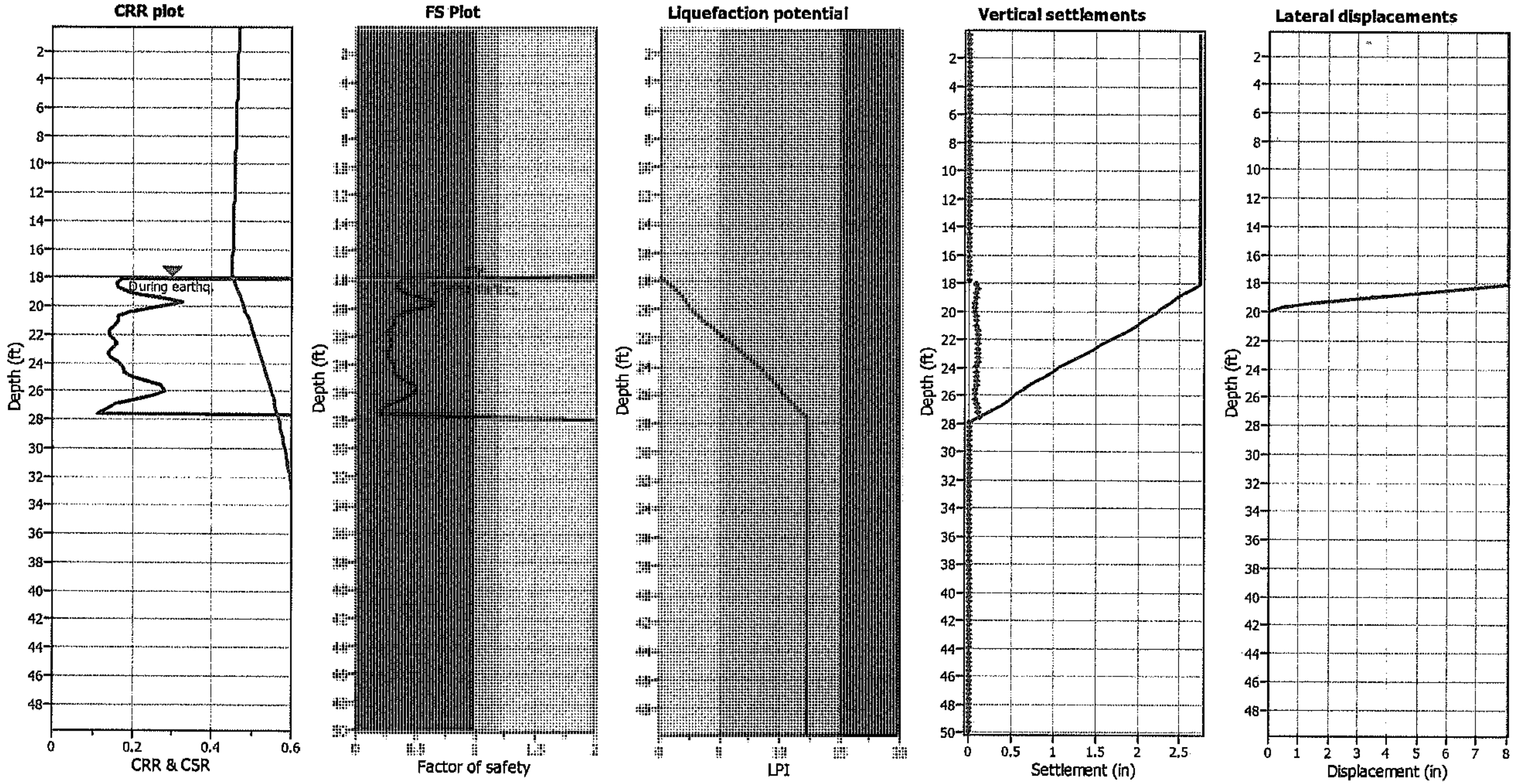
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:52 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-02

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	28.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

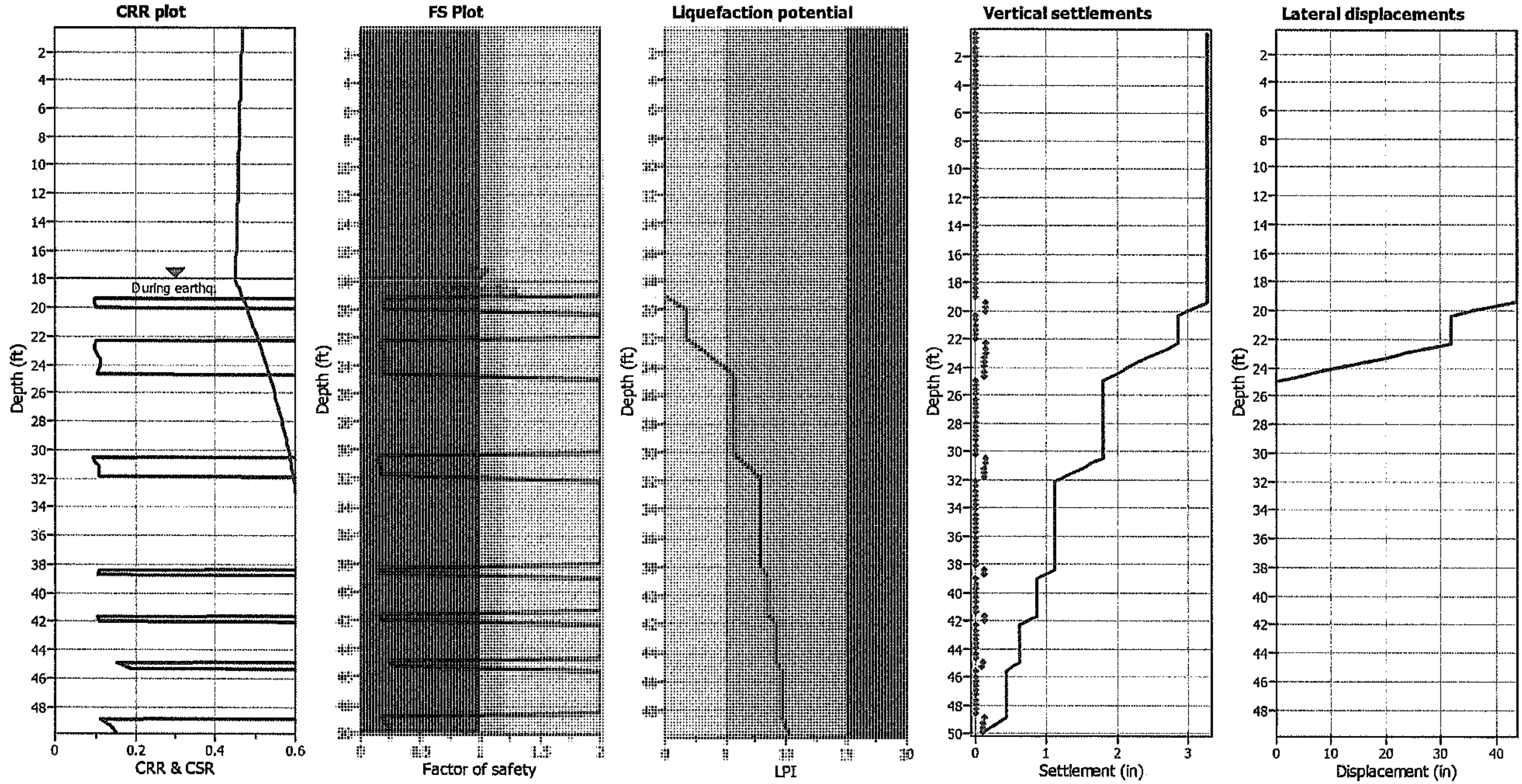
LPI color scheme

- Very high risk
- High risk
- Low risk

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-03

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

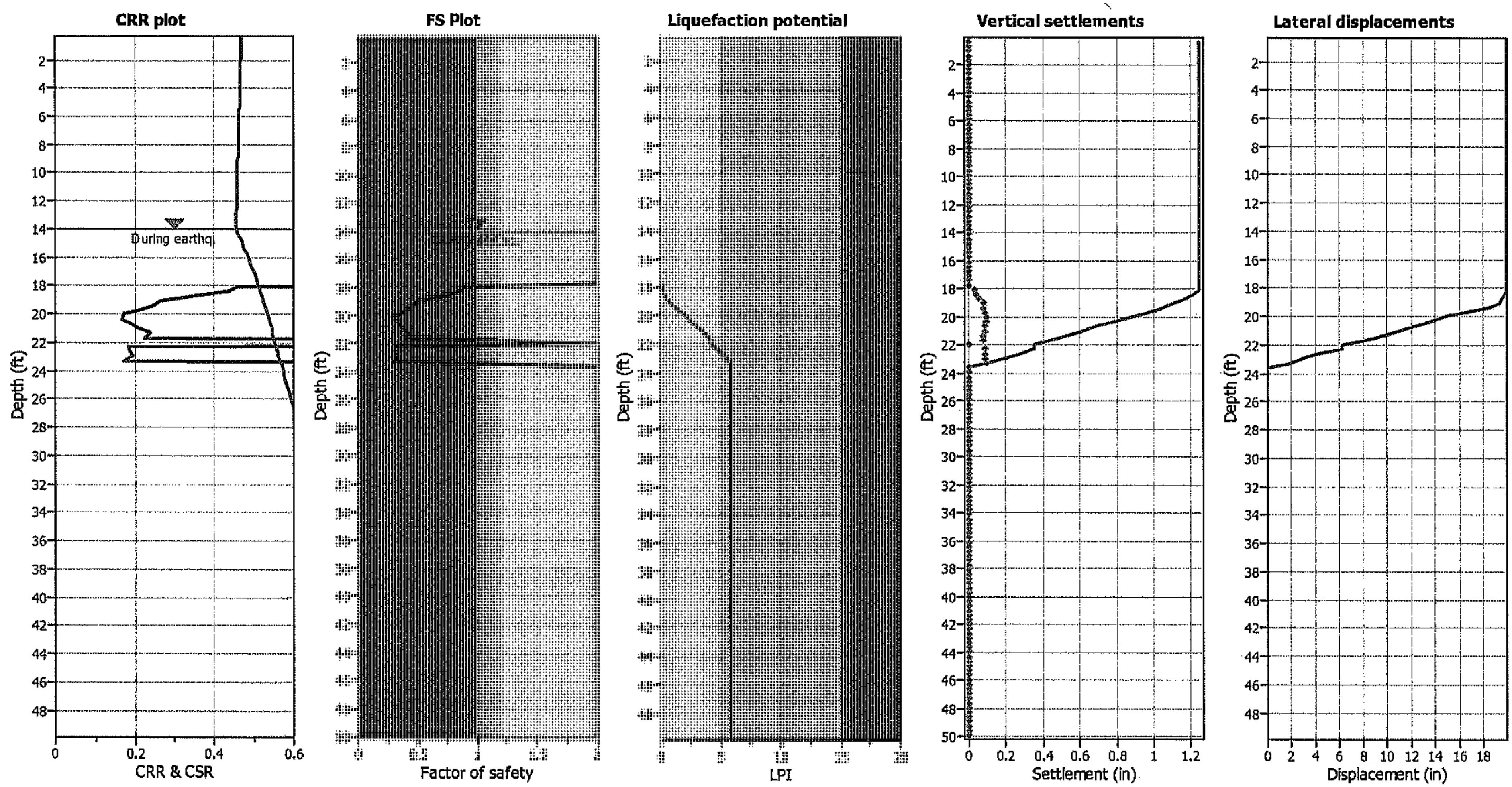
- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

- Very high risk
- High risk
- Low risk

This software is licensed to: Pacific Crest Engineering CPT name: CPT-04

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	14.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

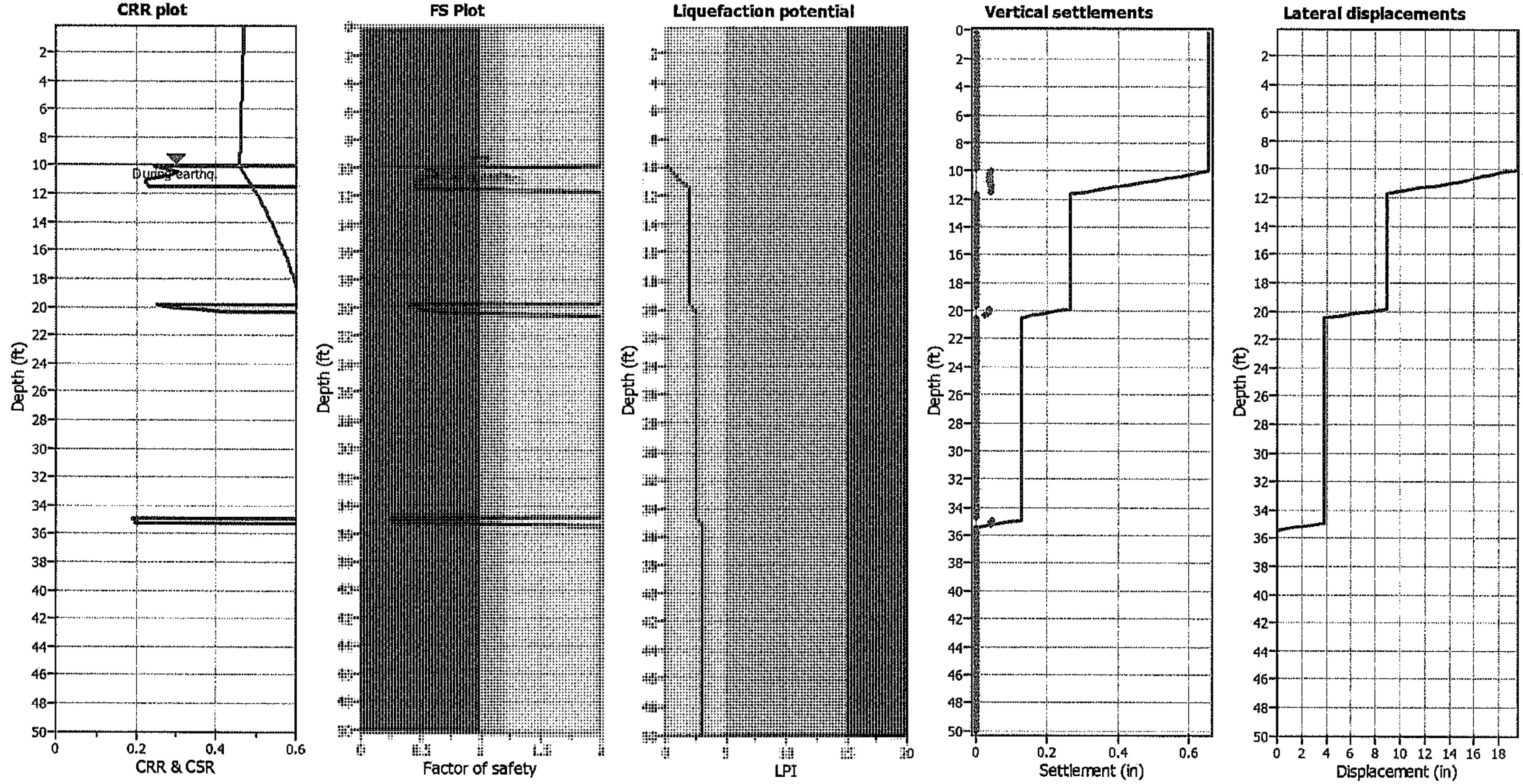
LPI color scheme

- Very high risk
- High risk
- Low risk

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-5

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

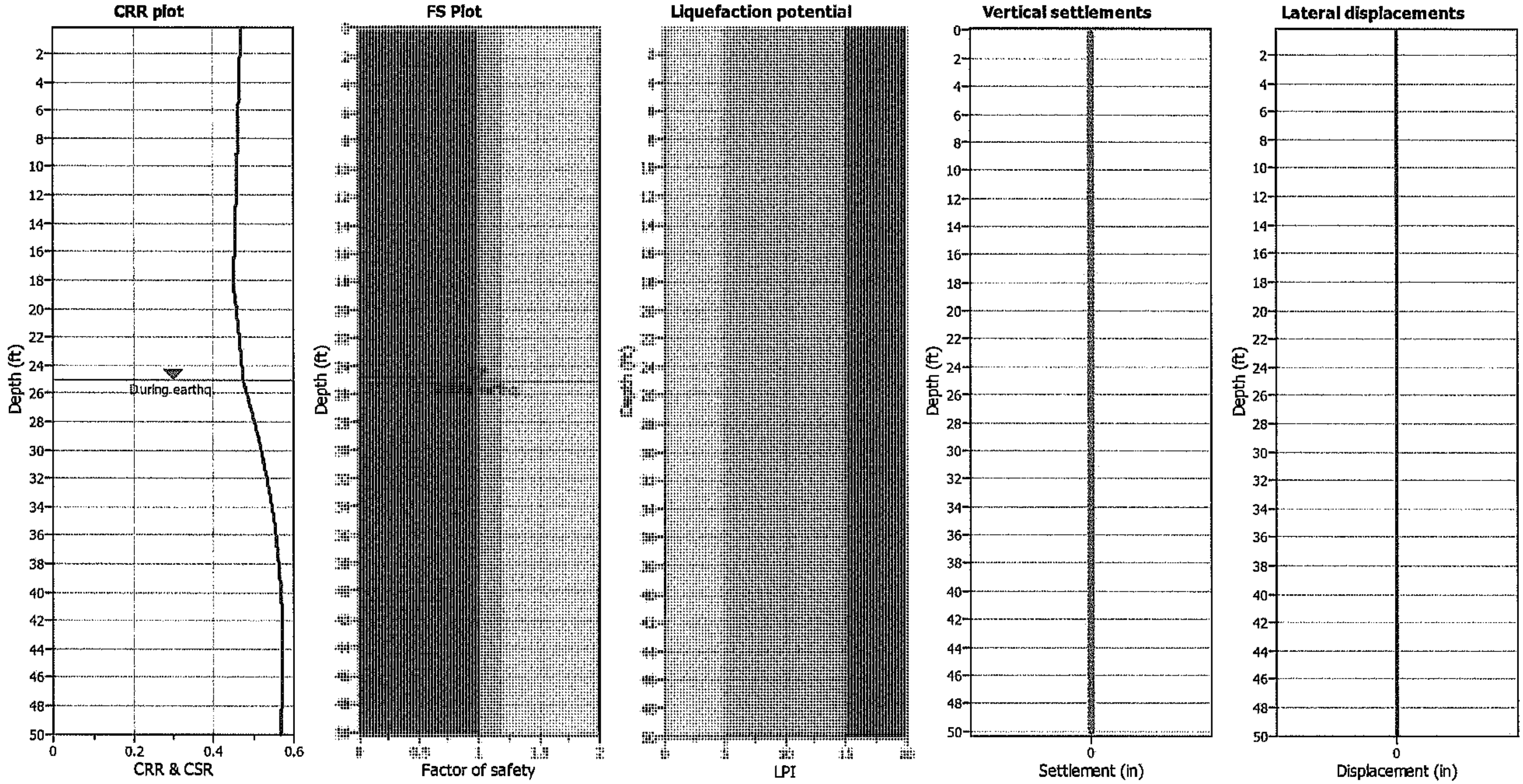
LPI color scheme

- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:54 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering CPT name: CPT-6

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

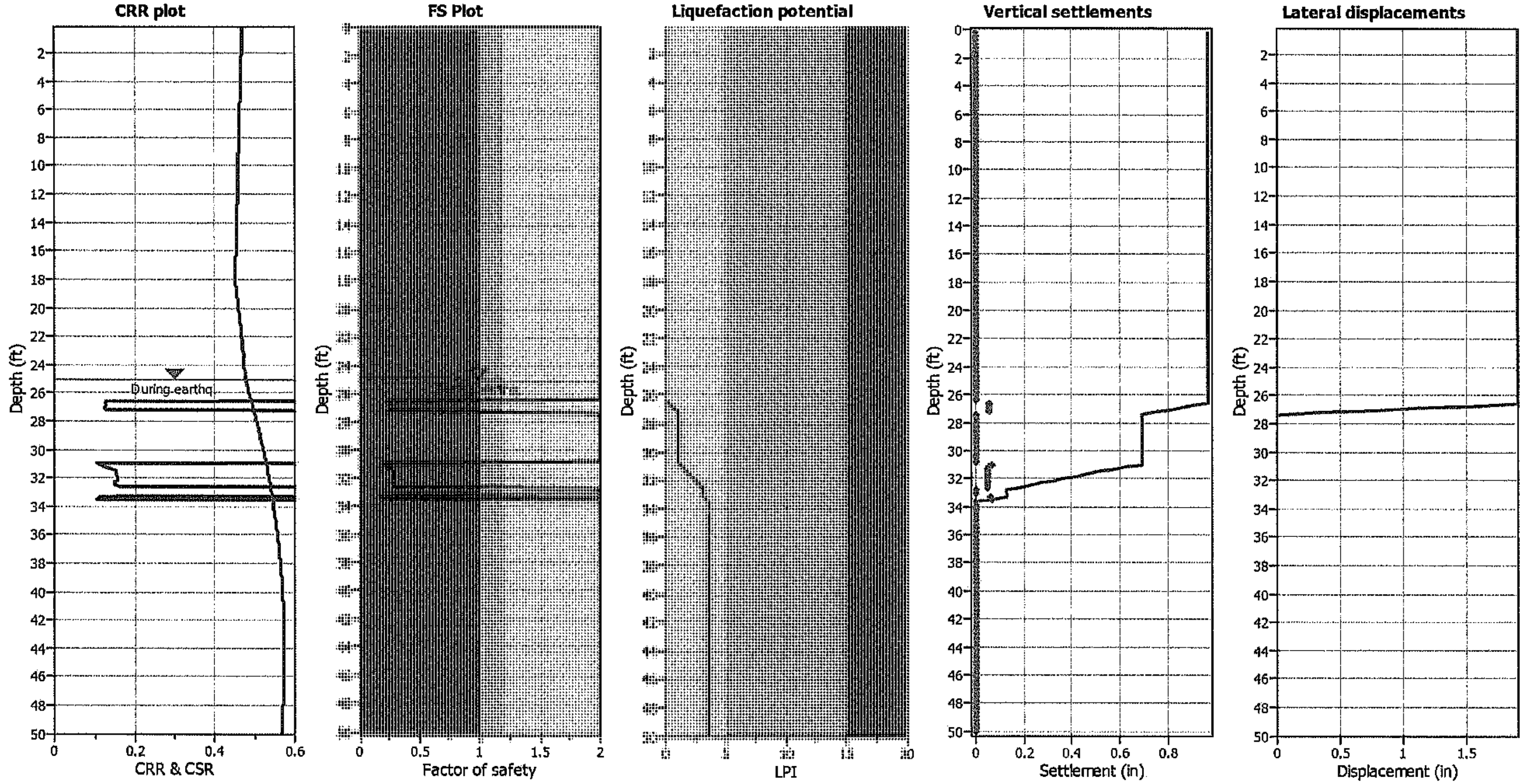
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:56 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-7

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

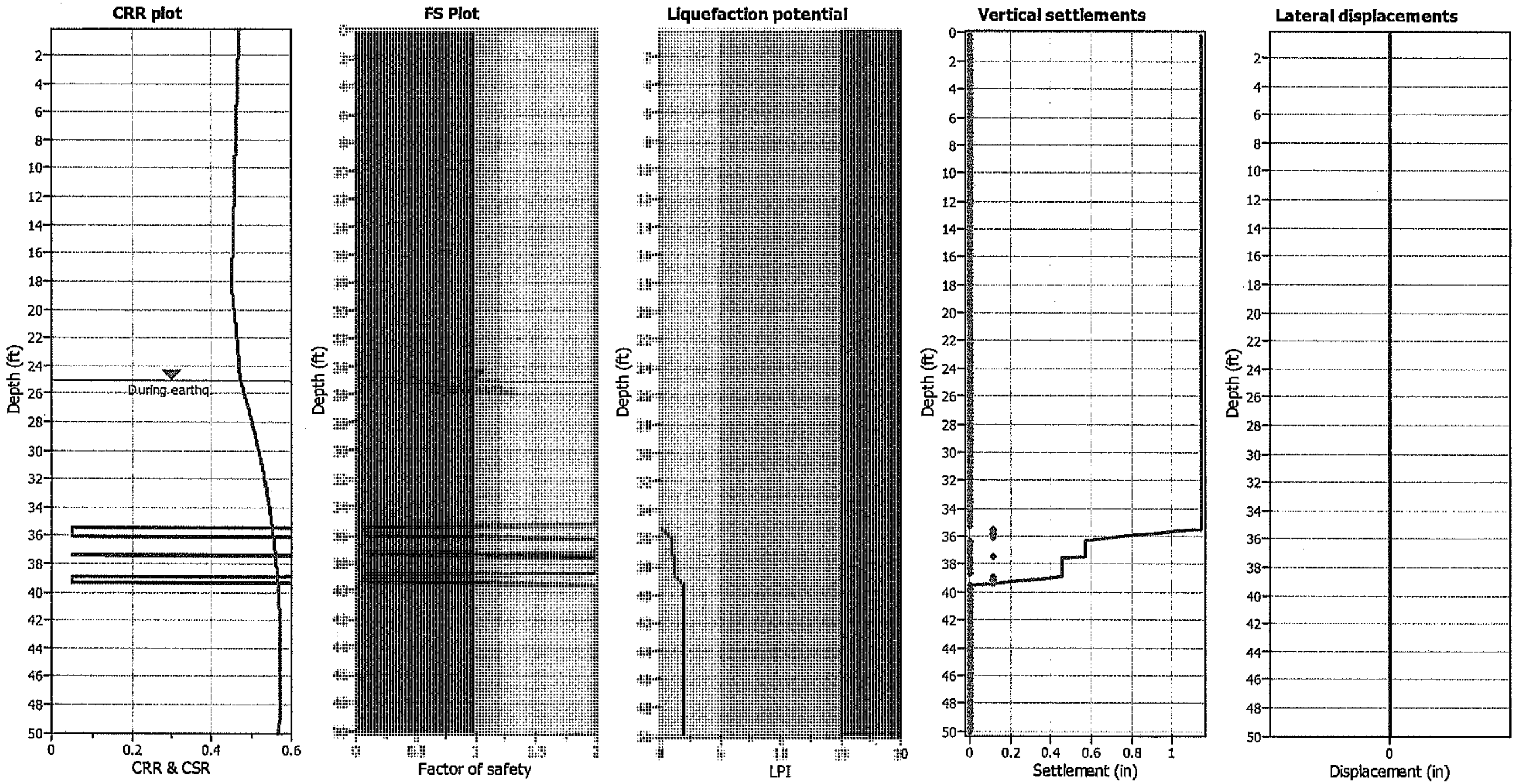
LPI color scheme

- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:58 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering | CPT name: CPT-8

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

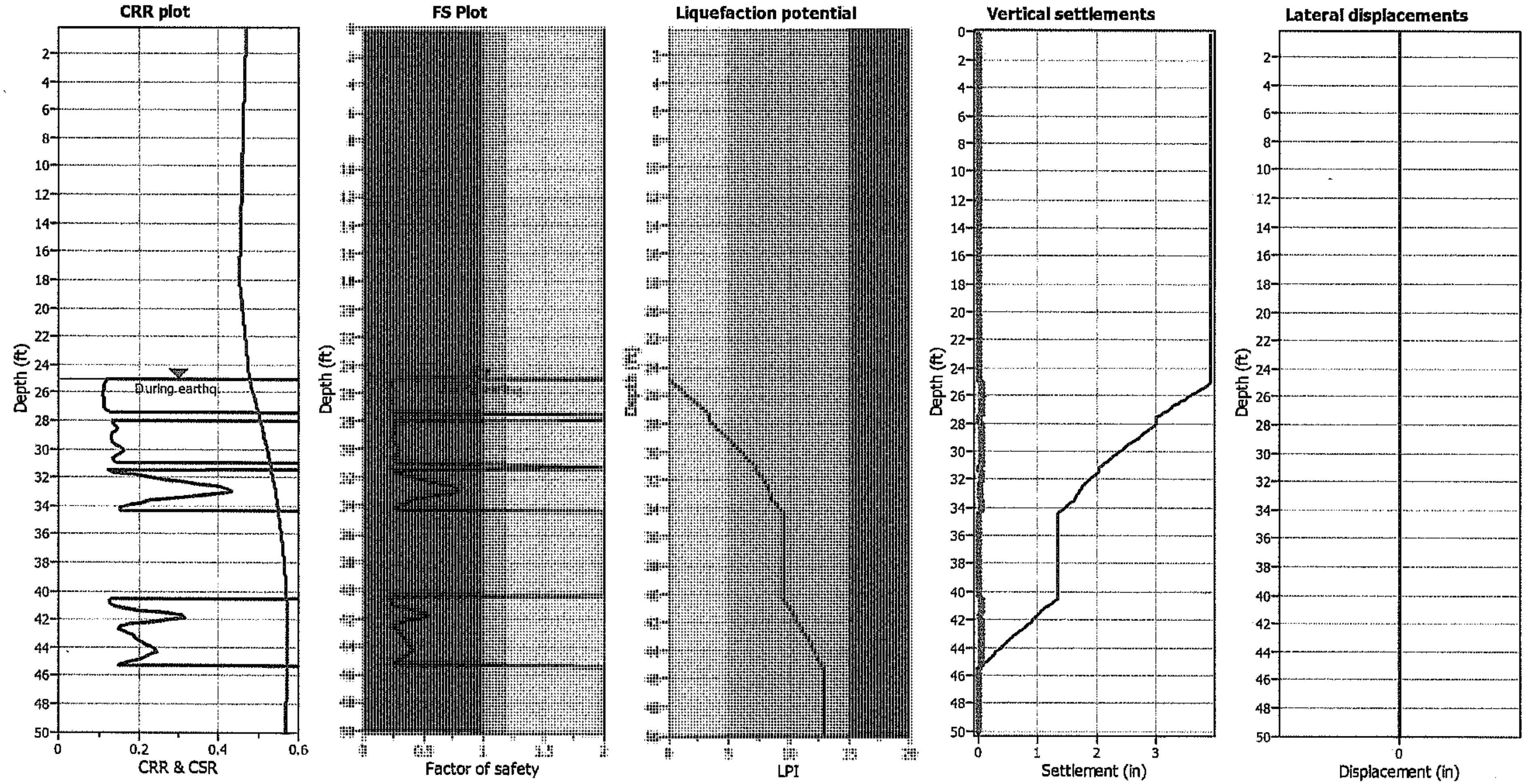
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:01 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-9

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	**Fill weight:**	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	**Transition detect. applied:**	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	**K_σ applied:**	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	**Clay like behavior applied:**	No
Peak ground acceleration:	0.63	Use fill:	No	**Limit depth applied:**	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	**Limit depth:**	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

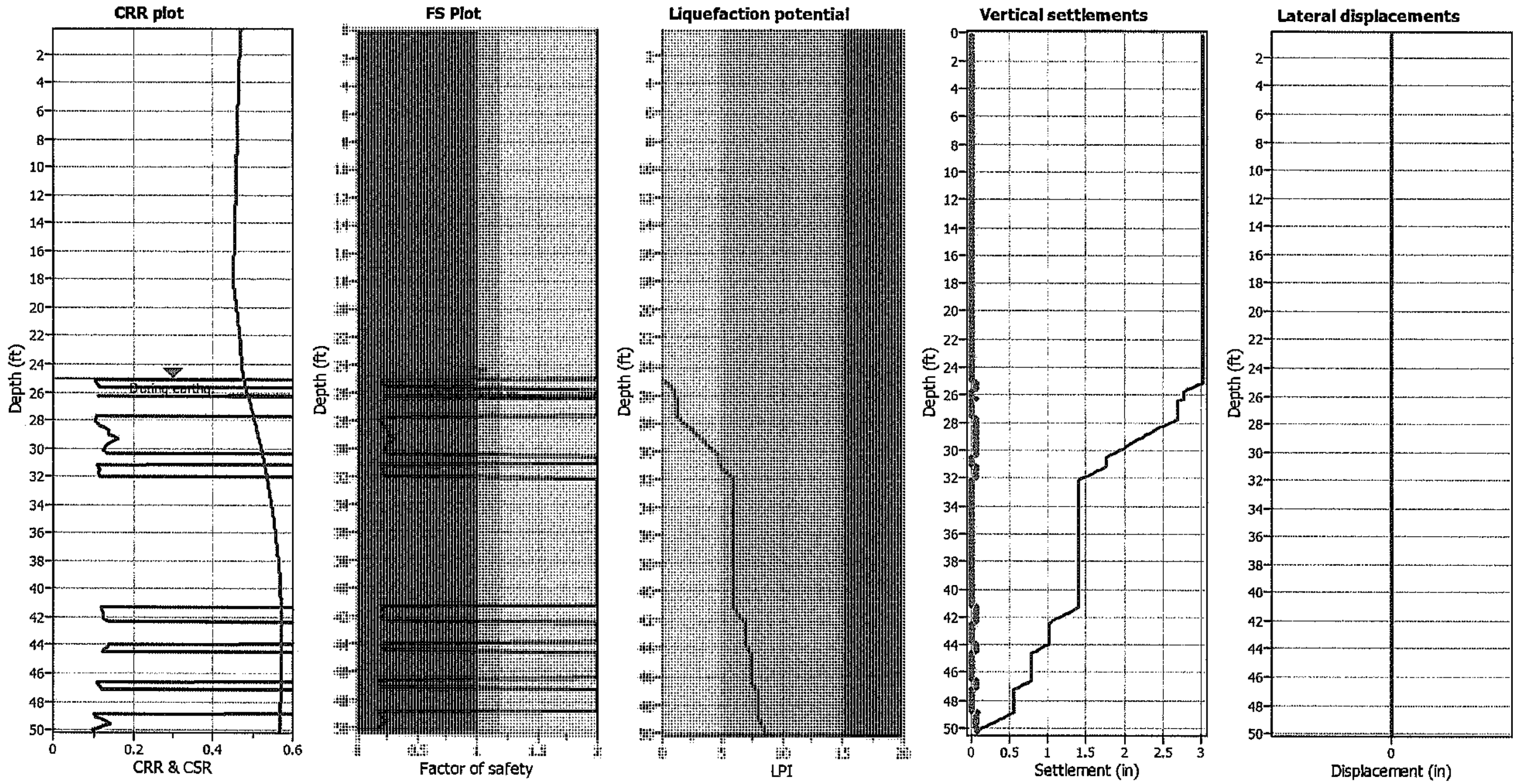
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:03 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-10

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:06 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

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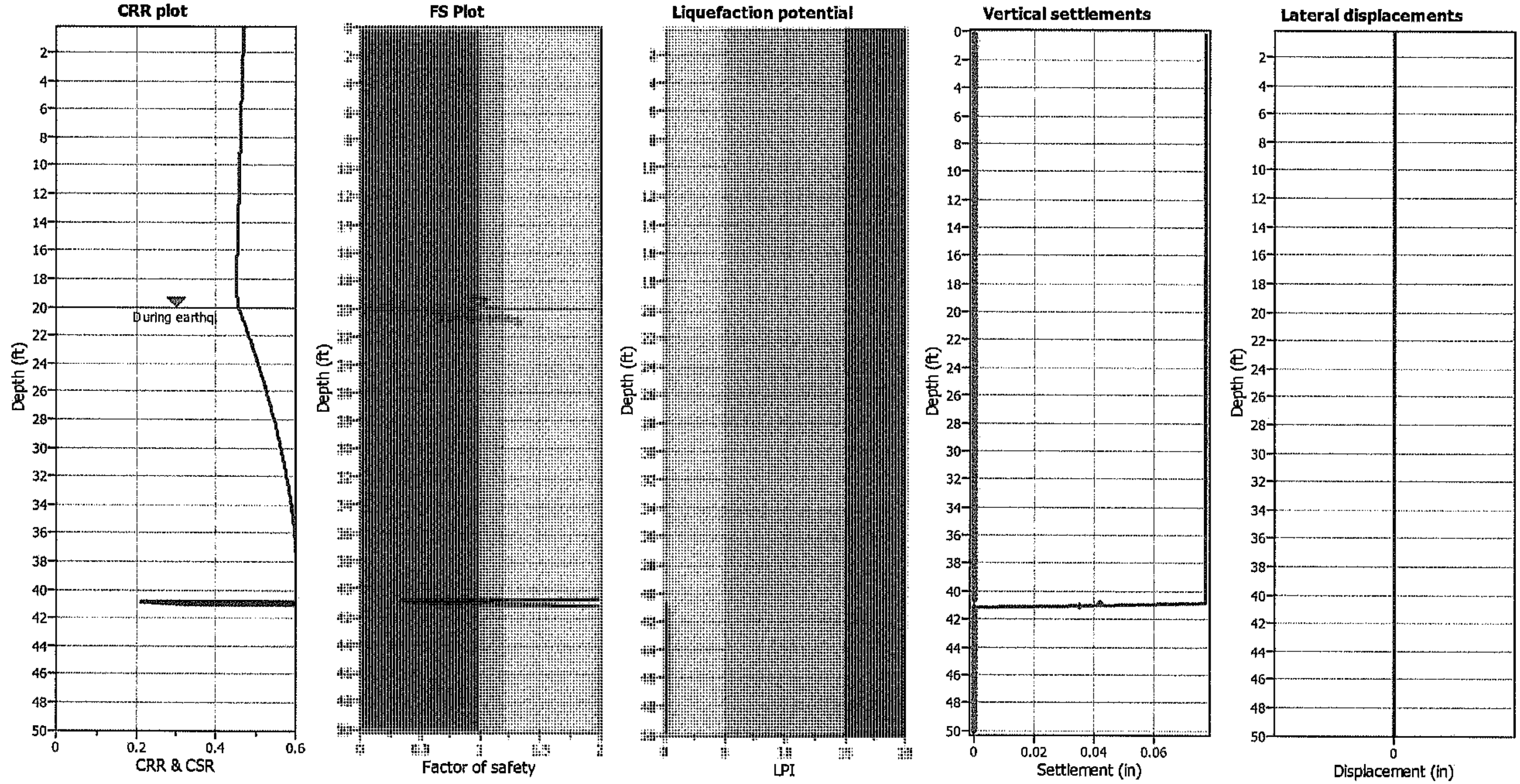
CPT name: CPT-11

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A		
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No		
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes		
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No		
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No		
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A		

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

- Very high risk
- High risk
- Low risk

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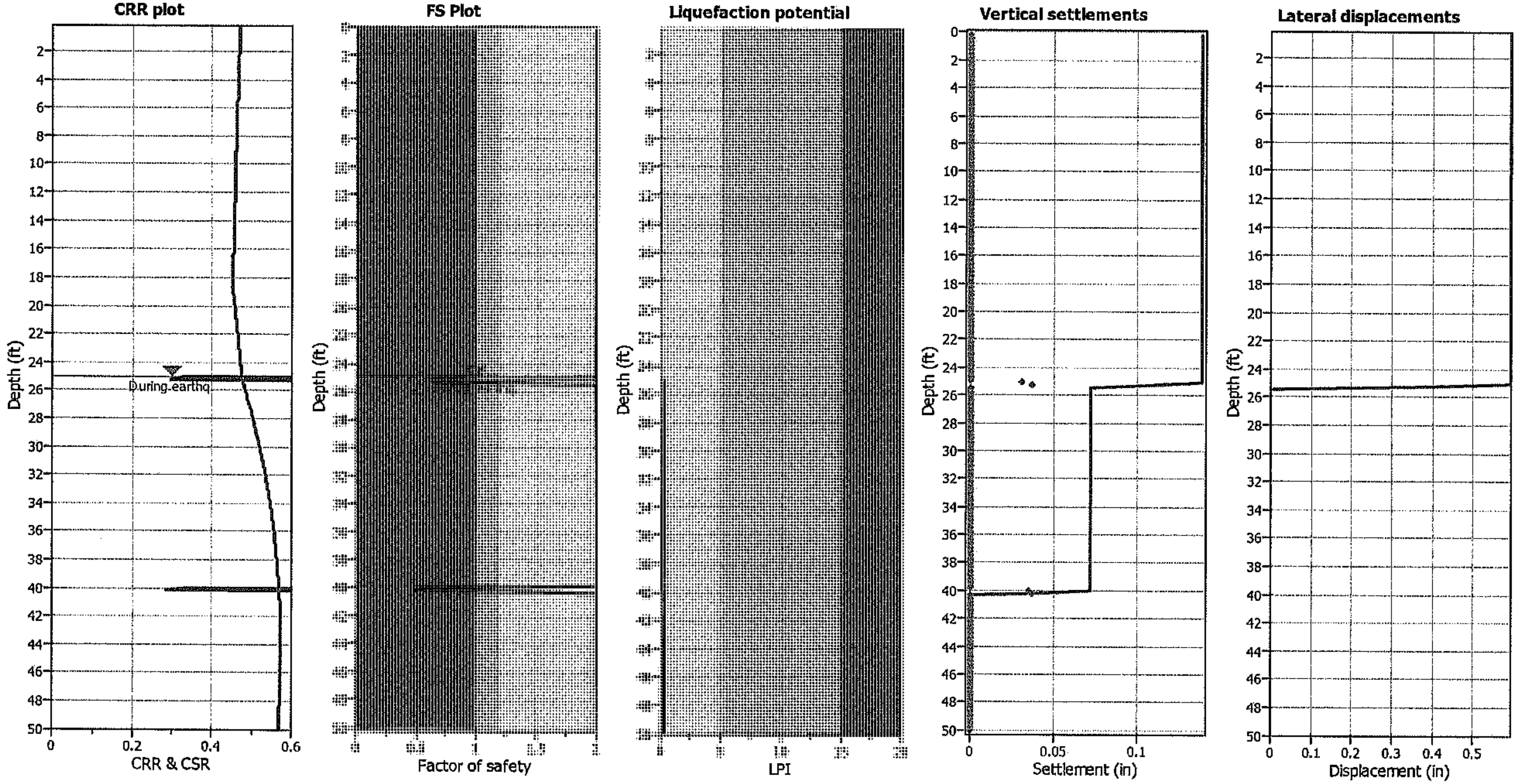
CPT name: CPT-12

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	35.00 ft	Fill height:	N/A	Limit depth:	N/A

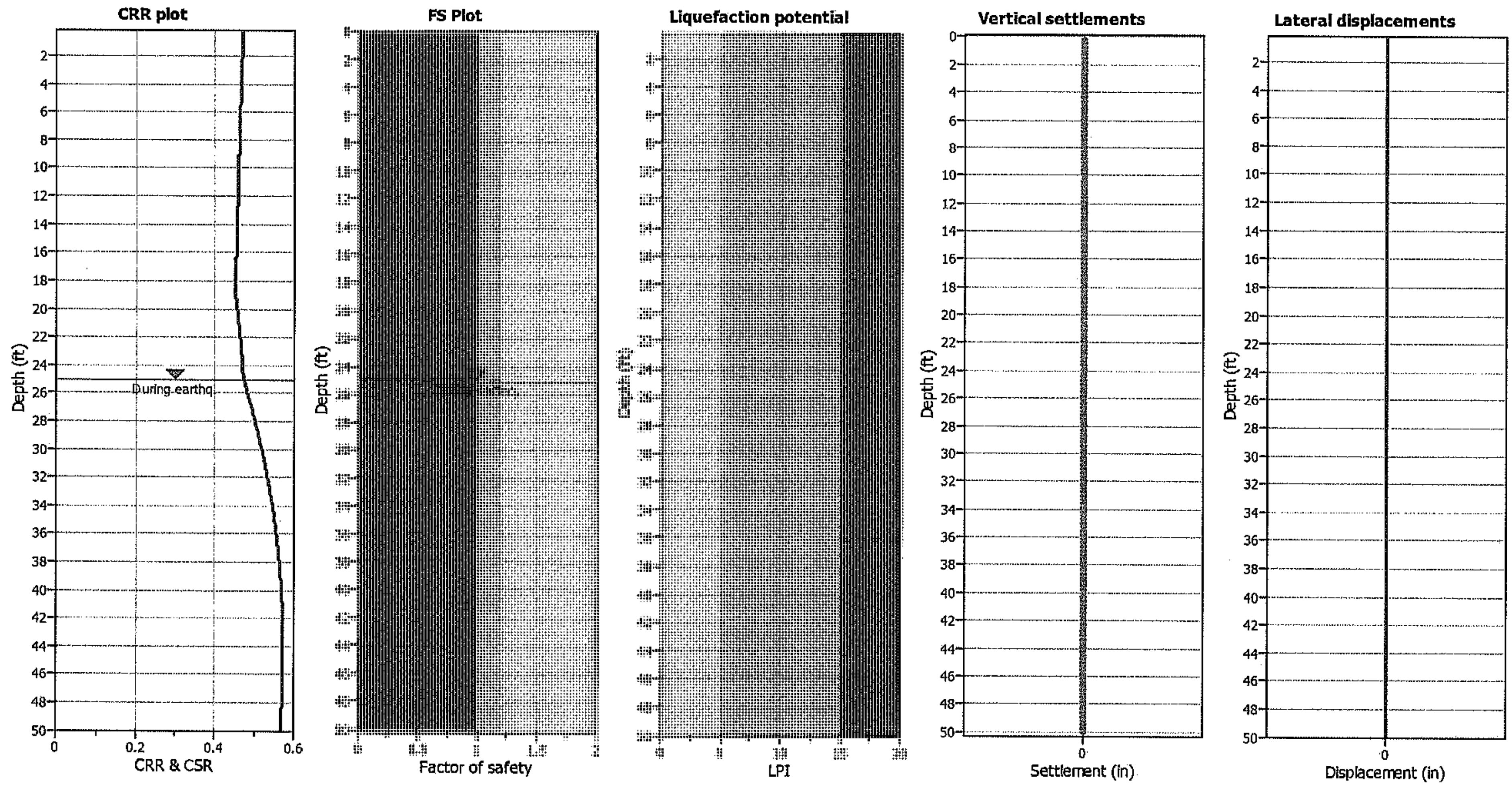
F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



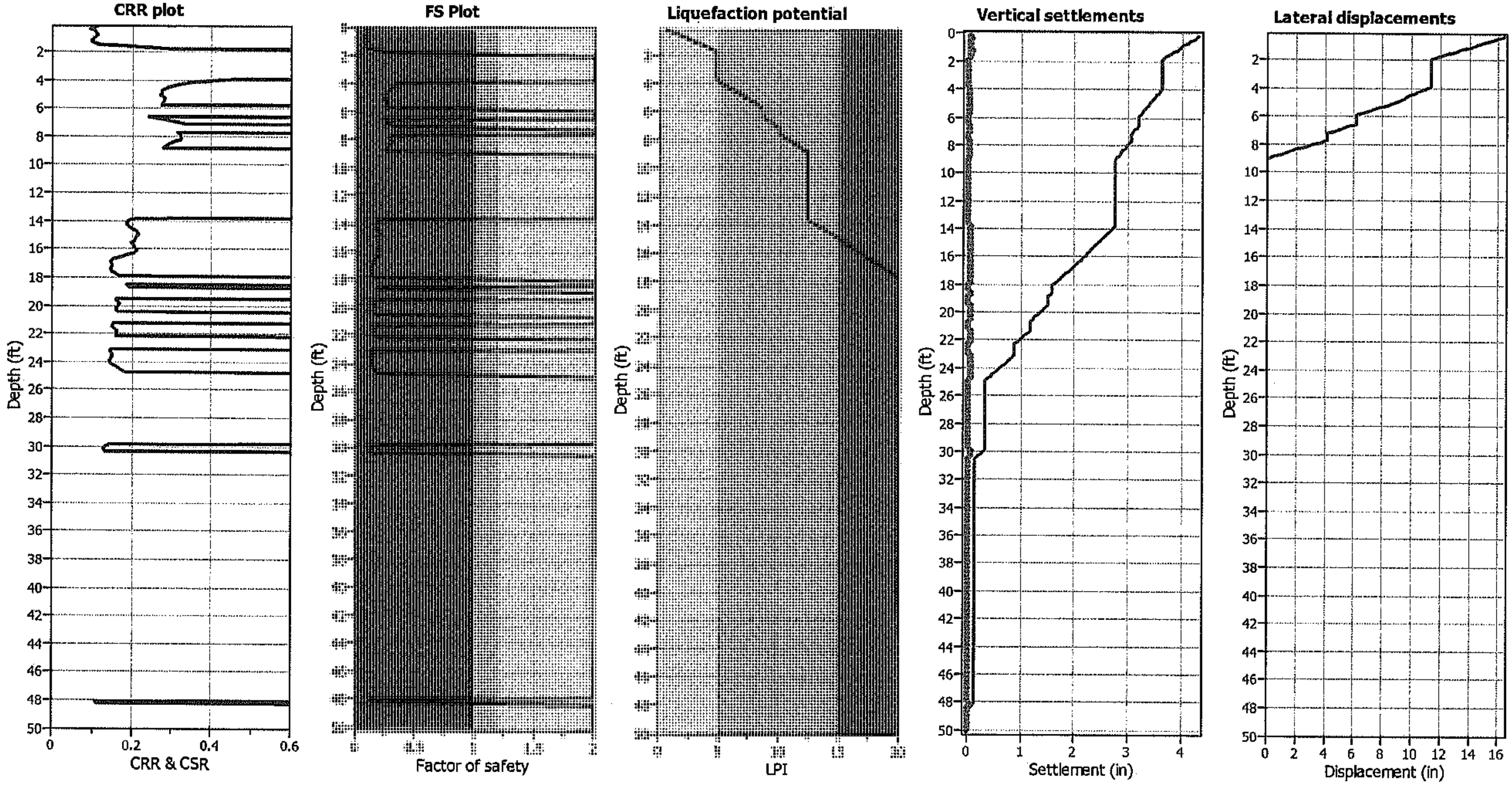
Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	35.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme
- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	0.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	N/A

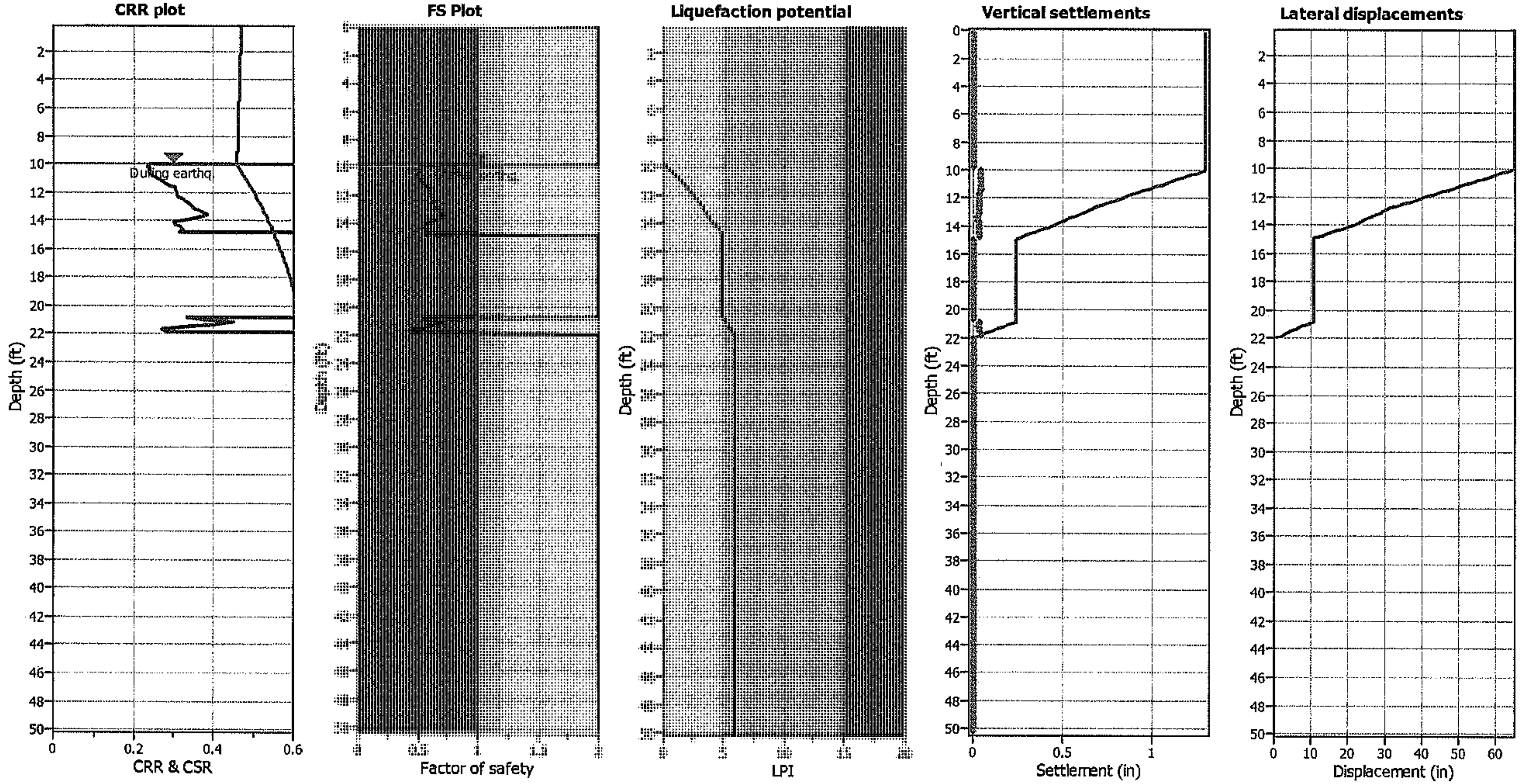
F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme
- Very high risk
- High risk
- Low risk

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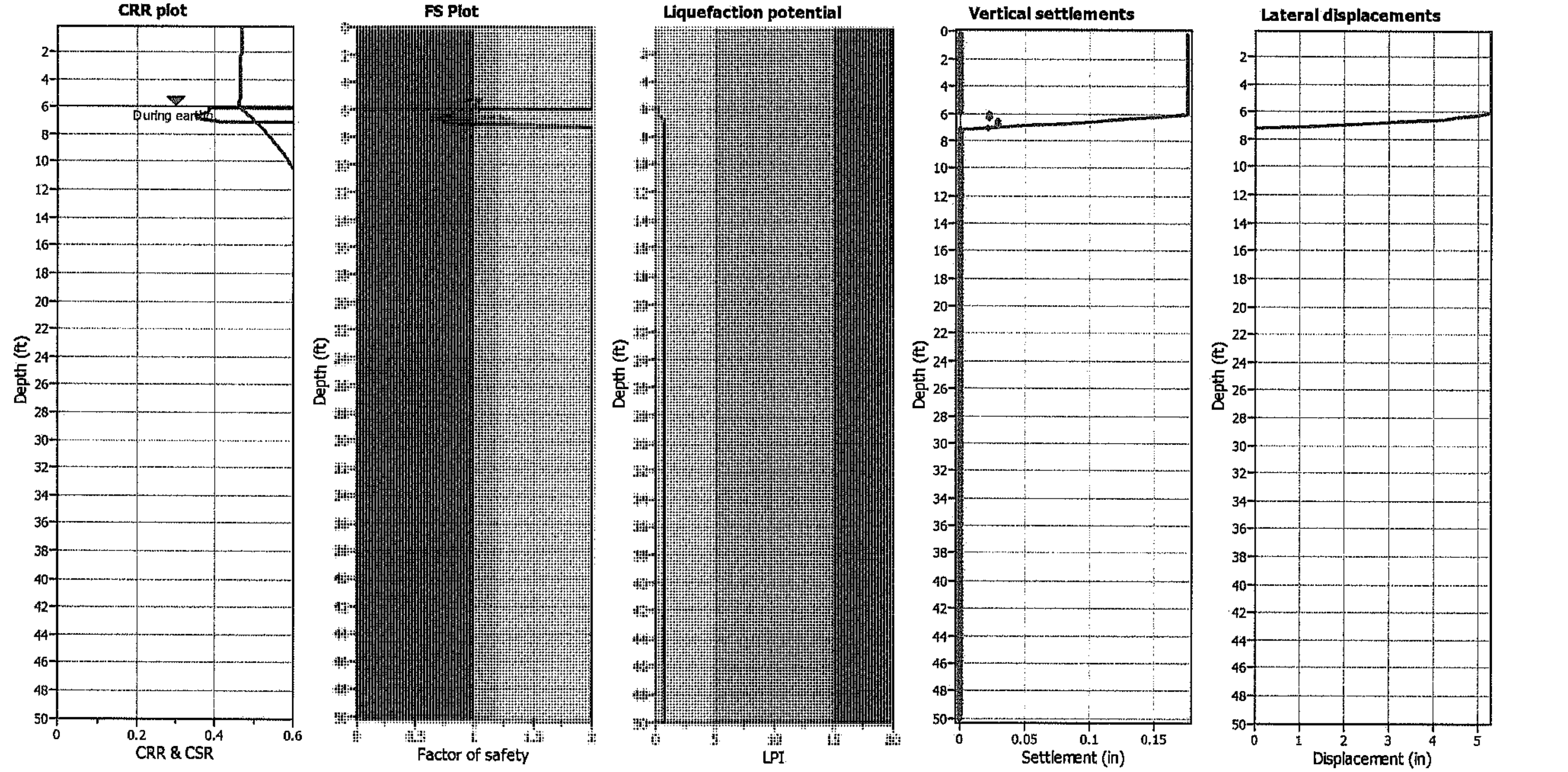
CPT name: CPT-16

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	6.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

- Very high risk
- High risk
- Low risk

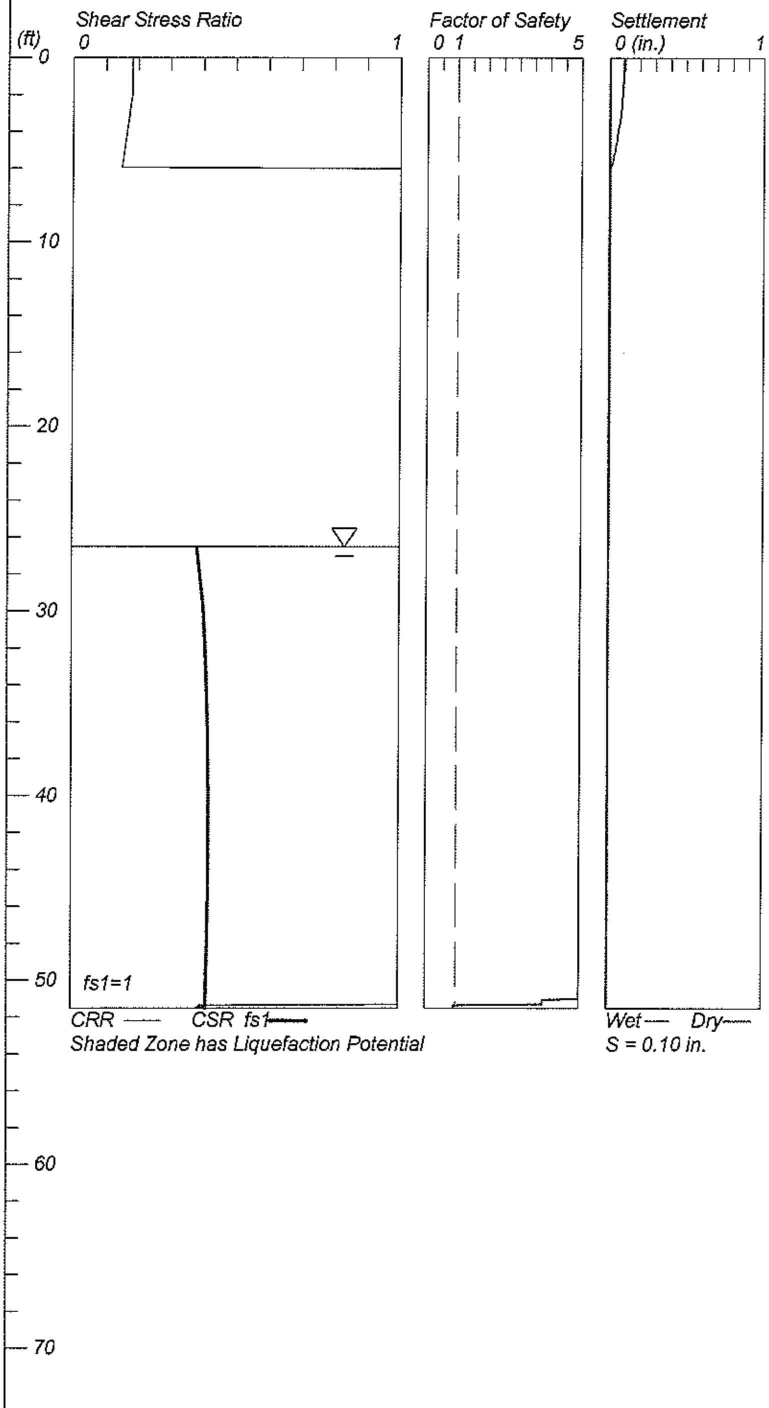
CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/3/2009, 9:56:16 AM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-4 Water Depth=26.5 ft

Magnitude=7.9
Acceleration=0.63g



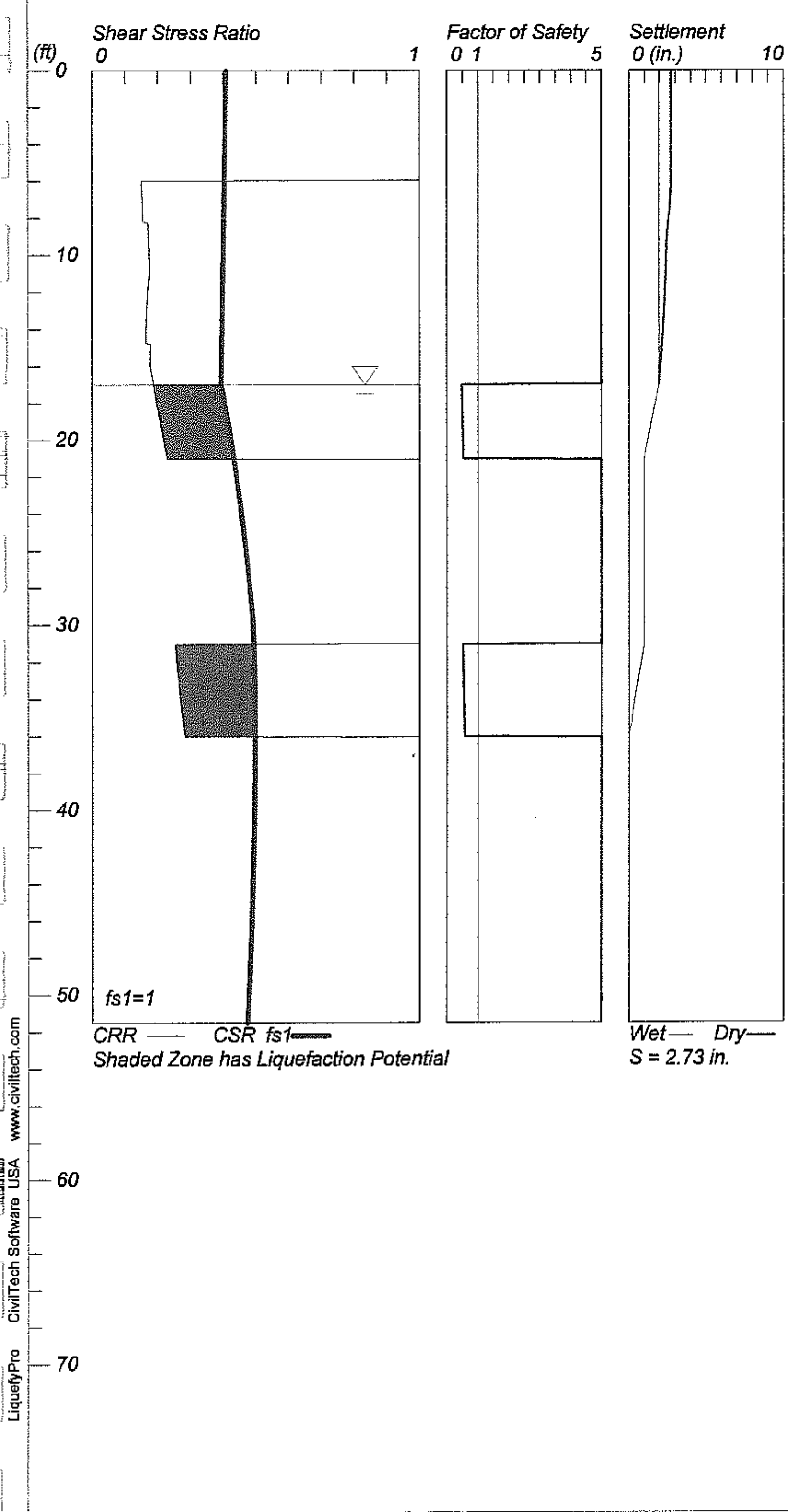
Soil Description	Raw SPT	Unit Weight	Fines %
Brown Poorly Graded SAND	12	120	
	12	120	
Dary Gray CLAY	10	120	NoLq
Mottled Tan and Brown CLAY	8	120	NoLq
Mottled Light Brown, Gray and Red Brown Silty CLAY	26	120	NoLq
Mottled Gray and Red-Brown CLAY with Sand	17	120	NoLq
Mottled Gray and Red-Brown CLAY	28	120	NoLq
	28	120	NoLq
	28	120	NoLq
Mottled Gray and Red-Orange Silty CLAY\SILT	20	120	NoLq
	36	120	NoLq
Gray Silty CLAY\SILT	39	120	
Gray Brown SILT			

LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-6 Water Depth=17 ft

Magnitude=7.9
Acceleration=0.63g



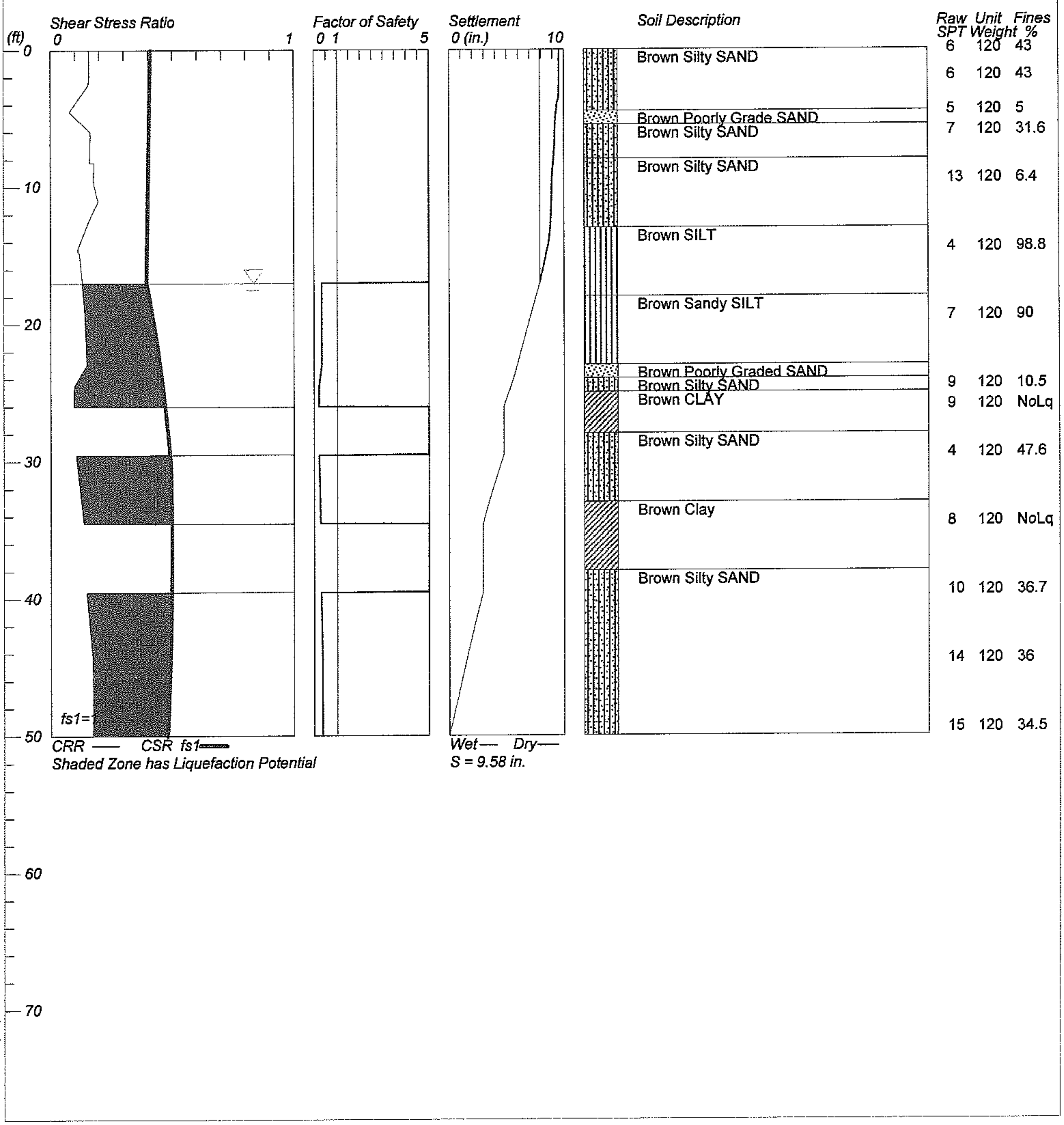
Soil Description	Raw SPT	Unit Weight	Fines %
Mottled Light Brown and Dark Brown Sandy CLAY	12	120	NoLq
	12	120	NoLq
Brown Silty SAND	7	120	25
Brown Silty SAND	14	120	6.1
Brown Sandy SILT			
Brown Clayey SAND	10	120	32.3
Brown CLAY with Sand	16	120	NoLq
Mottled Light Gray and Red Tan Silty CLAY\SILT	23	120	NoLq
Mottled Brown, Gray and Red Brown SILT	20	120	
Mottled Blue Gray and Red Brown Silty CLAY\SILT	23	120	NoLq
	25	120	NoLq
	25	120	NoLq
Mottled Bue Gray, Red Brown and Gray Silty CLAY\SILT	27	120	NoLq

LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-8 Water Depth=17 ft

Magnitude=7.9
Acceleration=0.63g

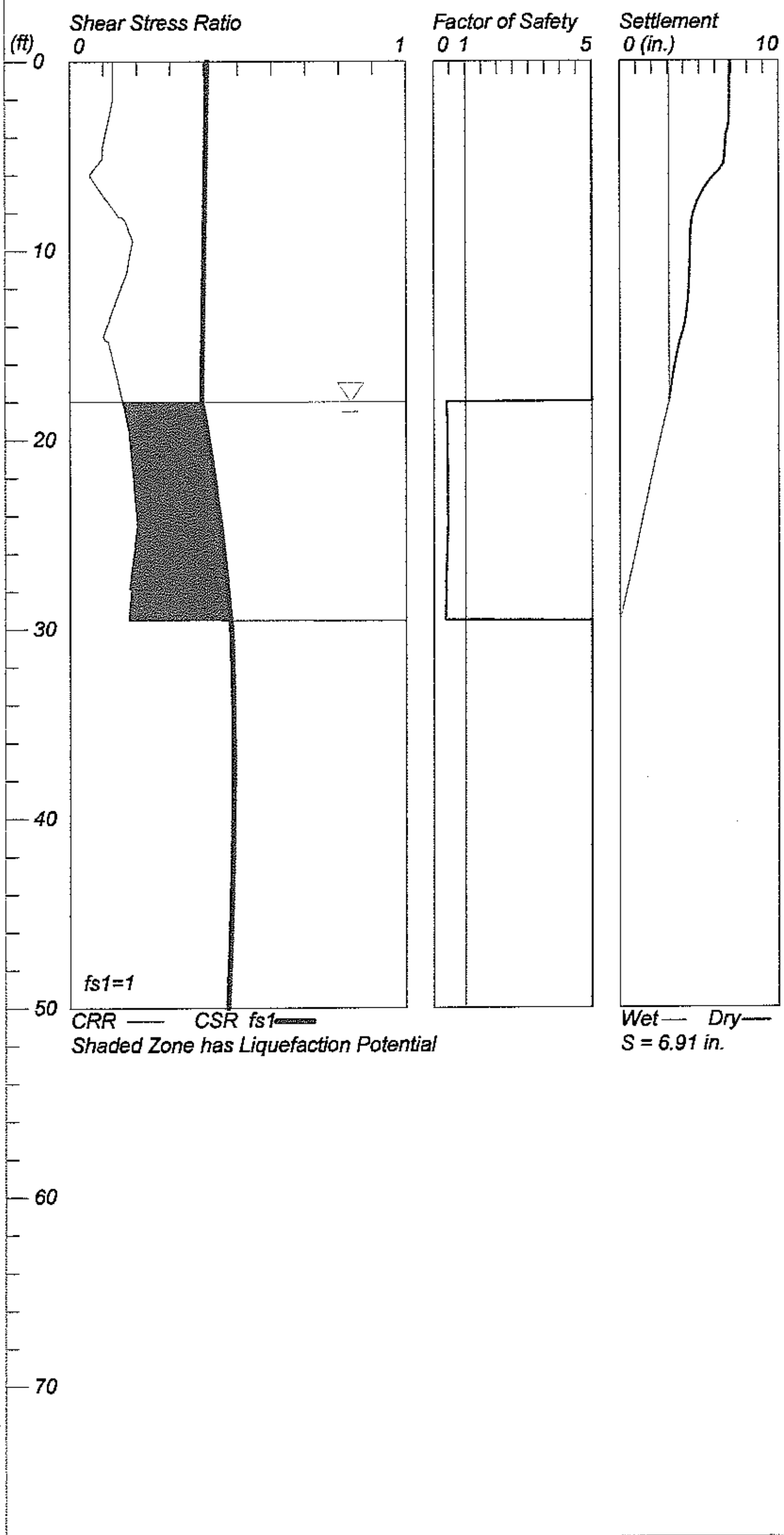


LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-10 ***Water Depth=18 ft***

Magnitude=7.9
Acceleration=0.63g



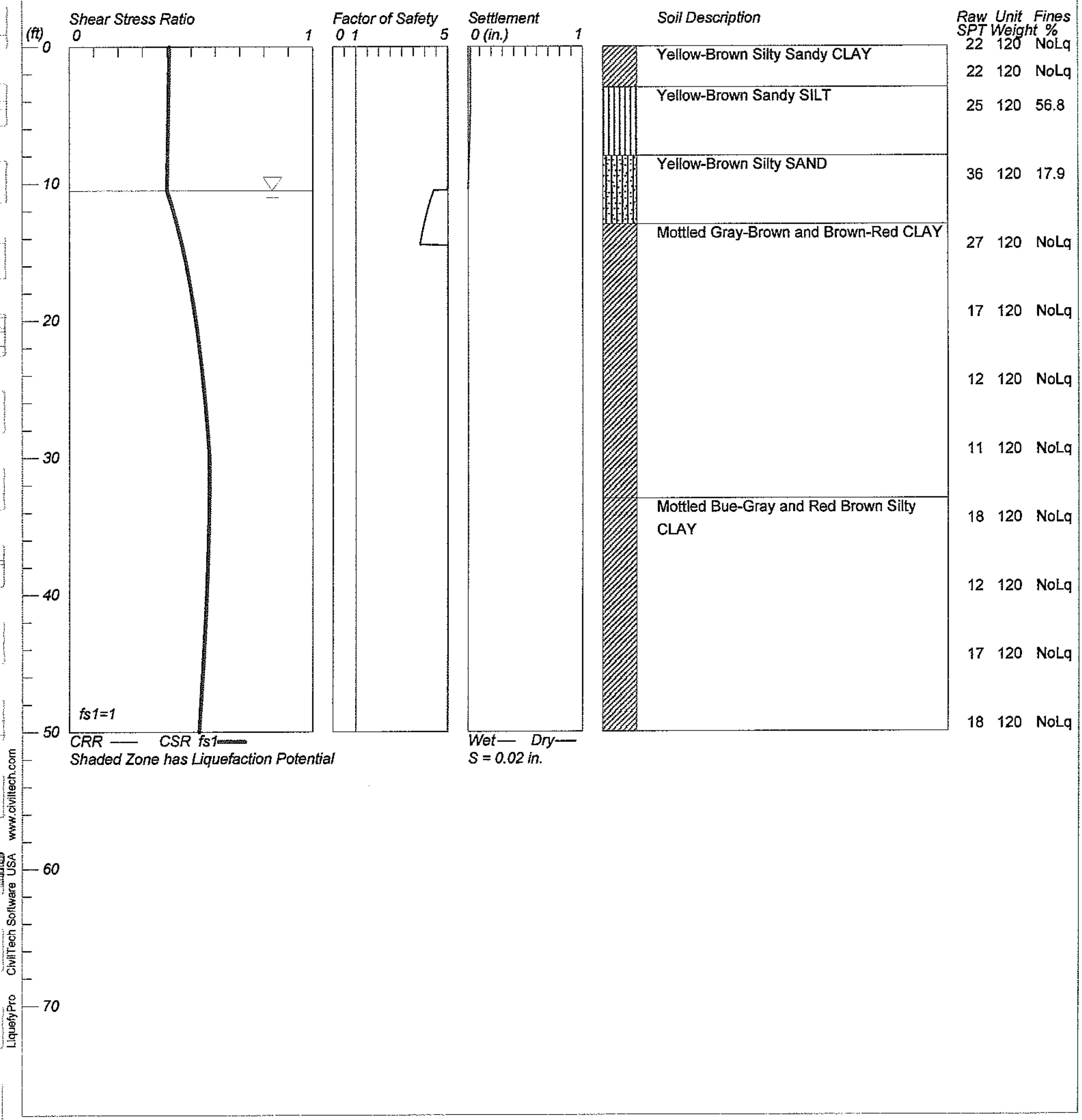
Soil Description	Raw SPT	Unit Weight	Fines %
Brown Silty SAND	4	120	49.4
	4	120	49.4
	2	120	49.4
	2	120	14.4
Brown Poorly Graded SAND	9	120	44.3
Brown Silty SAND	7	120	16.0
	12	120	27.7
Brown Silty SAND	16	120	27.7
Brown Sandy CLAY	14	120	NoLq
Mottled Brown, Gray-Brown and Red-Brown CLAY	14	120	NoLq
	10	120	NoLq
Mottled Blue-Gray and Yellow-Brown CLAY	14	120	NoLq
Blue-Gray CLAY	14	120	NoLq

LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-11 Water Depth=10.5 ft

Magnitude=7.9
Acceleration=0.63g

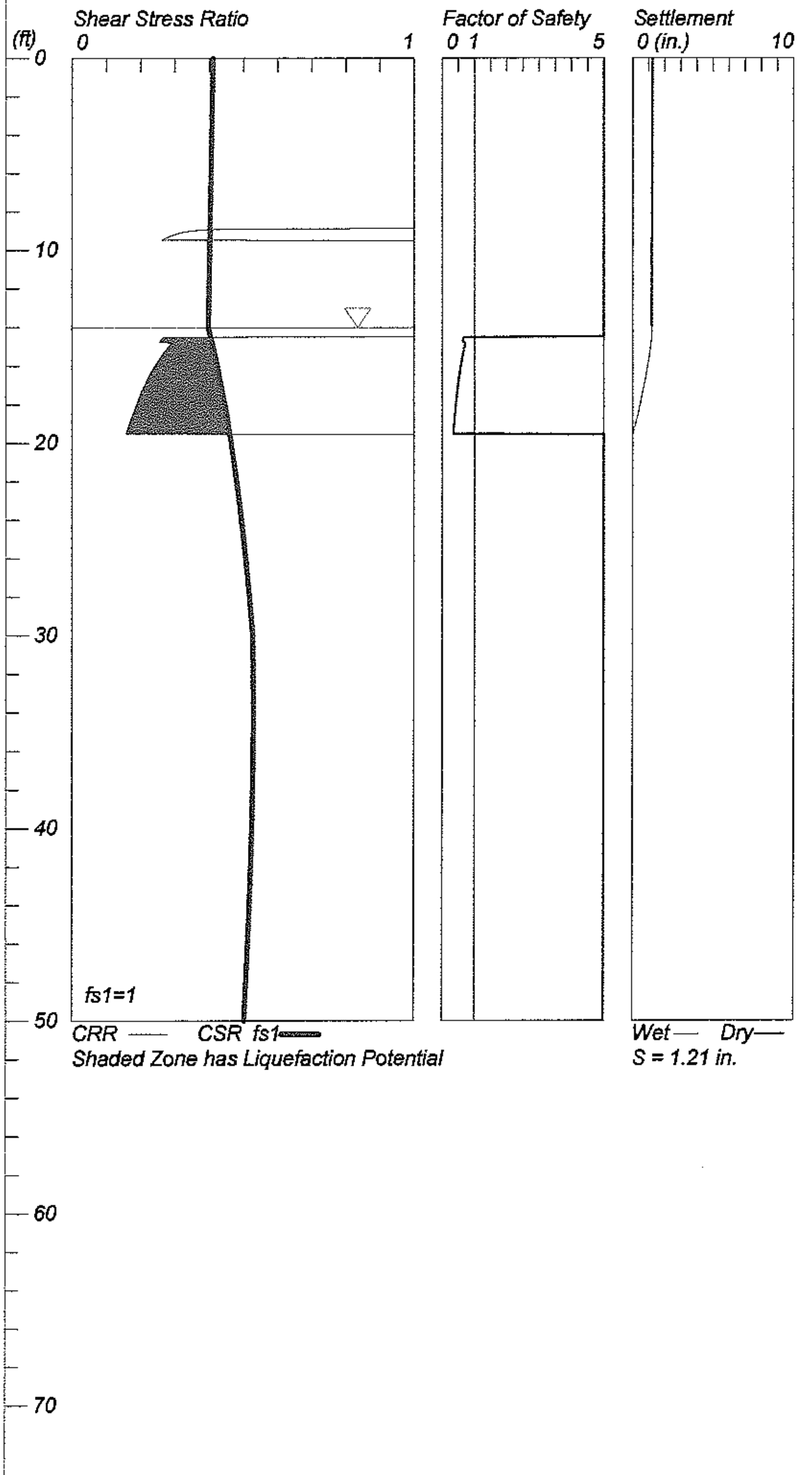


LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-12 Water Depth=14 ft

Magnitude=7.9
Acceleration=0.63g



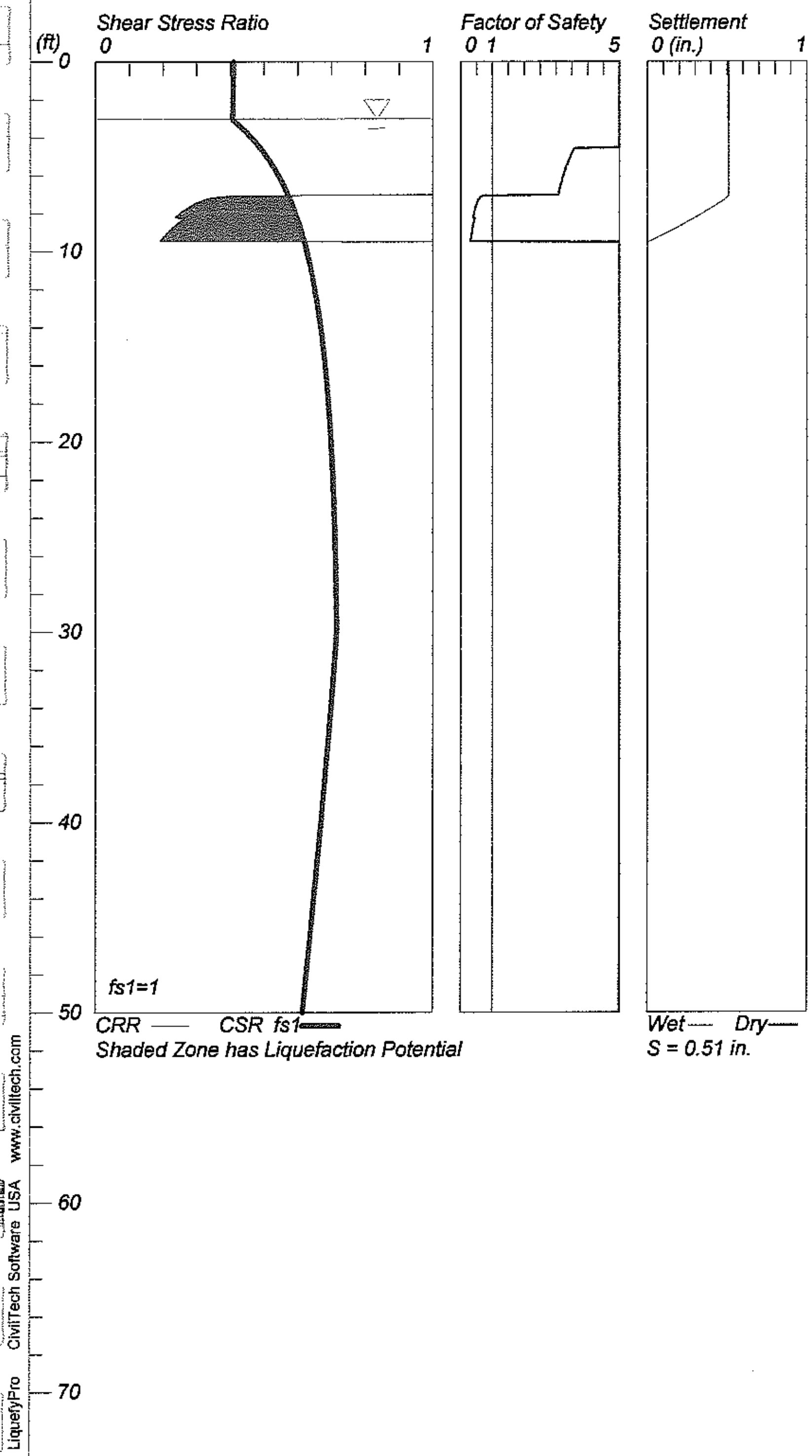
Soil Description	Raw SPT	Unit Weight	Fines %
Mottled Brown, Gray-Tan and Red-Orange Sandy CLAY	16	120	NoLq
	16	120	NoLq
Mottled Dark Brown and Red-Brown Clayey SAND	36	120	47.6
Brown CLAY with Sand	13	120	NoLq
Mottled Red-Brown and Gray-Brown SAND	17	120	33.2
Mottled Gray and Red-Brown CLAY with Sand	9	120	NoLq
Mottled Gray and Red-Brown CLAY	11	120	NoLq
	13	120	NoLq
	16	120	NoLq
Mottled Gray and Red-Orange Silty CLAY	10	120	NoLq
	16	120	NoLq
Bue-Gray Silty CLAY	16	120	NoLq

LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-16 Water Depth=3 ft

Magnitude=7.9
Acceleration=0.63g



Soil Description	Raw SPT	Unit Weight	Fines %
Mottled Black Brown CLAY	12	120	NoLq
Mottled Brown Tan and Gray Tan Sandy CLAY	15	120	NoLq
Mottled Gray Tan and Red Orange CLAY; Brown SAND with Clay; Mottled Gray and Red Brown CLAY	23	120	60
Mottled Gray and Red Brown SILT	9	120	NoLq
Mottled Gray Brown and Red Brown CLAY	12	120	NoLq
	19	120	NoLq
	17	120	NoLq
Mottled Gray and Red Brown Silty CLAY	18	120	NoLq
Mottled Blue Gray and Red Brown CLAY	18	120	NoLq
	15	120	NoLq
	20	120	NoLq
	20	120	NoLq

****
****

LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: H:\PF\2008\0829\Liquefaction\B-4.liq
Title: Atkinson Lane
Subtitle: Boring No.4

Surface Elev.=
Hole No.=B-4
Depth of Hole= 51.5 ft
Water Table during Earthquake= 26.5 ft
Water Table during In-Situ Testing= 36.5 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-4
Depth of Hole=51.5 ft
Water Table during Earthquake= 26.5 ft
Water Table during In-Situ Testing= 36.5 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
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*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	12.0	120.0	0.0
2.0	12.0	120.0	0.0
6.0	10.0	120.0	NoLiq
11.0	8.0	120.0	NoLiq
16.0	26.0	120.0	NoLiq
21.0	17.0	120.0	NoLiq
26.0	28.0	120.0	NoLiq
31.0	28.0	120.0	NoLiq
36.0	28.0	120.0	NoLiq
41.0	20.0	120.0	NoLiq
46.0	36.0	120.0	NoLiq

51.0	39.0	120.0	0.0

Output Results:
Settlement of saturated sands=0.01 in.
Settlement of dry sands=0.09 in.
Total settlement of saturated and dry sands=0.10 in.
Differential Settlement=0.048 to 0.063 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.18	0.41	5.00	0.01	0.09	0.10
2.00	0.18	0.41	5.00	0.01	0.08	0.08
4.00	0.17	0.41	5.00	0.01	0.05	0.06
6.00	2.00	0.40	5.00	0.01	0.00	0.01
8.00	2.00	0.40	5.00	0.01	0.00	0.01
10.00	2.00	0.40	5.00	0.01	0.00	0.01
12.00	2.00	0.40	5.00	0.01	0.00	0.01
14.00	2.00	0.40	5.00	0.01	0.00	0.01
16.00	2.00	0.39	5.00	0.01	0.00	0.01
18.00	2.00	0.39	5.00	0.01	0.00	0.01
20.00	2.00	0.39	5.00	0.01	0.00	0.01
22.00	2.00	0.39	5.00	0.01	0.00	0.01
24.00	2.00	0.39	5.00	0.01	0.00	0.01
26.00	2.00	0.38	5.00	0.01	0.00	0.01
28.00	2.00	0.39	5.00	0.01	0.00	0.01
30.00	2.00	0.41	5.00	0.01	0.00	0.01
32.00	2.00	0.41	5.00	0.01	0.00	0.01
34.00	2.00	0.41	5.00	0.01	0.00	0.01
36.00	2.00	0.42	5.00	0.01	0.00	0.01
38.00	2.00	0.42	5.00	0.01	0.00	0.01
40.00	2.00	0.42	5.00	0.01	0.00	0.01
42.00	2.00	0.42	5.00	0.01	0.00	0.01
44.00	2.00	0.42	5.00	0.01	0.00	0.01
46.00	2.00	0.42	5.00	0.01	0.00	0.01
48.00	2.00	0.42	5.00	0.01	0.00	0.01
50.00	2.00	0.42	5.00	0.01	0.00	0.01

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

Units   Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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

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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: H:\PF\2008\0829\Liquefaction\B-6.liq
Title: Atkinson Lane
Subtitle: Boring No.6

Surface Elev.=
Hole No.=B-6
Depth of Hole= 51.5 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-6
Depth of Hole=51.5 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
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*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	12.0	120.0	NoLiq
2.0	12.0	120.0	NoLiq
6.0	7.0	120.0	25.0
11.0	14.0	120.0	6.1
16.0	10.0	120.0	32.3
21.0	16.0	120.0	NoLiq
26.0	23.0	120.0	NoLiq
31.0	20.0	120.0	32.3
36.0	23.0	120.0	NoLiq
41.0	25.0	120.0	NoLiq
46.0	25.0	120.0	NoLiq

51.0 27.0 120.0 NoLiq

Output Results:

Settlement of saturated sands=1.94 in.
Settlement of dry sands=0.80 in.
Total settlement of saturated and dry sands=2.73 in.
Differential Settlement=1.367 to 1.805 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	1.94	0.80	2.73
2.00	2.00	0.41	5.00	1.94	0.80	2.73
4.00	2.00	0.41	5.00	1.94	0.80	2.73
6.00	0.15	0.40	5.00	1.94	0.80	2.73
8.00	0.15	0.40	5.00	1.94	0.63	2.57
10.00	0.17	0.40	5.00	1.94	0.46	2.40
12.00	0.17	0.40	5.00	1.94	0.38	2.31
14.00	0.17	0.40	5.00	1.94	0.25	2.19
16.00	0.18	0.39	5.00	1.94	0.09	2.02
18.00	0.20	0.40	0.49*	1.68	0.00	1.68
20.00	0.22	0.42	0.51*	1.19	0.00	1.19
22.00	2.00	0.44	5.00	0.95	0.00	0.95
24.00	2.00	0.46	5.00	0.95	0.00	0.95
26.00	2.00	0.47	5.00	0.95	0.00	0.95
28.00	2.00	0.48	5.00	0.95	0.00	0.95
30.00	2.00	0.49	5.00	0.95	0.00	0.95
32.00	0.26	0.49	0.52*	0.76	0.00	0.76
34.00	0.27	0.50	0.54*	0.37	0.00	0.37
36.00	0.28	0.50	0.57*	0.01	0.00	0.01
38.00	2.00	0.50	5.00	0.00	0.00	0.00
40.00	2.00	0.50	5.00	0.00	0.00	0.00
42.00	2.00	0.49	5.00	0.00	0.00	0.00
44.00	2.00	0.49	5.00	0.00	0.00	0.00
46.00	2.00	0.49	5.00	0.00	0.00	0.00
48.00	2.00	0.48	5.00	0.00	0.00	0.00
50.00	2.00	0.48	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 Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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

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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: H:\PF\2008\0829\Liquefaction\B-8.liq
Title: Atkinson Lane
Subtitle: Boring No.8

Surface Elev.=
Hole No.=B-8
Depth of Hole= 50.0 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:

Surface Elev.=
Hole No.=B-8
Depth of Hole=50.0 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
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*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
   Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	6.0	120.0	43.0
2.0	6.0	120.0	43.0
4.5	5.0	120.0	5.0
6.0	7.0	120.0	31.6
9.5	13.0	120.0	6.4
14.5	4.0	120.0	98.8
19.5	7.0	120.0	90.0
24.5	9.0	120.0	10.5
26.0	9.0	120.0	NoLiq
29.5	4.0	120.0	47.6
34.5	8.0	120.0	NoLiq

39.5	10.0	120.0	36.7
44.5	14.0	120.0	36.0
49.5	15.0	120.0	34.5

Output Results:
Settlement of saturated sands=7.89 in.
Settlement of dry sands=1.69 in.
Total settlement of saturated and dry sands=9.58 in.
Differential Settlement=4.790 to 6.323 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.16	0.41	5.00	7.89	1.69	9.58
2.00	0.16	0.41	5.00	7.89	1.67	9.57
4.00	0.10	0.41	5.00	7.89	1.49	9.38
6.00	0.16	0.40	5.00	7.89	1.32	9.21
8.00	0.16	0.40	5.00	7.89	1.20	9.09
10.00	0.18	0.40	5.00	7.89	1.05	8.95
12.00	0.17	0.40	5.00	7.89	0.98	8.87
14.00	0.12	0.40	5.00	7.89	0.77	8.67
16.00	0.12	0.39	5.00	7.89	0.27	8.16
18.00	0.13	0.40	0.33*	7.55	0.00	7.55
20.00	0.14	0.42	0.34*	6.88	0.00	6.88
22.00	0.15	0.44	0.33*	6.24	0.00	6.24
24.00	0.11	0.46	0.25*	5.57	0.00	5.57
26.00	0.09	0.47	0.20*	4.75	0.00	4.75
28.00	2.00	0.48	5.00	4.72	0.00	4.72
30.00	0.11	0.49	0.22*	4.55	0.00	4.55
32.00	0.12	0.49	0.24*	3.80	0.00	3.80
34.00	0.13	0.50	0.27*	3.09	0.00	3.09
36.00	2.00	0.50	5.00	2.91	0.00	2.91
38.00	2.00	0.50	5.00	2.91	0.00	2.91
40.00	0.15	0.50	0.30*	2.77	0.00	2.77
42.00	0.16	0.49	0.32*	2.17	0.00	2.17
44.00	0.17	0.49	0.35*	1.61	0.00	1.61
46.00	0.17	0.49	0.35*	1.07	0.00	1.07
48.00	0.17	0.48	0.36*	0.53	0.00	0.53
50.00	0.17	0.48	0.36*	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 Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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

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Input File Name: H:\PF\2008\0829\Liquefaction\B-10.liq
Title: Atkinson Lane
Subtitle: Boring No.10

Surface Elev.=
Hole No.=B-10
Depth of Hole= 50.0 ft
Water Table during Earthquake= 18.0 ft
Water Table during In-Situ Testing= 28.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-10
Depth of Hole=50.0 ft
Water Table during Earthquake= 18.0 ft
Water Table during In-Situ Testing= 28.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
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*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
   Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	4.0	120.0	49.4
2.0	4.0	120.0	49.4
4.5	2.0	120.0	49.4
6.0	2.0	120.0	14.4
9.5	9.0	120.0	44.3
14.5	7.0	120.0	16.0
19.5	12.0	120.0	27.7
24.5	16.0	120.0	27.7
29.5	14.0	120.0	NoLiq
34.5	14.0	120.0	NoLiq
39.5	10.0	120.0	NoLiq

44.5	14.0	120.0	NoLiq
49.5	14.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=3.08 in.
Settlement of dry sands=3.83 in.
Total settlement of saturated and dry sands=6.91 in.
Differential Settlement=3.456 to 4.562 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.13	0.41	5.00	3.08	3.83	6.91
2.00	0.13	0.41	5.00	3.08	3.81	6.89
4.00	0.10	0.41	5.00	3.08	3.58	6.66
6.00	0.06	0.40	5.00	3.08	2.92	6.01
8.00	0.14	0.40	5.00	3.08	1.54	4.63
10.00	0.18	0.40	5.00	3.08	1.33	4.42
12.00	0.15	0.40	5.00	3.08	1.24	4.33
14.00	0.11	0.40	5.00	3.08	0.96	4.05
16.00	0.13	0.39	5.00	3.08	0.39	3.47
18.00	0.16	0.39	0.40*	3.08	0.00	3.08
20.00	0.18	0.41	0.43*	2.51	0.00	2.51
22.00	0.19	0.43	0.44*	1.97	0.00	1.97
24.00	0.20	0.44	0.45*	1.46	0.00	1.46
26.00	0.19	0.46	0.42*	0.95	0.00	0.95
28.00	0.18	0.47	0.39*	0.42	0.00	0.42
30.00	2.00	0.48	5.00	0.00	0.00	0.00
32.00	2.00	0.48	5.00	0.00	0.00	0.00
34.00	2.00	0.49	5.00	0.00	0.00	0.00
36.00	2.00	0.49	5.00	0.00	0.00	0.00
38.00	2.00	0.49	5.00	0.00	0.00	0.00
40.00	2.00	0.49	5.00	0.00	0.00	0.00
42.00	2.00	0.48	5.00	0.00	0.00	0.00
44.00	2.00	0.48	5.00	0.00	0.00	0.00
46.00	2.00	0.48	5.00	0.00	0.00	0.00
48.00	2.00	0.48	5.00	0.00	0.00	0.00
50.00	2.00	0.47	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 Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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

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Input File Name: H:\PF\2008\0829\Liquefaction\B-11.liq
Title: Atkinson Lane
Subtitle: Boring No.11

Surface Elev.=
Hole No.=B-11
Depth of Hole= 50.0 ft
Water Table during Earthquake= 10.5 ft
Water Table during In-Situ Testing= 20.5 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-11
Depth of Hole=50.0 ft
Water Table during Earthquake= 10.5 ft
Water Table during In-Situ Testing= 20.5 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
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*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	22.0	120.0	NoLiq
2.0	22.0	120.0	NoLiq
4.5	25.0	120.0	56.8
9.5	36.0	120.0	17.9
14.5	27.0	120.0	NoLiq
19.5	17.0	120.0	NoLiq
24.5	12.0	120.0	NoLiq
29.5	11.0	120.0	NoLiq
34.5	18.0	120.0	NoLiq
39.5	12.0	120.0	NoLiq
44.5	17.0	120.0	NoLiq

49.5	18.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=0.00 in.
Settlement of dry sands=0.02 in.
Total settlement of saturated and dry sands=0.02 in.
Differential Settlement=0.010 to 0.013 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	0.00	0.02	0.02
2.00	2.00	0.41	5.00	0.00	0.02	0.02
4.00	2.00	0.41	5.00	0.00	0.02	0.02
6.00	1.75	0.40	5.00	0.00	0.02	0.02
8.00	1.75	0.40	5.00	0.00	0.01	0.01
10.00	1.75	0.40	5.00	0.00	0.00	0.00
12.00	1.75	0.43	4.11	0.00	0.00	0.00
14.00	1.75	0.46	3.84	0.00	0.00	0.00
16.00	2.00	0.48	5.00	0.00	0.00	0.00
18.00	2.00	0.50	5.00	0.00	0.00	0.00
20.00	2.00	0.52	5.00	0.00	0.00	0.00
22.00	2.00	0.53	5.00	0.00	0.00	0.00
24.00	2.00	0.55	5.00	0.00	0.00	0.00
26.00	2.00	0.56	5.00	0.00	0.00	0.00
28.00	2.00	0.57	5.00	0.00	0.00	0.00
30.00	2.00	0.58	5.00	0.00	0.00	0.00
32.00	2.00	0.58	5.00	0.00	0.00	0.00
34.00	2.00	0.57	5.00	0.00	0.00	0.00
36.00	2.00	0.57	5.00	0.00	0.00	0.00
38.00	2.00	0.57	5.00	0.00	0.00	0.00
40.00	2.00	0.56	5.00	0.00	0.00	0.00
42.00	2.00	0.56	5.00	0.00	0.00	0.00
44.00	2.00	0.55	5.00	0.00	0.00	0.00
46.00	2.00	0.55	5.00	0.00	0.00	0.00
48.00	2.00	0.54	5.00	0.00	0.00	0.00
50.00	2.00	0.53	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   Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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

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Input File Name: H:\PF\2008\0829\Liquefaction\B-12.liq
Title: Atkinson Lane
Subtitle: Boring No.12

Surface Elev.=
Hole No.=B-12
Depth of Hole= 50.0 ft
Water Table during Earthquake= 14.0 ft
Water Table during In-Situ Testing= 24.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-12
Depth of Hole=50.0 ft
Water Table during Earthquake= 14.0 ft
Water Table during In-Situ Testing= 24.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
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*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	16.0	120.0	NoLiq
2.0	16.0	120.0	NoLiq
4.5	36.0	120.0	47.6
9.5	13.0	120.0	NoLiq
14.5	17.0	120.0	33.2
19.5	9.0	120.0	NoLiq
24.5	11.0	120.0	NoLiq
29.5	13.0	120.0	NoLiq
34.5	16.0	120.0	NoLiq
39.5	10.0	120.0	NoLiq
44.5	16.0	120.0	NoLiq

49.5	16.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=1.18 in.
Settlement of dry sands=0.03 in.
Total settlement of saturated and dry sands=1.21 in.
Differential Settlement=0.606 to 0.799 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	1.18	0.03	1.21
2.00	2.00	0.41	5.00	1.18	0.03	1.21
4.00	2.00	0.41	5.00	1.18	0.03	1.21
6.00	1.75	0.40	5.00	1.18	0.02	1.21
8.00	1.75	0.40	5.00	1.18	0.02	1.20
10.00	2.00	0.40	5.00	1.18	0.00	1.18
12.00	2.00	0.40	5.00	1.18	0.00	1.18
14.00	2.00	0.40	5.00	1.18	0.00	1.18
16.00	0.24	0.42	0.57*	0.92	0.00	0.92
18.00	0.19	0.44	0.42*	0.44	0.00	0.44
20.00	2.00	0.46	5.00	0.00	0.00	0.00
22.00	2.00	0.48	5.00	0.00	0.00	0.00
24.00	2.00	0.49	5.00	0.00	0.00	0.00
26.00	2.00	0.51	5.00	0.00	0.00	0.00
28.00	2.00	0.52	5.00	0.00	0.00	0.00
30.00	2.00	0.53	5.00	0.00	0.00	0.00
32.00	2.00	0.53	5.00	0.00	0.00	0.00
34.00	2.00	0.53	5.00	0.00	0.00	0.00
36.00	2.00	0.53	5.00	0.00	0.00	0.00
38.00	2.00	0.53	5.00	0.00	0.00	0.00
40.00	2.00	0.52	5.00	0.00	0.00	0.00
42.00	2.00	0.52	5.00	0.00	0.00	0.00
44.00	2.00	0.52	5.00	0.00	0.00	0.00
46.00	2.00	0.51	5.00	0.00	0.00	0.00
48.00	2.00	0.51	5.00	0.00	0.00	0.00
50.00	2.00	0.50	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 Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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

```
*************************************************************************************
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                                   LIQUEFACTION ANALYSIS CALCULATION SHEET

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                                        (425) 453-6488  Fax (425) 453-5848

*************************************************************************************
*******************
        Licensed to ,   3/2/2009       11:15:57 AM

        Input File Name: H:\PF\2008\0829\Liquefaction\B-16.liq
        Title:  Atkinson Lane
        Subtitle:  Boring No.16

        Surface Elev.=
        Hole No.=B-16
        Depth of Hole= 50.0 ft
        Water Table during Earthquake= 3.0 ft
        Water Table during In-Situ Testing= 13.0 ft
        Max. Acceleration= 0.63 g
        Earthquake Magnitude= 7.9

 Input Data:
        Surface Elev.=
        Hole No.=B-16
        Depth of Hole=50.0 ft
        Water Table during Earthquake= 3.0 ft
        Water Table during In-Situ Testing= 13.0 ft
        Max. Acceleration=0.63 g
        Earthquake Magnitude=7.9

        Earthquake Magnitude=7.9
        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*
        6. Hammer Energy Ratio,                               Ce = 1.25
        7. Borehole Diameter,                                   Cb= 1
        8. Sampling Method,                                   Cs= 1
        9. User request factor of safety (apply to CSR) ,   User= 1
           Plot one CSR curve (fs1=1)
        10. Use Curve Smoothing: Yes*
        * Recommended Options

        In-Situ Test Data:
```

Depth ft	SPT	gamma pcf	Fines %
0.0	12.0	120.0	NoLiq
2.0	15.0	120.0	NoLiq
4.5	23.0	120.0	60.0
9.5	9.0	120.0	NoLiq
14.5	12.0	120.0	NoLiq
19.5	19.0	120.0	NoLiq
24.5	17.0	120.0	NoLiq
29.5	18.0	120.0	NoLiq
34.5	18.0	120.0	NoLiq
39.5	15.0	120.0	NoLiq
44.5	20.0	120.0	NoLiq

49.5	20.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=0.51 in.
Settlement of dry sands=0.00 in.
Total settlement of saturated and dry sands=0.51 in.
Differential Settlement=0.254 to 0.335 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	0.51	0.00	0.51
2.00	2.00	0.41	5.00	0.51	0.00	0.51
4.00	2.00	0.46	5.00	0.51	0.00	0.51
6.00	1.75	0.54	3.23	0.51	0.00	0.51
8.00	0.25	0.59	0.42*	0.34	0.00	0.34
10.00	2.00	0.63	5.00	0.00	0.00	0.00
12.00	2.00	0.65	5.00	0.00	0.00	0.00
14.00	2.00	0.67	5.00	0.00	0.00	0.00
16.00	2.00	0.68	5.00	0.00	0.00	0.00
18.00	2.00	0.69	5.00	0.00	0.00	0.00
20.00	2.00	0.70	5.00	0.00	0.00	0.00
22.00	2.00	0.70	5.00	0.00	0.00	0.00
24.00	2.00	0.71	5.00	0.00	0.00	0.00
26.00	2.00	0.71	5.00	0.00	0.00	0.00
28.00	2.00	0.71	5.00	0.00	0.00	0.00
30.00	2.00	0.71	5.00	0.00	0.00	0.00
32.00	2.00	0.71	5.00	0.00	0.00	0.00
34.00	2.00	0.70	5.00	0.00	0.00	0.00
36.00	2.00	0.69	5.00	0.00	0.00	0.00
38.00	2.00	0.68	5.00	0.00	0.00	0.00
40.00	2.00	0.67	5.00	0.00	0.00	0.00
42.00	2.00	0.66	5.00	0.00	0.00	0.00
44.00	2.00	0.65	5.00	0.00	0.00	0.00
46.00	2.00	0.64	5.00	0.00	0.00	0.00
48.00	2.00	0.63	5.00	0.00	0.00	0.00
50.00	2.00	0.61	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 Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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

APPENDIX D

Feasibility Level Engineering Geology Report

ZINN GEOLOGY
3085 Corriker Lane, Suite B
Soquel, California 95073
Tel. 831.476.8443 Fax 831.476.1491
eczinn@cruzio.com

GEOLOGICAL FEASIBILITY INVESTIGATION

Atkinson Lane Development For Specific Plan/Master Plan
Watsonville, California

Job #2008010-G-SC
29 June 2008 (Revised 2 March 2009)

Engineering Geology ⚒ Coastal Geology ⚒ Fault & Landslide Investigations

ZINN GEOLOGY
Soquel, California 95073
Tel. 831.476.0443 Fax 831.476.1491

29 June 2008 (Revised 2 March 2009) Job #2008010-G-SC

Pacific Crest Engineering
Attention: Michael Kleames
444 Airport Boulevard, Suite 106
Watsonville, CA 95076-2062

Re: Geological feasibility investigation
Atkinson Lane Development Specific Plan/Master Plan
Watsonville, California

Dear Mr. Kleames:

Our geologic report for the project referenced above is attached. This report documents geologic conditions at the study area and addresses in a preliminary fashion the potential hazards to the proposed development. Based on the information gathered and analyzed in the steps outlined in the report, it is our opinion that the proposed development is geologically feasible, and will be subject to “ordinary” risks as defined in Appendix B, provided our recommendations are followed. Appendix B should be reviewed in detail by all future professionals, developers and all property owners to determine whether an "ordinary" risk as defined in the appendix is acceptable. If this level of risk is unacceptable to them, then the geologic hazards in question should be mitigated to reduce the corresponding risks to an acceptable level.

Portions of the study area bordering Corralitos Creek appear to subjected to a greater than ordinary risk due to flooding hazards, as portrayed upon Figure 5.

The subject property is located in an area of high seismic activity and will be subject to strong seismic shaking in the future. The controlling seismogenic source for the subject property is the Zayante-Vergeles fault, 1.5 kilometers to the northeast. The design earthquake on this fault should be a M_w 7.0. Expected duration of strong shaking for this event is about 16 seconds. Although it yields lower seismic shaking values, the expected duration of strong shaking for a M_w 7.9 earthquake on the San Andreas fault is about 38 seconds. Deterministic analysis for the site yields a mean peak ground acceleration of 0.63 g with an associated effective peak acceleration of 0.47, and a mean peak ground acceleration plus one dispersion of 0.94 g.

Most of the study area is subject to a low potential for landsliding to occur within the design life of most structures, corresponding to an ordinary risk for this hazard. However, it is our opinion that the Corralitos Creek embankment can be prone to failure if undercut by the creek or subjected to strong seismic shaking on nearby faults. Hence, development should be set back from the crest of the embankment to mitigate the risk and lower it to ordinary. It should be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see below) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

Based upon our qualitative analysis, we conclude that liquefaction and lateral spreading may occur during the lifetime of the proposed developments and will create a greater than ordinary risk if is not adequately mitigated. We hasten to add, however, that our analysis is qualitative in nature. If at any time the project geotechnical engineer performs a more robust quantitative liquefaction analysis that concludes that liquefaction is not a potential hazard, we will defer to that conclusion. We have plotted several prescriptive lateral spreading set back lines as dictated by Pacific Crest Engineering upon our geological map (see Plate 1), as requested by Pacific Crest Engineering.

Readers of this report, particularly design professionals, should read the body of the text for a more substantial discussion of the above-listed conclusions, and the accompanying recommendations.

If you have any questions or comments regarding this report, please contact us at your earliest convenience.

Sincerely

Zinn Geology

PROFESSIONAL GEOLOGIST
ERIK N. ZINN
No. 2139
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

By Erik N. Zinn
Principal Geologist
C.E.G. No. 2139

TABLE OF CONTENTS

PLATE 1 - GEOLOGIC SITE MAP and PLATE 2 - GEOLOGIC CROSS SECTIONS - In pocket at back of report.

NOTE: Plates and figures must accompany text of report in order for report to be considered complete.

INTRODUCTION

This report presents the results of our geological feasibility investigation for the future proposed developments for the undeveloped farm land east of Atkinson Lane in Watsonville, California. The area studied for this project is bound by Corralitos Creek and existing residential development along Atkinson Lane, Paloma Way, Brewington Avenue, and Brookhaven Lane. The site is being considered for future residential development by the County of Santa Cruz (Figure 1 and Plate 1).

The purpose of this investigation was to evaluate the geologic feasibility of constructing an entire residential development for the study area, complete with the typical types of attendant utilities such as storm drains, sewers, water supply lines and other various types of utilities. We have investigated in a preliminary fashion the potential geologic hazards relevant to the proposed development.

SCOPE OF INVESTIGATION

Work performed during this study included:

1. A review of geologic and geotechnical engineering literature pertinent to the subject property, including an attempt to review existing geological and geotechnical engineering reports for the surrounding developed areas available at the County of Santa Cruz and City of Watsonville planning departments.

2. Examination and interpretation historical vertical stereo pair aerial photographs.

3. Geologic reconnaissance of the property and surrounding area, including site-specific geological mapping.

4. Review of small-diameter boring and cone penetrometer testing sounding data obtained by Pacific Crest Engineering Inc. [PCEI] and locations of their borings and soundings upon the digital base map provided to us by RBF Consulting.

5. Deterministic seismic hazards analysis.

6. Analysis and interpretation of the geologic data and preparation of this report.

No subsurface investigation was performed at this site by our firm.

REGIONAL GEOLOGIC SETTING

The study area lies in the Watsonville lowlands, on the western flank of the Santa Cruz Mountains, in the central portion of the Coast Ranges physiographic province of California (Figure 2). This portion of the Coast Ranges is formed by a series of rugged, linear ridges and valleys following the pronounced northwest to southeast structural grain of central California geology. The Santa Cruz Mountains are mostly underlain by a large, elongate prism of granitic and metamorphic basement rocks, known collectively as the Salinian Block. These rocks are separated from contrasting basement rock types to the northeast and southwest by the San Andreas and San Gregorio-Nacimiento strike-slip fault systems, respectively. Overlying the granitic basement rocks is a sequence of dominantly marine sedimentary rocks of Paleocene to Pliocene age and non-marine sediments of Pliocene to Pleistocene age (Figure 1).

Throughout the Cenozoic Era, this portion of California has been dominated by tectonic forces associated with lateral or "transform" motion between the North American and Pacific lithospheric plates, producing long, northwest-trending faults such as the San Andreas and San Gregorio, with horizontal displacements measured in tens to hundreds of miles. Accompanying the northwest direction of the horizontal (strike-slip) movement of the plates have been episodes of compressive stress, reflected by repeated episodes of uplift, deformation, erosion and subsequent redeposition of sedimentary rocks. Near the crest of the Santa Cruz Mountains, this tectonic deformation is most evident in the sedimentary rocks older than the middle Miocene, and consists of steeply dipping folds, overturned bedding, faulting, jointing, and fracturing. Along the coast, the ongoing tectonic activity is most evident in the formation of a series of uplifted marine terraces. The Loma Prieta earthquake of 1989 is the most recent reminder of the geologic unrest in the region.

The Quaternary history of the Watsonville lowlands has been dominated by fluvial, marine and eolian deposition because the central Monterey Bay region has been relatively stable, while the northern Monterey Bay region has been tectonically uplifted. The earth materials in the vicinity of the study area are mostly fluvial and alluvial fan sediments graded to one or more Sangamon highstands of sea level (Dupré; 1975a & b, 1984, 1990; Dupré and Tinsley, 1980).

REGIONAL SEISMIC SETTING

California's broad system of strike-slip faulting has had a long and complex history. Some of these faults present a seismic hazard to the subject property. The most important of these are the San Andreas, Zayante(-Vergeles) and Monterey Bay-Tularcitos fault zones (Figures 2 and 3). These faults are considered to be capable of producing large magnitude earthquakes (Cao et al., 2003). Each fault is discussed below. Locations of epicenters associated with the faults are shown in Figure 3.

San Andreas Fault

The San Andreas fault is active and represents the major seismic hazard in northern California (Working Group on Northern California Earthquake Potential [NCEP], 1996). The main trace of the San Andreas fault trends northwest-southeast and extends over 700 miles from the Gulf of California through the Coast Ranges to Point Arena, where the fault extends offshore.

Geologic evidence suggests that the San Andreas fault has experienced right-lateral, strike-slip movement throughout the latter portion of Cenozoic time (the past 20 to 30 million years), with cumulative offset of hundreds of miles. Surface rupture during historical earthquakes, fault creep, and historical seismicity confirm that the San Andreas fault and its branches, the Hayward, Calaveras, and San Gregorio faults, are all active today.

Historical earthquakes along the San Andreas fault and its branches have caused significant seismic shaking in the Monterey Bay area. The two largest historically recent earthquakes on the San Andreas to affect the area were the moment magnitude (M_w) 7.9 San Francisco earthquake of 18 April 1906 (actually centered near Olema) and the M_w 6.9 Loma Prieta earthquake of 17 October 1989. The San Francisco earthquake caused severe seismic shaking and structural damage to many buildings in the Monterey Bay area. The Loma Prieta earthquake appears to have caused more intense seismic shaking than the 1906 event in localized areas of the Santa Cruz Mountains, even though its regional effects were not as extensive. There were also significant earthquakes in northern California along or near the San Andreas fault in 1838, 1865 and possibly 1890 (Sykes and Nishenko, 1984; NCEP, 1996).

Geologists have recognized that the San Andreas fault system can be divided into segments with "characteristic" earthquakes of different magnitudes and recurrence intervals (Working Group on California Earthquake Probabilities [WG], 1988 and 1990). A study by NCEP in 1996 has redefined the segments and the characteristic earthquakes for the San Andreas fault system in northern and central California. Two "locked" overlapping segments of the San Andreas fault system represent the greatest potential hazard to the property.

The first segment is defined by the rupture that occurred from Cape Mendocino to San Juan Bautista along the San Andreas fault during the great M_w 7.9 earthquake of 1906. The NCEP (1996) has hypothesized that this "1906 rupture" segment experiences earthquakes with comparable magnitudes at intervals of about two hundred years.

The second segment is defined by the rupture zone of the M_w 6.9 Loma Prieta earthquake. Although it is uncertain whether this "Santa Cruz Mountains" segment has a characteristic earthquake independent of great San Andreas fault earthquakes, the NCEP (1996) has assumed an "idealized" earthquake of M_w 7.0 with the same right-lateral slip as the 1989 Loma Prieta earthquake but having an independent segment recurrence interval of 138 years and a multi-segment recurrence interval of 400 years.

The 2002 WG (2003) segmentation model is largely similar to that adopted by NCEP in 1996, although they have added more complexity to the model, and have reduced the forecasted magnitudes for the different segments. The 2002 California probabilistic seismic hazard maps issued by the California Geological Survey (Cao et al., 2003) appear to have largely adopted the earthquake magnitudes issued by the 2002 WG. The most significant change in modeling the San Andreas Fault Zone by Cao et al. (2003) is the elimination of a singular listing of the penultimate event, the 1906 Mw 7.9 earthquake (although such an event can be derived by looking at the aggregate probability of the individual segments rupturing together, as they did in 1906).

In spite of the increasing complexity of the models addressing different size earthquakes with different recurrence intervals on the sundry segments of this fault, it is undeniable that the 1906

M_w 7.9 earthquake still eclipses all the other events which have occurred on the San Andreas fault in this region. Keeping this in mind, it is important that any site-specific seismic analyses performed for development on the property take the 1906 event into account, particularly since the empirical evidence presented by field researchers indicates the 1906 event recurs every several centuries.

Zayante (-Vergeles) Fault

The Zayante fault lies west of the San Andreas fault and trends about 50 miles northwest from the Watsonville lowlands into the Santa Cruz Mountains. The southern extension of the Zayante fault, known as the Vergeles fault, merges with the San Andreas fault south of San Juan Bautista.

The Zayante-Vergles fault has a long, well-documented geological history of vertical movement (Clark and Reitman, 1973), probably accompanied by right-lateral, strike-slip movement (Hall et al., 1974; Ross and Brabb, 1973). Stratigraphic and geomorphic evidence indicates the Zayante-Vergles fault has undergone late Pleistocene and Holocene movement and is potentially active (Buchanan-Banks et al., 1978; Coppersmith, 1979).

Some historical seismicity may be related to the Zayante-Vergles fault (Griggs, 1973). For instance, the Zayante-Vergles fault may have undergone sympathetic fault movement during the 1906 earthquake centered on the San Andreas fault, although this evidence is equivocal (Coppersmith, 1979). Seismic records strongly suggest that a section of the Zayante-Vergles fault approximately 3 miles long underwent sympathetic movement in the 1989 earthquake. The earthquake hypocenters tentatively correlated to the Zayante-Vergles fault occurred at a depth of 5 miles; no instances of surface rupture on the fault have been reported.

In summary, the Zayante-Vergles fault should be considered potentially active. The NCEP (1996) considers it capable of generating a magnitude 6.8 earthquake with an effective recurrence interval of 10,000 years. Alternatively, Cao et al. (2003) considers this fault capable of generating a maximum earthquake of Mw 7.0, with no stated recurrence interval.

Monterey Bay-Tularcitos Fault Zone

The Monterey Bay-Tularcitos fault zone is 6 to 9 miles wide, about 25 miles long, and consists of many en échelon faults identified during shipboard seismic reflection surveys (Greene, 1977). The fault zone trends northwest-southeast and intersects the coast in the vicinity of Seaside and Ford Ord. At this point, several onshore fault traces have been tentatively correlated with offshore traces in the heart of the Monterey Bay-Tularcitos fault zone (Greene, 1977; Clark et al., 1974; Burkland and Associates, 1975). These onshore faults are, from southwest to northeast, the Tularcitos-Navy, Berwick Canyon, Chupines, Seaside, and Ord Terrace faults. Only the larger of these faults, the Tularcitos-Navy and Chupines, are shown on Figure 2. It must be emphasized that these correlations between onshore and offshore portions of the Monterey Bay-Tularcitos fault zone are only tentative; for example, no concrete geologic evidence for connecting the Navy and Tularcitos faults under the Carmel Valley alluvium has been observed, nor has a direct connection between these two faults and any offshore trace been found.

Outcrop evidence indicates a variety of strike-slip and dip-slip movement associated with onshore and offshore traces. Earthquake studies suggest the Monterey Bay-Tularcitos fault zone is predominantly right-lateral, strike-slip in character (Greene, 1977). Stratigraphically, both offshore and onshore fault traces in this zone have displaced Quaternary beds and, therefore, are considered potentially active (Buchanan-Banks et al., 1978). One offshore trace, which aligns with the trend of the Navy fault, has displaced Holocene beds and is therefore active by definition (Buchanan-Banks et al., 1978).

Seismically, the Monterey Bay-Tularcitos fault zone may be historically active. The largest historical earthquakes *tentatively* located in the Monterey Bay-Tularcitos fault zone are two events, estimated at 6.2 on the Richter Scale, in October 1926 (Greene, 1977). Because of possible inaccuracies in locating the epicenters of these earthquakes, it is possible that they actually occurred on the nearby San Gregorio fault zone (Greene, 1977). Another earthquake in April 1890 might be attributed to the Monterey Bay-Tularcitos fault zone (Burkland and Associates, 1975).

The NCEP (1996) has assigned an earthquake of M_w 7.1 with an effective recurrence interval of 2,600 years to the Monterey Bay-Tularcitos fault zone, based on Holocene offshore offsets. Petersen et al. (1996) have a similar earthquake magnitude, but for a recurrence interval of 2,841 years. Their earthquake is based on a composite slip rate of 0.5 millimeters per year (after Rosenberg and Clark, 1995).

Cao et al. (2003) has developed a model for the Monterey Bay fault zone that combines slip rates of the different segments, resulting in a composite slip rate of 0.5 mm per year and a forecasted earthquake of Mw 7.3, with no stated recurrence interval. The Cao et al. (2003) model adopted implicitly assumes that all the assessed segments in the Monterey Bay fault zone each have an independent slip rate of 0.1 mm per year (based upon the one slip rate developed by Rosenberg and Clark, 1995 for the Tularcitos segment), and essentially assigns the composite slip rate to the Tularcitos trace of the Monterey Bay fault zone.

SITE GEOLOGIC SETTING

The Geologic Map (Plate 1) and Geological Cross Sections (Plate 2) graphically depict relevant geologic information for the study area. See also the Local Geology Map (Figure 4), Flood Insurance Rate Index Map (Figure 5), Fault Index Map (Figure 6) and Liquefaction Susceptibility Map (Figure 7) for information of a more general nature.

Topography

The study area consists of gently rolling hills descending east to the nearly flat flood-plain of Corralitos Creek. The rolling hills are extensively cultivated, primarily by strawberry crops, with wild grasses and stands of eucalyptus and oak making up the balance. Grading in the form of disturbances related to tilling and minor road cuts and fill prisms are typically less than several feet high and sloped at least 2:1 (horizontal:vertical). The Corralitos Creek flood-plain is vegetated with varied crops. Most of the flood plain generally slopes very gently to the north toward Corralitos Creek, with the exception of a small pond near the western edge of the study area. Existing grading in this terrain is primarily restricted to tilling related to farming practices and spots along the creek where the natural levees have been enhanced with fill. The total thickness of the levee fill is unknown, but likely exceeds ten feet. The creek has incised between 10 and 32 feet below the natural flood plain and the rolling hills respectively.

Earth Materials

The study area sits within the Watsonville Lowlands, a nominally subsiding basin dominated by river and creek deposition in conjunction with fluctuating sea levels, caused by cycles of continental glaciation, for about the last one million years. This interplay has given rise to a series of fluvial (creek) deposits interlayered with and overlain by sand dune and marine terrace deposits. The most detailed regional geologic mapping in the Watsonville Lowlands region has been performed by Dupré and Tinsley (1980, see Figure 4), and our following descriptions of the earth materials and their distribution in the study area closely follows the work performed by them. There are other more modern geological citations available for this region, such as Brabb et al. (1997) and Wagner et al. (2002), but all of those publications have simply compiled the most detailed original work done in the region by Dupré and Tinsley (1980) rather than reflecting an original body of work that sheds new light on the deposits in the Watsonville Lowlands.

The overall thickness of the unconsolidated flood-plain deposits in the study area is about 100 feet (Pajaro Valley Water Management Agency [PVWMA], 1995). The alluvial deposits in turn overlie Pleistocene terrace deposits and Aromas Sand. The total thickness of the Quaternary sediments in the study area is about 775 feet. The Quaternary sedimentary package is underlain by about 1800 feet of Tertiary sedimentary rocks, and ultimately granitic basement rock.

The rolling hills terrain and the entire flood-plain are probably underlain at some depth by the mid-Quaternary age Aromas Sand, a sequence of fluvial and dune sediments. The Aromas Sand is a heterogeneous sequence of relatively well consolidated eolian and fluvial sand, silt, clay and gravel.

Basin deposits, levee deposits, younger flood-plain deposits, and older flood-plain deposits (respectively shown as Qb, Qyfa, Qyf and Qof on Plate 3) are exposed at the ground surface in the vicinity of the study area (see Figure 4). They are chiefly composed of unconsolidated, interfingering and interbedded layers of clay, silt and fine sand.

As noted earlier, the mapping performed by Dupré and Tinsley (1980) is the most detailed map to date of Quaternary deposits in this area. The results of the small diameter borings and cone penetrometer soundings performed by and PCEI for this investigation are mostly consistent with the regional research portrayed upon Figure 4. Turning to our cross section for the site (Plate 2), we note that the site is predominantly underlain by older flood-plain deposits and the fluvial facies of the Watsonville Terrace Deposits (Qwf on the map and sections), composed of three stratigraphic subunits, a sand package, underlain by a clay package, with silt package appearing to underlie everything across the site to the depths explored for this project. As may be noted on the geological cross sections, the lateral and vertical variations are extremely complex within the generalized subunits, as is typically found in dynamic fluvial environments. Additionally, it should be noted that the complexity of the stratigraphy appears to be directly correlative to the spacing and array between the borings and the soundings. In our opinion, a plausible assumption is that the site stratigraphy is very complex, with very few, if any specific stratigraphic beds being continuous across the site, as is typically found in dynamic fluvial environments.

The older flood-plain deposits appear to thicken to the north and east across the site, which is consistent with the model of a backfilling basin starting in the Late Pleistocene and continuing through today. Corralitos Creek and the Pajaro River are essentially "drowning" in their own sediment loads as the Pacific Ocean continues to rise and encroach inland through the millennia. Near the western edge of the site, a pond has been created and backfilled also. It is unclear at this stage if the formation of the pond has arisen from natural backfilling and flooding by Corralitos Creek or if it formed as result of the rim of fill that lines its' eastern periphery.

The contacts between the different units and subunits portrayed on the cross section (Plate 2) are largely conjectural outside of the immediate drilling and sounding areas, due to the distance between the subsurface investigations and the lateral and vertical variations in the underlying fluvial stratigraphy. Nonetheless, we have attempted to extrapolate the contacts beyond the immediate subsurface work utilizing the results of our mapping, aerial photo analysis and geological synthesis to bring some geological perspective to the geometric relationship between the different units and subunits.

Minor pockets of artificial fill are scattered across the site, based upon our site reconnaissance and aerial photo analysis. Although we have shown some fill on our geologic site map, we have not attempted to map its' distribution in cross section because of the prohibitively small scale used for this phase of the project.

Drainage and Groundwater

Drainage across the site is primarily by sheet flow across the uplands and flood plain to the north and east. As noted earlier, a fill berm partially blocks drainage from the pond along the western edge of the site.

Groundwater was encountered to within six feet of the ground surface by PCEI during their drilling program. No seeps were observed on the site.

It has always been our understanding that the regionally persistent groundwater in the Watsonville area is more than 100 feet below the ground surface, due to overdraft of the underlying aquifers. The ground water encountered by PCEI in their drilling program may have been seasonally-perched groundwater, or shallow groundwater resulting from spring irrigation on the property.

Nonetheless, for the purposes of liquefaction analysis, PCEI appears to have assumed a groundwater table that starts at an elevation near the thalweg of Corralitos Creek and that progressively descends to the south, away from the creek. PCEI appears to have discounted the groundwater encountered above this elevation in the field in their borings and soundings as water perched seasonally within laterally discontinuous transmissve beds. This seems reasonably conservative from a geological perspective, considering the above-listed information procured from their field investigation.

GEOLOGIC HAZARDS

In our opinion, the primary geologic hazards that could potentially impact the proposed developments for this project are flooding, seismic shaking, landsliding, liquefaction-induced settlement and liquefaction-induced lateral spreading. We considered the possibility that the site could be impacted by faulting, but the nearest mapped active fault is the Zayante-Vergeles fault, located approximately 4000 feet northeast of the study area.

Flooding Hazard

Portions of the proposed development area are located within Federal Emergency Management Agency (FEMA) flood zones X and AE (FEMA, 2006) (see Figure 5).

All of Zone AE is an area that can be inundated to some extent by the calculated 100-year flood. As such, we do not recommend that the development be placed within this zone, if avoidable. As may be noted on Figure 5, this zone encroaches the flood plain beyond the centerline of Corralitos Creek as much as 439 feet (in the extreme northeastern corner of the study area).

Portions of Zone X shown on Figure 5 portray a "buffer zone" beyond Zone AE that is subject to inundation by the 500-year flood, or inundation less than one foot by floods with lower recurrence interval. Similar to the recommendation for Zone AE above, we do not recommend that the development be placed within this zone, if avoidable.

As may be noted on Figure 5, base flood elevations have been determined by FEMA for the stretch of the study area bounded by Corralitos Creek. Future planning and design work for the layout of the proposed developments should rely upon site-specific surveying that is tied into FEMA benchmarks, with the boundaries of the flood zone accurately portrayed on an adequate topographic base map prepared by a Registered Land Surveyor or Civil Engineer, so that the hazard and risk due to flooding can be adequately assessed. If during the course of development structures are placed within the flood zones at grade, the risk due to flooding will clearly be greater than ordinary. If that is case, the elevation of the bottom of the lowest horizontal structural member of the lowest floor should be at or above the base flood elevation, as required by FEMA. However, with that said, we strongly recommend that future structures be altogether left out of the mapped flood zones if possible, which will adequately mitigate the risk due to the flooding by lowering it to ordinary.

Seismic Shaking Hazard

Seismic shaking on the subject properties will be intense during the next major earthquake along local fault systems. A common measure of the intensity of ground shaking is the Modified

Mercalli Intensity Scale (Table 1), a subjective measure of the effect of ground shaking on man-made structures and the earth's surface. Intensity varies with distance from the causative fault, but can also vary greatly with local geologic setting. Lawson et al. (1908) lists a Rossi-Forel Intensity of VII to VIII for the subject properties as a result of the 1906 earthquake, although it should be emphasized that this estimate is based on a small number of field observations in an area sparsely

TABLE 1
Modified Mercalli Intensity Scale

The modified Mercalli scale measures the intensity of ground shaking as determined from observations of an earthquake's effect on people, structures, and the Earth's surface. Richter magnitude is not reflected. This scale assigns to an earthquake event a Roman numeral from I to XII as follows:

I	Not felt by people, except rarely under especially favorable circumstances.
II	Felt indoors only by persons at rest, especially on upper floors. Some hanging objects may swing.
III	Felt indoors by several. Hanging objects may swing slightly. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV	Felt indoors by many, outdoors by few. Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing automobiles rock. Windows, dishes, doors rattle. Wooden walls and frame may creak.
V	Felt indoors and outdoors by nearly everyone; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset; some dishes and glassware broken. Doors swing; shutters, pictures move. Pendulum clocks stop, start, change rate. Swaying of tall trees and poles sometimes noticed.
VI	Felt by all. Damage slight. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks and books fall off shelves; pictures off walls. Furniture moved or overturned. Weak plaster and masonry cracked.
VII	Difficult to stand. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in badly designed or poorly built buildings. Noticed by drivers of automobiles. Hanging objects quiver. Furniture broken. Weak chimneys broken. Damage to masonry; fall of plaster, loose bricks, stones, tiles, and unbraced parapets. Small slides and caving in along sand or gravel banks. Large bells ring.
VIII	People frightened. Damage slight in specially designed structures; considerable in ordinary substantial buildings, partial collapse; great in poorly built structures. Steering of automobiles affected. Damage or partial collapse to some masonry and stucco. Failure of some chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed pilings broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX	General panic. Damage considerable in specially designed structures; great in substantial buildings, with some collapse. General damage to foundations; frame structures, if not bolted, shifted off foundations and thrown out of plumb. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground; liquefaction.
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Landslides on river banks and steep slopes considerable. Water splashed onto banks of canals, rivers, lakes. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI	Few, if any masonry structures remain standing. Bridges destroyed. Broad fissures in ground; earth slumps and landslides widespread. Underground pipelines completely out of service. Rails bent greatly.
XII	Damage nearly total. Waves seen on ground surfaces. Large rock masses displaced. Lines of sight and level distorted. Objects thrown upward into the air.

populated in 1906. Preliminary estimates of Modified Mercalli intensities at the subject properties during the Loma Prieta earthquake are about VII (Stover et al., 1990). Refer to Table 1 for the relevant portion of the Modified Mercalli Scale. Modified Mercalli Intensities of VII to VIII are possible (see Table 1 for a description of the Mercalli Intensity Scale).

Deterministic Seismic Shaking Analysis

For the purpose of evaluating deterministic peak ground accelerations for the site, we have considered four seismic sources, the San Andreas, Monterey Bay - Tularcitos and Zayante (-Vergeles) fault zones. While other faults or fault zones in this region may be active, their potential contributions to deterministic seismic hazards at the site are overshadowed by this fault. Table 2 shows the moment magnitude of the characteristic or maximum earthquake, estimated recurrence interval and the distance from the site for each of this fault system. We took the fault data from "Database of potential sources for earthquakes larger than magnitude 6 in Northern California" (WGONCEP, 1996), Petersen et al. (1996) and Cao et al.(2003). Also shown on Table 2 are calculated on-site accelerations from the listed earthquake derived using several different methods. These accelerations are based on attenuation relationships derived from the analysis of historical earthquakes. Because the historical data can be interpreted in different ways, there are a number of different attenuation relationships available. We have employed a fairly conservative attenuation relationship for rock/shallow soil sites in deriving the acceleration values listed in Table 2.

TABLE 2
Faults, Earthquakes and Deterministic Seismic Shaking Data

Fault	Moment Magnitude of Characteristic or Maximum Earthquake (M_w)	Estimated Recurrence Interval (years)	Distance from Site (km)	Estimated Mean Peak Ground Acceleration (g)[1]	Estimated Mean + One Dispersion Ground Acceleration (g)[1]	Maximum Considered Earthquake Ground Motion[2] (g)
Zayante-Vergeles	7.0	10,000	1.5	0.63	0.94	0.95
Monterey Bay - Tularcitos	7.3	2841	25.3	0.24	0.35	0.36
San Andreas (1906 rupture)	7.9	210	6.3	0.46	0.68	0.69

[1] Sadigh et al., 1997
[2] FEMA, 1998

The "maximum considered earthquake ground motion," as defined by FEMA (1998), is also listed in Table 2. FEMA (1998) and the National Earthquake Hazards Reduction Program suggest that in regions of high seismicity, such as coastal California, the appropriate design level for ground shaking is the deterministically derived mean peak horizontal ground acceleration multiplied by 1.5. Applying this method to the subject properties results in ground shaking parameters roughly equivalent to the deterministically derived mean values plus one dispersion.

If the deterministically derived accelerations are used for engineering analysis on the subject properties, we recommend utilizing the attenuation relationship developed by Sadigh et al. (1997) for deep soil. It is important to note that predicting seismic shaking intensity is a field that is dominated heavily by theory, with a paucity of near-field station readings in deep soil settings. It should also be noted that the accelerations listed in Table 2 are only average values. Therefore, we caution that the listed values are approximations, rather than precise predictions. Actual measured "free-field" accelerations may be larger.

Based on the results listed in Table 2, the mean peak ground acceleration expected at the property will be approximately 0.63 g, the maximum earthquake ground motion (mean acceleration plus one dispersion) expected at the subject properties will be approximately 0.94 g, based on a M_w 7.0 earthquake centered on the Zayante-Vergeles fault zone 1.5 kilometers northeast of the site.

Naeim and Anderson (1993) found that "effective peak acceleration" (EPA) is more typically about 75 percent of the peak acceleration. Effective peak acceleration is comparable to "repeatable high ground acceleration" (after Ploessel and Slossen, 1974) and is generally considered to represent the large number of lower amplitude peaks on an accelerogram recording. This suggests that the mean peak horizontal ground acceleration of 0.63 g would generate an EPA of approximately 0.47 g.

The duration of strong shaking is dependent on magnitude. Dobry et al. (1978) have suggested a relationship between magnitude and duration of "significant" or strong shaking expressed by the formula:

$$\text{Log } D = 0.432\, M - 1.83$$ (where D is the duration and M is the magnitude).

On the basis of the above relationship, the duration of strong shaking associated with a magnitude 7.0 earthquake (the characteristic earthquake for the Zayante-Vergeles fault zone) is estimated to be about 16 seconds. In contrast, the duration of strong shaking associated with a magnitude 7.9 earthquake (the characteristic earthquake for the San Andreas fault) is estimated to be about 38 seconds. Considering the recurrence intervals of the San Andreas and Zayante-Vergeles faults, the proposed residences are much more likely to experience the characteristic event on the San Andreas, with lower peak accelerations than the design earthquake on the Zayante-Vergeles but lasting about two times as long (see Table 2). Bear in mind that the duration of strong seismic shaking may be even more critical as a design parameter than the peak acceleration itself.

Landsliding Hazard

Most of the study area is subject to a low potential for landsliding to occur within the design life of most structures, corresponding to an ordinary risk for this hazard. However, the Corralitos Creek embankment is fairly steep and ranges in height between 10 and 32 feet above the thalweg of the creek, and is underlain by Pleistocene age sediments that can be prone to failure if undercut by the creek or subjected to strong seismic shaking on nearby faults. Keeping this mind, we recommend that structures be sited at least 50-feet away from the crest of the embankment to avoid siting them within an area that could conceivably be affected by landsliding within the next 50-years.

In summary, it is our opinion that the proposed development will be subject to a greater than ordinary risk related to the landsliding hazard if the recommended mitigation measure is not pursued. It should also be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see next section) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

Liquefaction and Lateral Spreading Hazards

The physical process of seismically induced liquefaction is well understood (Youd, 1973; Seed and Idriss, 1982; National Research Council, 1985). During an earthquake seismic waves travel through the earth and vibrate the ground. In cohesionless, granular materials having low relative density (loose sands for example), this vibration can disturb the particle framework, thus leading to increased compaction of the material and reduction of pore space between the framework grains. If the sediment is saturated, water occupying the pore spaces resists this compaction and exerts pore pressure that reduces the contact stress between the sediment grains. With continued shaking, transfer of intergranular stress to pore water can generate pore pressures great enough to cause the sediment to lose its strength and change from a solid state to a liquefied state. This mechanical transformation can cause various kinds of ground failure at or near the ground surface.

The liquefaction process typically occurs at depths less than 50 feet below the ground surface, although liquefaction can occur at deeper intervals, given the right conditions. The most susceptible zone occurs at depths shallower than 30 feet below the ground surface. Diminished susceptibility as depth increases is due to the increased firmness of deeper sedimentary materials, which can be attributed mainly to two factors: 1) increased overburden pressure resulting from the load of overlying sediment layers, and 2) increased geologic age. These two factors tend to create a denser packing of sediment grains in the deeper sedimentary materials, which thus are less likely to experience the additional compaction and elevated pore pressures that are necessary to induce loss of shear strength and liquefaction during an earthquake.

Liquefaction can lead to several types of ground failure, depending on slope conditions and the geologic and hydrologic setting (Seed, 1968; Youd, 1973; Tinsley et al, 1985). The four most common types of ground failure are: 1) lateral spreads, 2) flow failures, 3) ground oscillation and 4) loss of bearing strength. Sand boils (injections of fluidized sediment) commonly accompany these different types of ground failure and form sand volcanoes at the ground surface or convolute layering and sand dikes in subsurface sediment layers.

Detailed studies of different earthquakes and associated liquefaction events (Lawson, 1908; Youd and Hoose, 1978; Tinsley and Dupré, 1992; Obermeier, 1989; Ziony, 1985; Youd and Wieczorek, 1982; Muir and Scott, 1982) has shown the following:

1. Lateral spreading is generally limited to unconsolidated late Holocene fluvial, basin, estuarine and channel-fill deposits. The toes of the lateral spreads are typically located in the faces of active channel margins. The heads of lateral spreads are typically located between the contact of young channel deposits with either overbank deposits of equivalent age, or overbank deposits of older Holocene units. Lateral spread fissures tend to follow the flow directions of the fluvial deposits.

2. Lateral spread fissures have occurred as far as 7 miles away from the main channel of a river in fluvial environments (Obermeier, 1989), and have been mapped up to 0.5 miles in length. The lateral spreads appear to occur most commonly on slopes with gradients of 0.3 to 3 degrees. During the 1989 Loma Prieta earthquake, lateral spread failures occurred as far as 150 meters from the active stream channel of the Pajaro River (in the Watsonville region to the north). The 1989 Loma Prieta earthquake induced failures had lateral displacements of a few millimeters to 2 meters and vertical displacements that were typically less than 30 centimeters. Extensive damage due to liquefaction and lateral spreading appears to have occurred along the main channel of the Salinas River during the 1906 earthquake. At the Salinas River bridge crossing (Hilltown), the foundation piles at the south end of the bridge moved 6 to 7 feet southward, and an oil pipeline crossing the bridge was buckled due to 7 feet of shortening. The pipeline was also extensively damaged where it was buried near the active channel of the river.

The subject site does not appear to have experienced liquefaction historically (Lawson, 1908; Youd and Hoose, 1978; Dupré and Tinsley, 1980). The site is located in an area of Quaternary earth materials described as having low and moderate liquefaction susceptibility by Dupré and Tinsley (1980) (Figure 7). No liquefaction or lateral spreading was reported to have occurred during the 1989 Loma Prieta earthquake on the subject site, or directly nearby. The different types of ground failure associated with liquefaction often leave geomorphic evidence after the event in the form of scarps, and open (or infilled) ground cracks, and sand volcanoes. This type of evidence can be readily observed via site reconnaissance or aerial photo analysis on undisturbed ground long after the liquefaction has occurred. However, if the ground surface is disturbed by subsequent grading activity (such as farm-related tilling), the ground information is erased.

We did not observe evidence of differential settlement, lurch cracking or lateral spreading during our aerial photo analysis or our site reconnaissance. However, any evidence of past liquefaction may have been obscured by the farming and cultural activities at the site.

In spite of the paucity of historical evidence of damage related to liquefaction-induced settlement, Pacific Crest Engineering has performed liquefaction and settlement analyses for the site. The underlying soils analyzed for this project appeared to meet the preliminary screening criteria for liquefiable soils, considering the relatively soft and loose density of the sediments, presence of shallow groundwater, and abundance of nearby faults capable of generating large magnitude earthquakes. After analyzing the soils, Pacific Crest Engineering concluded that some of the sand and silt beds underlying the proposed development area are susceptible to liquefaction (using conservative assumptions). The most liquefiable deposits appear to have been related to the older flood-plain deposits near the Corralitos Creek embankment. Additionally, it appears that the some sections of the Pleistocene age Watsonville Terrace Deposits are also potentially liquefiable, which is slightly contradictory to the regional liquefaction susceptibility map by Dupré and Tinsley (1980).

Calculated lateral spreading displacements by Pacific Crest Engineering range between 0 and 65 inches, with the bulk of the soils experiencing liquefaction-related lateral spreading occurring creek-ward of a line set back approximately 150-feet from the top the Corralitos Creek bank (see Plate 1).

The area of the pond also appears to be an area of concern with respect to liquefaction and lateral spreading, as indicated by the preliminary analysis by Pacific Crest Engineering. As a result of their analysis, they have recommended that proposed developments be set back at least 50-feet from the high water mark of the pond or the edge of the riparian/wetlands boundary, whichever is greater.

A recent peer-reviewed journal paper by Youd et al. (2009) has addressed the apparent discrepancy between calculated/predicted lateral spreading displacements and actual observed displacements in the field after an earthquake. The researchers for this paper studied liquefaction and lateral spreading sites in Turkey that were subjected to the M_w 7.5 1999 Kocaeli, Turkey Earthquake. The findings from their study that are germane to this project are as follows:

1. Fine-grained sediments that should have liquified using the criteria of Bray and Sancio (2006) did not display lateral spread displacements;
2. The absence of lateral spread at the sites studied was due to either: (a) the tendency for nonplastic silts at low confining stress to dilate during shear; or (b) the inherent undrained shear strength of liquefied plastic silts and clays;
3. Zero-displacement lateral spread sites previously studied and analyzed by prior researchers, such Youd et al. (2002) were discarded even though those sites may have been underlain by liquefiable sediments, which subsequently results in an overestimation of lateral spread displacement calculations;
4. Sites with complex liquefiable stratigraphy (such as the Atkinson Lane site) may record negligible lateral spread displacements in the field during earthquakes due to the discontinuous lenses of sediment with sufficient shear resistance in the discontinuities to prevent the lateral spread.

In summary, liquefaction occurs where young, unconsolidated, saturated sands and silts are subjected to intense seismic shaking. Although only some of the earth materials in the proposed area of development are not considered to have high liquefaction potential by regional researchers, the site-specific analysis by Pacific Crest Engineering indicates that the potential is high for liquefaction to occur within the design life of the proposed development for at least a portion of all the sediment packages across the site. Additionally, the presence of liquefiable sediments that may be exposed in the Corralitos Creek embankment leads us to conclude that there may also be a high potential for lateral spreading to impact proposed developments that are close to the embankment. However, a recent paper by Youd et al. (2009) appears to indicate that calculated lateral spread displacements may be higher than the actual field measured displacements, particularly for fine-grained sediments in complex stratigraphic sites.

Based upon our qualitative analysis, we conclude that liquefaction and lateral spreading may occur during the lifetime of the proposed developments and will create a greater than ordinary risk if is not adequately mitigated. We hasten to add, however, that our analysis is qualitative in nature. If at any time the project geotechnical engineer performs a more robust quantitative liquefaction analysis that concludes that liquefaction is not a potential hazard, we will defer to that conclusion.

At the request of Pacific Crest Engineering, we have plotted a lateral spreading hazard set back boundary upon our geological map (See Plate 1). We have also taken the liberty of plotting the 50-foot setback line encircling the pond area, using the high water mark on the orthophoto base as a guide for the line (see Plate 1).

CONCLUSIONS

Based on the information gathered and analyzed in the steps outlined above, it is our opinion that the proposed development is geologically feasible, and will be subject to "ordinary" risks as defined in Appendix B, provided our recommendations are followed. Appendix B should be reviewed in detail by all future professionals, developers and all property owners to determine whether an "ordinary" risk as defined in the appendix is acceptable. If this level of risk is unacceptable to them, then the geologic hazards in question should be mitigated to reduce the corresponding risks to an acceptable level.

Portions of the study area bordering Corralitos Creek appear to subjected to a greater than ordinary risk due to flooding hazards, as portrayed upon Figure 5.

The subject property is located in an area of high seismic activity and will be subject to strong seismic shaking in the future. The controlling seismogenic source for the subject property is the Zayante-Vergeles fault, 1.5 kilometers to the northeast. The design earthquake on this fault should be a M_w 7.0. Expected duration of strong shaking for this event is about 16 seconds. Although it yields lower seismic shaking values, the expected duration of strong shaking for a M_w 7.9 earthquake on the San Andreas fault is about 38 seconds. Deterministic analysis for the site yields a mean peak ground acceleration of 0.63 g with an associated effective peak acceleration of 0.47, and a mean peak ground acceleration plus one dispersion of 0.94 g.

Most of the study area is subject to a low potential for landsliding to occur within the design life of most structures, corresponding to an ordinary risk for this hazard. However, it is our opinion that the Corralitos Creek embankment can be prone to failure if undercut by the creek or subjected to strong seismic shaking on nearby faults. Hence, development should be set back from the crest of the embankment to mitigate the risk and lower it to ordinary. It should be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see below) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

Based upon our qualitative analysis, we conclude that liquefaction and lateral spreading may occur during the lifetime of the proposed developments and will create a greater than ordinary risk if is not adequately mitigated. We hasten to add, however, that our analysis is qualitative in nature. If at any time the project geotechnical engineer performs a more robust quantitative liquefaction analysis that concludes that liquefaction is not a potential hazard, we will defer to that conclusion. We have plotted several prescriptive lateral spreading set back lines as dictated by Pacific Crest Engineering upon our geological map (see Plate 1), as requested by Pacific Crest Engineering.

RECOMMENDATIONS

1. As may be noted on Figure 5, base flood elevations have been determined by FEMA for the stretch of the study area bounded by Corralitos Creek. Future planning and design work for the layout of the proposed developments should rely upon site-specific surveying that is tied into FEMA benchmarks, with the boundaries of the flood zone accurately portrayed on an adequate topographic base map prepared by a Registered Land Surveyor or Civil Engineer, so that the hazard and risk due to flooding can be adequately assessed.

   We strongly recommend that future structures be altogether left out of the mapped flood zones if possible, which will adequately mitigate the risk due to the flooding by lowering it to ordinary. If during the course of development structures are placed within the flood zones at grade, the risk due to flooding will clearly be greater than ordinary. If that is case, the elevation of the bottom of the lowest horizontal structural member of the lowest floor should be at or above the base flood elevation, as required by FEMA.

2. With respect to the risk related to the landsliding of the creek embankment, we recommend that structures be sited at least 50-feet away from the crest of the embankment. It should also be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see below) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

3. The project geotechnical engineer should perform a quantitative analysis of liquefaction-induced hazards, such as settlement and lateral spreading. Foundations and structural elements for the proposed developments should also be designed to resist the forces generated by liquefaction and lateral spreading, unless a more robust quantitative analysis by the project geotechnical engineer indicates that this is unnecessary. All proposed development should lie behind the prescriptive lateral spreading hazard line that is set back 150-feet from the top of the creek bank, as dictated by Pacific Crest Engineering. Additionally, all proposed development should be set back at least 50-feet from the pond high water line or riparian/wetland boundary, as recommended by Pacific Crest Engineering.

4. The project engineers and designers should review our seismic shaking parameters and choose a value appropriate for their particular analyses if necessary.

5. We recommend that all drainage from improved surfaces such as walkways, patios, roofs, and driveways be collected and dispersed on site in such a way as to avoid ponding on the ground adjacent to a building site or spilling directly onto steep slopes without some form of erosion protection. Gutters should be utilized on rooftops, channeling drainage to appropriate storm drain facilities, the pond, or Corralitos Creek.

INVESTIGATIVE LIMITATIONS

1. Our services consist of professional opinions and recommendations made in accordance with generally accepted engineering geology principles and practices. No warranty, expressed or implied including any implied warranty of merchantability or fitness for the purpose is made or intended in connection with our services or by the proposal for consulting or other services, or by the furnishing of oral or written reports or findings.

2. The analysis and recommendations submitted in this report are based on the geologic information derived from the steps outlined in the scope of services section of this report. The information is derived from necessarily limited natural and artificial exposures. Consequently, the conclusions and recommendations should be considered preliminary.

3. The conclusions and recommendations noted in this report are based on probability and in no way imply the site will not possibly be subjected to ground failure or seismic shaking so intense that structures will be severely damaged or destroyed. The report does suggest that building structures at the subject site, in compliance with the recommendations noted in this report, is an "ordinary" risk as defined in Appendix B.

4. This report is issued with the understanding that it is the duty and responsibility of the owner or his representative or agent to ensure that the recommendations contained in this report are brought to the attention of the architect and engineer for the project, incorporated into the plans and specifications, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

5. The findings of this report are valid as of the present date. However, changes in the conditions of property and its environs can occur with the passage of time, whether they be due to natural processes or to the works of man. In addition, changes in applicable or appropriate standards occur whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or partially, by changes outside our control. Therefore, the conclusions and recommendations contained in this report cannot be considered valid beyond a period of two years from the date of this report without review by a representative of this firm.

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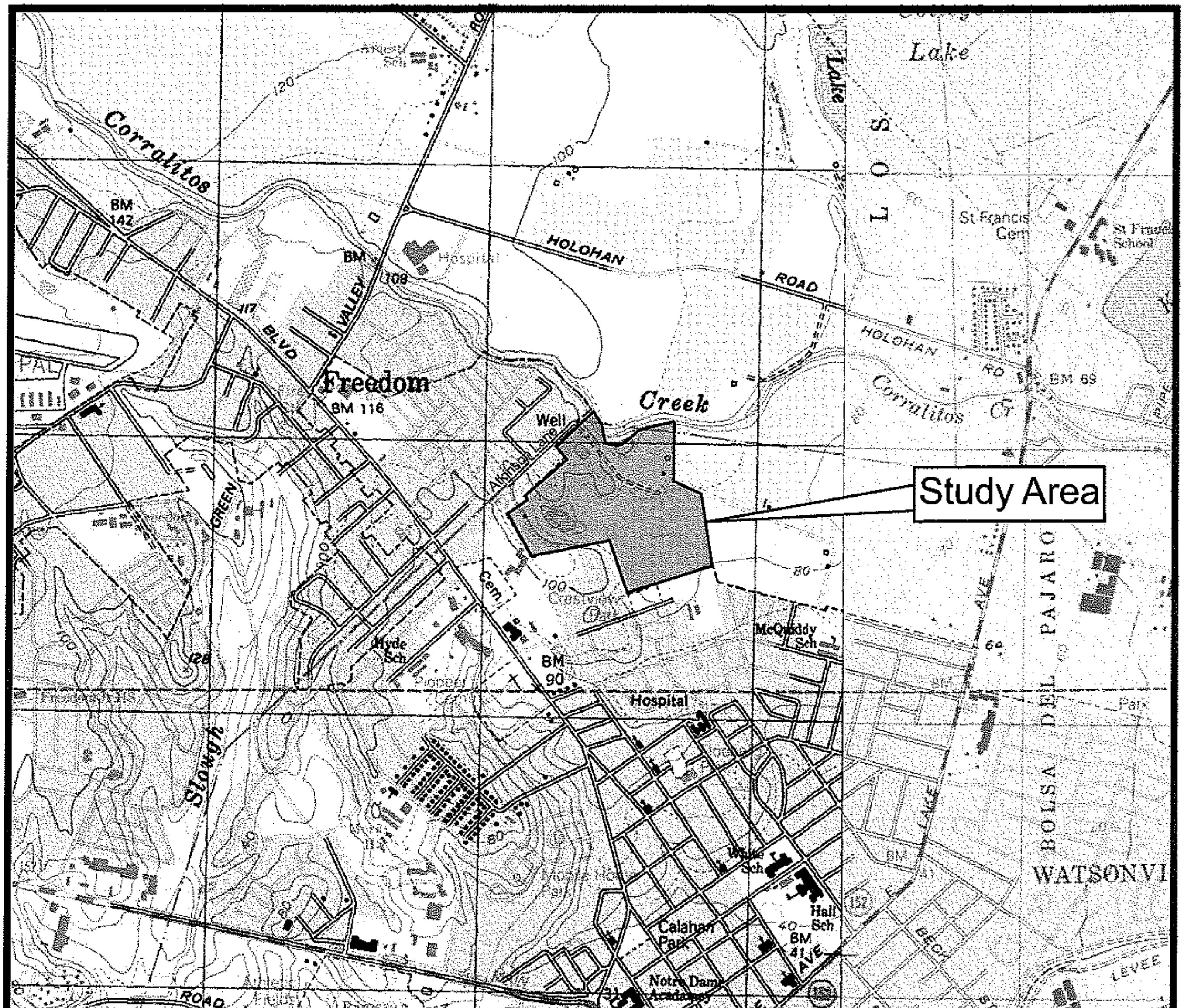
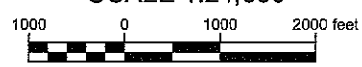
APPENDIX A

FIGURES

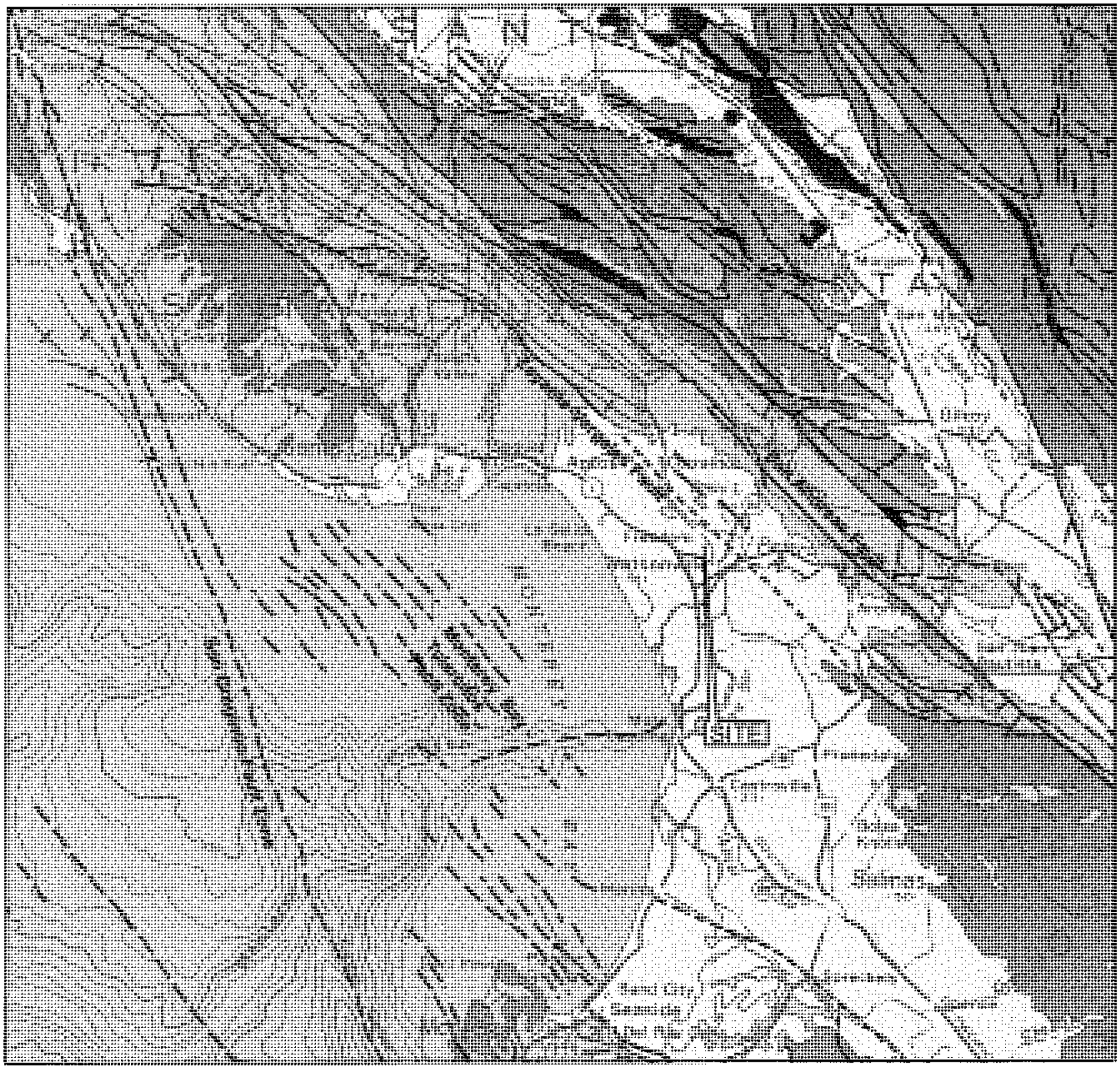


BASE MAP: U.S. Geological Survey, 1954 (photorevised 1995), Watsonville West Quadrangle, California, 7.5' topographic series, scale 1:24,000 and U.S. Geologic Survey, 1955 (photorevised 1995), Wastonville East Quadrangle, California 7.5' topographic series 1:24,000.

SCALE 1:24,000



ZINN GEOLOGY	**Topographic Index Map** *Atkinson Lane EIR* Atkinson Lane Watsonville, California	**FIGURE #** **1** JOB # 2008010-G-SC



Reference: Jennings, C.W., 1977, Geologic Map of California: California Department of Conservation, Division of Mines and Geology, scale 1:750,000.
Digital Data: Saucedo, G.J., Bedford, D.R., Raines, G.L., Miller, R.J., and Wentworth, C.M., 2000, GIS Data for the Geologic Map of California: California Department of Conservation, Division of Mines and Geology, CD-ROM 2000-007, ver. 2.0.

EXPLANATION

Geologic Units

- Quaternary Deposits
- Quaternary Volcanics
- Tertiary Sedimentary Rocks
- Tertiary Volcanic Rocks
- Pre-Tertiary Sedimentary Rocks
- Pre-Tertiary Volcanic Rocks
- Grantic Intrusive Rocks
- Franciscan Complex
- Ultramafic Rocks
- Pre-Tertiary Metamorphic Rock
- Pre-Cambrian Metamorphic and Igneous Rocks

Symbols

- contact
- fault, certain
- fault,approx. located
- fault, concealed or inferred
- anticline
- monocline
- syncline

N
W E
S

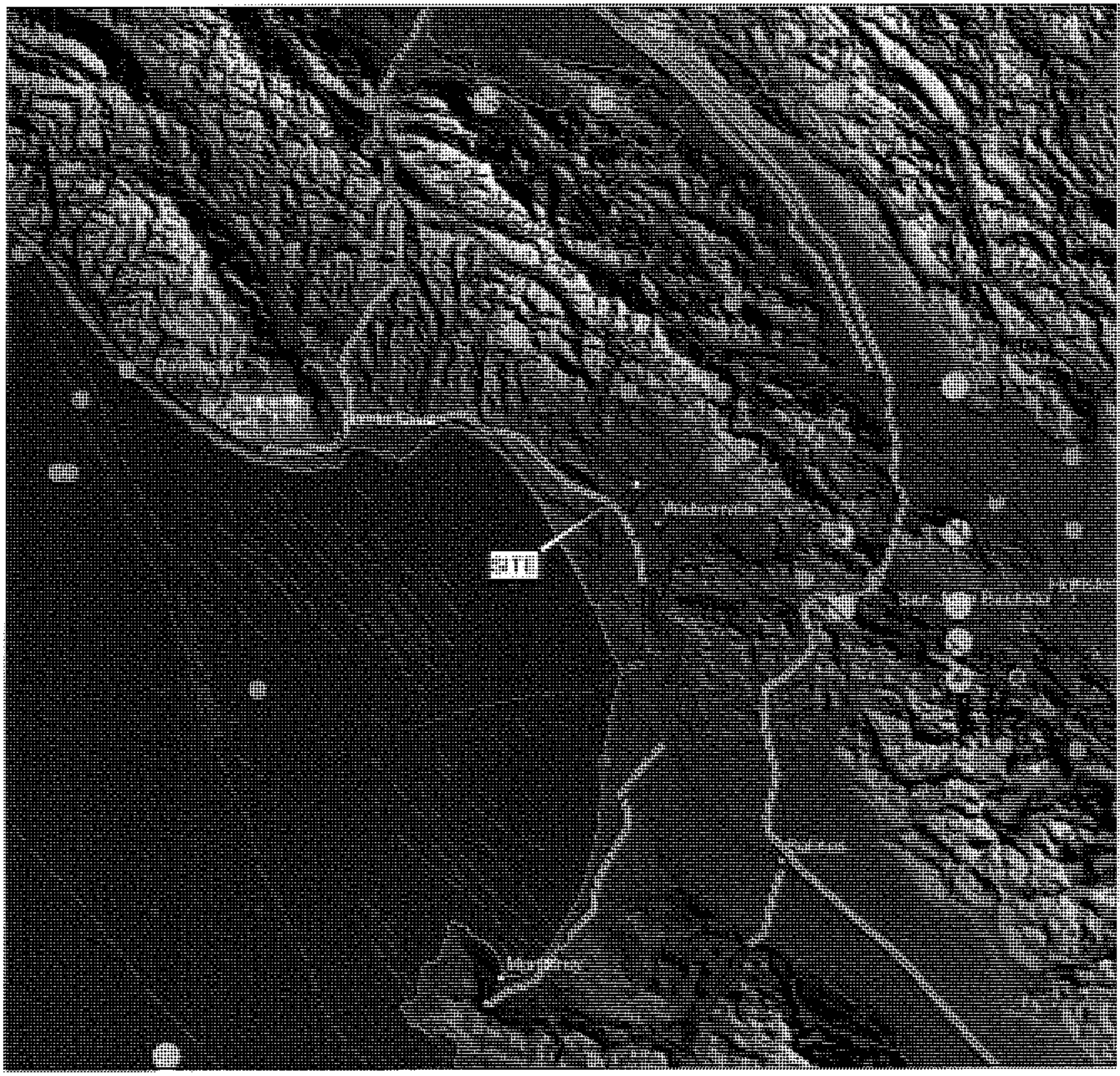
SCALE 1:500,000

10 Miles 0

ZINN GEOLOGY

Regional Geologic Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
2
JOB #
2008010-G-SC



Seismicity Information: Magnitude 4 and greater earthquakes, compiled from various sources, 1769 to 2000; available at www.consrv.cagov/CGS/rghm/quakes/cgs2000_fnl.txt
Fault Information: Jennings, C.W., 1977, Geologic map of California: California Department of Conservation, Division of Mines and Geology, scale 1:750,000

EXPLANATION

Symbols

- fault, certain
- fault,approx. located
- fault, concealed or inferred

Earthquake Magnitude

- 4.0 to 4.99
- 5.0 to 5.99
- 6.0 to 6.99
- 7.0 +

N
W E
S

SCALE 1:500,000

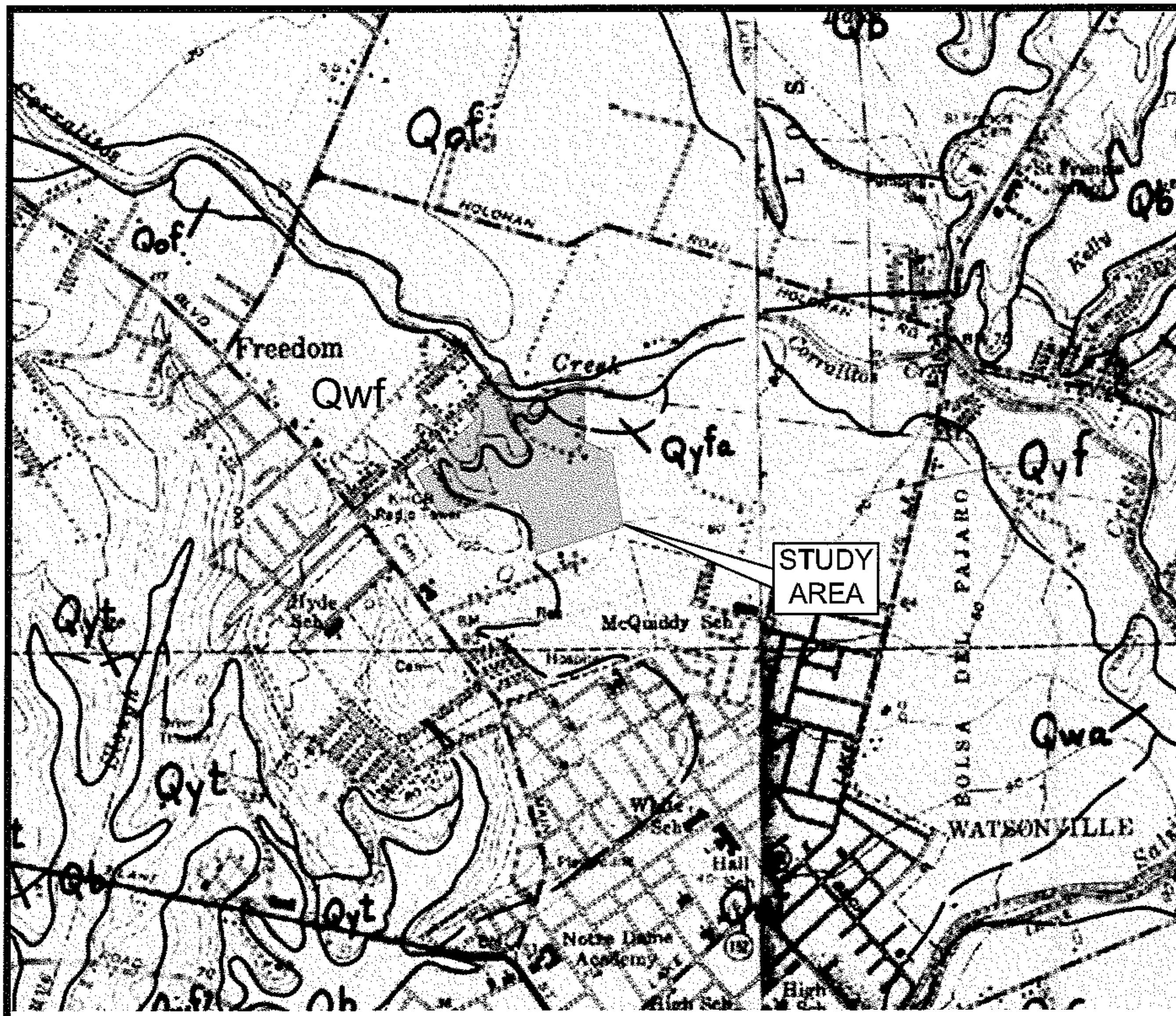
10 5 0 10

Miles

ZINN GEOLOGY

Regional Seismicity Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
3
JOB #
2008010-G-SC

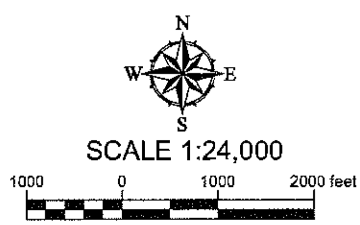


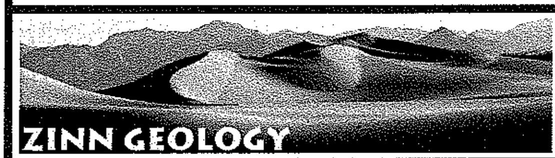
BASE MAP: "MAPS SHOWING GEOLOGY AND LIQUEFACTION POTENTIAL OF NORTHERN MONTEREY AND SOUTHERN SANTA CRUZ COUNTIES, CALIFORNIA", Dupre and Tinsley, 1980, Sheet 1 of 2, Scale 1:62,500, U.S. Geological Survey Miscellaneous Field Studies Map MF-1199.

EXPLANATION

Qb	Basin deposits
Qyf	Younger flood-plain deposits
Qyfa	Veneer of younger flood-plain deposits
Qof	Older flood-plain deposits
Qyt	Younger terrace deposits
Qwf	Fluvial facies - Terrace deposits of Watsonville
Qwa	Alluvial fan facies - Terrace deposits of Watsonville

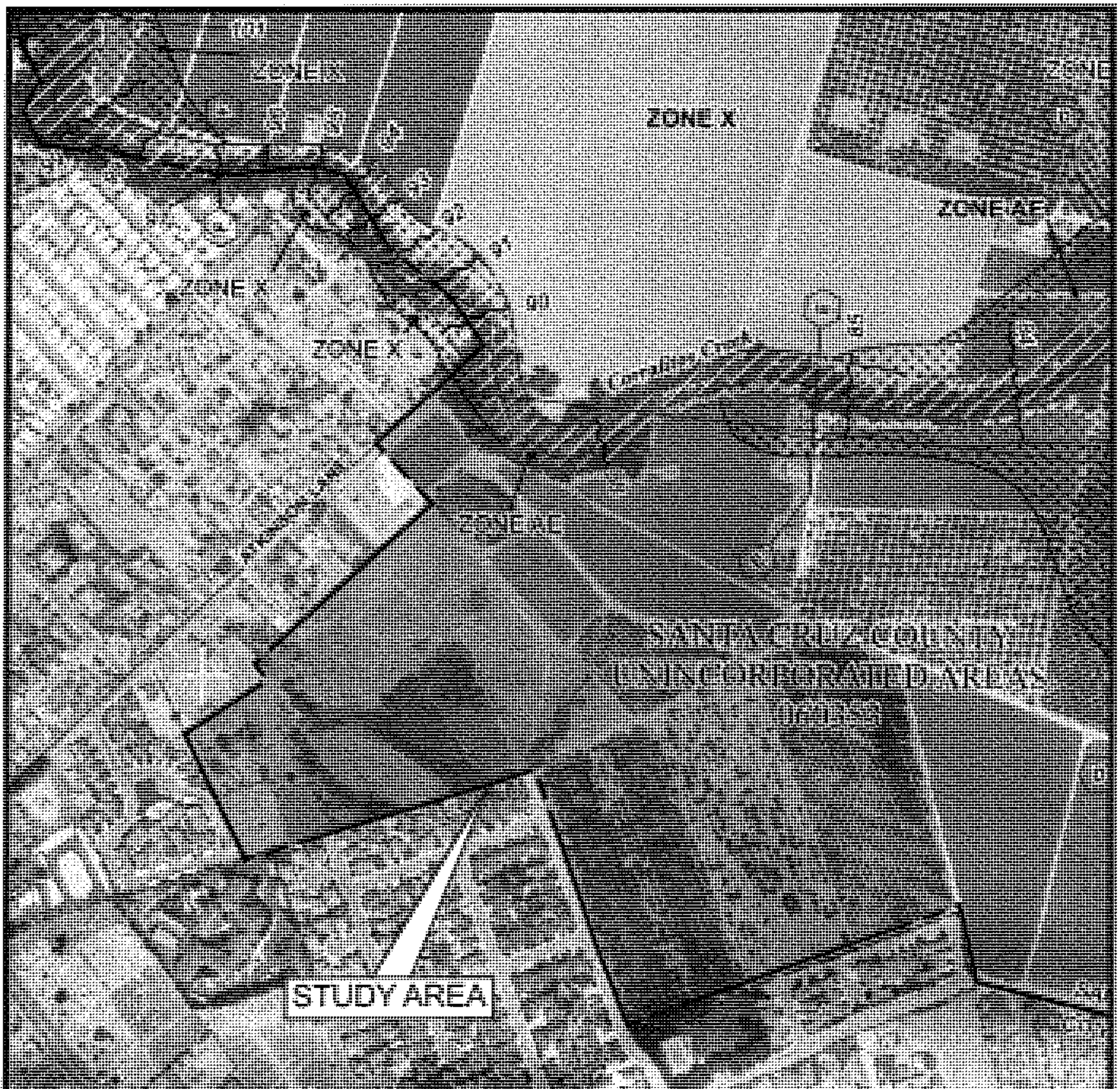
Earth materials contact





Local Geologic Index Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
4
JOB #
2008010-G-SC



BASE MAP: Flood Insurance Rate Map, Santa Cruz County, California (unincorporated areas), community-panel # 0360D. Federal Emergency Management Agency, effective March 2, 2006.

Explanations of Zone Designations

ZONE X — Areas Determined to be outside the 0.2% annual chance floodplain.

ZONE X in — Areas of average 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less that 1 foot or with daringe areas less than 1 square mile; and areas protected b levees from 1% annual chance flood.

ZONE AE in — Special Flood Hazards Area Subject To Inundation By The 1% annual Chance Flood

Floodway Areas in ZONE AE

SCALE 1:12000

ZINN GEOLOGY

FLOOD INSURANCE RATE INDEX MAP

Atkinson Lane EIR

Atkinson Lane

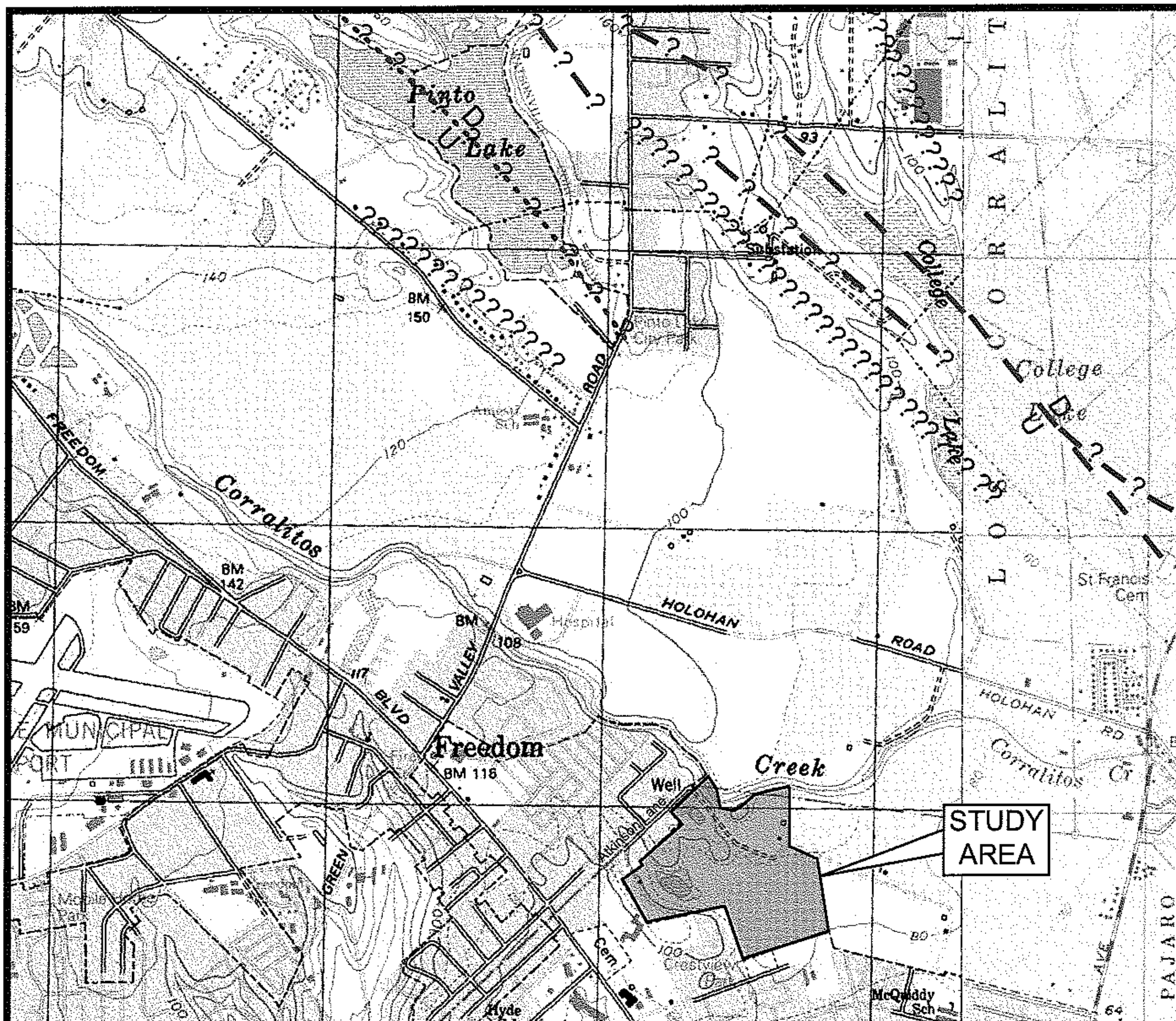
Watsonville, California

FIGURE #

5

JOB #

2002010-G-SC



BASE MAP: U.S. Geological Survey, 1954 (photorevised 1995), Watsonville West Quadrangle, California, 7.5' topographic series, scale 1:24,000, U.S. Geological Survey, 1955 (photorevised 1995), Wastonville east Quadrangle, California 7.5' topographic series 1:24,000. Excerpts of fault traces taken from Hall et al. (1974), "Faults and their potential hazards in Santa Cruz County", U.S. Geological Survey Miscellaneous Field Studies Map MF-626, scale 1:62,500.COUNTY, CALIFORNIA, USGS.

EXPLANATION

— — ... Probable Fault - Dashed where exposed; dotted where concealed

—? —? ...? Possible Fault - Dashed where exposed; dotted where concealed

????????? Photolineament of unknown origin

N
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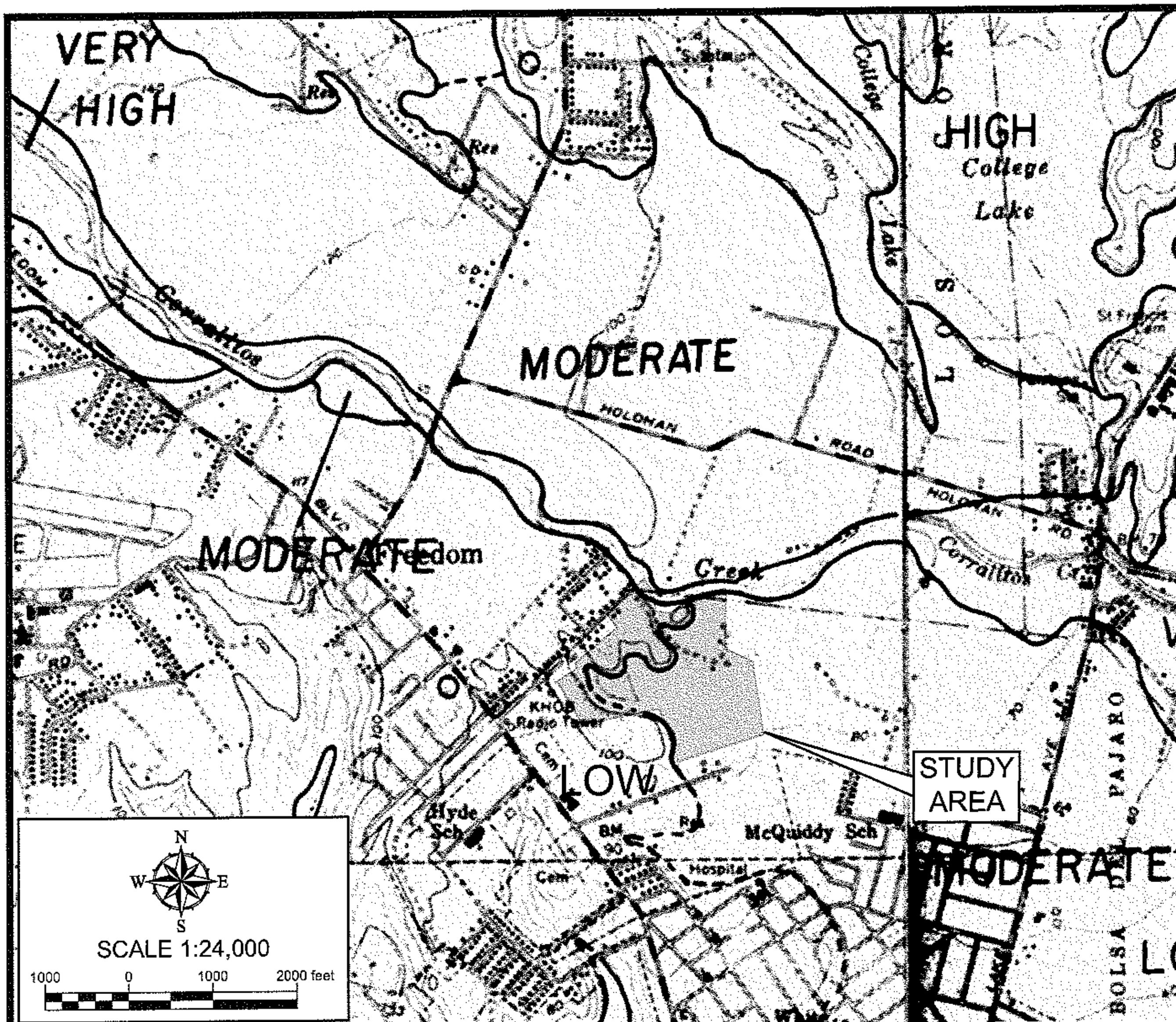
SCALE 1:24,000

1000 0 1000 2000 feet

ZINN GEOLOGY

Fault Index Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
6
JOB #
2008010-G-SC



BASE MAP: "MAPS SHOWING GEOLOGY AND LIQUEFACTION POTENTIAL OF NORTHERN MONTEREY AND SOUTHERN SANTA CRUZ COUNTIES, CALIFORNIA", Dupre and Tinsley, 1980, Sheet 2 of 2, Scale 1:62,500, U.S. Geological Survey Miscellaneous Field Studies Map MF-1199.

ZONES OF LIQUEFACTION SUSCEPTIBILITY

VERY HIGH SUSCEPTIBILITY FOR LIQUEFACTION: Sediments that are characterized by high susceptibilities for liquefaction (based on engineering tests) and for which there is historical evidence of extensive liquefaction-induced ground failure in the 1906 earthquake are classified as having very high susceptibility for liquefaction. Sediments in this zone are very likely to liquefy (and fail) in the event of even a moderate earthquake. The zone is mainly restricted to younger flood-plain deposits, as well as some basin deposits, beach sand, and dune sand in the vicinity of Moss Landing.

HIGH SUSCEPTIBILITY FOR LIQUEFACTION: Sediments for which engineering tests, the presence of shallow water tables, and the local presence of free faces indicate high susceptibility for liquefaction, but for which no historical evidence for liquefaction has been reported, are classed as having high susceptibility. Sediments in this zone are likely to liquefy in the even of a nearby major earthquake. Includes some basin deposits and younger flood-plain deposits, as well as most undifferentiated alluvial deposits and abandoned channel-fill deposits. Most dune sand and some beach sand are also included.

MODERATE SUSCEPTIBILITY FOR LIQUEFACTION: Sediments classed as having moderate susceptibility may liquefy in the event of a nearby major earthquake; they include sediments for which high susceptibilities were calculated but historical evidence for liquefaction is absent. Includes older flood-plain deposits, most basin and colluvium deposits, most undifferentiated alluvial deposits, and some late Pleistocene to Holocene eolian deposits.

ZINN GEOLOGY

Liquefaction Susceptibility Index Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
7
JOB #
2008010-G-SC

APPENDIX B

SCALE OF ACCEPTABLE RISKS FROM GEOLOGIC HAZARDS

SCALE OF ACCEPTABLE RISKS FROM SEISMIC GEOLOGIC HAZARDS		
Risk Level	Structure Types	Extra Project Cost Probably Required to Reduce Risk to an Acceptable Level
Extremely low[1]	Structures whose continued functioning is critical, or whose failure might be catastrophic: nuclear reactors, large dams, power intake systems, plants manufacturing or storing explosives or toxic materials.	No set percentage (whatever is required for maximum attainable safety).
Slightly higher than under "Extremely low" level.[1]	Structures whose use is critically needed after a disaster: important utility centers; hospitals; fire, police and emergency communication facilities; fire station; and critical transportation elements such as bridges and overpasses; also dams.	5 to 25 percent of project cost.[2]
Lowest possible risk to occupants of the structure.[3]	Structures of high occupancy, or whose use after a disaster would be particularly convenient: schools, churches, theaters, large hotels, and other high rise buildings housing large numbers of people, other places normally attracting large concentrations of people, civic buildings such as fire stations, secondary utility structures, extremely large commercial enterprises, most roads, alternative or non-critical bridges and overpasses.	5 to 15 percent of project cost.[4]
An "ordinary" level of risk to occupants of the structure.[3,5]	The vast majority of structures: most commercial and industrial buildings, small hotels and apartment buildings, and single family residences.	1 to 2 percent of project cost, in most cases (2 to 10 percent of project cost in a minority of cases).[4]

1 Failure of a single structure may affect substantial populations.

2 These additional percentages are based on the assumptions that the base cost is the total cost of the building or other facility when ready for occupancy. In addition, it is assumed that the structure would have been designed and built in accordance with current California practice. Moreover, the estimated additional cost presumes that structures in this acceptable risk category are to embody sufficient safety to remain functional following an earthquake.

3 Failure of a single structure would affect primarily only the occupants.

4 These additional percentages are based on the assumption that the base cost is the total cost of the building or facility when ready for occupancy. In addition, it is assumed that the structures would have been designed and built in accordance with current California practice. Moreover the estimated additional cost presumes that structures in this acceptable-risk category are to be sufficiently safe to give reasonable assurance of preventing injury or loss of life during and following an earthquake, but otherwise not necessarily to remain functional.

5 "Ordinary risk": Resist minor earthquakes without damage: resist moderate earthquakes without structural damage, but with some non-structural damage; resist major earthquakes of the intensity or severity of the strongest experienced in California, without collapse, but with some structural damage as well as non-structural damage. In most structures it is expected that structural damage, even in a major earthquake, could be limited to repairable damage. (Structural Engineers Association of California)

Source: *Meeting the Earthquake,* Joint Committee on Seismic Safety of the California Legislature, Jan. 1974, p.9.

SCALE OF ACCEPTABLE RISKS FROM NON-SEISMIC GEOLOGIC HAZARDS[6]		
Risk Level	Structure Type	Risk Characteristics
Extremely low risk	Structures whose continued functioning is critical, or whose failure might be catastrophic: nuclear reactors, large dams, power intake systems, plants manufacturing or storing explosives or toxic materials.	1. Failure affects substantial populations, risk nearly equals nearly zero.
Very low risk	Structures whose use is critically needed after a disaster: important utility centers; hospitals; fire, police and emergency communication facilities; fire station; and critical transportation elements such as bridges and overpasses; also dams.	1. Failure affects substantial populations. Risk slightly higher than 1 above.
Low risk	Structures of high occupancy, or whose use after a disaster would be particularly convenient: schools, churches, theaters, large hotels, and other high rise buildings housing large numbers of people, other places normally attracting large concentrations of people, civic buildings such as fire stations, secondary utility structures, extremely large commercial enterprises, most roads, alternative or non-critical bridges and overpasses.	1. Failure of a single structure would affect primarily only the occupants.
"Ordinary" risk	The vast majority of structures: most commercial and industrial buildings, small hotels and apartment buildings, and single family residences.	1. Failure only affects owners /occupants of a structure rather than a substantial population. 2. No significant potential for loss of life or serious physical injury. 3. Risk level is similar or comparable to other ordinary risks (including seismic risks) to citizens of coastal California. 4. No collapse of structures; structural damage limited to repairable damage in most cases. This degree of damage is unlikely as a result of storms with a repeat time of 50 years or less.
Moderate risk	Fences, driveways, non-habitable structures, detached retaining walls, sanitary landfills, recreation areas and open space.	1. Structure is not occupied or occupied infrequently. 2. Low probability of physical injury. 3. Moderate probability of collapse.

[6] Non-seismic geologic hazards include flooding, landslides, erosion, wave runup and sinkhole collapse