GEOTECHNICAL EXPLORATION
CANDLESTICK POINT CENTER INFRASTRUCTURE IMPROVEMENTS
SAN FRANCISCO, CALIFORNIA

Submitted to:
Mr. B.H. Bronson Johnson
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Prepared by:
ENGEO Incorporated

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Project No:
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Mr. B.H. Bronson Johnson
Lennar Urban
One California Street, Suite 2700
San Francisco, CA 94111

Subject: Candlestick Point Center (CP Center)
Infrastructure Improvements
San Francisco, California

DESIGN GEOTECHNICAL REPORT

Dear Mr. Johnson:

We prepared this geotechnical report for the Infrastructure Improvement design at the Candlestick Point Center (CP Center) project in San Francisco, California as outlined in our agreement dated March 6, 2013. We characterized the subsurface conditions at the site to provide the enclosed geotechnical recommendations for design.

Our experience and that of our profession clearly indicate that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to review the project plans and specifications and provide geotechnical observation and testing services during construction. Please let us know when working drawings are nearing completion, and we will be glad to discuss these additional services with you.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Jeff Fippin, GE

Leroy Chan, GE

Daniel S. Haynosch, GE

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

We prepared this geotechnical report for design of the proposed infrastructure improvements at the CP Center site in San Francisco, California. This report addresses geotechnical aspects of the project related to mass grading, utilities, roadways, streetscape and related secondary improvements. It should be noted that separate, subsequent reports will be required for design of vertical improvements. Our approved scope of work included:

- Service Plan Development
- Supplemental Subsurface Field Exploration
- Soil Laboratory Testing
- Data Analysis and Conclusions
- Report Preparation

For our use, we received:

- A grading plan by BKF titled "Candlestick Point, Jamestown Avenue and Arelious Walker, Proposed Grading Plan," dated March 26, 2013.

- A plan by BKF titled "Grading and Storm Drain System Master Plan for the Candlestick Point Development," dated August 16, 2013.

- AutoCAD files showing additional grading information for the project.

The plans show grading for a pad as well as proposed elevations for perimeter roads surrounding the retail pad.

The assessments and recommendations contained in this report are in general compliance with the San Francisco Building Code, the Seismic Hazards Mapping Act and CGS Special Publication 117A "Guidelines for Evaluating and Mitigating Seismic Hazards in California.

1.2 PROJECT LOCATION

As shown in Figure 1, the site is located in the southeastern portion of the City of San Francisco in the Candlestick Point neighborhood. As shown in Figure 2, the project site covers the footprint of the existing football stadium and portions of the perimeter parking lot and access roads. The project is surrounded by Jamestown Road on the west, the extension of Harney Way on the southeast, and the extension of Ingerson Avenue on the northeast.

1.3 PROJECT DESCRIPTION

At the current time, the development plans for the retail site are conceptual and include a superpad constructed at approximately project Elevation 110 feet (Datum = City of SF Datum plus 100 feet). The pad will be surrounded by extensions of existing Harney Way, Ingerson Avenue and Arelious Walker. Improvements are planned to realign the southern portion of Jamestown Avenue to intersect with the extension of Arelious Walker. The realignment of Jamestown Avenue will involve cuts of up to 12 feet with a retaining wall constructed on the western side of the roadway. The realigned portion of Jamestown Avenue will intersect with Arelious Walker near the existing turnaround at approximately Elevation 137 feet and slope upwards towards the north to tie in to the existing alignment at approximately Elevation 237 feet.

A 2.5:1 (horizontal:vertical) slope will be constructed sloping down from the extension of Arelious Walker to the retail pad. This slope will be 40 feet tall at the highest point.

The extension of Harney Way will intersect with Arelious Walker at approximately Elevation 120 feet and slope down to the intersection with Ingerson Avenue at approximately Elevation 110 feet. Slopes along Harney Way and Ingerson Avenue are shown as 3:1 or flatter.

The majority of the grading will consist of cut. Fill up to 8 feet thick will be placed in the eastern corner of the retail pad near the intersection of Ingerson Avenue and Harney Way and in the northern corner of the retail pad near the intersection of Ingerson Avenue and Arelious Walker. On average, cuts will be on the order of 5 feet or less, however in the southern corner of the site, the grade will be lowered by as much as 37 feet near the existing Jamestown Avenue turnaround at the stadium. At the north side of the existing stadium, grade will be lowered as much as 25 feet. The proposed slope between Arelious Walker sloping down to the retail pad will be constructed by excavating in to the existing slope.

1.4 EXISTING GEOTECHNICAL DATA

The site and vicinity have been investigated in the past. Subsurface explorations performed previously are shown on Figure 2. The reports associated with these previous explorations are:

- Treadwell and Rollo – A Geotechnical Investigation Report was prepared dated March 3, 1998. The investigation included drilling 16 test borings, advancing 18 cone

penetration tests (CPT), and conducting five seismic refraction surveys between August 5 and September 16, 1997.

- ENGEO 2011 – "Geotechnical Report, Hunters Point Shipyard Phase II Candlestick Point Redevelopment, San Francisco, California," dated November 10, 2011. The subsurface exploration included seven borings, 12 CPTs, ten surface samples, and two percolation tests performed on Candlestick Point.

Several of the borings, CPTs and surface sampling were performed immediately adjacent to and within the project limits.

FINDINGS

1.5 GEOLOGY AND SEISMICITY

1.5.1 Geology

A published geologic map of the site and vicinity (Figure 3; Bonilla, 1971, 1998) indicates that the subject site is underlain primarily by Cretaceous and Jurassic Franciscan Complex rock with artificial fill at the north-eastern and eastern portions of the site. According to Bonilla (1998) Franciscan Complex rocks at the site generally comprise greenstone, chert and interbedded sandstone and shale. Bonilla maps Pleistocene undifferentiated sedimentary deposits at the southern portion of the site. Artificial fills mapped at the eastern portion of the site generally comprise clay, sand, silt, rock fragments, organic matter and man-made debris (Bonilla, 1998).

We prepared a Site Geologic Map, Figure 4, based on geologic field mapping conducted by an ENGEO geologist in 2010. Mapping focused primarily on bedrock units exposed in road-cuts along Jamestown Avenue and Arelious Walker at the western portion of the site. The various geologic units shown on Figure 4 are described below.

1.5.1.1 Existing fill

Areas of existing fill have been mapped where they are relatively wide spread in plain view and where the fill is more than about a foot or so in thickness. The most significant areas of artificial fill (Qaf) at the site are present along Jamestown Avenue, northeastern portion of the stadium, and existing parking lots in the eastern portion of the site in the vicinity of the proposed intersection of Ingerson Avenue and West Harney Way. With the exception of the northeastern portion, the existing stadium is located predominantly in an area of bedrock cut with relatively minor fills (generally less than 5 feet thick) with thicker fills to the northeast. The fill within the stadium and paved parking area generally consists of a mixture of soil and bedrock-derived material excavated from the adjacent ridge areas. Subsurface explorations and visual examination of exposures shows that the fills consist of sand, gravelly clay, silty and sandy clay and silty gravel. Based on our subsurface data and the review of the previous subsurface

information provided, the coarse grained material varies in density from loose to medium dense, and fine grained materials are typically very stiff. As shown in Figure 5, the artificial fill to the north, east and south of the project limit is mapped in a Liquefaction Seismic Hazard Zone by the State of California Geologic Survey. The USGS map is intended to be used for baseline studies since it is based on correlation between liquefaction potential and geologic units applied across a region mapped with a scale 1:24,000 to 1:200,000. This map is acknowledged to be limited and detailed liquefaction potential evaluation with geotechnical borings and site-specific studies by a licensed professional are necessary.

1.5.1.2 Young Bay Mud

The southeast portion of the study area, in the vicinity of proposed Ingerson Avenue and Harney Way is beyond the former shoreline as mapped in 1903 and shown in aerial photographs from 1938. This area of the site is underlain by compressible Young Bay Mud up to approximately 50 feet thick beneath the fill. The Young Bay Mud thickness generally increases away from the former shoreline.

The Young Bay Mud is normally consolidated to slightly overconsolidated. Post-construction settlement as a result of consolidation of Young Bay Mud subjected to construction loading and new loads from fill or structures may have long-term detrimental effects on buildings and infrastructure within the project area. Further discussion of the effects of this soft/compressible soil and possible mitigation measures are provided in this report.

1.5.1.3 Alluvial Soil

The Young Bay Mud is typically underlain by interbedded stiff clay, medium dense to dense sand, silty sand, and gravel layers.

1.5.1.4 Old Bay Mud

Borings that penetrated through the alluvial soil encountered stiff to hard clay referred to locally as Old Bay Mud or Yerba Buena Mud. The Old Bay Mud is similar in material composition but is much stiffer and significantly less compressible compared to the Young Bay Mud. Occasionally, a layer of alluvium was encountered beneath the Old Bay Mud.

1.5.1.5 Bedrock

The site is underlain by Jurassic- and Cretaceous-age Franciscan bedrock, including greenstone, chert, graywacke, and shale. Bedrock exposures can be found in the slopes above Jamestown Avenue and Arelious Walker. The borings encountered greenstone, graywacke, serpentinite, and shale. Areas where bedrock is currently exposed are shown on the Site Geologic Map, Figure 4. The weak to very strong bedrock varies from yellowish brown to dark gray in color. Bedrock structure is somewhat chaotic with bedding, fractures and foliations in various directions. The

predominant trend of bedding is generally NE striking and NW dipping. Dips vary widely with values ranging from 14 to 69 degrees as shown on Figure 4.

Franciscan Greenstone. Franciscan greenstone (KJg) units mapped at the site vary widely in strength and appearance due to the differing degrees of alteration and thus have be subdivided into five subunits (see Figure 4 for details). Greenstone subunits vary from very weak and extremely weathered to strong and moderately weathered. Subunits are typically very closely to closely fractured.

Franciscan Chert. Franciscan chert (KJfc) units mapped at the site are typically strong, very thinly bedded, and closely to moderately fractured.

Franciscan Graywacke. Franciscan graywacke (KJfs) mapped at the site is typically medium strong, closely fractured with shale interbeds.

Franciscan Meta-Siltstone. Franciscan meta-siltstone (KJfl) mapped at the site is typically extremely weak, very thinly bedded to laminated, and highly weathered.

Franciscan Shale. Franciscan shale (KJfsh) mapped at the site is typically extremely weak, and laminated.

Serpentinite. Serpentinite (sp) mapped at the site is typically extremely weak, and sheared with polished, slickensided surfaces.

1.5.2 Seismicity

Numerous small earthquakes occur every year in the San Francisco Bay Region and larger earthquakes have been recorded and can be expected to occur in the future. Figure 6 shows the approximate locations of these faults and significant historic earthquakes recorded within the Greater Bay Area Region. The most common nearby active faults within 30 miles of the site and their estimated maximum earthquake magnitudes are provided in the following table based on United States Geologic Survey (USGS) 2008 National Seismic Hazard Maps. An active fault is defined by the State Mining and Geology Board as one that has had surface displacement within Holocene time (about the last 11,000 years) (Hart, 1997).

TABLE 2.1.2-1
Regional Faults

Fault Name	Approximate Distance (miles)	Direction from Site	Estimate of Maximum Magnitude (Ellsworth)
N. San Andreas	5.9	West	7.9
San Gregorio	10.6	West	7.5
Hayward-Rodgers Creek	12.2	East	7.3

Fault Name	Approximate Distance (miles)	Direction from Site	Estimate of Maximum Magnitude (Ellsworth)
Monte Vista-Shannon	20.4	Southeast	6.5
Calaveras	21.8	East	7.0
Mount Diablo Thrust	22.0	East	6.7
Green Valley	25.2	Northeast	6.8
Point Reyes	29.2	Northwest	6.9

Site: Latitude = 37.7136; Longitude = -122.3861

The United States Geologic Survey evaluated the Bay Area seismicity through a study by the Working Group on California Earthquake Probabilities (WGCEP, 2007). WGCEP estimated that there is a 21 percent probability that a moment magnitude (M_w) of 6.7 or greater earthquake will occur on the San Andreas fault within 30 years of the publish date (2007 – 2037). WGCEP estimated there is a 31 percent probability that a moment magnitude (M_w) of 6.7 or greater earthquake will occur on the Hayward Fault within the same time period. The aggregate probability of a similarly sized earthquake in the San Francisco Bay Area was estimated to be 63 percent in the study.

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults are believed to exist within the site. Fault rupture through the site, therefore, is not anticipated.

1.6 SURFACE CONDITIONS

During our field exploration, we performed a brief site reconnaissance and observed the following site features:

- The majority of the site is occupied by the Candlestick Point stadium and associated parking lots.

- Jamestown Avenue and Ingerson Avenue enter the site from the northwest. Ingerson Avenue has a bus turnaround adjacent to the southwest corner of the stadium.

- The site slopes downward from Jamestown Ave to Ingerson Avenue. The existing slopes range from approximately 1:1 (horizontal:vertical) to 1.5:1. The slope is up to approximately 100 feet tall at the northern boundary of the site.

- The hillside above Jamestown Avenue is approximately 400 feet above the lowest point of the street. The bottom portion of this hillside ranges from approximately 1:1 to 1.5:1 for approximately the bottom 200 to 300 feet of the slope and then flattens out significantly. We observed shallow slides in isolated portions of the hillside; these minor slides are shown on Figure 4.

Please refer to the Site Plan, Figure 2, for more information on site features.

1.7 FIELD EXPLORATION

We performed supplemental subsurface exploration within the stadium and within the perimeter outside of the stadium as part of this report. The exploration included a seismic refraction line, four borings and one rock core. The borings and rock core are labeled 2-CP-B4 through-B8; boring designations 2-CP-B1 through –B3 were reserved for the exploration work at the Alice Griffith Development that will be submitted under separate cover. The seismic refraction line was approximately 700 feet in length and was performed across the football stadium as shown on Figure 2.

The borings were drilled using hollow stem auger and rotary-wash methods and ranged from approximately 10 to 16 feet in depth below existing ground surfaces. All of the borings terminated in bedrock. During drilling, samples were collected by driving either a 2.5-inch OD Standard Penetration Sampler or a 3-inch outside-diameter (O.D.) California-type split-spoon sampler fitted with 6-inch-long brass liners. The samplers were driven with a 140-pound automatic trip hammer falling a distance of 30 inches. The penetration of the sampler was field recorded as the number of blows needed to drive the sampler 18 inches in 6-inch increments. The boring log shows the number of blows required for the last one foot of penetration, and the blow counts have not been converted using any correction factors.

Coring 2-CP-B6 was performed using HQ sampling methods. During coring, we recorded the rock quality designation (RQD) drilling rate, and recovery percent as well as logging the observed characteristics of the rock.

The borings and rock core were logged in the field by an ENGEO representative. The field logs were then used to develop the report borelogs in Appendix A. The log depicts subsurface conditions encountered within the borings for the date of drilling; however, subsurface conditions may vary with time. The seismic refraction line was performed by a subconsultant; the subconsultant's report is included in Appendix B.

1.8 SUBSURFACE CONDITIONS

Based on information obtained to date, bedrock was encountered either at the surface of the site in areas of previous cuts or at a shallow depth (less than 5 feet) where fill overlie bedrock. Explorations previously performed near the northern and southern boundaries of the site encountered significantly thicker layers of fill, sedimentary deposits associated with the Bay, and deeper bedrock. As shown on Figure 7, the mapped shoreline from a 1903 shoreline map indicates that the historic shoreline falls inside the project boundaries. The thickness of Young Bay Mud is greatest near the intersection of Harney Way and Ingerson Avenue, where the previous borings encountered Young Bay Mud as thick as 50 feet. In some explorations outside of the historic shoreline, the explorations encountered thicker layers of fill with no Young Bay

Mud; this information suggests that fill placement caused "Mud waves" which displaced the Young Bay Mud locally. Based on the previously collected data, these areas of displaced Young Bay mud are expected to be isolated and relatively small in area within the project limits.

1.9 GROUNDWATER CONDITIONS

None of our current borings encountered groundwater. Groundwater was encountered in some of the previous explorations. Several of the previous exploration borings within and adjacent to the project site encountered groundwater. The following table summarizes reported groundwater observations during previous explorations performed within and adjacent to the project limits.

TABLE 2.5-1
Groundwater Observations

Boring Location	Approximate Elevation of Groundwater (Feet)*
CP-B1	Not Encountered
CP-B2	-11.2
CP-B3	-13
DB-5	-7.5
DB-8	-8.25
DB-10	Not Encountered
DB-11	-6.8
DB-14A	-7.5

**Elevation datum based on City and County of San Francisco (CCSF)*

It should be recognized that fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, sea level and other factors not evident at the time measurements were made.

2.0 CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the site is suitable for the proposed development, provided the geotechnical recommendations in this report are properly incorporated into the design plans and specifications.

The primary geotechnical concerns that could affect development on the site are shallow rock excavatibility, slope construction, liquefiable potential of undocumented fill, and compressible soil.

2.1 SHALLOW ROCK EXCAVATION AND SUITABILITY

The following is provided for informational purposes. A grading contractor should perform their own assessment of appropriate equipment during the bid process.

As previously discussed, the majority of the proposed site is underlain by shallow Franciscan bedrock. Based on our seismic refraction testing, the shear wave velocity of the upper 10 feet of bedrock at the center of the site is approximately 8,000 feet per second (fps) or less. We anticipate that cuts to proposed grade in this area of the site can be accomplished with a D9 or larger bulldozer. However, localized massive hard rock should be expected, especially in the deeper cuts along Jamestown Avenue, which may be difficult or impractical to rip in-place. In this area and in cuts greater than 10 feet, the rock should be expected to be marginally rippable with large equipment such as a D11 bulldozer with a single tooth ripper shank, and non-rippable boulders and other resistant particles should be expected resulting in overexcavation and reconstruction of the cutslope. It is also possible that limited areas may require hydraulic hammers or controlled blasting to perform the excavation; the use of controlled blasting would be subject to the City and County of San Francisco approval. If blasting is considered to be a viable option, consideration needs to be given to dust control and vibration monitoring. Alternative methods of excavation in hard rock include expansion grouting, hydraulic loading, controlled foam injection, and specialized mechanical fracturing methods.

If excavation of resistant rock result in oversize rock fragments beyond the size acceptable for engineered fill placement. It is likely that the oversize rock fragments will need to be processed with specialized equipment. Material that cannot be broken down to less than 12 inches in diameter may need to be removed from the site or selectively placed at the bottom of deeper fills on other portions of the project as approved by the Geotechnical Engineer; in general, the planned fill at this site is not deep enough to accept large diameter rocks; and in the areas where planned fill is thick enough to accept larger sized particles, the fill is within roadways and large particles placed in mass fill would likely cause issues with utility excavation. It may be beneficial for the grading contractors to perform test excavations near Jamestown Avenue prior to preparation of their bids to determine the most efficient means and methods of excavation.

Similarly, we anticipate that it will be possible to trench most of the bedrock using large excavator-type equipment. Localized lenses of massive hard rock are expected that will require laborious trenching efforts and may necessitate the use of excavators equipped with single-tooth ripping hooks or hydraulic hammers. Trenching of localized hard rock is likely to result in over-break of trench walls and oversized trench spoils. Depending on the phasing of construction, it may be preferable to overexcavate bedrock in areas of proposed trenching during grading when more effective and powerful equipment is available.
To assist in utility and foundation construction, we recommend that the upper 5 feet of the retail pad be excavated, processed and placed as engineered fill during site grading. Once building layouts have been determined, the depth of overexcavation may need to be modified so that the differential thickness of fill across a building pad is limited. For preliminary planning,

differential fill thickness no greater than 10 feet over a 100-foot horizontal distance should be considered. This differential fill thickness may be modified depending on location, building type, layout and grading.

2.2 SLOPE CONSTRUCTION

In general, the planned cut and fill slope gradients are acceptable. If the grading plan is modified, cut slopes should be maintained at 2:1 or flatter and fill slopes should be 3:1 or flatter.

Because of the chaotic nature of the bedrock at the site, it is anticipated that the planned 40 foot high slope below Arelious Walker will primarily encounter hard rock with localized areas of adverse rock conditions. It is our understanding that this is a temporary slope that will eventually be replaced with a parking structure retaining wall. While the existing slope below Jamestown Avenue in this area does not exhibit areas of adverse conditions, limited sloughing was mapped above Jamestown Avenue.

The risk of rockfall in this formation is considered low, however, depending on the actual conditions encountered during grading and the duration of this temporary slope condition, it is possible that erosion and weathering may result in debris falling from the cut slope over time; some maintenance may be required to remove debris at the base of the slope. We recommend that a temporary ditch be installed at the base of the slope to capture runoff.

2.3 EXISTING FILL

As previously mentioned, the majority of the site is underlain by non-engineered fill. The fill thickness is relatively thin (less than 5 feet) in the area of the existing stadium, however the fill is significantly thicker outside of the existing shoreline. Non-engineered fills can undergo excessive settlement, especially under new fills or building loads. As discussed earlier in this report, the borings encountered fill up to 40 feet thick near the planned intersection of Ingerson Avenue and Harney Way. Where feasible, particularly within the retail pad, we recommend complete removal of the undocumented fill to allow for consistent foundation types for buildings. If undocumented fill is encountered during site clearing, where feasible the existing fill should be removed to competent native soil, as discussed in Section 6.2. If deeper fills that extend to significant depths below groundwater are encountered, then alternative mitigation methods such as deep foundations for buildings and flexible utility connections may be necessary.

2.4 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, and ground lurching. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift, soil liquefaction, lateral spreading, landslides, tsunamis, flooding or seiches is considered low to negligible at the site.

2.4.1 Ground Rupture

Since there are no known active faults crossing the property and the site is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the subject property.

2.4.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, all structures should be designed using sound engineering judgment and the current California Building Code (CBC) requirements, as a minimum. Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead-and-live loads. The code-prescribed lateral forces are generally considered to be substantially smaller than the comparable forces that would be associated with a major earthquake. Therefore, structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

2.4.3 Liquefaction

We evaluated the susceptibility of the on-site fill material to liquefaction of sands, as well as the susceptibility of gravels and low plasticity fines to seismic loading based on methodology presented by, Bray and Sancio (2006), Idriss and Boulanger, 2004 and Seed et al, 2003 and others. The literature suggests that “transitional” material like silts and clays may be susceptible to seismic softening. As a result, we have divided our evaluation of liquefaction into soils exhibiting “sand-like” behavior and those exhibiting “clay-like” behavior. We have assessed the seismic susceptibility and deformation potential at the site based on material properties from laboratory testing and in-situ CPT data as discussed in the following sections. Our analyses of liquefaction potential were performed using a PGA of 0.61 and a M_w 7.9 earthquake; the PGA

value is based on the 2013 California Building Code and the earthquake magnitude is associated with an earthquake on the San Andreas Fault.

2.4.3.1 Analyses of Clay-Like Material.

We have evaluated the susceptibility of fine-grained soil within the fill at the Candlestick Point site using the methods described in Bray and Sancio (2006) and criteria proposed by Idriss and Boulanger (2004). These methods evaluate the potential for cyclic softening based on the in-situ moisture content of the soil and properties determined during plasticity index testing. Based on this lab testing, the fine-grained soil that we sampled and tested within the fill at the Candlestick Point site is not expected to be susceptible to cyclic softening (a phenomenon similar to liquefaction where soil loses strength as a result of cyclic loading).

2.4.3.2 Analyses of Sand-Like Material

Our empirically-based analyses of the subsurface data collected from CPTs and borings are described in the following sections.

CPT Data

We evaluated liquefaction resistance and related settlement based on the CPT data from our 2011 report previously referenced. The analysis was performed in accordance with procedures developed by Robertson (2009) using the computer software Cliq. The software employs methodology discussed by Youd et al, (2001) Moss et. al. (2006), and Robertson (2009) to assess the liquefaction of sandy materials as well as cyclic softening of clay. The software uses methodology by Zhang (2004) to estimate post-liquefaction displacement.

To assess liquefaction hazard, we have calculated both the Factor of Safety and the Liquefaction Potential Index (LPI) for each CPT, as defined by Iwasaki (1982). LPI is a relative hazard index, calculated on a point-by-point basis using the factor of safety against liquefaction, as a function of depth. LPI has been correlated to observed damage in existing liquefaction case studies and is a more appropriate indicator of risk than factor of safety alone. The computed discrete factors of safety with depth, from which the LPI values for each CPT are derived, are summarized on the attached Cliq Output in Appendix E.

Deformation of the ground surface is a common result of liquefaction. Vertical settlement may result from densification of the deposit or volumetric loss from venting to the ground surface. We calculated potential liquefaction induced settlement estimates from the CPT data using the program CLiq. The estimates of potential liquefaction-induced settlement are included in Appendix E.

At the Candlestick Point site, our analyses indicate that potential volumetric settlement of the in-situ fill is highly variable. Based on the methodology described above, estimated settlement within the in-situ fill ranges from less than 1 inch to over 11 inches at the various explorations.

Analysis of two CPTs performed within the project limits (CP-CPT1 and CP-CPT4) indicate between 3 and 8 inches of potential liquefaction settlement assuming no mitigation, such as removal and replacement is performed.

Boring Data

We also performed an analysis of the potential liquefaction at the site based on our borings. We collected SPT blow counts and samples of the subsurface soil and used the laboratory test results and recorded blow counts to assess liquefaction using analytical methods published by Youd et al. (2001), Seed et al. (2003), and Idriss & Boulanger (2008). Recorded blow count resistances (N-value) were corrected for sampler and hammer type, overburden pressure, boring diameter, and fines content. As with the CPT data, we calculated potential settlement based on the results of our boring data using methods published by Ishihara and Yoshimine in 1992. The results of our liquefaction analyses performed on data from the borings are included in Appendix E

In general, our borings encountered less potentially liquefiable soil than our CPTs though the estimated settlement is similar. Borings CP-B2 and CP-B3, both drilled near the perimeter of the site, indicate between 6 and 9 inches of potential liquefaction settlement.

2.4.3.3 Summary of Liquefaction Analyses

In summary, based on our interpretation of the existing data and anticipated site variability, we estimate that the areas underlain by artificial fill during reclamation of the site may experience between 1 and 12 inches of seismically induced settlement in localized areas within the project site. This degree of settlement would be unsuitable for performance of shallow utilities, rigid pavements, surface drainage and buildings on shallow foundations constructed in areas underlain by the artificial fills. Gravity utilities may have issues with proper flow and providing design capacity. Utilities may also be subject to failure due to pipe breaks from differential settlement.

Mitigation is possible using a variety of options. Due to the limited extent and depth of liquefiable soil, removal and replacement as engineered fill may be feasible in the areas of shallow existing fills. However, fill is expected to average approximately 25 feet in thickness and extend to as deep as 40 feet in limited areas. Due to shallow groundwater, and the depth to the bottom of the fill and adjacent existing utilities and structures, complete removal of all potentially liquefiable material in all improvement areas is likely infeasible. As an alternative to removal of liquefiable material, in-situ densification may be implemented to reduce the amount of liquefiable material, decrease settlement and reduce the chance of sand boiling. In-situ densification can be achieved by impact at the ground surface in order to densify the potentially liquefiable soil reducing the potential for liquefaction. These methods result in varying amounts of noise and vibration depending on the weight used and the frequency of the impact. A method such as rapid impact compaction (RIC) may be appropriate in some areas of planned improvements, whereas deep dynamic compaction may be a viable alternative over areas of fill greater than 15 feet in thickness.

Due to high variability of the fill, differential settlement over a typical building footprint may be on the order of half the total settlement; buildings planned in the deepest fills will likely need to be founded on deep foundations due to the potential liquefaction induced settlement. In areas of shallower fill, stiffened mat foundations may be feasible. Ground improvement by means of surface impact for buildings would likely damage infrastructure previously installed making this alternative for building construction likely infeasible for buildings.

Due to the degree of anticipated settlement and difficulty in implementing the potential mitigation measures, it may be preferable to forego the above recommended liquefaction-specific mitigation measures within areas of planned improvements. If mitigation is not performed, the project should anticipate that improvements will need to be repaired after a major seismic event.

2.4.4 Ground Lurching

Ground lurching is a result of the rolling motion imparted to the ground surface during energy released by an earthquake. Such rolling motion can cause ground cracks to form in weaker soils. The potential for the formation of these cracks is considered greater at contacts between deep alluvium and bedrock. Such an occurrence is possible at the site as in other locations in the Bay Area region, but based on the site location, it is our opinion that the offset is expected to be nominal.

2.4.5 Shoreline Stability

Our previous report identified potential shoreline stability issues that could propogate as much as 150 feet from the shoreline. We do not anticipate that these lateral stability issues will impact the proposed development site, but will need to be addressed for adjacent projects.

2.5 CONSOLIDATION SETTLEMENT OF YOUNG BAY MUD

Based on our review of published maps, and the existing information, northeast and southeast perimeters of the site are underlain by natural soft, highly compressible Young Bay Mud deposits. Young Bay Mud deposits are of particular concern since these deposits are highly compressible and may be susceptible to significant settlement when subjected to additional loading, either through the placement of additional fill and/or additional structural loads. In addition, these deposits have low strength characteristics and may be problematic for underground construction due to their instability in temporary cuts and slopes. In general, these materials are not considered suitable for reuse as engineered fill and will necessitate mitigation as discussed in following sections of this report.

It should be noted that our current understanding of the project is that buildings will be pile supported where situated over thick fills and Young Bay Mud deposits, and therefore surcharging will be designed to accommodate only additional fill loads in improvement areas and not additional structural loads. It should also be noted that once the horizontal infrastructure is constructed that surcharging to accommodate additional building loads may no longer be an option to address

consolidation settlements due to the potential damage that may be caused to adjacent utilities and other improvements.

The estimated Elevation of the bottom of the Young Bay Mud is shown on Figure 4. Also shown on Figure 4 is the currently proposed grading plan. Fill is planned along Harney Way and Ingerson Avenue; the current grading plan calls for the fill to range from approximately 5 to 10 feet in these areas. In general, the Young Bay Mud is approximately 10 to 15 feet in thickness with the thickness increasing dramatically near the intersection of Harney Way and Ingerson Avenue; Boring CP-B3 encountered approximately 50 feet of Young Bay Mud approximately 200 feet east of this intersection. Based on our existing information, we estimate Young Bay Mud is approximately 30 feet thick at this intersection.

In general, consolidation settlement in limited areas due to new fill placement over existing Young Bay Mud is anticipated to be approximately 1 foot or less with approximately 70 percent of the settlement occurring in the first year after placement. However, near the intersection of Harney Way and Ingerson Avenue, consolidation settlement could be as great as 3 feet with less than 40 percent of the settlement occurring in the first year after placement.

This amount of settlement would be unsuitable for performance of shallow utilities, rigid pavements, surface drainage and buildings on shallow foundations. Mitigation of the Young Bay Mud can be accomplished through removal, surcharging, use of lightweight fill or ground improvement. For portions of the site, where Young Bay Mud is less than 10 feet in thickness and existing fill is to be removed, it may be feasible to remove the Young Bay Mud. In other areas, surcharging appears to be a feasible solution. In the thickest areas of Young Bay Mud (the isolated areas with 20 feet or more of Young Bay Mud) wick drains may be necessary to reduce the required surcharge time to less than 1 year. A plan showing the limits where surcharge maybe considered for mitigation is provided in Figure 8. Once the construction phasing schedule is developed and grading plans finalized, we recommend developing a surcharge plan showing the amount of recommended fill for surcharge and areas and spacing for wick drains, if necessary.

As an alternative to surcharge, the removal of existing fill and placement of lightweight fill (on the order of 30 pounds per square foot) would result in extremely limited settlement. Where 10 feet of fill is planned over Young Bay Mud, the weight of the new fill could be compensated by removing approximately the upper 2½ feet of existing fill and constructing to finish grade using lightweight fill. In building areas, a similar approach could be performed if the weight of the building is added in the calculation of thickness of lightweight fill.

Even with proper surcharging, some amount of long term areal settlement from secondary compression of the Young Bay Mud should be anticipated. The magnitude of this residual settlement will be dependent on the amount of fill placed, thickness of Young Bay Mud, and time allowed for surcharging. In general, this secondary settlement will be approximately 10 percent of the primary settlement (between 1 and 4 inches). Foundations and structures may be designed by the Structural Engineer to accommodate some additional movement as a result of

this secondary compression settlement. It may be appropriate to increase surface grades to compensate for anticipated settlements. Similarly, it may be practical to increase design inverts for planned gravity utilities to accommodate potential settlements and maintain positive flow gradients.

Future improvements on adjacent blocks and streets could result in loading of the foundation soil below the roads. This loading could result in settlement and damage to the improvements. We recommend that consideration be given to future improvements when designing the current project. It may be feasible to extend mitigation into adjacent future project areas so that future mitigation does not adversely affect the planned infrastructure.

2.6 CORROSIVITY CONSIDERATIONS

An evaluation of possible corrosion impacts to study area improvements has not been conducted. We recommend that chemical tests be conducted on the subgrade soils of the final building pads prior to building and utility construction. The primary purpose of this testing will be to determine the concrete design parameters for foundation construction. The proximity to the Bay and corrosion considerations from the marine environment should be considered in the corrosion mitigation for the design of the project.

2.7 NATURALLY OCCURRING ASBESTOS

Some ultramafic rock, such as serpentinite and potentially greenstone, contains the fibrous mineral chrysotile, which is considered an asbestos mineral. Based on supplemental laboratory testing performed as part of this exploration (Appendix F), no naturally occurring asbestos (NOA) was detected in soil collected from our current borings at the site. However, during our previous 2009 exploration (Appendix F), trace amounts of naturally occurring asbestos (NOA) were detected in soil and rock collected as surface samples at Candlestick Point. Two of three samples collected near Jamestown Road encountered chrysolite. Based on our research, the fill at Candlestick Point was predominantly derived from local bedrock and has the potential to contain NOA in varying amounts. Asbestos is considered hazardous when it becomes airborne. Additional testing from the current exploration is pending and the results will be issued as an addendum to this report when ready.

It is our opinion that the project will be required to follow the rules and regulations outlined in the Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying and Surface Mining Operations established by the Bay Area Air Quality Management District (District) under California Code of Regulations, Title 17, Section 93015. The purpose of this regulation is to reduce public exposure to NOA from construction and mining activities that emit dust, which may contain NOA. The ATCM requires regulated operations engaged in road construction and maintenance activities, construction and grading operations, and quarrying and surface mining operations in areas where NOA is likely to be found, to employ the best available dust mitigation measures in order to reduce and control dust emissions.

As part of compliance with the ATCM, an Asbestos Dust Mitigation Plan (ADMP) should be prepared by a qualified representative for approval by the BAAQMD and for inclusion in the contract documents.

3.0 2010 AND 2013 CBC SEISMIC DESIGN PARAMETERS

We provide the 2013 CBC seismic parameters in Table 4.0-1 for your use and comparison in planning structural design. The 2013 CBC is scheduled to be adopted for implementation in January 2014. Due to changes in methodology, the 2013 CBC seismic design parameters are higher than the 2010 CBC values. We selected the Mapped MCE Geometric Mean Peak Ground Acceleration (PGA_M) of 0.61g for liquefaction analysis based on values presented in ASCE 7-10. We classified this site as Site Class C for the tables below, however, we have assumed a Site Class D in determining the PGA_M to represent the softer ground in the areas subject to liquefaction. Depending on how the geohazards on the site are mitigated, structures constructed in the southeast portion of the site near the planned intersection of Harney Way and Ingerson Avenue may need to be designed for a different site soil classification. This additional information should be developed during building design.

TABLE 3.0-1
2013 CBC Seismic Design Parameters

Parameter	2013 CBC
Site Soil Classification	C
0.2 second Spectral Response Acceleration, S_S	1.51
1.0 second Spectral Response Acceleration, S_1	0.68
Site Coefficient, F_A	1.0
Site Coefficient, F_V	1.3
Maximum considered earthquake spectral response accelerations for short periods, S_{MS}	1.51
Maximum considered earthquake spectral response accelerations for 1-second periods, S_{M1}	0.89
Design spectral response acceleration at short periods, S_{DS}	1.01
Design spectral response acceleration at 1-second periods, S_{D1}	0.59
Long period transition-period, T_L	12 seconds

Site: Latitude = 37.7136; Longitude = -122.3861

4.0 CONSTRUCTION MONITORING

Our experience and that of our profession clearly indicate that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to:

1. Review the final grading and foundation plans and specifications prior to construction to determine whether our recommendations have been implemented, and to provide additional or modified recommendations, if necessary. This also allows us to check if any changes have occurred in the nature, design or location of the proposed improvements and provides the opportunity to prepare a written response with updated recommendations.

2. Perform construction monitoring to check the validity of the assumptions we made to prepare this report. All earthwork operations should be performed under the observation of our representative to check that the site is properly prepared, the selected fill materials are satisfactory, and that placement and compaction of the fills has been performed in accordance with our recommendations and the project specifications. Sufficient notification to us prior to earthwork is essential.

If we are not retained to perform the services described above, then we are not responsible for any party's interpretation of our report (and subsequent addenda, letters, and verbal discussions).

5.0 EARTHWORK RECOMMENDATIONS

The relative compaction and optimum moisture content of soil referred to in this report are based on the most recent ASTM D1557 test method. Compacted soil is not acceptable if it is unstable. It should exhibit only minimal *flexing* or *pumping*, as determined by an ENGEO representative.

As used in this report, the term "moisture condition" refers to adjusting the moisture content of the soil by either drying if too wet or adding water if too dry. We define "structural areas" as any area sensitive to settlement of compacted soil. These areas include, but are not limited to building pads, sidewalks, and pavement areas.

It is important that all construction activities be performed under the observation of the Geotechnical Engineer's field representative, in accordance with the recommendations contained herein.

5.1 GENERAL SITE CLEARING

The contractor should clear areas to be developed of all surface and subsurface deleterious materials including existing building foundations, slabs, buried utility and irrigation lines, pavements, debris, and designated trees, shrubs, and associated roots. The contractor should clean and backfill excavations extending below the planned finished site grades with suitable material compacted to the recommendations presented in this section. All backfill should be observed and tested by a representative of the Geotechnical Engineer. Foundations for the stadium will need to be completely removed and properly backfill. If deep foundations are present, the upper 10 feet of the foundation should be removed and the location surveyed for consideration in planning new building foundations.

Following clearing, strip the site to remove surface organic materials. Strip organics from the ground surface to a depth of at least 2 to 3 inches below the surface. Remove strippings from the site or, if considered suitable by the landscape architect and owner, use them in landscape fill.

If undocumented fill is encountered during site clearing, all existing fill should be removed to competent native soil, as determined by a representative of the Geotechnical Engineer.

5.2 OVER-OPTIMUM SOIL MOISTURE CONDITIONS

The contractor should anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, or during or following periods of rain. As indicated above, groundwater was typically encountered at an Elevation between -6 and -11 feet; overly wet conditions should be anticipated for excavations that extend below these elevations. Wet soil can make proper compaction difficult or impossible. Wet soil conditions can be mitigated by:

1. Frequent spreading and mixing during warm dry weather;
2. Mixing with drier materials;
3. Mixing with a lime, lime-fly ash, or cement product; or
4. Stabilizing with aggregate, geotextile stabilization fabric, or both.

Options 3 and 4 should be evaluated and approved by an ENGEO representative prior to implementation.

5.3 ACCEPTABLE FILL

Onsite soil is suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 4 inches in maximum dimension.
Imported fill materials should be approved by the Geotechnical Engineer, meet the above requirements and have a plasticity index less than 12. Allow ENGEO to sample and test proposed imported fill materials at least 72 hours prior to delivery to the site.

5.4 FILL COMPACTION

5.4.1 Grading in Structural Areas

The contractor should perform subgrade compaction prior to fill placement, following cutting operations, and in areas left at grade as follows.

1. Scarify to a depth of at least 8 inches;

2. Moisture condition soil to at least 2 percentage points over the optimum moisture content; **and**

3. Compact the soil to at least 90 percent relative compaction. Compact the upper 6-inches of finish pavement subgrade to at least 95 percent relative compaction prior to aggregate base placement.

After the subgrade has been compacted, the contractor should place and compact acceptable fill (defined in Section 6.3) as follows:

1. Spread fill in loose lifts that do not exceed 8 inches;

2. Moisture condition lifts to at least 2 percentage points over the optimum moisture content; **and**

3. Compact fill to at least 90 percent relative compaction; compact the upper 6 inches of fill in pavement areas to at least 95 percent relative compaction prior to aggregate base placement.

The Contractor should compact the pavement Caltrans Class 2 Aggregate Base section to at least 95 percent relative compaction (ASTM D1557). The aggregate base should be moisture conditioned to or slightly above the optimum moisture content prior to compaction.

5.4.2 Underground Utility Backfill

The contractor is responsible for conducting all trenching and shoring in accordance with CALOSHA requirements. Project consultants involved in utility design should specify pipe bedding materials.

In structural areas, the contractor should place and compact trench backfill as follows:

1. Trench backfill should have a maximum particle size of 4 inches;

2. Moisture condition trench backfill to at least 2 percentage points above the optimum moisture content. Moisture condition backfill outside the trench;

3. Place fill in loose lifts not exceeding 12 inches; and

4. Compact fill to at least 90 percent relative compaction.

Jetting of backfill is not an acceptable means of compaction.

5.4.3 Landscape Fill

In landscaping areas, the contractor should process, place and compact fill in accordance with Sections 6.4.1 and 6.4.2, except compact to at least 85 percent relative compaction.

6.0 FOUNDATION RECOMMENDATIONS

Depending on building types and foundation loads, it is likely that shallow foundations can be used to support retail buildings within the limits of the historic shoreline. The use of deep foundations outside of the historic shoreline will be required unless mitigation for settlement of Young Bay Mud and liquefiable soil is incorporated into the project prior to construction of the infrastructure. Site-specific foundation recommendations will be prepared once building layouts, types and loading have been determined and provided to us for review.

7.0 EXTERIOR FLATWORK

Exterior flatwork includes items such as concrete sidewalks, steps, and outdoor courtyards exposed to foot traffic only. Provide a minimum section of 5 inches of concrete over 4 inches of aggregate base. The contractor should:

1. Compact the aggregate base to at least 90 percent relative compaction (ASTM D1557).

2. Thicken flatwork edges to at least 8 inches to help control moisture variations in the subgrade and place wire mesh or rebar within the middle third of the slab to help control the width and offset of cracks.

3. Construct control and construction joints in accordance with current Portland Cement Association Guidelines.

8.0 PAVEMENT DESIGN

8.1 PAVEMENTS

The City of San Francisco standard pavement design, consists of a 2-inch-thick wearing course of HMA (hot mix asphalt concrete) constructed over a minimum 6-inch-thick Portland cement concrete (PCC) “base” underlain by a compacted soil subgrade. Due to the soil types underlaying this site, and potential settlement from soft soil compression and liquefaction and thermal shrinking and expanding of the PCC base, we anticipate that the standard pavement section will evidence cracks in the pavement surface early in the pavement design life. We recommend increasing the thickness of the HMA wearing course to 4 inches or increasing the HMA thickness to 3 inches and placing a “fabric” such as Owens-Corning-Trumbull’s TruPave, or GlasGrid by Tensar in the middle of the HMA layer to retard surface cracking.

As an alternative to the City of San Francisco standard minimum pavement design provided above, we provide flexible pavement sections for various traffic indices using an R-value of 35 for the granular fill based on Section 630 of the Caltrans Highway Design Manual (including the asphalt factor of safety). As discussed in our April 5, 2013 letter titled “Hunters Point Shipyard Phase II and Candlestick Point,” we opine that a flexible pavement system may perform better

than the City of San Francisco's standard pavement design in areas underlain by existing fill and Young Bay Mud.

TABLE 8.1-1
Recommended Asphalt Concrete Pavement Sections

	Section	
Traffic Index	**Asphalt Concrete (inches)**	**Class 2 Aggregate Base (inches)**
5	3	5
6	3.5	7
7	4	9

Notes: AC is asphalt concrete
AB is Class 2 aggregate base material with a minimum R-value of 78

The Traffic Index should be determined by the Civil Engineer or appropriate public agency. These sections are for estimating purposes only. Actual sections to be used should be based on R-value tests performed on samples of actual subgrade materials recovered at the time of grading. Pavement construction and all materials should comply with the requirements of the Standard Specifications of the State of California Department of Transportation, Civil Engineer, and appropriate public agency.

8.2 SUBGRADE COMPACTION

Subgrade soil within the upper 36 inches of finished roadway surface, extending from back of curb to back of curb within roadway areas should be compacted to at least 95 percent relative compaction prior to placement of PCC. Moisture condition subgrade soils to or slightly above the optimum moisture content prior to compaction.

8.3 AGGREGATE BASE COMPACTION (FLEXIBLE PAVEMENT ALTERNATIVE)

If flexible pavement design is used, the contractor should compact the pavement Caltrans Class 2 Aggregate Base to at least 95 percent relative compaction (ASTM D1557). Moisture condition aggregate base to or slightly above the optimum moisture content prior to compaction. Aggregate Base should meet the requirements for ¾-inch maximum Caltrans Class 2 Aggregate Base per the latest Caltrans Standard Specifications.

If desired, pavement cutoff barriers should be considered where pavement areas lie downslope of any landscape areas that are to be irrigated, and should extend to a depth of at least 4 inches below the base of the PCC. Cutoff barriers may consist of deepened concrete curbs or deep-root moisture barriers.

9.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1 for the CP Center project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strived to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty is expressed or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data is representative of the actual subsurface conditions across the site. Considering possible underground variability of soil, rock, stockpiled material, and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, notify us immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include excavation sloping or shoring, soil volume change factors, flood potential, or a geohazard exploration. In addition, our geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, then notify the proper regulatory officials immediately.

This document must not be subject to unauthorized reuse that is, reusing without our written authorization. Such authorization is essential because it requires us to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

Actual field or other conditions will necessitate clarifications, adjustments, modifications or other changes to our documents. Therefore, we must be engaged to prepare the necessary clarifications, adjustments, modifications or other changes before construction activities commence or further activity proceeds. If our scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

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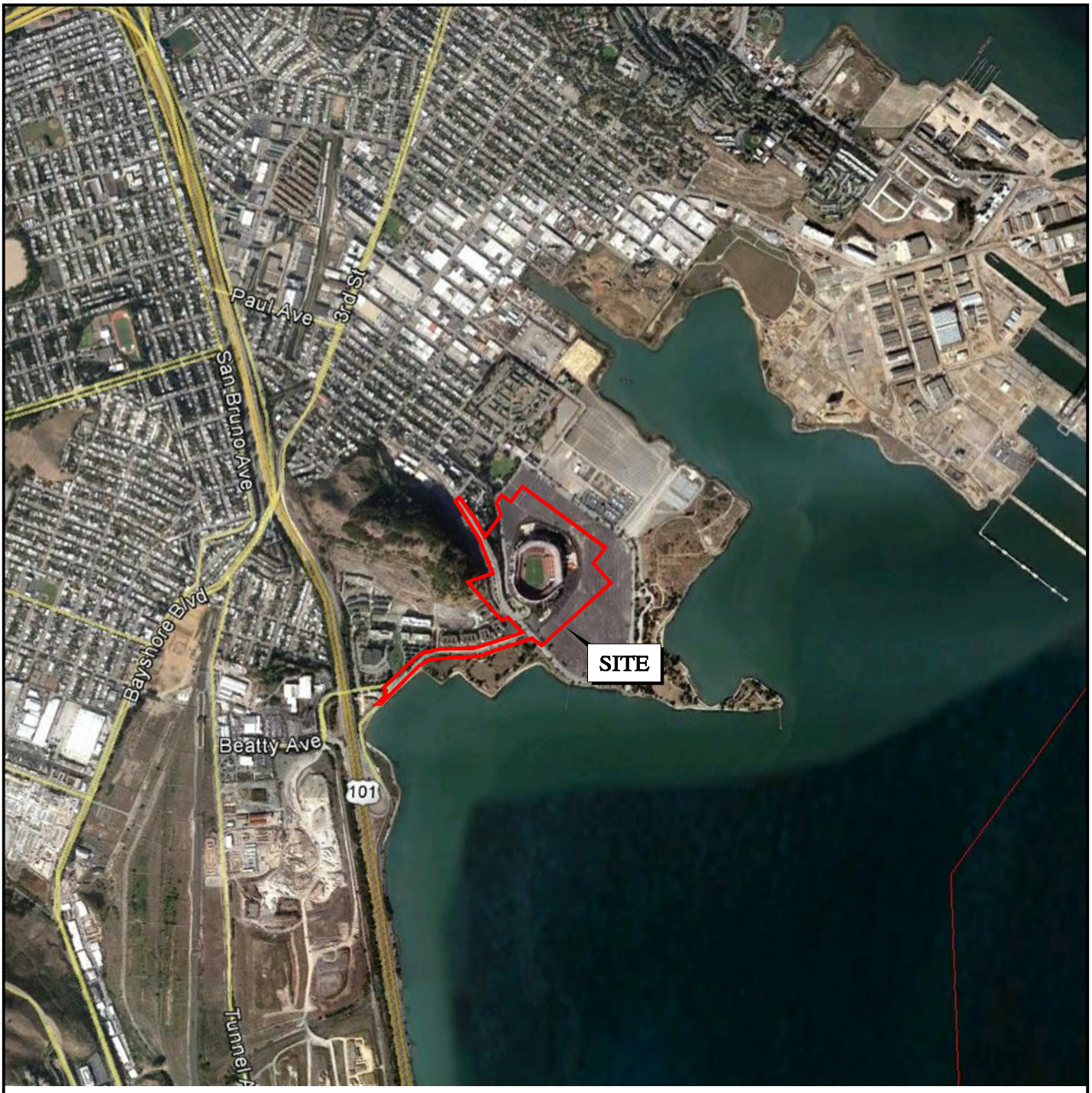
FIGURES



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0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: GOOGLE EARTH PRO

ENGEO Expect Excellence

VICINITY MAP

CANDLESTICK POINT CENTER

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002		FIGURE NO. 1
SCALE: AS SHOWN		
DRAWN BY: LL	CHECKED BY: LC	

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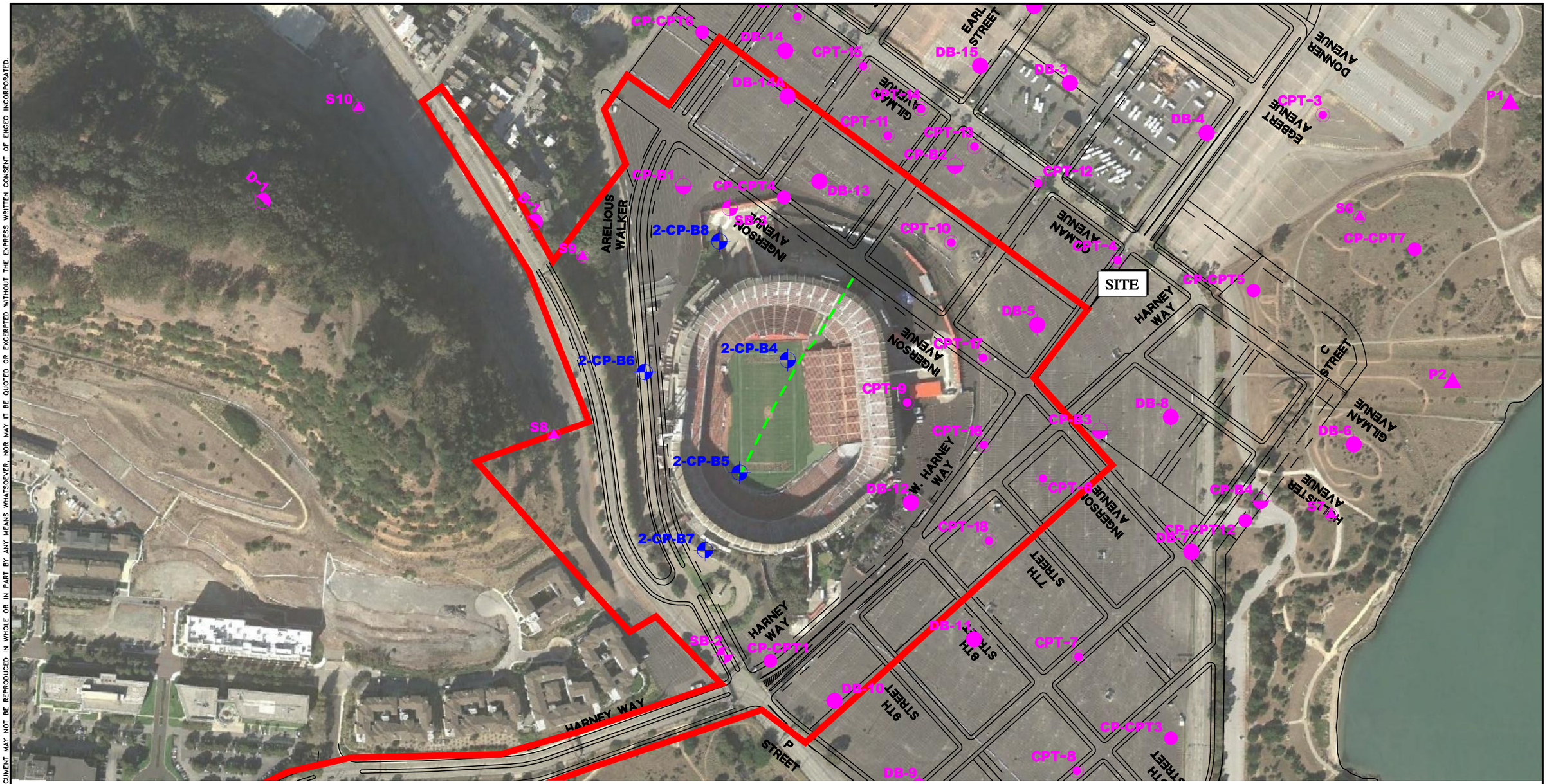

EXPLANATION

- APPROXIMATE LOCATION OF SEISMIC REFRACTION LINE (NORCAL)
- 2-CP-B8 — APPROXIMATE LOCATION OF EXPLORATORY BORING (ENGEO)
- CP-B7 — APPROXIMATE LOCATION OF PREVIOUS EXPLORATORY BORING (ENGEO)
- CP-CPT11 — APPROXIMATE LOCATION OF PREVIOUS CONE PENETRATION TEST (ENGEO)
- S10 — APPROXIMATE LOCATION OF PREVIOUS SURFACE SAMPLING (ENGEO)
- DB-16 — APPROXIMATE LOCATION OF PREVIOUS BORING (TREADWELL & ROLLO)
- CPT-18 — APPROXIMATE LOCATION OF PREVIOUS CONE PENETRATION TEST (TREADWELL & ROLLO)
- P2 — APPROXIMATE LOCATION OF PREVIOUS PERCOLATION TEST (ENGEO)

N

0 FEET 300
0 METERS 150

BASE MAP SOURCE: GOOGLE EARTH PRO

ENGEO Expect Excellence

SITE PLAN
CANDLESTICK POINT CENTER
SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002	FIGURE NO. 2A
SCALE: AS SHOWN	
DRAWN BY: LL	CHECKED BY: LC

ORIGINAL FIGURE PRINTED IN COLOR

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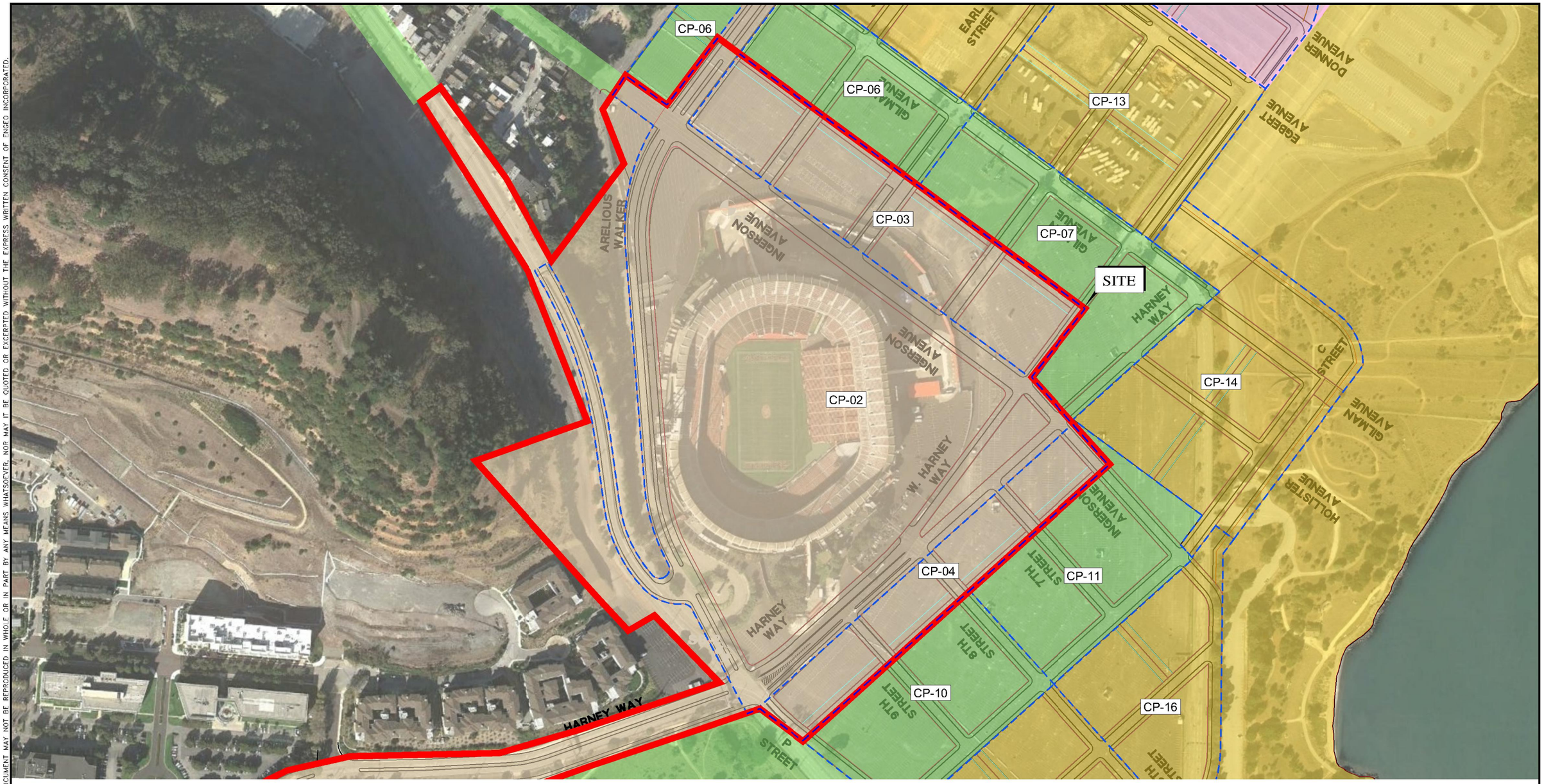

EXPLANATION

- SUB PHASE BOUNDARY LINE
- MAJOR PHASE 1 AREA
- MAJOR PHASE 2 AREA
- MAJOR PHASE 3 AREA
- MAJOR PHASE 4 AREA

N

0 FEET 300
0 METERS 150

BASE MAP SOURCE: GOOGLE EARTH PRO

ENGEO Expect Excellence

SITE PLAN WITH MAJOR AND SUB PHASE DESIGNATION
CANDLESTICK POINT CENTER
SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002
SCALE: AS SHOWN
DRAWN BY: LL CHECKED BY: LC

FIGURE NO. 2B

ORIGINAL FIGURE PRINTED IN COLOR

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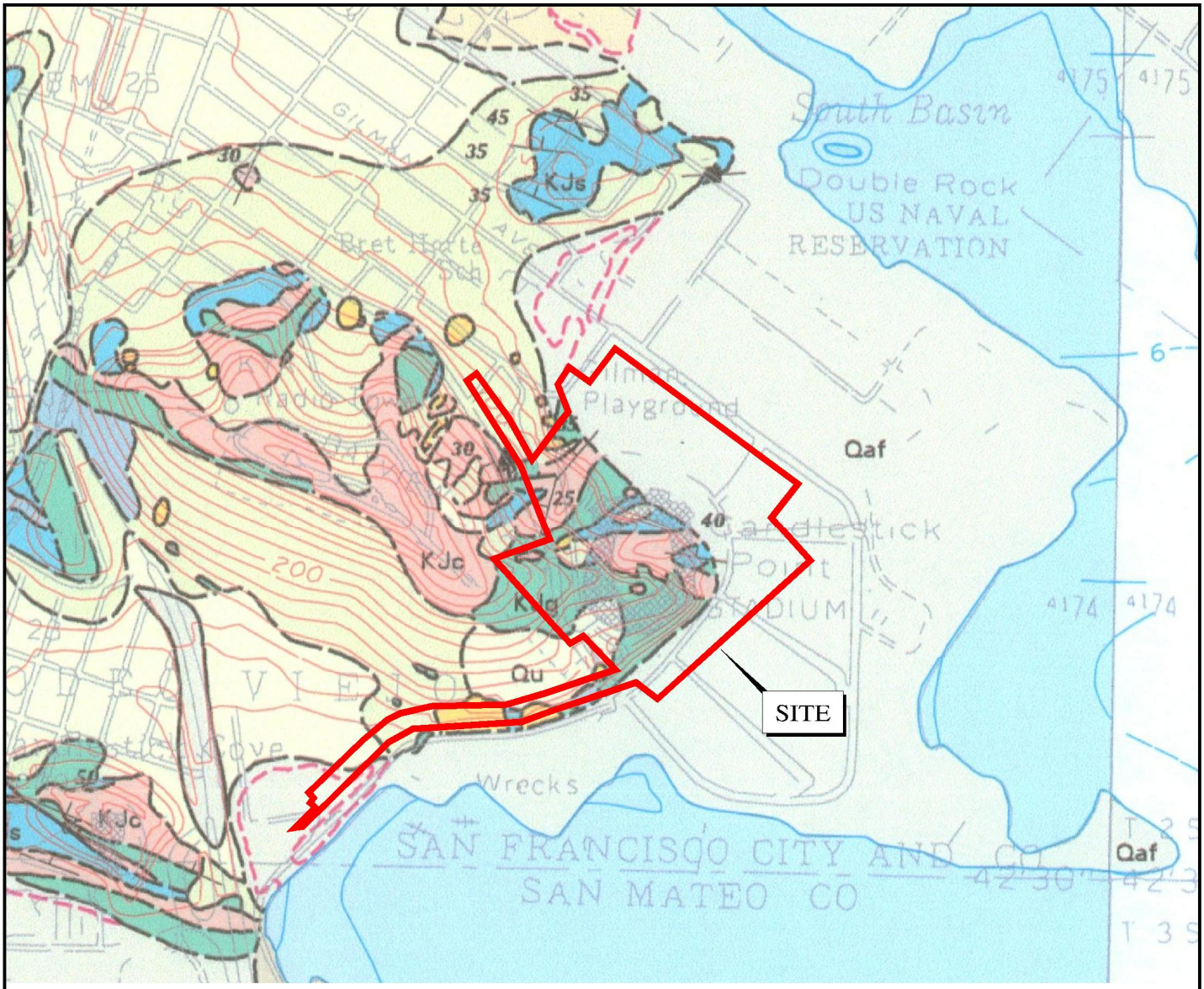

EXPLANATION

——— CONTACT, CERTAIN	Qaf ARTIFICIAL FILL
— — — CONTACT, APPROXIMATELY LOCATED	Qaf/tf ARTIFICIAL FILL OVER TIDAL FLAT
	Qsr SLOPE DEBRIS AND RAVINE FILL
	Qu SEDIMENTARY DEPOSITS, UNDIFFERENTIATED
	KJs SANDSTONE AND SHALE
	KJc CHERT
	KJg GREENSTONE
	sp SERPENTINE

N

0 FEET 1000
0 METERS 500

BASE MAP SOURCE: BONILLA, 1998

ENGEO Expect Excellence

REGIONAL GEOLOGIC MAP

CANDLESTICK POINT CENTER

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002		FIGURE NO. 3
SCALE: AS SHOWN		
DRAWN BY: LL	CHECKED BY: LC	

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ORIGINAL FIGURE PRINTED IN COLOR

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0 FEET 100
0 METERS 50

EXPLANATION

- SHORELINE FROM 1903 MAPPING
- -70 CONTOURS ON THE BASE OF BAY FILL DEPOSITS*
- -80 CONTOURS ON THE BASE OF THE YOUNGER BAY MUD*
- GEOLOGIC CONTACT, DOTTED WHERE CONCEALED
- SHEAR ZONE DOTTED WHERE CONCEALED
- STRIKE AND DIP OF BEDDING
- APPROXIMATE LOCATION OF SLOPE FAILURE
- CHERT BED
- Qaf FILL
- SPRING
- OBSCURED / NOT MAPPED

KJfg1 GREENSTONE, DARK GREENISH GRAY, MEDIUM STONG, VERY CLOSELY TO CLOSELY FRACTURED, DISCONTINUOUS QUARTZ VEINS AND NODUALS (TO 5ll) RQD APPROXIMATELY 40-60 (1).

KJfg2 GREENSTONE, GRAY, WEATHERS TO ORANGE, PINK, GREEN AND YELLOW, VERY WEAK TO WEAK, CLOSILY TO VERY CLOSELY FRACTURED, QUARTZ FILLED FRACTURES, INTERBEDDED WITH MEDIUM STRONG CHERT BEDS (TO 3' THICK), RILLS FORM ON WEATHERED CUT SURFACES (3).

KJfg3 GREENSTONE, YELLOWISH BROWN TO GRAYISH GREEN, HIGHLY ALTERED, NO APPARENT FOLIATIONS OR STURCTURE, INTACT WEAK BLOCKS OF GREENSTONE WITHIN, WEATHERS TO SOIL AT SURFACE, VEGETATED WITH POMPOUS GRASS (4).

KJfg4 GREENSTONE, ORANGE, WEAK, HIGHLY WEATHERED, IRON OXIDE STAINING THROUGHOUT, VERY CLOSELY TO CLOSELY FRACTURED, SOME CHERT, QUARTZ AND CLORITE (3).

KJfg5 GREENSTONE, GRAY, WEATHERS TO ORANGE, PURPLE AND GREEN, MEDIUM STRONG, CLOSELY FRACTURED, QUARTZ FILLED FRACTURES (TO 1/2ll), LESS ALTERED THAN SURROUNDING GREENSTONE UNITS (2).

KJfc BANDED CHERT, PINK, STRONG, VERY THINLY BEDDED, CLOSELY TO MODERATELY FRACTURED, Mn STAINING ALONG BEDS RQD APPROXIMATELY 60-80 (1).

KJfs GRAYWACKY, GRAY, MEDIUM STRONG, CLOSELY FRACTURED, SOME QUARTZ FILLED VEINS (TO 1/4ll), COMMONLY INTERBEDDED WITH SHALE, WEATHERS TO ORANGE.

KJfl META SILTSTONE, LIGHT GRAY, EXTREMELY WEAK, HEGHLY WEATHERED, VERY THINLY BEDDED TO LAMINATED (4).

KJfsh SHALE, DARK GRAY, EXTREMELY WEAK, LAMINATED, FOLDED (3).

sp SERPENTINIZED OR SHEARED GREENSTONE

BASE MAP SOURCE: UNKNOWN

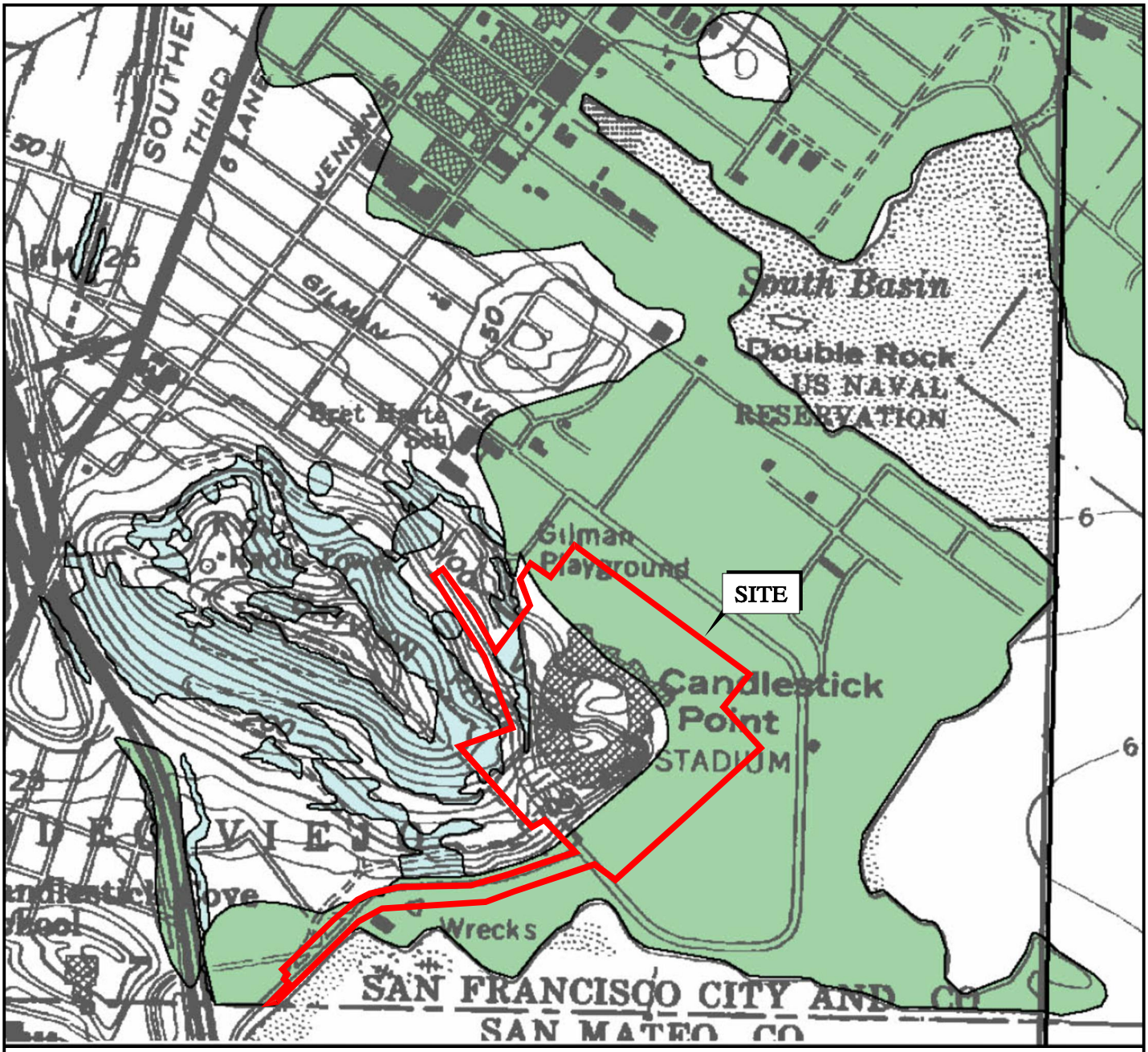
ENGEO Expect Excellence

HILLSIDE SITE GEOLOGIC MAP
CANDLESTICK POINT CENTER
SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002
SCALE: AS SHOWN
DRAWN BY: LL
CHECKED BY: LC

FIGURE NO 4

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

LIQUEFACTION

AREAS WHERE HISTORIC OCCURRENCE OF LIQUEFACTION, OR LOCAL GEOLOGICAL, GEOTECHNICAL AND GROUNDWATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(c) WOULD BE REQUIRED

EARTHQUAKE-INDUCED LANDSLIDES

AREAS WHERE PREVIOUS OCCURRENCE OF LANDSLIDE MOVEMENT, OR LOCAL TOPOGRAPHIC, GEOLOGICAL, GEOTECHNICAL AND SUBSURFACE WATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(c) WOULD BE REQUIRED

BASE MAP SOURCE: DEPARTMENT OF CONSERVATION, 2001

ENGEO Expect Excellence

SEISMIC HAZARD ZONE MAP

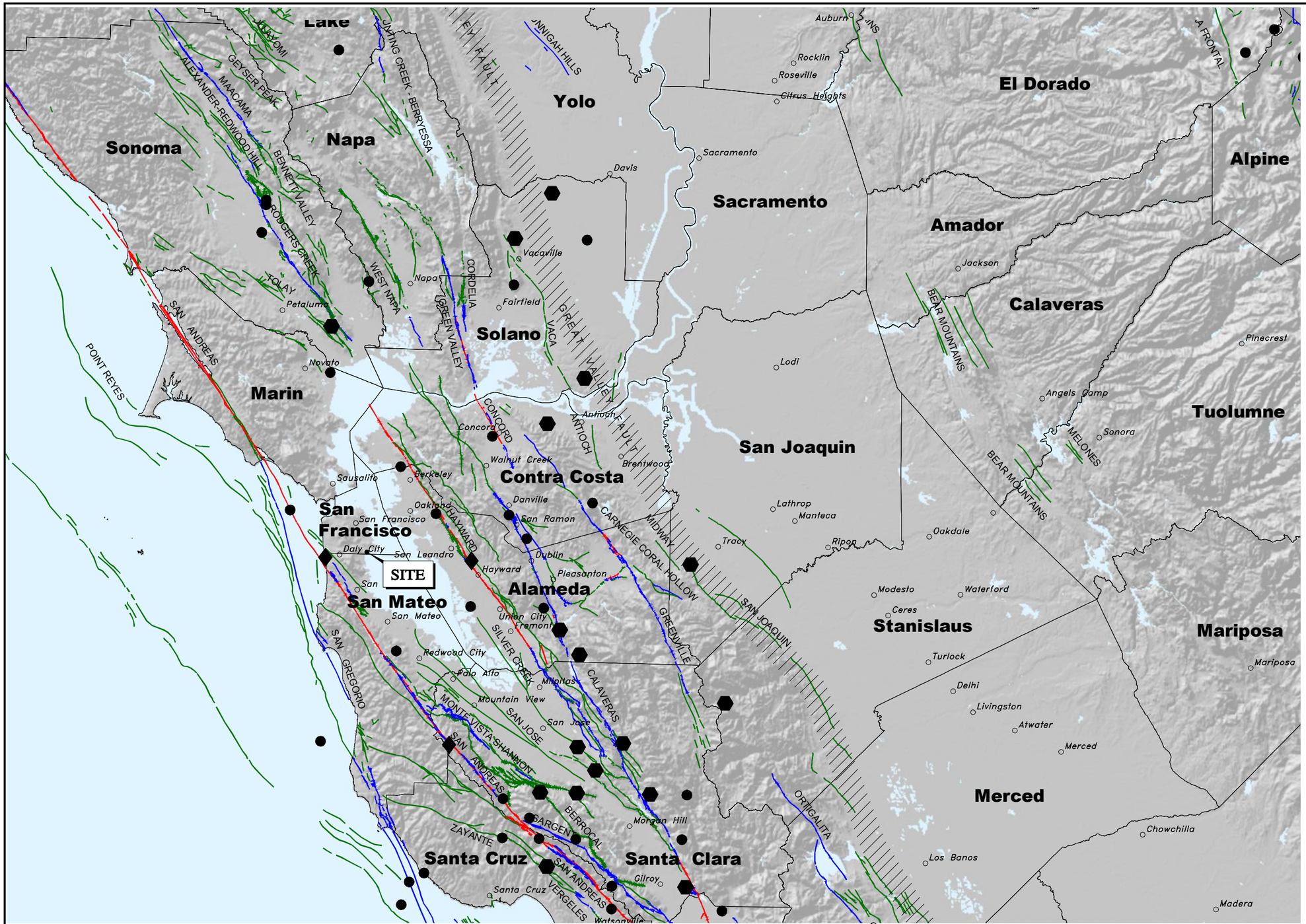
CANDLESTICK POINT CENTER

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002	FIGURE NO. 5
SCALE: AS SHOWN	
DRAWN BY: LL	CHECKED BY: LC

G:\Drafting\DRAFTING2_Dwg\8472\001\GEX\Retail Center\8472001002-GEX-5-SeisHazZone-0613.dwg Plot Date: 9-17-13 llee

ORIGINAL FIGURE PRINTED IN COLOR



BASE MAP SOURCE:
HILLSHADE IMAGE BASED ON 1-ARC SECOND S.R.T.M. DATABASE
U.S.G.S. QUATERNARY FAULT DATABASE, NOVEMBER, 2010
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800-2000)

ENGEO Expect Excellence

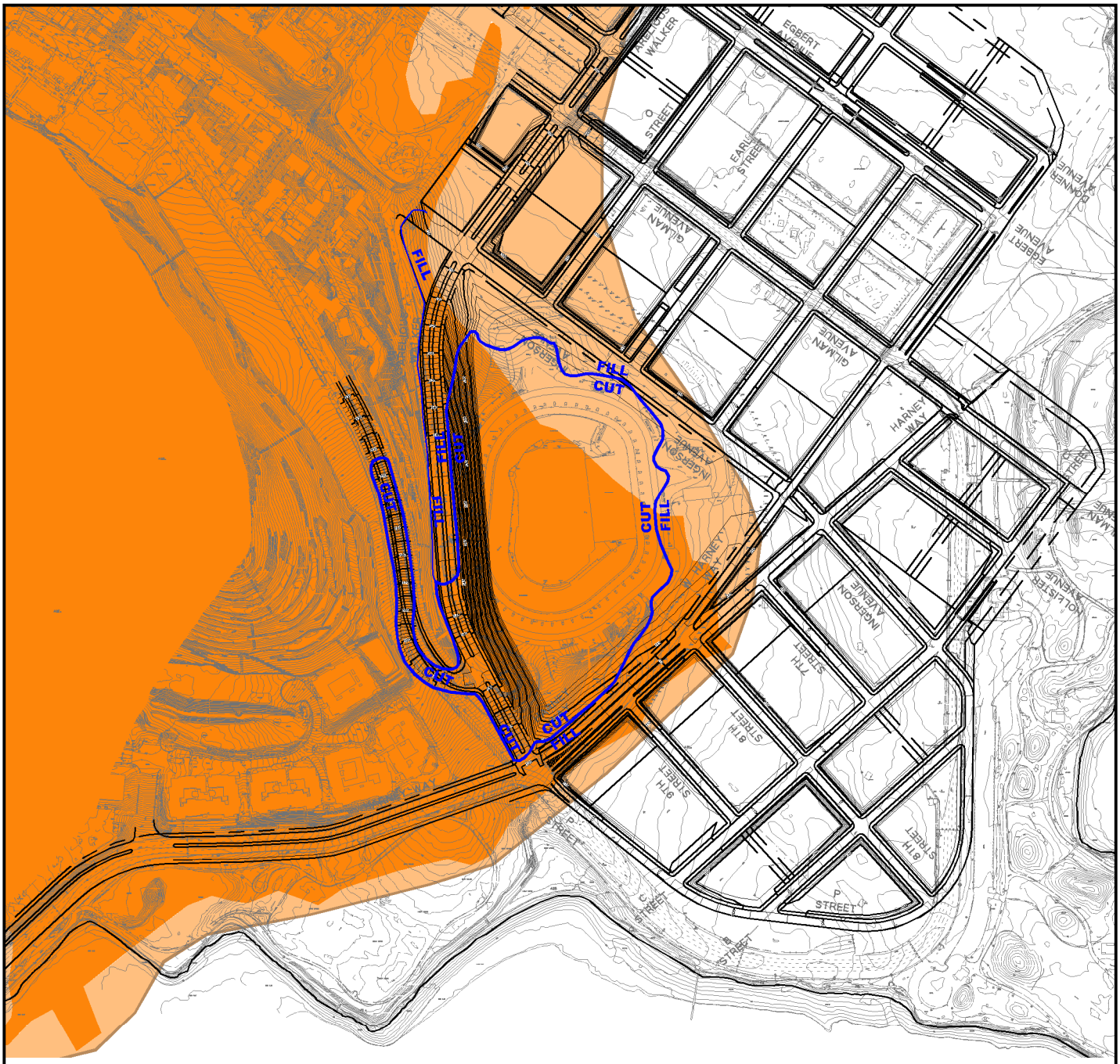
REGIONAL FAULTING AND SEISMICITY

CANDLESTICK POINT CENTER
SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002		FIGURE NO 6
SCALE: AS SHOWN		
DRAWN BY: LL	CHECKED BY: LC	

ORIGINAL FIGURE PRINTED IN COLOR

G:\Drafting\DRAFTING2_Dwg\8472\001\GEX\Retail Center\8472001002-GEX-6-RegFaultSies-0613.dwg Plot Date:9-17-13 llee



N

EXPLANATION

ONSHORE AREAS, 1903

INTERTIDAL ZONE, 1903

CUT / FILL — CUT AND FILL LINE

0 FEET 500

0 METERS 250

BASE MAP SOURCE: RADMAN AERIAL SURVEYS, 2013

ENGEO Expect Excellence

PROPOSED GRADING WITH HISTORIC SHORELINE

CANDLESTICK POINT CENTER

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002

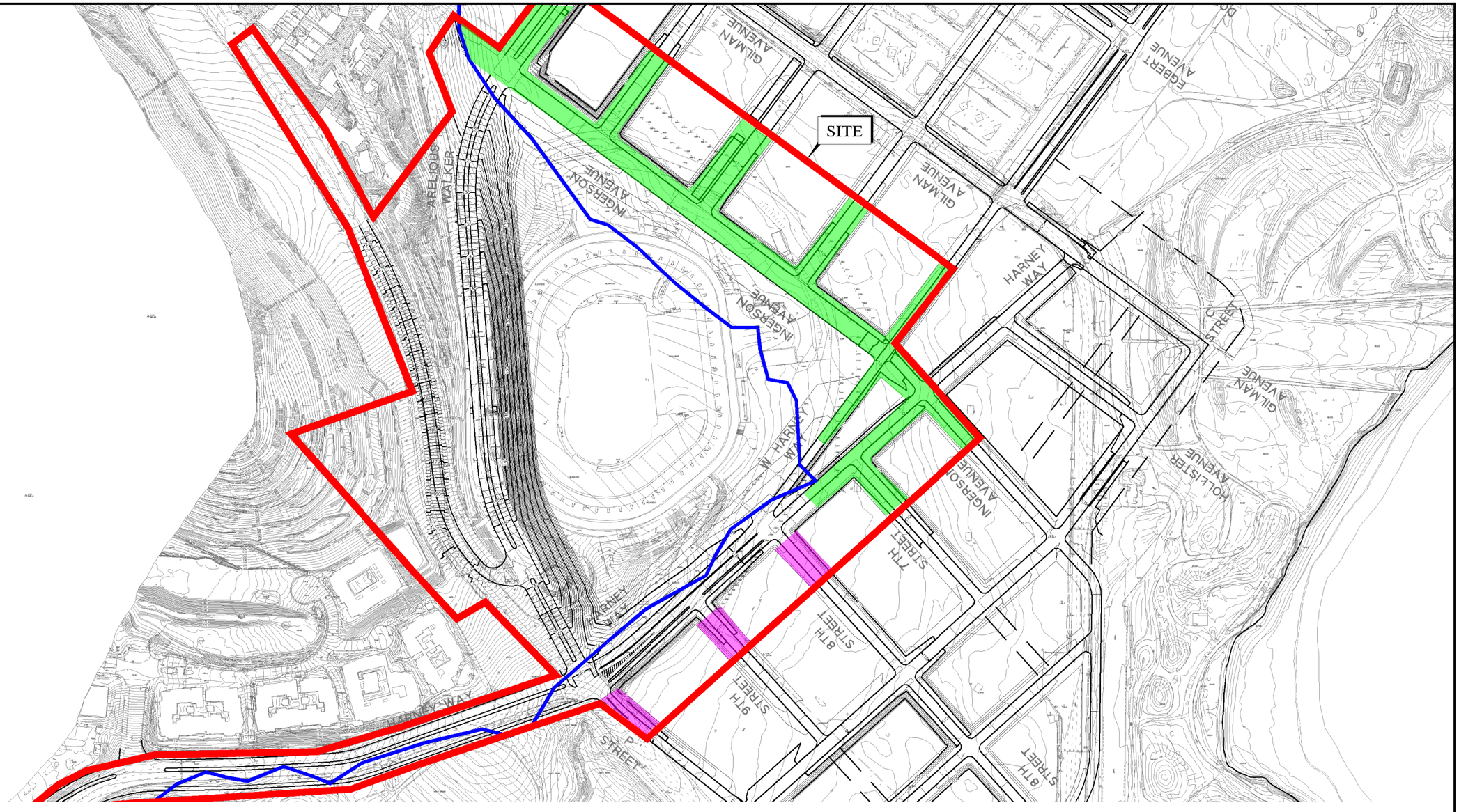
SCALE: NO SCALE

DRAWN BY: LL CHECKED BY: LC

FIGURE NO. 7

G:\Drafting\DRAFTING2_Dwg\8472\001\GEX\Retail Center\8472001002-GEX-7-PropGrdHistoric-0613.dwg Plot Date: 9-18-13 llee

ORIGINAL FIGURE PRINTED IN COLOR



N

0 FEET 300

0 METERS 150

EXPLANATION

- 1903 SHORELINE
- APPROXIMATE LOCATION OF LIKELY SURCHARGE
- APPROXIMATE LOCATION OF POTENTIAL BAY MUD REMOVAL

BASE MAP SOURCE: BKF, 2013

ENGEO Expect Excellence

LIMITS OF LIKELY SURCHARGE & REMOVAL AREAS
CANDLESTICK POINT CENTER
SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.001.002
SCALE: AS SHOWN
DRAWN BY: LL CHECKED BY: LC

FIGURE NO. 8

G:\Drafting\DRAFTING2_Dwg\8472\001\GEX\Retail Center\8472001002-GEX-8-LimitsSurcharge-0613.dwg Plot Date: 9-18-13 llee

ORIGINAL FIGURE PRINTED IN COLOR

APPENDIX A

Boring Logs (This Study)

APPENDIX A

LOG OF BORING 2-CP-B3

ENGEO INCORPORATED

Geotechnical Exploration
Candlestick Park
San Francisco, CA
8472.001.002

DATE DRILLED: 3/12/2013
HOLE DEPTH: Approx. 54 ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (): Approx. 18 ft.

LOGGED / REVIEWED BY: A. Salehian / LC
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			GRAVELLY ELASTIC SILT (ML), dark brown, moist, with subangular fine to coarse gravel, (Fill)												
			SILT (ML), yellowish red, very stiff, moist, 5 to 10% subangular fine to coarse gravel, (Fill)			18	27	15	12		10.2	122.2		3.0*	PP
5	1		POORLY GRADED GRAVEL WITH CLAY (GP), brown, medium dense, moist, (Fill)			17				15					
	2		WELL GRADED GRAVEL WITH CLAY (GW), brown, loose, moist, with fine to coarse-grained sand, (Fill)			11									
10	3		POORLY GRADED SAND (SP), brown, very loose, wet, 5 to 10% subanguar fine gravel, (Fill)			3				9	16.8				
	4		Wood, tire, debris, <5% seashells, (Fill)												
15	5														
20	6		5 to 10% clay			2				37					
			FAT CLAY (CH), dark gray, medium stiff, wet, (Young Bay Mud)										615*		TV
	7					100 psi	102	36	66				560		LVS
25													1025*		TV
	8					100 psi								0.75*	PP
						200 psi									
30	9		POORLY GRADED SAND (SP), dark gray, wet, <5% clay, (Alluvium)											3.75*	PP

LOG - SHEAR AND UNCONF STRENGTH 8472001002 CP BORING LOGS 03-22-13.GPJ ENGEO INC.GDT 6/17/13

LOG OF BORING 2-CP-B3

ENGEO INCORPORATED

Geotechnical Exploration
Candlestick Park
San Francisco, CA
8472.001.002

DATE DRILLED: 3/12/2013
HOLE DEPTH: Approx. 54 ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (): Approx. 18 ft.

LOGGED / REVIEWED BY: A. Salehian / LC
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	10		BECOMES greenish gray, dense			33									
35															
	11		BECOMES medium dense			17									
40															
	12														
	13		FAT CLAY (CH), light gray, stiff, wet, (Old Bay Mud)			16							1830	1.75* 2.75*	PP UU PP
45															
	14		POORLY GRADED SAND (SP), greenish gray, dense, wet, (Alluvium)												
			CLAY (CL), greenish gray, very stiff, wet			50/5"									
50	15														
	16		Contains fine-grained sand			11									
			Bottom of boring at approximately 54 feet Groundwater level was not encountered due to drilling method												

LOG - SHEAR AND UNCONF STRENGTH 8472001002 CP BORING LOGS 03-22-13.GPJ ENGEO INC.GDT 6/17/13

LOG OF BORING 2-CP-B4

ENGEO INCORPORATED

Geotechnical Exploration
Candlestick Park
San Francisco, CA
8472.001.002

DATE DRILLED: 3/8/2013
HOLE DEPTH: Approx. 16 ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (): Approx. 25 ft.

LOGGED / REVIEWED BY: A. Salehian / LC
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			POORLY GRADED SAND (SP), grayish brown, medium dense, moist, <5% rootlets, (Fill)												
	1		5 to 10% debris, with subangular coarse gravel			14									
5			GREYWACKE, closely fractured, completely weathered, (Franciscan Bedrock)			50/4"									
	2		Slightly weathered			96/10"									
10	3					50/3"									
	4														
15						50/6"									
			Bottom of boring at approximately 16 feet Groundwater level was not encountered												

LOG - SHEAR AND UNCONF STRENGTH 8472001002 CP BORING LOGS 03-22-13.GPJ ENGEO INC.GDT 6/17/13

LOG OF BORING 2-CP-B5

ENGEO INCORPORATED

Geotechnical Exploration
Candlestick Park
San Francisco, CA
8472.001.002

DATE DRILLED: 3/8/2013
HOLE DEPTH: Approx. 10¼ ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (): Approx. 27 ft.

LOGGED / REVIEWED BY: A. Salehian / LC
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			POORLY GRADED SAND (SP), grayish brown, moist, <5% rootlets, (Fill)												
	1		SERPENTINITE, black with green, moderately weathered, (Franciscan Bedrock)			50/3"									
5						50/3"									
	2					50/3"									
			SHALE, moderately weathered, (Franciscan Bedrock)												
10	3					50/3"									
			Bottom of boring at approximately 10.25 feet Groundwater level was not encountered												

LOG OF BORING 2-CP-B7

Geotechnical Exploration
Candlestick Park
San Francisco, CA
8472.001.002

DATE DRILLED: 3/7/2013
HOLE DEPTH: Approx. 10¼ ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (): Approx. 58 ft.

LOGGED / REVIEWED BY: A. Salehian / LC
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			3" thick asphalt												
			GRAVELLY LEAN CLAY (CL), orangeish brown, with subangular fine gravel (Fill)												
	1														
5			BASALT, dark yellowish brown with dark gray, crushed, highly weathered (Franciscan Bedrock)			50/6"									
	2														
10	3		Moderately weathered			50/3"									
			Bottom of boring at approximately 10.25 feet												
			Groundwater level was not encountered												

LOG OF BORING 2-CP-B8

ENGEO INCORPORATED

Geotechnical Exploration
Candlestick Park
San Francisco, CA
8472.001.002

DATE DRILLED: 3/8/2013
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (): Approx. 26 ft.

LOGGED / REVIEWED BY: A. Salehian / LC
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			GRAVELLY LEAN CLAY (CL), brown, very stiff, moist, with angular fine gravel, (Fill)												
	1					30								3.75*	PP
5						27									
	2		5 to 10% angular fine to coarse gravel											2.5*	PP
			GREYWACKE, orangeish brown, highly weathered (Franciscan Bedrock)			95									
10	3					80									
			Bottom of boring at approximately 11.5 feet Groundwater level was not encountered												

LOG - SHEAR AND UNCONF STRENGTH 8472001002 CP BORING LOGS 03-22-13.GPJ ENGEO INC.GDT 6/17/13

APPENDIX B

Seismic Refraction Report (NorCal Geophysical)

APPENDIX B

NORCAL GEOPHYSICAL CONSULTANTS, INC.

June 26, 2013

ENGEO
332 Pine Street, Suite 300
San Francisco, California 94104

Subject: Seismic Refraction Survey
Candlestick Point
San Francisco, California
NORCAL Project No. 13-241.51

Attention: Mr. Leroy Chan

This report presents the findings of a seismic refraction survey performed by NORCAL Geophysical Consultants, Inc. for ENGEO at Candlestick Point in San Francisco, California. The geophysical survey was conducted on May 28, 2013 by California Professional Geophysicist William E. Black (PGp No. 843) and Senior Geophysical Technician Travis W. Black. Site logistical support and property owner liaison was provided by Messrs. Eugenio Diaz and Leroy Chan of Engeo.

The seismic refraction survey was conducted at two sites within the Candlestick Point area of San Francisco, California. One is the stadium at Candlestick Park and the other is a tenement housing area referred to as the "Alice Griffith Parcel". The general locations of both sites are shown on the index maps included on Plates 1 and 3. The purpose of this seismic refraction survey is to measure the depth, configuration, and seismic compressional (P-) wave velocity of the bedrock underlying both sites.

1.0 METHODOLOGY

The seismic refraction method is used to determine the seismic velocity structure of the subsurface. Compressional (P) wave energy generated by an impulsive source at the surface propagates into the earth. When the P-waves encounter an increase in seismic velocity, they are refracted along the interface and back to the surface where they are detected by a collinear array of geophones. The detected signals are recorded on a multi-channel seismograph and are analyzed to determine the shot point-to-geophone travel times. These data can be used along with the corresponding shot point-to-geophone distances to determine the depth, thickness, and velocity of subsurface seismic layers.

2.0 DATA ACQUISITION

We collected seismic refraction data using 24-geophones and 7-shot points distributed in collinear arrays (spreads). Seismic energy was produced at each shot point using multiple impacts with either a 16# sledge hammer, or an accelerated weight drop, against a metal plate placed on the ground surface. The device used depended on site access. The resulting

compressional (P-) wave energy was detected by ***OYO Geospace*** geophones with a natural frequency of 8-Hz and recorded using a Geometrics ***Geode*** distributed array seismic system (photo at left). This instrument has 24-channels with 24 bit A/D converters. However, it can be networked with additional units to expand the system up to 120-channels. The Geode was networked to a field computer which was used to display the recorded wave forms and to archive the seismic data.

3.0 DATA PROCESSING

The seismic refraction data were processed using the computer program ***SeisImager*** by Geometrics, Inc. This is an interactive program that is used to determine the shot point to geophone travel times, and to compute a 2D model based on those times. Once we had determined the travel times for a given line, we used the programs time-term algorithm to compute a preliminary 2D seismic model. We then used that model as input for the programs tomographic routine. Using this procedure, the program divided the starting model into a network of cells and assigned velocities to those cells based on the starting model. The program then traced refracted seismic travel paths through those cells and computed the associated travel times. It then compared the computed travel times with the measured times and adjusted the velocities of the appropriate cells to improve the fit. We programmed the software to continue this procedure for 30-iterations. At the end of the 30-iterations the travel times associated with the computed model matched the observed travel times to an accuracy of 1.5 milliseconds (msec) or better. Once a satisfactory model was computed, we used the computer program ***Surfer 11.0*** by Golden Software, Ltd of Golden, Colorado to contour the modeled data to produce a color contoured cross-section illustrating the distribution of seismic velocity vs. depth and distance.

The seismic refraction surveys conducted at Candlestick Park and the Alice Griffith Parcel are described in the following sections. Each section includes a description of the specific data acquisition procedures used at each site, a presentation of the results and a discussion regarding our interpretation of the results.

4.0 CANDLESTICK PARK SEISMIC REFRACTION SURVEY

4.1 SITE DESCRIPTION

Candlestick Park consists of a football stadium, the surrounding paved parking lots and a nearby camp ground. An aerial photograph of the stadium is shown on Plate 1. The general location of the stadium is shown in the vicinity map included on the plate. The seismic refraction survey was conducted inside the stadium and extended out through one of the tunnels into the parking lot. The floor of the stadium was flat and open and covered by closely cropped grass. The floor of the tunnel was concrete paved and sloped slightly towards the northeast. The parking lot outside the stadium was basically flat, open and asphalt paved.

Two test borings were installed inside the stadium by others. The locations of these borings, labeled 2-CP-B4 and 2-CP-B5, are shown on Plate 1. The geologic logs from the borings, as provided by Engeo, indicate that the upper 10- to 16-ft of the subsurface consists of 2- to 4-ft of poorly graded sand overlying Franciscan Formation bedrock. In B-4 the rock consisted of serpentine from depths of 2- to 9-ft overlying shale to the bottom of the boring at 10-ft. In B-5 the rock consisted of greywacke from a depth of 4-ft to the bottom of the boring at 16-ft.

4.2 DATA ACQUISITION

We collected seismic refraction data along a 710-ft long transect (line) that trended diagonally (southwest to northeast) across the football field and through a tunnel into the parking lot on the northeast side of the stadium. The location of the line, labeled Line 1, is represented by the red line shown on Plate 1. Line 1 comprised three end-to-end seismic spreads. Each spread consisted of 24-geophones and 7-shot points distributed in a collinear array. The geophones were distributed at 10-ft intervals and the shot points were distributed at 40- to 45-ft intervals beginning 10-ft from the first geophone in the array and ending 10-ft past the last geophone. The spreads were distributed so that the last geophone in the first spread became the first geophone in the second spread. Similarly, the last geophone in the second spread served as the first geophone in the last spread. A portion of the geophone array is shown in Figure 1.

Seismic energy was produced at each shot point using a Digipulse AWD-100 mounted on the back of an all-terrain vehicle (ATV), as shown in Figure 2. This device consists of a cylindrically shaped 100# weight that is dropped from a height of approximately 24-inches onto a 12" x 12" aluminum plate on the ground surface. Large elastic bands attached to the weight cause it to accelerate as it drops. The weight is lifted into place for each drop by a battery powered hydraulic ram. An accelerometer attached to the strike plate transmits a triggering pulse to the seismograph each time the weight strikes the plate.

Figure 1: A portion of Line 1 looking southwest. Yellow objects on ground surface are geophones.

Figure 2: AWD-100 mounted on ATV

4.3 RESULTS

The results of the seismic refraction survey are illustrated by the seismic velocity cross-section (profile) for Line 1 shown on Plate 2. The color shaded contours on this profile indicate the distribution of P-wave velocities with depth and distance beneath the seismic line. The relationship between contour color and velocity is indicated by the velocity scale shown at the bottom of the profile. The P-wave velocity contours are relatively uniform and flat-lying except over the last 250-ft of the line where they dip to the northeast. The contours also indicate that the P-wave velocity increases rapidly with depth, from as low as 1,000-ft/sec at the surface to in excess of 14,000-ft/sec at depth. Correlation of the P-wave contours with the geologic logs from borings 2-CP-B4 and 2-CP-B5 suggest that velocities less than 5,000-ft/sec (brown to yellow contours) probably represent poorly graded sand and that the remainder of the profile (green, blue and purple contours) represents bedrock. That being the case, the variations in velocity within the bedrock sequence are probably related to variations in the degree to which the rock is weathered. This relationship is that the higher the velocity of the rock, the less weathered it is. The wide range of velocities suggests a wide variation in weathering, from moderately weathered (green to blue contours) at the top of the bedrock sequence to little weathered (purple contours) at depths ranging from about 5- to 40-ft.

5.0 ALICE GRIFFITH PARCEL SEISMIC REFRACTION SURVEY

5.1 SITE DESCRIPTION

The Alice Griffith Parcel (AGP) is a tenement housing project located in the Candlestick Point area of San Francisco, California. An aerial photograph of the area is shown on Plate 3.The vicinity map included on the plate shows the general location of the AGP. The seismic refraction survey was conducted in a "V" shaped lot between tenement buildings enclosed by Nichols Street on the northeast, southeast and southwest and by Cameron Way on the northwest. Each arm of the V is approximately 250-ft long and 45- to 65-ft wide. The ground surface within the west arm slopes downward to the southwest and the surface in the east arm slopes downward to the southeast. The ground cover in the survey area ranged from sparse, short, dry grass to exposed soil or rock.

5.2 DATA ACQUISITION

Seismic refraction data were collected along two transects (lines) labeled Line 2 and Line 3, as shown on Plate 3. Each line was 200-ft long and consisted of 7-shot points and 24-geophones distributed in a collinear array. The geophones were distributed at 8-ft intervals and the shot points were distributed at 32- to 36-ft intervals starting 8-ft from the first geophone and ending 8-ft beyond the last geophone in the array. Seismic energy was produced at each shot point through multiple impacts with a 16#-sledge hammer against a metal plate placed on the ground surface.

5.3 RESULTS

The results of the seismic refraction survey are illustrated by the seismic velocity cross-sections (profiles) for Lines 2 and 3 shown on Plate 4. The color shaded contours on these profiles indicate the distribution of P-wave velocities with depth and distance beneath the seismic lines. The relationship between contour color and velocity is indicated by the velocity scale shown at the bottom of the plate. The contours are relatively uniform and flat-lying and indicate a gradual increase in velocity with depth; from around 1,000-ft/sec at the surface to over 11,000-ft/sec at depths of 40- to 45-ft. Since rock is exposed at the surface in the survey area, specifically along Line 2, it is our interpretation that the seismic velocity profiles shown on Plate 2 primarily represent bedrock and that the variations in velocity are related to variations in the degree to which the rock is weathered. This relationship is that the higher the velocity of the rock, the less it is weathered. The wide range of velocities suggests a wide variation in weathering, from decomposed at the surface (brown to yellow contours) to little weathered at depth (purple contours).

6.0 EXCAVATION CHARACTERISTICS

We specifically differentiated the velocity ranges comprising the P-wave velocity models shown on Plates 2 and 4 to coincide with the excavation characteristics (rippability) of the subsurface materials. This is based on information published by the Caterpillar Tractor Company for different types of excavating equipment (rippers) operating in different types of materials. The geologic logs from borings 2-CP-B4 and 2-CP-B5 at Candlestick Park indicate that the bedrock consists of Franciscan greywacke, serpentine and shale. We assume that the bedrock at the Alice Griffith Parcel is essentially the same. However, which ripper will be used for excavation is unknown at this time. Therefore, we have assumed, for estimating purposes, that the ripping equipment will consist of a Caterpillar multi or single shank No. 9 Ripper (D9R/D9T). Given these parameters, P-wave velocities ranging from 1,000- to 7,500-ft/sec (yellow to green contours) are rippable, velocities ranging from 7,500- to 9,500-ft/sec (blue contours) are marginally rippable and velocities in excess of 9,500-ft/sec (purple contours) are non-rippable. These velocity ranges should only be used as a general guideline. Actual ripping performance will depend on the bedding, induration, fracturing and jointing of the rock, the condition of the equipment and the skill of the operator.

6.1 Candlestick Park

According to the P-wave velocity profile shown on Plate 2, rippable material (green to yellow contours) is only about 10-ft thick beneath the first 460-ft of the profile. However, continuing northeastward it thickens considerably, reaching a thickness of about 40-ft at the northeast end of the line. Marginally rippable rock (blue contours) ranges in thickness from about 5- to 15-ft over the first 450-ft of the line where it is about 10-ft deep. However, proceeding northeastward the marginally rippable rock thickens to as much as 20-ft as its depth increases to 40-ft. Finally, non-rippable rock (purple contours) is 10- to 20-ft deep beneath the first 440-ft of the line. However, northeast of that point it drops off steeply, reaching a depth of 55-ft by Station 550-ft and maintaining that depth to the northeast end of the line.

6.2 Alice Griffith Parcel

According to the P-wave velocity profiles shown on Plate 4, rippable material (yellow to green contours) is 15- to 20-ft thick beneath most of Line 2 except at the southeast end of the line where it decreases in thickness to about 3-ft. Marginally rippable rock (blue contours) is about 17- to 22-ft deep beneath most of the Line 2 but comes within 3-ft of the surface at the southeast end of the line. Non-rippable rock (purple contours) is at depths ranging from 25- to 30-ft beneath the entire length of the line. A similar situation exists beneath Line 3, except at greater depths. Here, the rippable rock (yellow to green contours) is 25- to 30-ft thick beneath most of the line except at the northeast end where it thins to about 5-ft. Marginally rippable rock (blue contours) is 5- to 15-ft thick and occurs at depths of 25- to 30-ft beneath most of the line except

for the northeast end where it rises to within 5-ft of the surface. Non-rippable rock (purple contours) is only defined beneath the central to northeast portion of the line where it ranges in depth from 35-to 45-ft.

7.0 LIMITATIONS

It should be noted that the seismic refraction technique is based on the assumption that seismic velocity increases with depth. Any layers representing a decrease in velocity with depth, otherwise known as a velocity inversion, will not be defined and will result in the over-estimation of the depth of deeper, higher velocity layers. In addition, relatively thin layers might not be individually resolved and might, instead, be lumped together with other layers. Hard and soft zones within a given seismic layer will tend to be averaged into the velocity of that layer. Finally, there is not necessarily a one-to-one relationship between lithologic layers and seismic layers. It is entirely possible that two different types of material could have the same velocity. Alternatively, a change in velocity can occur within a single lithologic unit.

8.0 STANDARD CARE AND WARRANTY

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the shallow subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the level of skill ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate the opportunity to provide our services to Engeo, Inc. on this project. If you have any questions, or require additional geophysical services, please do not hesitate to call.

Sincerely,

NORCAL Geophysical Consultants, Inc.

William E. Black
Professional Geophysicist PGp-843

WEB/tlt

Enclosures: Plates 1 – 4

VICINITY MAP

SCALE
0 40 80 160
(1 inch = 80 feet)

LEGEND	
	SEISMIC REFRACTION LINE
	BORING

NORCAL

SITE LOCATION MAP
SEISMIC REFRACTION SURVEY
CANDLESTICK PARK

LOCATION: SAN FRANCISCO, CALIFORNIA

CLIENT: ENGEO

JOB #: 13-241.51

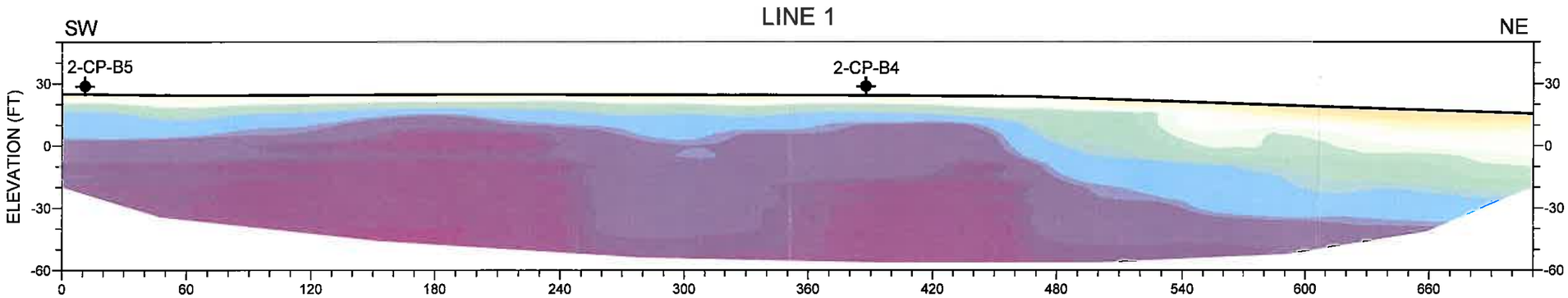
NORCAL GEOPHYSICAL CONSULTANTS INC.

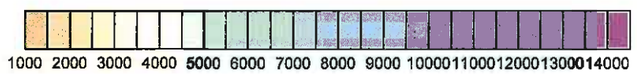
DATE: JUN. 2013

DRAWN BY: G.RANDALL

APPROVED BY: WEB

PLATE 1





LEGEND	
✦	BORING

SCALE

0 60 120

(1 inch = 60 feet)

NORCAL

LINE 1
SEISMIC REFRACTION SURVEY
CANDLESTICK PARK

LOCATION: SAN FRANCISCO, CALIFORNIA

CLIENT: ENGEO

JOB #: 13-241.51

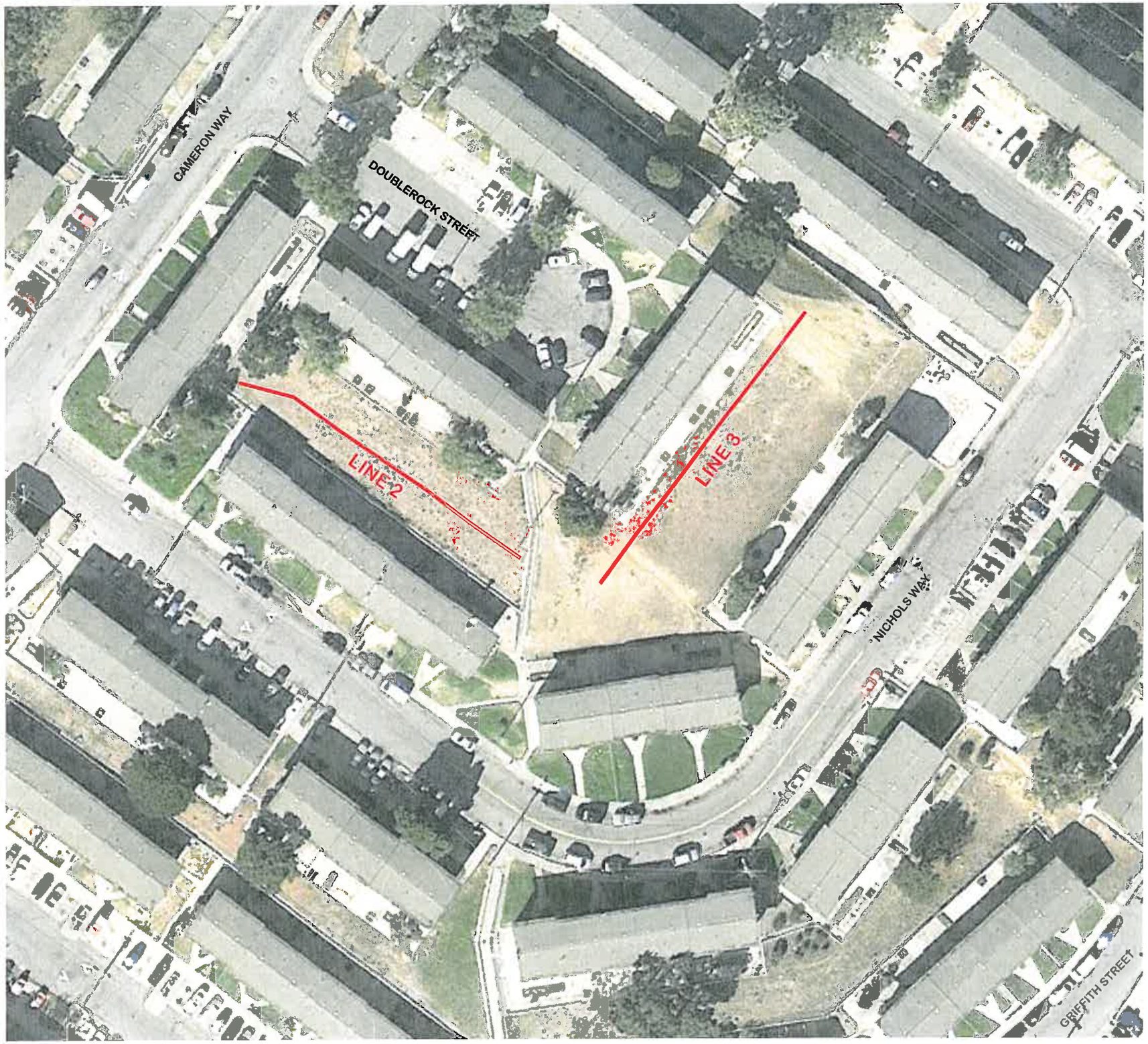
NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: JUN. 2013

DRAWN BY: G.RANDALL

APPROVED BY: WEB

PLATE 2



VICINITY MAP

N

SCALE
0 30 60 120
(1 inch = 60 feet)

LEGEND

	SEISMIC REFRACTION LINE

NORCAL

SITE LOCATION MAP
SEISMIC REFRACTION SURVEY
ALICE GRIFFITH PARCEL

LOCATION: SAN FRANCISCO, CALIFORNIA

CLIENT: ENGEO

JOB #: 13-241.51

NORCAL GEOPHYSICAL CONSULTANTS INC.

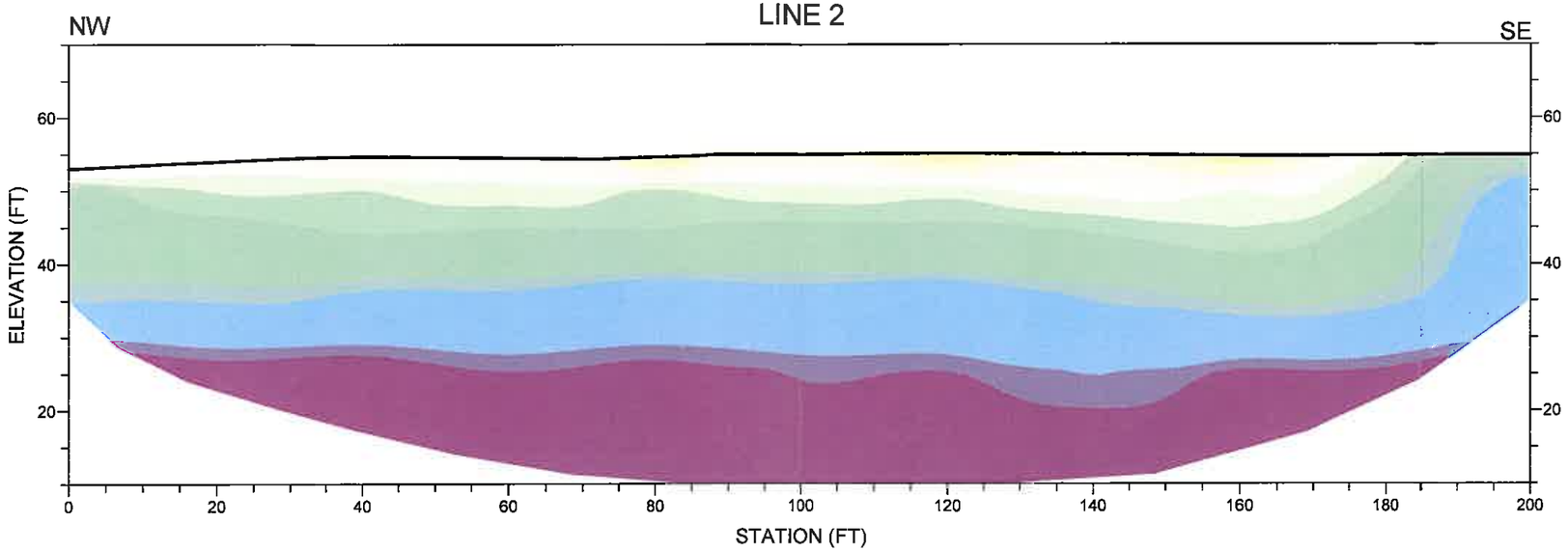
DATE: JUN. 2013

DRAWN BY: G.RANDALL

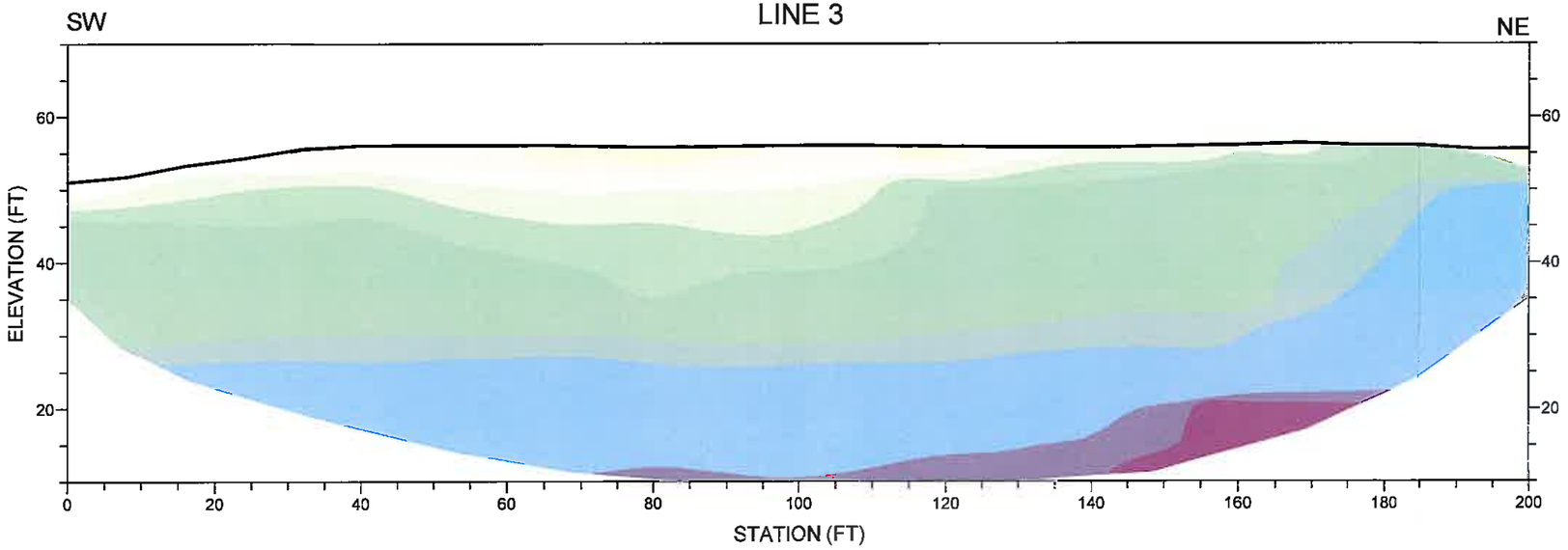
APPROVED BY: WEB

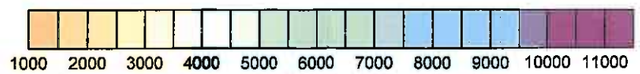
PLATE 3

LINE 2



LINE 3





SCALE

0 10 20 40

(1 inch = 20 feet)

NORCAL

LINES 2 & 3
SEISMIC REFRACTION SURVEY
ALICE GRIFFITH PARCEL

	LOCATION: SAN FRANCISCO, CALIFORNIA	PLATE 4
	CLIENT: ENGEO	
JOB #: 13-241.51	NORCAL GEOPHYSICAL CONSULTANTS INC.	
DATE: JUN. 2013	DRAWN BY: G.RANDALL	APPROVED BY: WEB

APPENDIX C

Previous Explorations (ENGEO)

APPENDIX C

KEY TO BORING LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW - Well graded gravels or gravel-sand mixtures GP - Poorly graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES	GM - Silty gravels, gravel-sand and silt mixtures GC - Clayey gravels, gravel-sand and clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW - Well graded sands, or gravelly sand mixtures SP - Poorly graded sands or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES	SM - Silty sand, sand-silt mixtures SC - Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS		ML - Inorganic silt with low to medium plasticity CL - Inorganic clay with low to medium plasticity OL - Low plasticity organic silts and clays
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %		MH - Elastic silt with high plasticity CH - Fat clay with high plasticity OH - Highly plastic organic silts and clays
	HIGHLY ORGANIC SOILS		PT - Peat and other highly organic soils

For fine-grained soils with 15 to 29% retained on the #200 sieve, the words "with sand" or "with gravel" (whichever is predominant) are added to the group name.

For fine-grained soil with >30% retained on the #200 sieve, the words "sandy" or "gravelly" (whichever is predominant) are added to the group name.

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE					CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4 "	3"	12"		
SILTS AND CLAYS	SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE			

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*
VERY SOFT	0-1/4
SOFT	1/4-1/2
MEDIUM STIFF	1/2-1
STIFF	1-2
VERY STIFF	2-4
HARD	OVER 4

SAMPLER SYMBOLS

- Modified California (3" O.D.) sampler
- California (2.5" O.D.) sampler
- S.P.T. - Split spoon sampler
- Shelby Tube
- Continuous Core
- Bag Samples
- Grab Samples
- NR No Recovery

MOISTURE CONDITION

DRY	Dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater

LINE TYPES

- ———— Solid - Layer Break
- – – – – – Dashed - Gradational or approximate layer break

GROUND-WATER SYMBOLS

- Groundwater level during drilling
- Stabilized groundwater level

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

ENGEO INCORPORATED

LOG OF BORING CP-B1

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/20/2009
HOLE DEPTH: Approx. 20 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 10 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY (CL), dark reddish brown, stiff, moist, medium plasticity, with fine- to medium-grained sand, with subangular fine gravel (FILL)										
5	1					19	26	13	13		12.7	100.2	1.20*
	2												
			SANDY CLAY (CL), dark reddish black, medium stiff, moist, medium plasticity, with fine- to medium-grained sand, with subangular fine gravel (FILL)										
10	3					11							0.80*
	4		becomes wet, with medium-grained sand, with angular rock fragments to 1 1/2 inch diameter										
15	5					28	22	12	10		10.8	120.8	
			GREYWACKE, gray, weak to very weak, very closely fractured, some healed fractures, machanically crushed (FRANCISCAN BEDROCK)										
20	6					46/6"							
			Bottom of boring at approximately 20 feet below ground surface. Groundwater not encountered during drilling.										

LOG OF BORING CP-B2

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/20/2009
HOLE DEPTH: Approx. 149 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY (CL), dark reddish brown, moist, medium plasticity, with fine- to medium-grained sand, with subangular fine gravel (FILL)										
	1												
5													
	2		CLAYEY GRAVEL (GC), reddish brown, very loose, wet, with fine- to medium-grained sand, well graded, angular, layered with gray clayey sand (FILL)										
						5					17.2	108.8	
10	3				▽	3							
			becomes loose, increased clay content										
	4					7							
15													
	5												
						5							
20	6												
			CLAYEY GRAVEL (GC), reddish brown, medium dense, wet, with fine- to coarse-grained sand, angular, rock fragments (FILL)										
25	7												
	8												

LOG OF BORING CP-B2

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/20/2009
HOLE DEPTH: Approx. 149 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			CLAYEY GRAVEL (GC), reddish brown, medium dense, wet, with fine- to coarse-grained sand, angular, rock fragments (FILL)			20				17			
30	9												
	10												
35			CLAY (CH), blue gray, soft, wet, some silt (YOUNG BAY MUD)										
	11												
						5							0.28*
40	12												
	13												
45							60	25	35		46.1	74.9	
	14												
	15												
50													
	16												
55		NR											
	17												

LOG OF BORING CP-B2

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/20/2009
HOLE DEPTH: Approx. 149 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			CLAY (CH), blue gray, soft, wet, some silt (YOUNG BAY MUD)										
	18		SILTY CLAY (CL), gray, stiff, moist (OLD BAY MUD)										
60													
	19												
							46	13	33				1.50*
65													
	20												
	21												
70													
	22												
			becomes very stiff			20					41.1	79.1	3.00*
75	23												
	24												
80													
	25												

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B2

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/20/2009
HOLE DEPTH: Approx. 149 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
85	26		SILTY CLAY (CL), gray, stiff, moist (OLD BAY MUD)			14							1.25*
90	27												
	28												
95	29		SILTY CLAY (CL), reddish brown, very stiff, moist, with fine-grained sand, with subangular, orange, fine sandstone and chert gravel (ALLUVIUM)			34					19.8	111.2	3.30*
	30												
100	31		CLAYEY SAND (SC), yellowish brown, very dense, wet, fine- to medium-grained sand, with lenses of clay bedded among clayey sand (ALLUVIUM)										
105	32					95							
	33												
110	34		CLAY (CH), blue gray, very stiff, moist, some silt (<10%), trace fine-grained sand (<5%) (OLD BAY MUD)										

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B2

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/20/2009
HOLE DEPTH: Approx. 149 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
115	35		CLAY (CH), blue gray, very stiff, moist, some silt (<10%), trace fine-grained sand (<5%) (OLD BAY MUD)			23	102	27	75		49	73.7	2.50*
120	36												
	37		SILTY CLAY (CL), dark gray, very stiff, moist, medium plasticity, with fine-grained sand, trace subangular, fine chert gravel (<5%) (ALLUVIUM)										
125	38					15							2.30*
	39												
130	40		SILTY CLAY (CL), dark reddish brown, hard, moist, with subangular gravel (ALLUVIUM)										
	41												
135						61	47	19	28		16.3	115.9	>4.50* 4.50*
	42		SITLY CLAY (CH), blue gray, hard, moist (OLD BAY MUD)										
140													

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B2

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/20/2009
HOLE DEPTH: Approx. 149 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SITLY CLAY (CH), blue gray, hard, moist (OLD BAY MUD)										
	43		SILTY CLAY (CL), reddish brown, hard, moist, with fine-grained sand, with Fe and Mn staining, with subrounded fine gravel (>10%), trace calcium carbonate nodules (>5%) (ALLUVIUM)										
	44												
145						37							>4.50*
	45		GREYWACKE, yellowish brown, weak (R2), very closely fractured, highly weathered (WH), Mn along fracture planes (FRANCISCAN BEDROCK)			50/4"							
			Bottom of boring at approximately 149 feet below ground surface. Groundwater encountered approximately 10½ feet below ground surface at time of drilling.										

LOG OF BORING CP-B3

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/30/2009
HOLE DEPTH: Approx. 136½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. -5½ ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			GRAVELLY CLAY (GC), reddish brown, soft, moist, with fine- to coarse-grained sand, with angular chert, asphalt, and greenstone clasts (FILL)		▽								
	1												
5													
	2												
						5					13.4	115.7	<0.5*
10	3		becomes brown, wet, no asphalt clasts										
	4					3							
15													
	5												
						4							
20	6												
			becomes stiff										
	7												
						14							1.90*
25			FAT CLAY (CH), blue gray, medium stiff, wet, with shell fragments (YOUNG BAY MUD)										0.80*
	8												

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B3

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/30/2009
HOLE DEPTH: Approx. 136½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. -5½ ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
30	9		FAT CLAY (CH), blue gray, medium stiff, wet, with shell fragments (YOUNG BAY MUD)			0							
			becomes soft				62	27	35				
35	10												
	11												
40	12		FAT CLAY (CH), gray, medium stiff, wet, no shell fragments (YOUNG BAY MUD)										
	13												
45	14						80	29	51				
50	15												
	16												
55	17												

LOG OF BORING CP-B3

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/30/2009
HOLE DEPTH: Approx. 136½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. -5½ ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			FAT CLAY (CH), gray, medium stiff, wet, no shell fragments (YOUNG BAY MUD)										
60	18												
	19		SILTY SAND (SM), olive gray, wet, medium-grained sand				15	17	NP	19			
			SILTY CLAY (CH), olive gray, soft, wet, with decomposed organics (YOUNG BAY MUD)										
65	20					0							
	21												
70		NR											
	22												
75	23		SANDY SILT (ML), olive gray, very stiff, wet, fine-grained sand, (ALLUVIUM)			42					30.8	91.6	3.00*
	24		SILTY CLAY (CL), gray, very stiff, wet, (ALLUVIUM)										
80						34							
	25		CLAYEY SILT (ML), yellowish gray, very stiff, wet, (ALLUVIUM)										3.50*
			SILTY CLAY (CL), yellowish brown, very stiff, wet, (ALLUVIUM)										

LOG OF BORING CP-B3

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/30/2009
HOLE DEPTH: Approx. 136½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. -5½ ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
85	26		SILTY CLAY (CL), yellowish brown, very stiff, wet, (ALLUVIUM)										
	27												
90						33							3.50*
	28												
			CLAY (CH), gray, stiff, (OLD BAY MUD)										
95	29												
	30												
100						14							1.00*
	31												
105	32												
	33		SILTY SAND (SM), gray, medium dense, wet, fine- to medium-grained sand, (ALLUVIUM)										
110						100/10"							
	34												

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B3

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/30/2009
HOLE DEPTH: Approx. 136½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. -5½ ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY SAND (SM), gray, medium dense, wet, fine- to medium-grained sand, (ALLUVIUM)			18							
115	35		CLAY (CH), light gray, medium stiff, wet, (OLD BAY MUD)										
	36												
120													
	37					21							0.80* 1.50*
			SANDY SILT (ML), gray, medium stiff, wet, fine-grained sand, (ALLUVIUM)										
			CLAY (CH), gray, soft, wet, (OLD BAY MUD)										
125	38												
	39												
			SANDY CLAY (CL), greenish gray, very stiff, wet, (OLD BAY MUD)										
130	40												
						87/11"							
	41		GREENSTONE, very weak, highly weathered (Franciscan Bedrock)										
135						84							
			Bottom of boring at approximately 136½ feet below ground surface. Groundwater encountered approximately 8 feet below ground surface at time of drilling.										

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY (CL), yellowish brown to dark gray, hard, moist, mottled with sandy clay, with angular fine gravels, with brick and wood debris (FILL)			17							4.20*
			SILTY SAND (SM), dark gray, dense, wet, with brick fragments, wood, and angular fine gravels (FILL)		▽	26	17	20	NP		31.8	73.8	1.20*
			SILTY CLAY (CH), blue gray, very soft to soft, wet, trace mussel, oyster and clam shells (YOUNG BAY MUD) Torvane = 0.25tsf			1							
			Field Vane Shear Peak Su (Fv Tsu) = 447 psf Field Vane Shear Residual Su (Tr) = 119 psf										
			becomes very soft, strong organic odor				76	30	46		60.9	63.9	
			Fv Tsu = 504 psf Tr = 119 psf										

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY (CH), blue gray, very soft to soft, wet, trace mussel, oyster and clam shells (YOUNG BAY MUD)										
	9		Fv Tsu = 668 psf Tr = 119 psf										
30													
	10												
35		NR					58	27	31		58	65.4	
	11		Fv Tsu = 495 psf Tr = 119 psf										
	12												
40													
	13		Fv Tsu = 659 psf Tr = 137 psf										
45			no shells										
	14												
	15		Fv Tsu = 697 psf Tr = 137 psf										
50							74	29	45		60	62.4	1.80
	16												
55													
	17												

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY (CH), blue gray, very soft to soft, wet, trace mussel, oyster and clam shells (YOUNG BAY MUD) Fv Tsu = 775 psf Tr = 207 psf										
60	18												
	19												
65	20		TX UU - su = 732 psf Fv Tsu = 766 psf Tr = 181psf				73	31	42		62.7	61.2	
70	21												
	22												
75	23		Fv Tsu = 1070 psf Tr = 316 psf										
	24		SANDY CLAY (CH), greenish gray, stiff to very stiff, moist, with silt, fine-grained sand. (OLD BAY MUD)										
80	25		TX UU - su = 2,400 psf Ts >= 1890 psf				23	9	14		15.6	118.7	2.90

LOG OF BORING CP-B4

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
85	26		SANDY CLAY (CH), greenish gray, stiff to very stiff, moist, with silt, fine-grained sand. (OLD BAY MUD)										
	27		SILTY CLAY (CH), yellowish brown, very stiff, moist, trace fine-grained sand (<5%), mottled with greenish gray sandy clay at top (ALLUVIUM)										
90						32					25.7	100.5	3.30*
	28												
95	29												
	30												
100	31												
105	32					19							2.10*
	33												
110	34												

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY (CH), yellowish brown, very stiff, moist, trace fine-grained sand (<5%), mottled with greenish gray sandy clay at top (ALLUVIUM)										
115	35												
	36												
			SAND (SW), brown, medium dense, wet, fine- to coarse-grained sand, with silt, trace clay, subrounded fine gravel (ALLUVIUM)										
120						14							
	37					18	10	20	NP	10	18.8	106.4	
125	38												
	39												
130			CLAYEY SAND (SC), gray, medium dense, wet, fine- to medium-grained sand, trace subrounded coarse-grained sand (<5%), trace wood (ALLUVIUM)										
	40												
	41												
135						27							
	42												
140													

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
	43		CLAYEY SAND (SC), gray, medium dense, wet, fine- to medium-grained sand, trace subrounded coarse-grained sand (<5%), trace wood (ALLUVIUM)										
	44												
145													
	45		FAT CLAY (CH), gray, stiff, moist, some silt, trace fine-to coarse-grained sand (>5%) (OLD BAY MUD)										
150													
	46					6							1.30*
	47												
155													
	48												
160													
	49												
	50												
165			becomes very stiff, with silt			30	93	28	65		45.6	80.2	2.50*
	51												

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			FAT CLAY (CH), gray, stiff, moist, some silt, trace fine-to coarse-grained sand (>5%) (OLD BAY MUD)										
170	52												
	53												
175			CLAY (CH), olive gray, very stiff, wet, with calcified greenstone nodules (OLD BAY MUD)										
	54												
180	55					39							3.00*
	56												
185	57												
190	58												
	59												
195						26							

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
	60		CLAY (CH), olive gray, very stiff, wet, with calcified greenstone nodules (OLD BAY MUD)										
200	61		CLAY (CH), brown, very stiff, wet, trace subrounded coarse-grained sand, (OLD BAY MUD)										
	62												
205	63												
210	64		Trace subrounded coarse-grained sand chert fragments.			61							
	65					29							
215	66												
	67												
220	68												

LOG OF BORING CP-B4

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/2/2009
HOLE DEPTH: Approx. 241½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 1 ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
225	69		CLAY (CH), brown, very stiff, wet, trace subrounded coarse-grained sand, (OLD BAY MUD)										
230	70												
	71												
235	72		GREYWACKE, dark gray, moderately strong (R3), highly weathered (WH), (FRANCISCAN BEDROCK)										
240	73												
			Bottom of Boring at approximately 241½ feet below ground surface. Groundwater encoutered at approximately 7 feet below ground surface at time of drilling.										

LOG OF BORING CP-B5

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/19/2009
HOLE DEPTH: Approx. 30½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 2½ ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			CLAYEY SILT (ML), yellow-brown, moist, with subrounded fine gravel, with coarse subangular sand. (FILL)										
	1		Trace fill gravel, with coarse subangular sand.										
5													
			SANDY SILT (ML), brown, moist, loose, medium sand, trace subround fine gravel. (FILL)			12					9.5		1.5
	2												
			SILTY SAND (SM), brown, wet, very loose, coarse grained sand, with fine subangular gravel. (FILL)										
10	3					5	21	25	NP	19	11.9	93.5	
						7							
	4												
			FAT CLAY (CH), olive grey, wet, soft. (YOUNG BAY MUD)										
15													
	5												
			No Recovery with Shelby Tube. SILTY SAND (SM), grey, wet, loose, medium sand. (ALLUVIUM)			9							
20	6		Heaving sand.			16	21	18	3	8			
			SAND (SP-SM), yellow brown, wet, medium dense, with silt. (ALLUVIUM)										
	7		SAND (SW-SM), dark brown, wet, very dense, fine to coarse grained sand, trace fine gravel. (ALLUVIUM)			46				10			
25													
	8												

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B5

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/19/2009
HOLE DEPTH: Approx. 30½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 2½ ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
30	9		SAND (SW-SM), dark brown, wet, dense, fine to coarse grained sand, trace fine gravel. (ALLUVIUM)			31							
			Bottom of Boring at approximately 30½ feet below ground surface. Groundwater encountered at approximately 11 feet below ground surface at time of drilling.										

LOG OF BORING CP-B6

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			GRAVEL (GP), dark brown, moist, angular gravel, with sand, with concrete, some brick and chemically treated wood with recycled AB (FILL)										
5	1												
	2												
10	3					34	26	35	NP	3			
			SANDY CLAY (CL), dark olive brown, hard, moist, with gravel, subrounded fine- to medium-grained sand, with angular, chert fragments to 2" diameter, with subrounded fine gravel and brick. (FILL)										
	4					30							
15							25	12	13		11.6	123.1	>4.50*
	5		CLAYEY GRAVEL (GC), dark brown, dense, wet, with coarse-grained sand, with silt, with wood fragments, concrete, and brick (FILL)										
						39							
20	6												
			SANDY CLAY (CL), olive brown, medium stiff, wet, 90% of sample is black coated treated wood (railroad ties) (FILL)										
	7												
			90% of sample is wood			18							
25	8												
			CLAY (CH), blue gray, wet, with silt, with clam and oyster shell fragments (YOUNG BAY MUD)										

LOG OF BORING CP-B6

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			CLAY (CH), blue gray, wet, with silt, with clam and oyster shell fragments (YOUNG BAY MUD)										
30	9	NR											
		NR											
	10												
35						50/4"							
	11		Debris from fill above at bottom of the hole. Sample contaminated.								12.1	92.3	
	12												
40			FAT CLAY (CH), gray, soft, wet, with silt, (YOUNG BAY MUD)										
	13												
45							88	33	55				
	14												
	15												
50													
	16												
55													
	17												

LOG OF BORING CP-B6

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			FAT CLAY (CH), gray, soft, wet, with silt, (YOUNG BAY MUD)										
	18		SILTY CLAY (CH), blue gray, very stiff, moist, with fine- to coarse-grained sand, (OLD BAY MUD)										
60													
	19												
65													
	20						38	15	23				3.50*
			SILTY CLAY (CH), olive brown, soft, moist, trace fine-grained sand, (OLD BAY MUD)										
	21												
70													
	22												
75													
	23												
	24												
80						22							
	25		CLAY (CH), gray, very stiff, moist, with silt, trace fine-grained sand (OLD BAY MUD)										2.20*

LOG OF BORING CP-B6

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
85	26		CLAY (CH), gray, very stiff, moist, with silt, trace fine-grained sand (OLD BAY MUD)										
	27												
90						11							1.30*
	28												
95	29												
	30												
100			SANDY CLAY (CL), gray, stiff, moist, fine- to coarse-grained sand, with silt, (ALLUVIUM)										
	31												
105	32		TX UU - su = 1,026 psf			22							2.00*
	33		SILTY SAND (SM), greenish gray, very dense, wet, fine-grained subangular sand (35% quartz), some clay (<10%) (ALLUVIUM)										
110	34												

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B6

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY SAND (SM), greenish gray, very dense, wet, fine-grained subangular sand (35% quartz), some clay (<10%) (ALLUVIUM)										
115	35												
	36												
120						84							
	37					79					20	107.6	
	38												
125													
	39												
130			SILTY CLAY (CL), gray, stiff to very stiff, moist, (OLD BAY MUD)										
	40												
	41												
135						18							2.90*
	42												
140													

LOG OF BORING CP-B6

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
	43		SILTY CLAY (CL), gray, stiff to very stiff, moist, (OLD BAY MUD)										
			CLAY (CH), blue gray, very stiff, moist, with silt, with decomposed roots, iron oxide coating along roots (OLD BAY MUD)										
145	44												
	45												
150													
	46		TX UU - su = 2,122 psf			21							2.30*
	47												
155													
	48												
160													
	49												
	50												
165			becomes stiff			11							
	51												

LOG OF BORING CP-B6

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
170	52		CLAY (CH), blue gray, very stiff, moist, with silt, with decomposed roots, iron oxide coating along roots (OLD BAY MUD)										
	53												
175													
	54		SILTY CLAY (CL-CH), greenish blue, very stiff, moist, with fine-to medium-grained clayey sand lenses, with rock clasts (OLD BAY MUD)										
180	55					69							3.20*
	56												
185			GREYWACKE, reddish brown, very weak (R1), extremely weathered, light gray clay filled fractures, weak dark reddish brown sandstone clasts within a residual soil matrix, plastic (FRANCISCAN BEDROCK)										
	57												
190	58												
	59												
195						38							

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B6

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/8/2009
HOLE DEPTH: Approx. 196½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 5¼ ft.

LOGGED / REVIEWED BY: C. Wright / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			Bottom of boring at approximately 136½ feet below ground surface. Groundwater encoutered at approximately 11 feet below ground surface at time of drilling.										

LOG OF BORING CP-B7

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/25/2009
HOLE DEPTH: Approx. 65½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 4 ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SANDY SILT (ML), brown, moist, trace coarse sand, trace brick fragments. (FILL)										
	1												
5			SILTY CLAY (CL), reddish brown, moist, stiff, with coarse subrounded sand, some greenstone fragments. (FILL)			13					11.3	107.6	2.50*
	2		Fragments of asphalt from cuttings.										
10	3					23	25	13	12				
	4		SILTY GRAVEL (GM), olive grey to black, wet, medium dense, with sand, lots of organics and wood debris, with concrete fragments. Highly organic. (FILL)										
15	5					21	26	18	8	23			
20	6		SANDY CLAY (CH), dark grey, wet, soft, fine sand, trace shell fragments, trace sandstone fragments. (YOUNG BAY MUD)			5					17.6	115.2	
			CLAY (CH), olive grey, wet, soft. (YOUNG BAY MUD)										
	7												
25													
	8		TX UU - su = 662 psf										3.50*

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-B7

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/25/2009
HOLE DEPTH: Approx. 65½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 4 ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SANDY CLAY (CH), dark grey, wet, soft, fine sand. (YOUNG BAY MUD)										
30	9					7							0.50*
	10												
35			SILTY SAND (SM), olive grey, wet, loose, fine sand. (ALLUVIUM)										
	11												
	12												
40			SILTY SAND (SM), yellow brown, wet, loose, fine sand. (ALLUVIUM)				19	19	NP	17			
			SILTY SAND (SM), yellow brown, wet, dense, fine sand. (ALLUVIUM)			52	18	18	NP	19			
	13												
45			CLAYEY SAND (SC), yellow brown, wet, loose. (ALLUVIUM)			8	24	17	7	34			
	14												
			SILTY SAND (SM), light olive grey, wet, medium dense, medium sand. (ALLUVIUM)										
	15												
50						30							
	16												
			Stiffer drilling.										
			GREYWACKE, weak, highly weathered, very thin bedding. (FRANCISCAN BEDROCK)										
55	17												

LOG OF BORING CP-B7

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 11/25/2009
HOLE DEPTH: Approx. 65½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 4 ft.

LOGGED / REVIEWED BY: L. Chan / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			GREYWACKE, weak, highly weathered, very thin bedding. (FRANCISCAN BEDROCK)										
	18												
60			No recovery.			50/3"							
						50/5"							
	19												
65						50/3"							
			Bottom of boring at approximately 65½ feet below ground surface. Groundwater not encountered during drilling.										

LOG OF BORING CP-Y1

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/11/2009
HOLE DEPTH: Approx. 96½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: J. White / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY GRAVEL (GM), reddish brown, dry, few 1 to 2 inch rock fragments. (FILL)										
5	1		SILTY GRAVEL (GM), brown, dense, moist, becomes wet, with sand, fine to coarse gravel. (FILL)										
10	2				▽	11	16	18	NP	12			
	3		Increasing clay content, few cobbles										
15	4		SAND (SW), very dark greenish gray, medium dense, wet, with fine and coarse gravel. (FILL)			9							
	5												
20	6		Concrete in shoe.			8	15	17	NP	8	16.3	115.3	
	7												
25	8		FAT CLAY (CH), very dark greenish gray, very soft, wet, few shell fragments. (YOUNG BAY MUD) Wood debris and concrete in sampler.			77							

LOG - GEOTECHNICAL 8472000001 GINT LOGS.GPJ ENGEO INC.GDT 9/30/11

LOG OF BORING CP-Y1

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/11/2009
HOLE DEPTH: Approx. 96½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: J. White / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			FAT CLAY (CH), very dark greenish gray, very soft, wet, few shell fragments. (YOUNG BAY MUD)			2							
30	9												
	10		FV Tsu = 562 psf Tr = 154 psf										
35	11												
	12		FV Tsu = 1021 psf Tr = 172 psf										
40	13		Same as above.				90	38	52		94	45.8	1.75*
45	14		Fv Tsu = 1281 psf Tr = 298 psf										
	15												
50	16		Fv Tsu = 1210 psf Tr = 252 psf				73	26	47				
55	17												

LOG OF BORING CP-Y1

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/11/2009
HOLE DEPTH: Approx. 96½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: J. White / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SANDY CLAY (CL), bluish gray, very stiff, wet to moist, medium grained sand. (OLD BAY MUD)										
60	18												
	19												
65	20												2.0*
	21												
70	22												
75	23		SILTY CLAY (CL), greenish gray, hard, moist, well developed clay films on gravel, some carbonate filaments. (OLD BAY MUD)			25							>4.50*
	24												
80	25		CLAY (CH), dark greenish gray, stiff, wet. (OLD BAY MUD)										

LOG OF BORING CP-Y1

ENGEO INCORPORATED

Geotechnical Feasibilty
CANDLESTICK POINT
SAN FRANCISCO, CA
8472.000.001

DATE DRILLED: 12/11/2009
HOLE DEPTH: Approx. 96½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV: Approx. 0¾ ft.

LOGGED / REVIEWED BY: J. White / BHBJ
DRILLING CONTRACTOR: WDC Exploration
DRILLING METHOD: HSA, Switch to Mud
HAMMER TYPE: 140 lb. Auto Trip

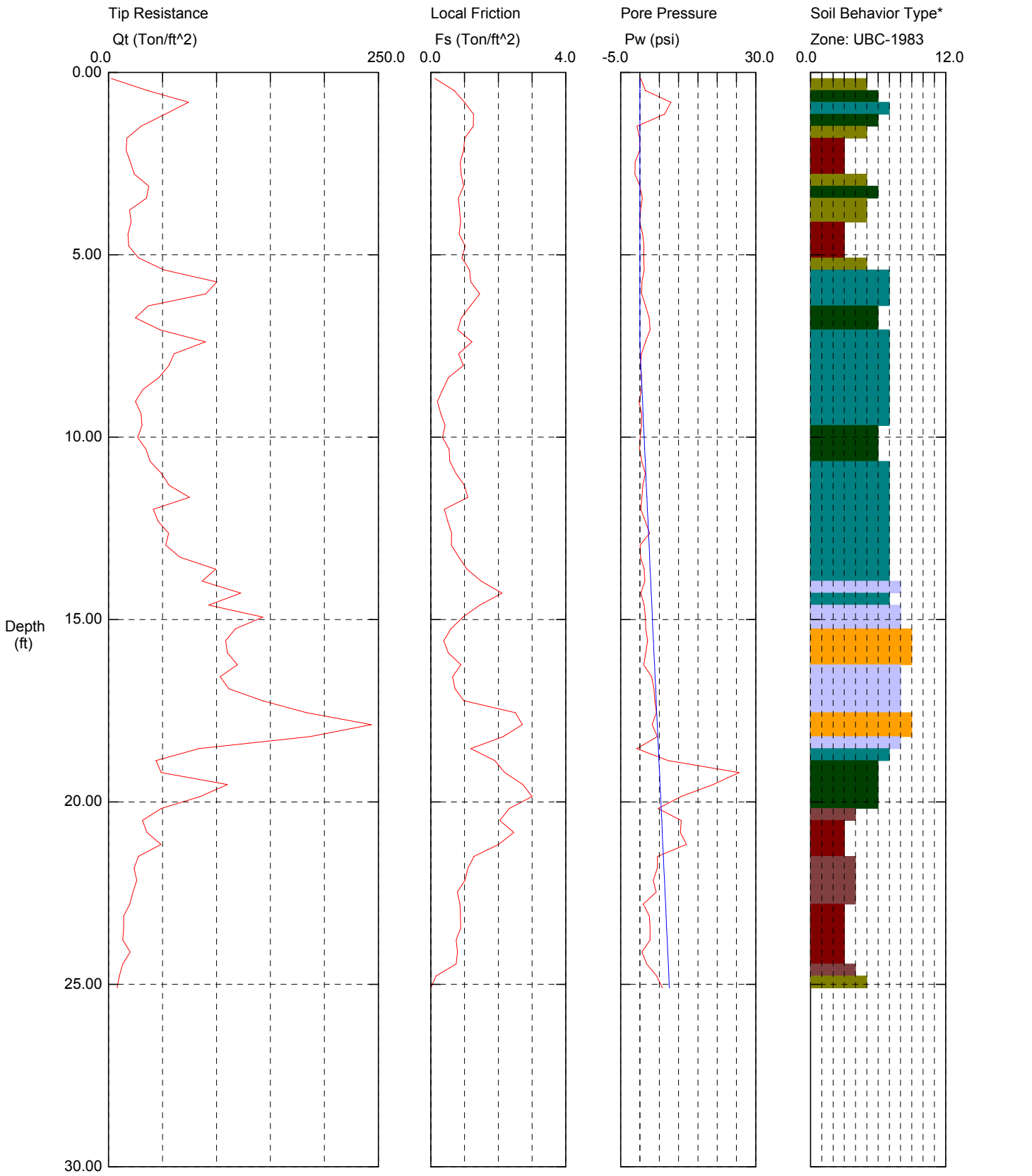
Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
85	26		CLAY (CH), dark greenish gray, stiff, wet. (OLD BAY MUD)			21							1.50*
	27												
90	28		SANDSTONE, yellowish brown, very weak, highly weathered, some iron staining, fine to medium grained sand. (FRANCISCAN BEDROCK)										
95	29					46							
			Bottom of boring at approximately 96½ feet below ground surface. Groundwater encoutered at approximately 9 feet below ground surfaceat time of drilling.										

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT1
Cone Used: 4583.124

CPT Date/Time: 11-20-09 11:43
Location: CP-CPT1
Job Number:



Maximum Depth = 25.10 feet

Depth Increment = 0.33 feet

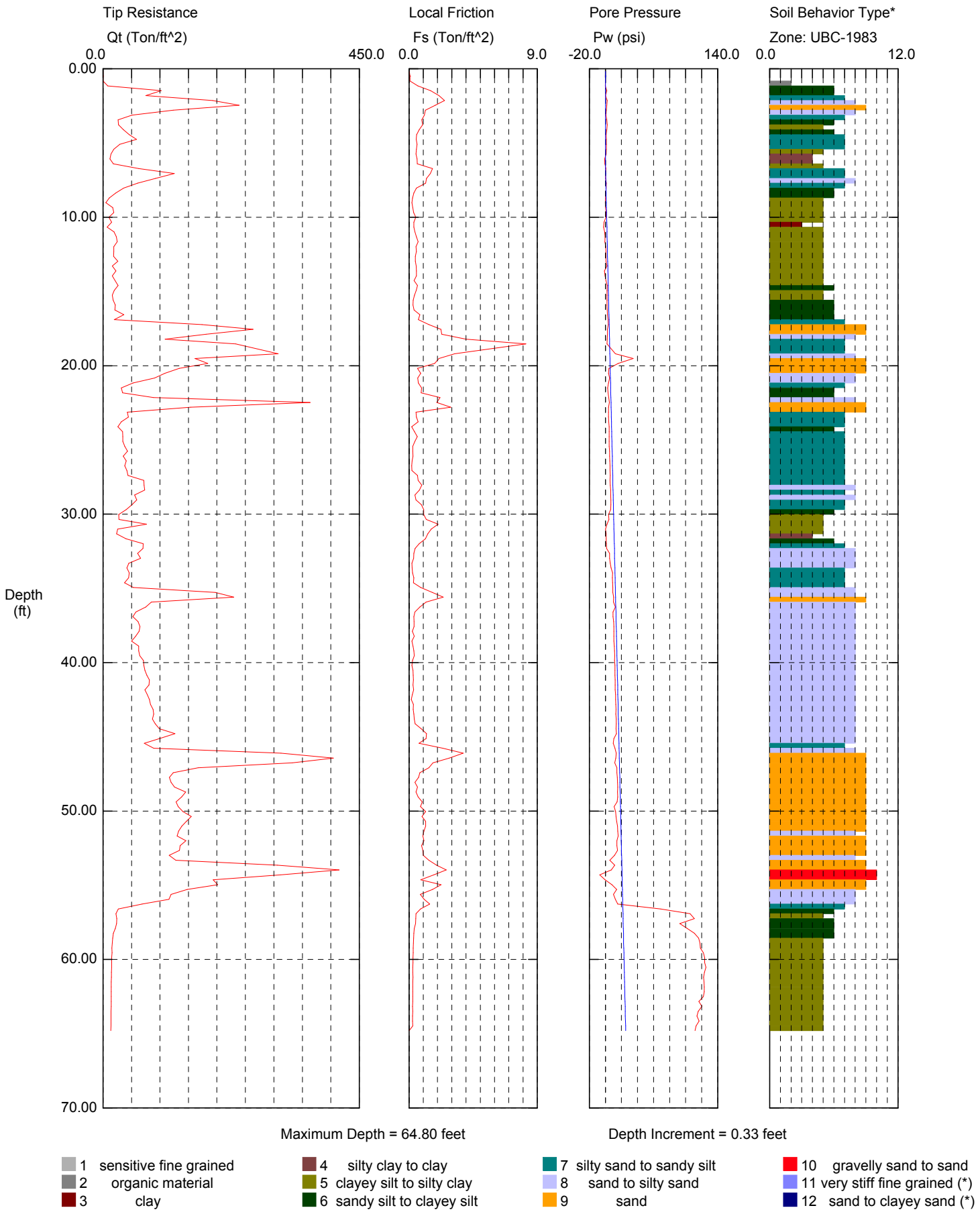
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT2
Cone Used: 4583.124

CPT Date/Time: 12-01-09 09:14
Location: CP-CPT2
Job Number:



Maximum Depth = 64.80 feet

Depth Increment = 0.33 feet

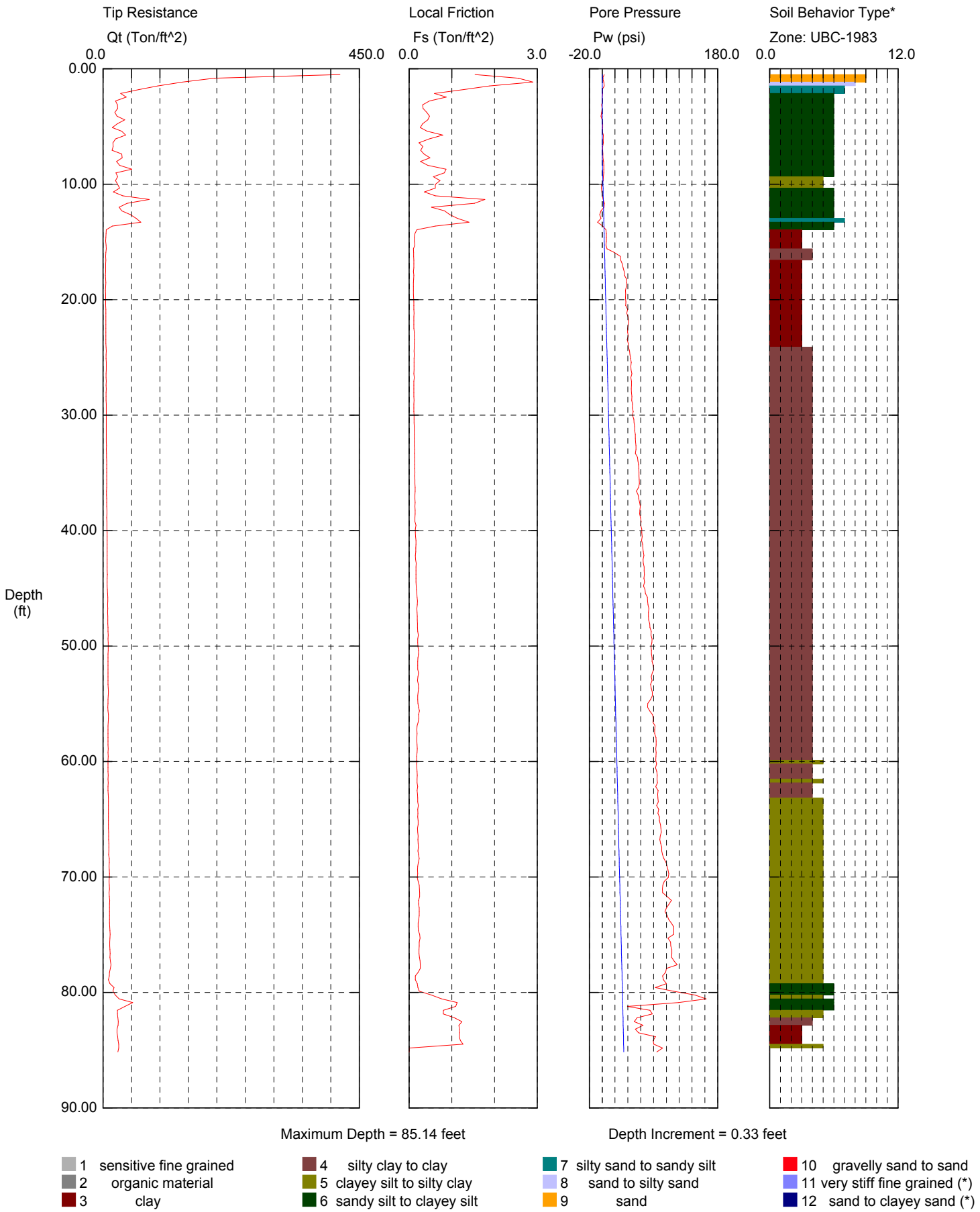
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT3
Cone Used: 4583.124

CPT Date/Time: 11-20-09 12:53
Location: CP-CPT3
Job Number:



Maximum Depth = 85.14 feet

Depth Increment = 0.33 feet

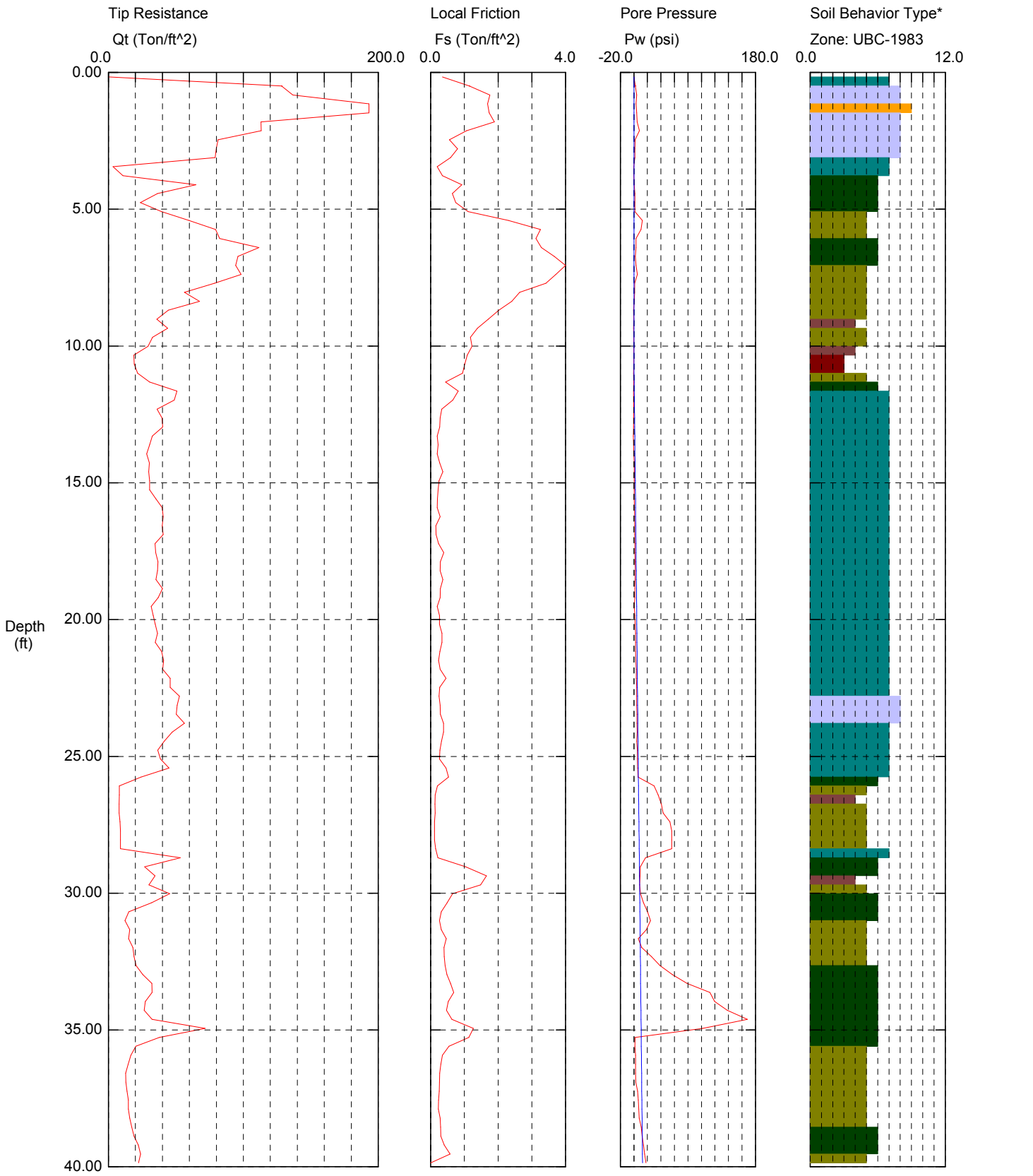
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT4
Cone Used: 4583.124

CPT Date/Time: 11-20-09 10:20
Location: CP-CPT4
Job Number:



Maximum Depth = 39.86 feet

Depth Increment = 0.33 feet

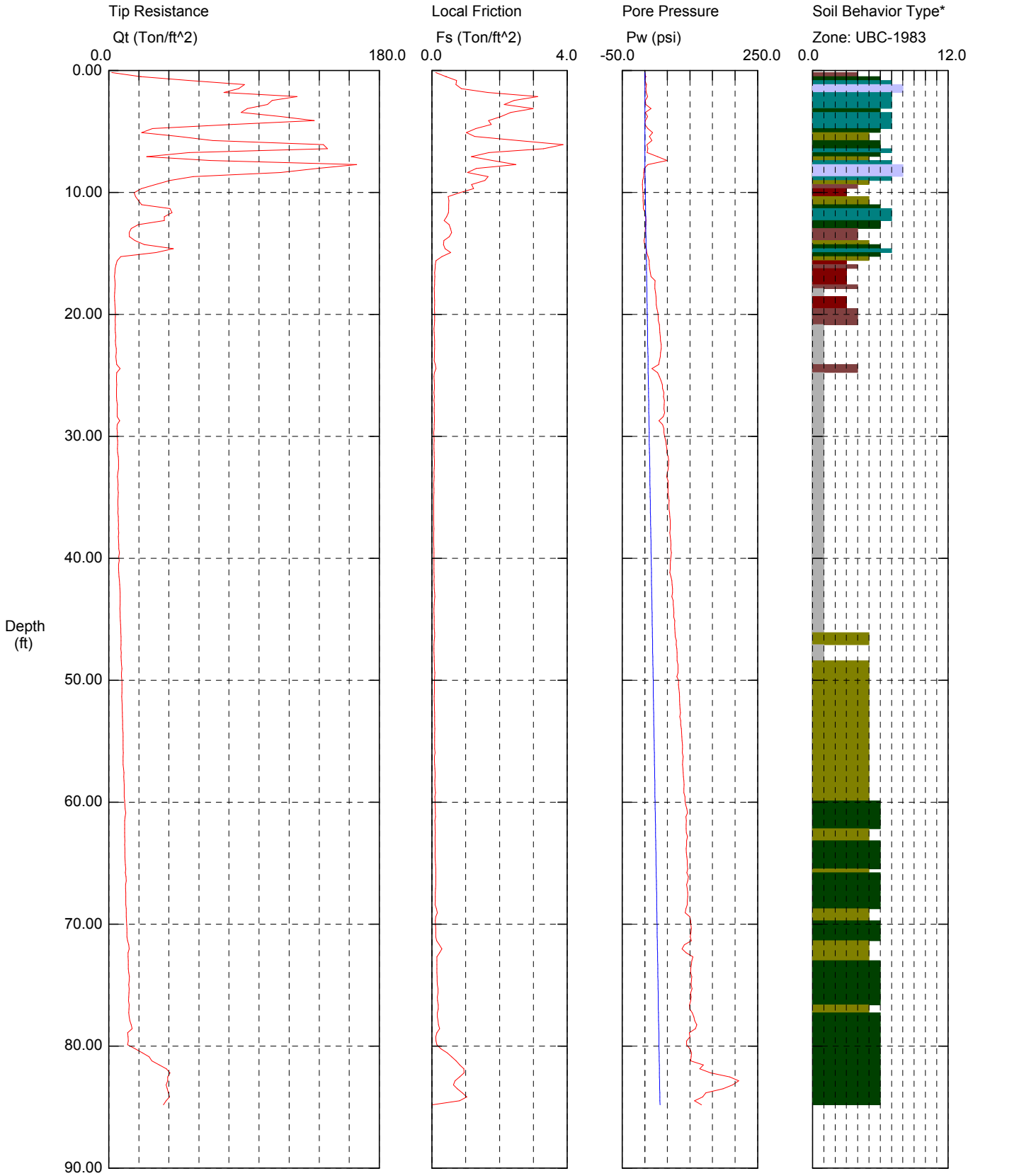
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT5
Cone Used: 4583.124

CPT Date/Time: 11-23-09 13:19
Location: CP-CPT5
Job Number:



Maximum Depth = 84.81 feet

Depth Increment = 0.33 feet

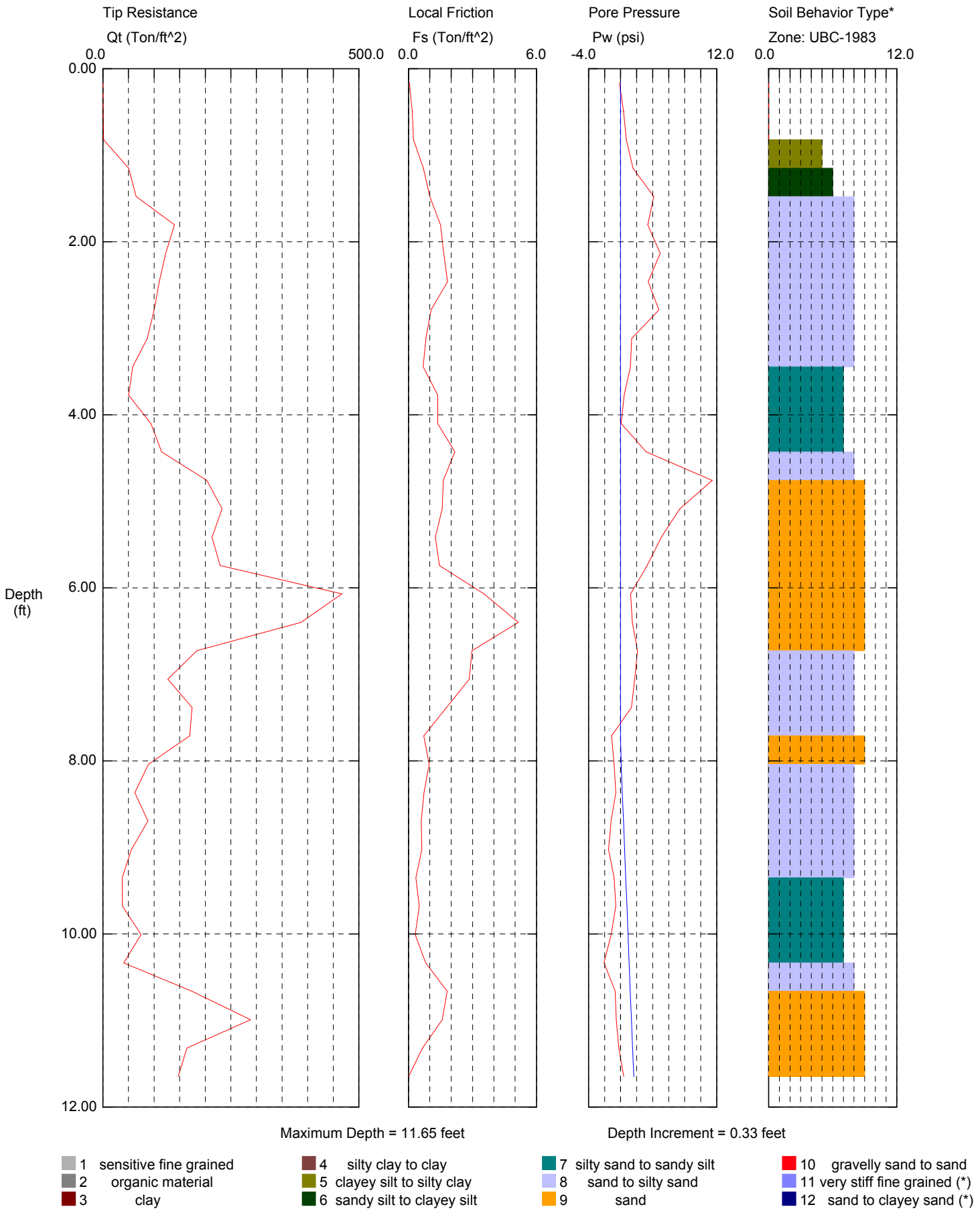
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT6
Cone Used: 4583.124

CPT Date/Time: 11-20-09 08:55
Location: CP-CPT6
Job Number:



Maximum Depth = 11.65 feet

Depth Increment = 0.33 feet

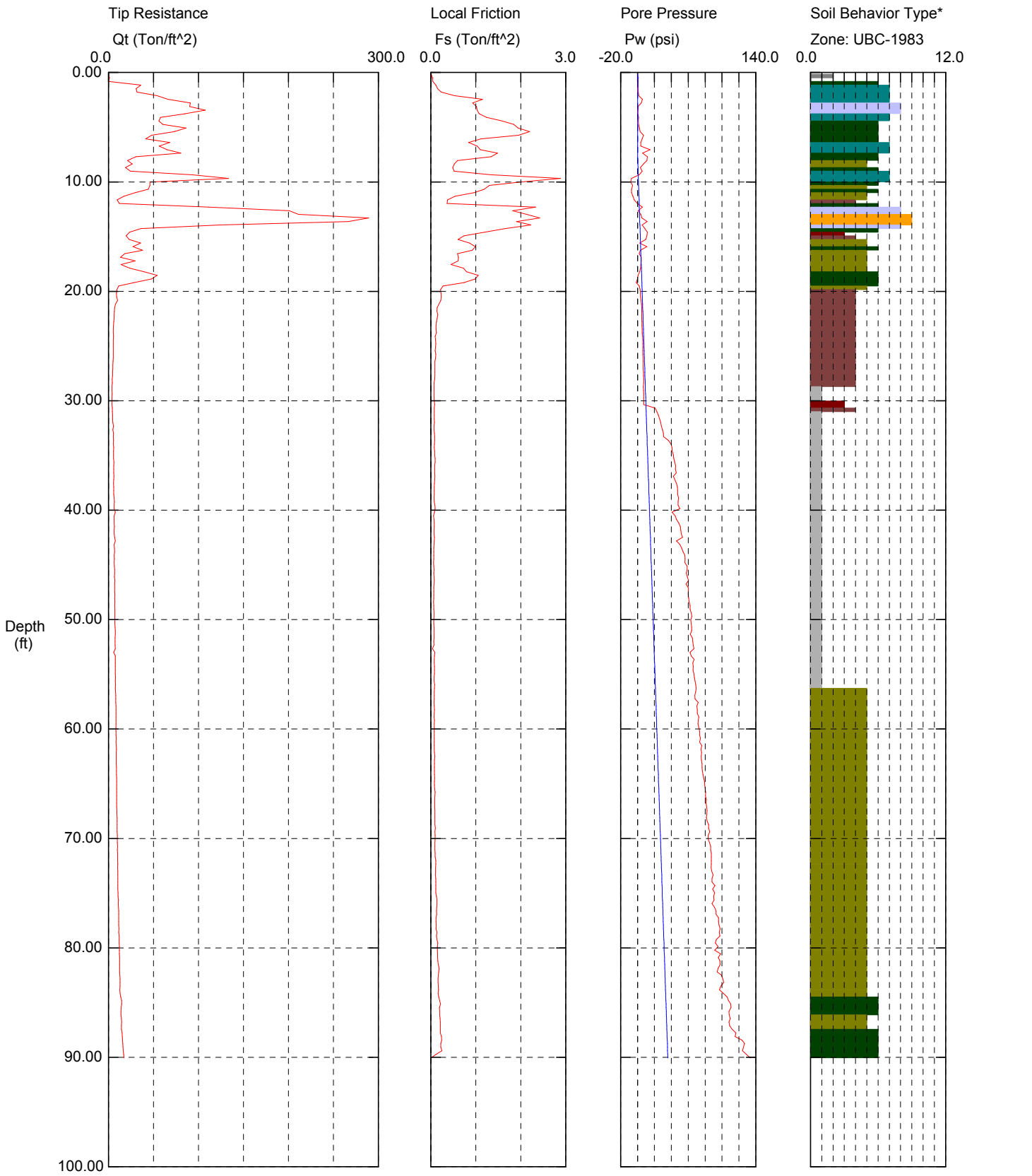
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT7
Cone Used: 4583.124

CPT Date/Time: 11-23-09 14:58
Location: CP-CPT7
Job Number:



Maximum Depth = 90.06 feet

Depth Increment = 0.33 feet

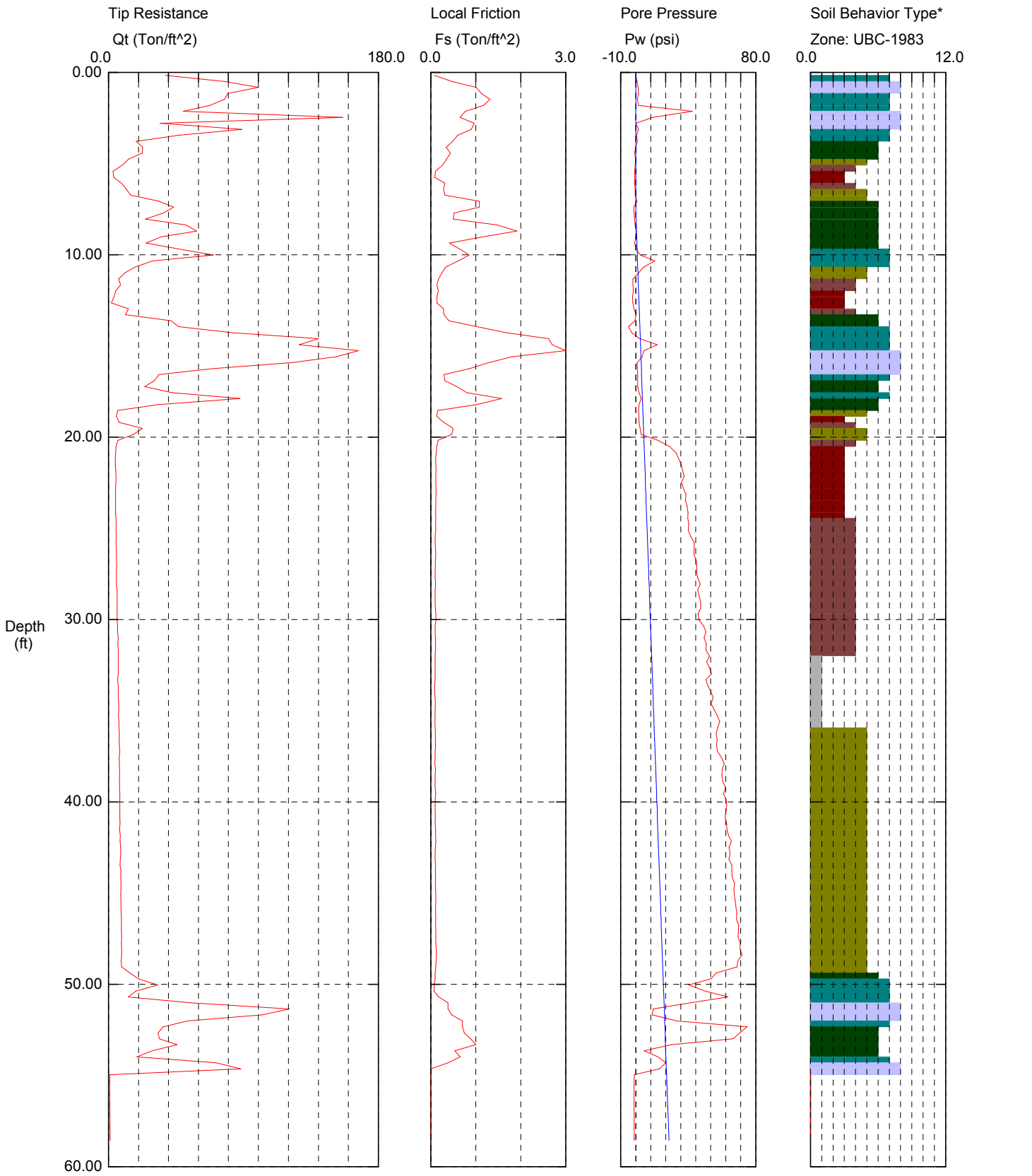
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT8
Cone Used: 4583.124

CPT Date/Time: 11-24-09 07:22
Location: CP-CPT8
Job Number:



Maximum Depth = 58.56 feet

Depth Increment = 0.33 feet

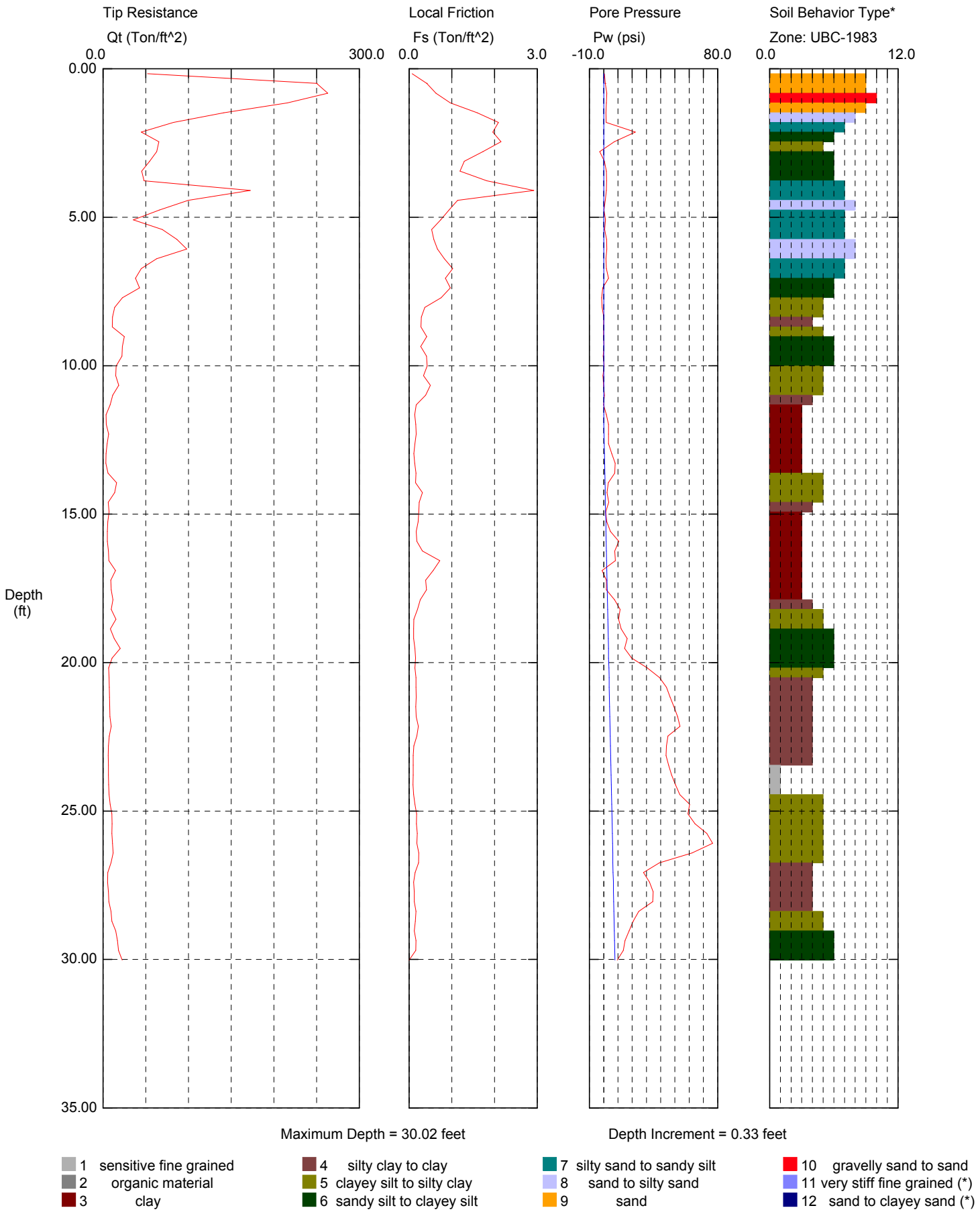
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT9
Cone Used: 4583.124

CPT Date/Time: 11-25-09 12:10
Location: CP-CPT9
Job Number:



Maximum Depth = 30.02 feet

Depth Increment = 0.33 feet

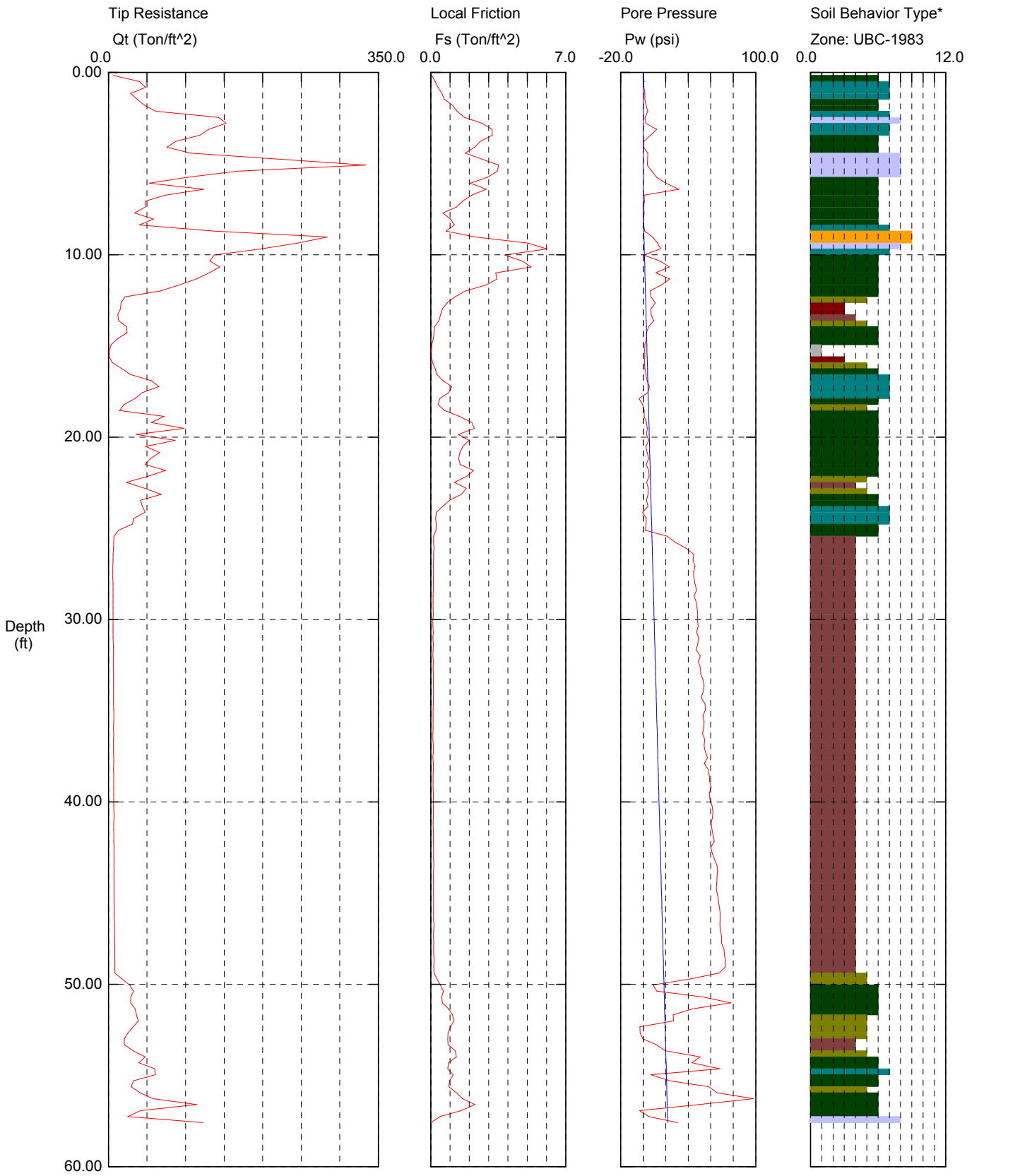
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT10
Cone Used: 4583.124

CPT Date/Time: 11-23-09 10:44
Location: CP-CPT10
Job Number:



Maximum Depth = 57.58 feet

Depth Increment = 0.33 feet

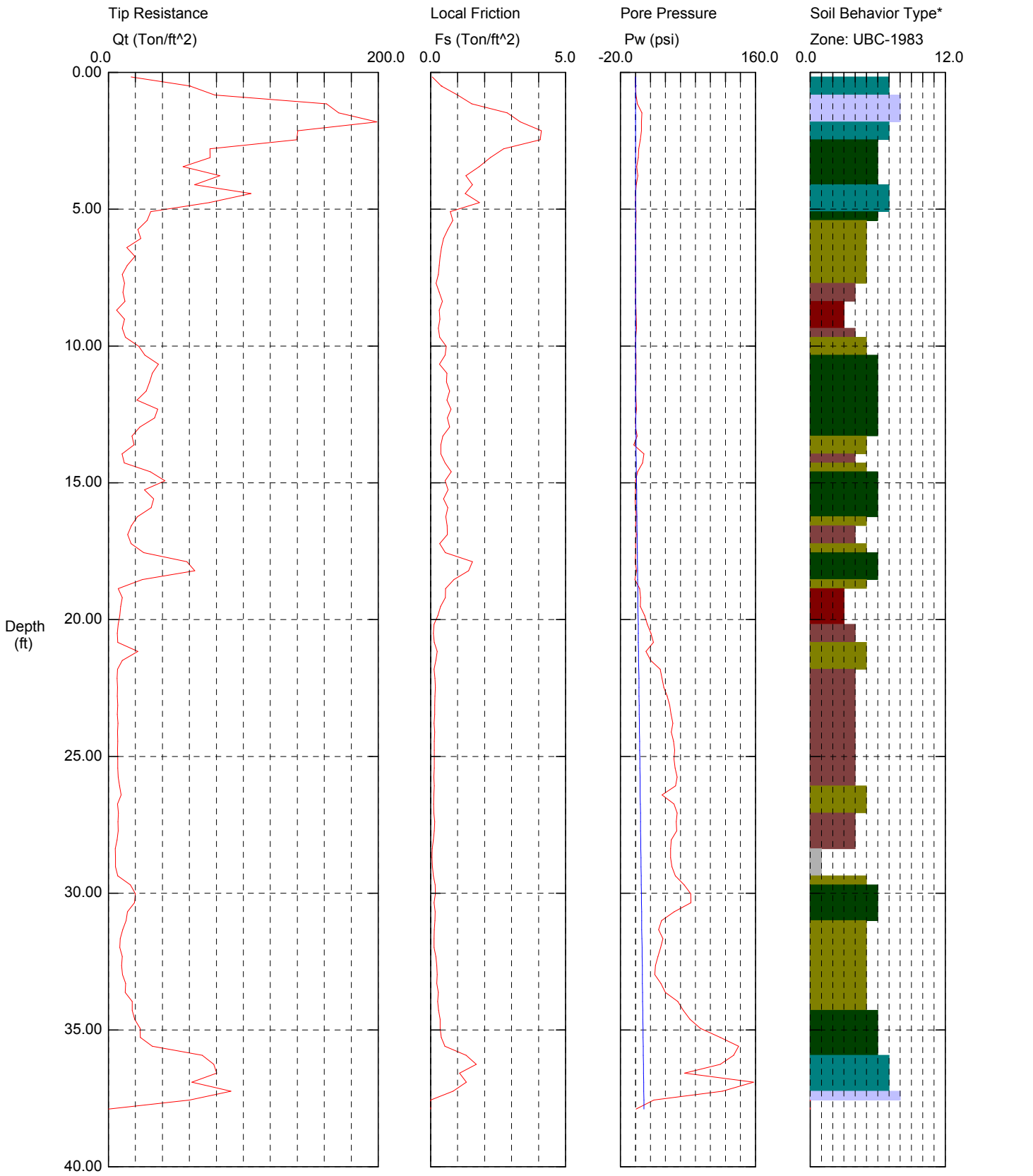
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT11
Cone Used: 4583.124

CPT Date/Time: 11-22-09 08:56
Location: CP-CPT11
Job Number:



Maximum Depth = 37.89 feet

Depth Increment = 0.33 feet

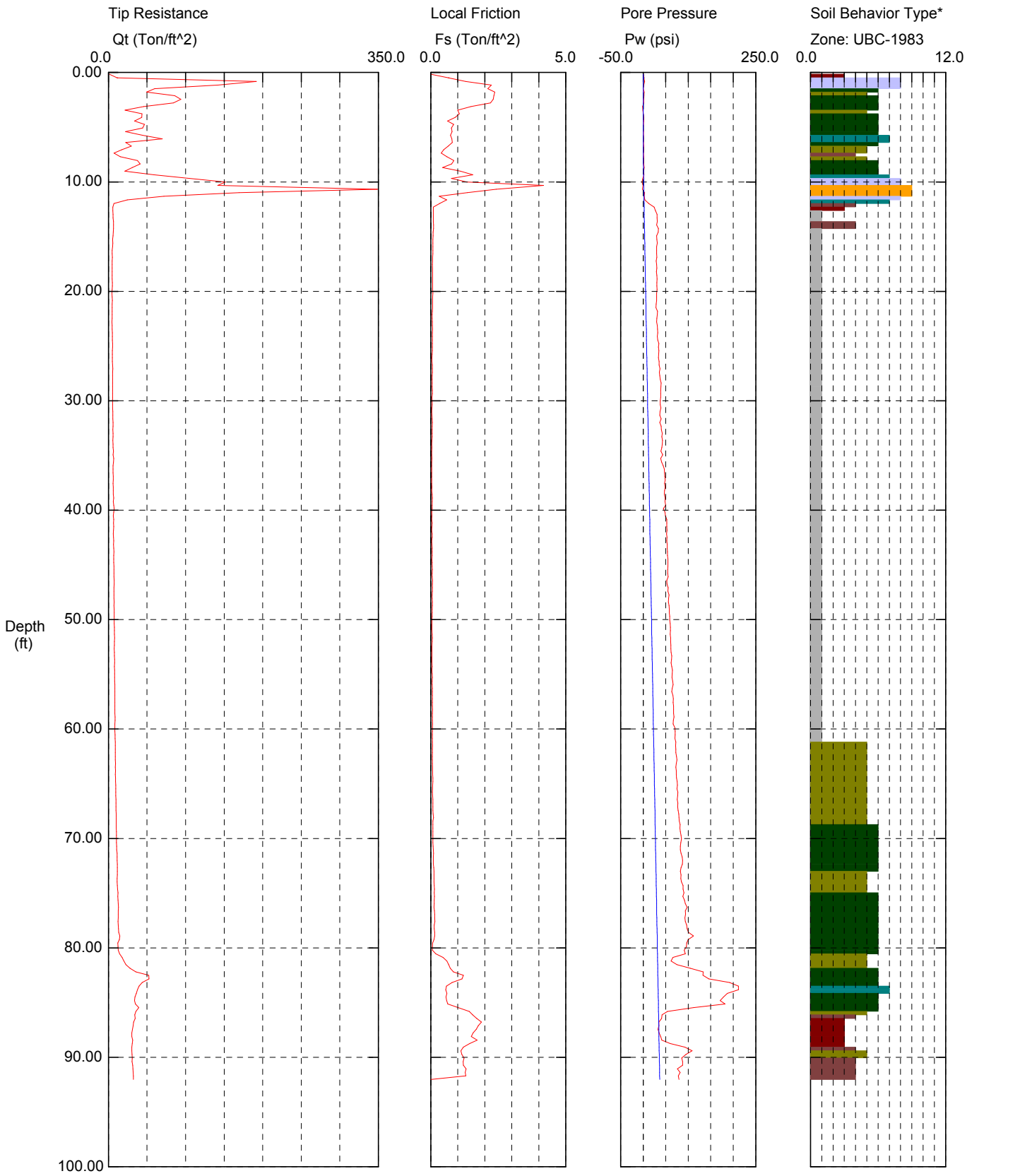
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT12
Cone Used: 4583.124

CPT Date/Time: 11-24-09 10:56
Location: CP-CPT12
Job Number:



Maximum Depth = 92.03 feet

Depth Increment = 0.33 feet

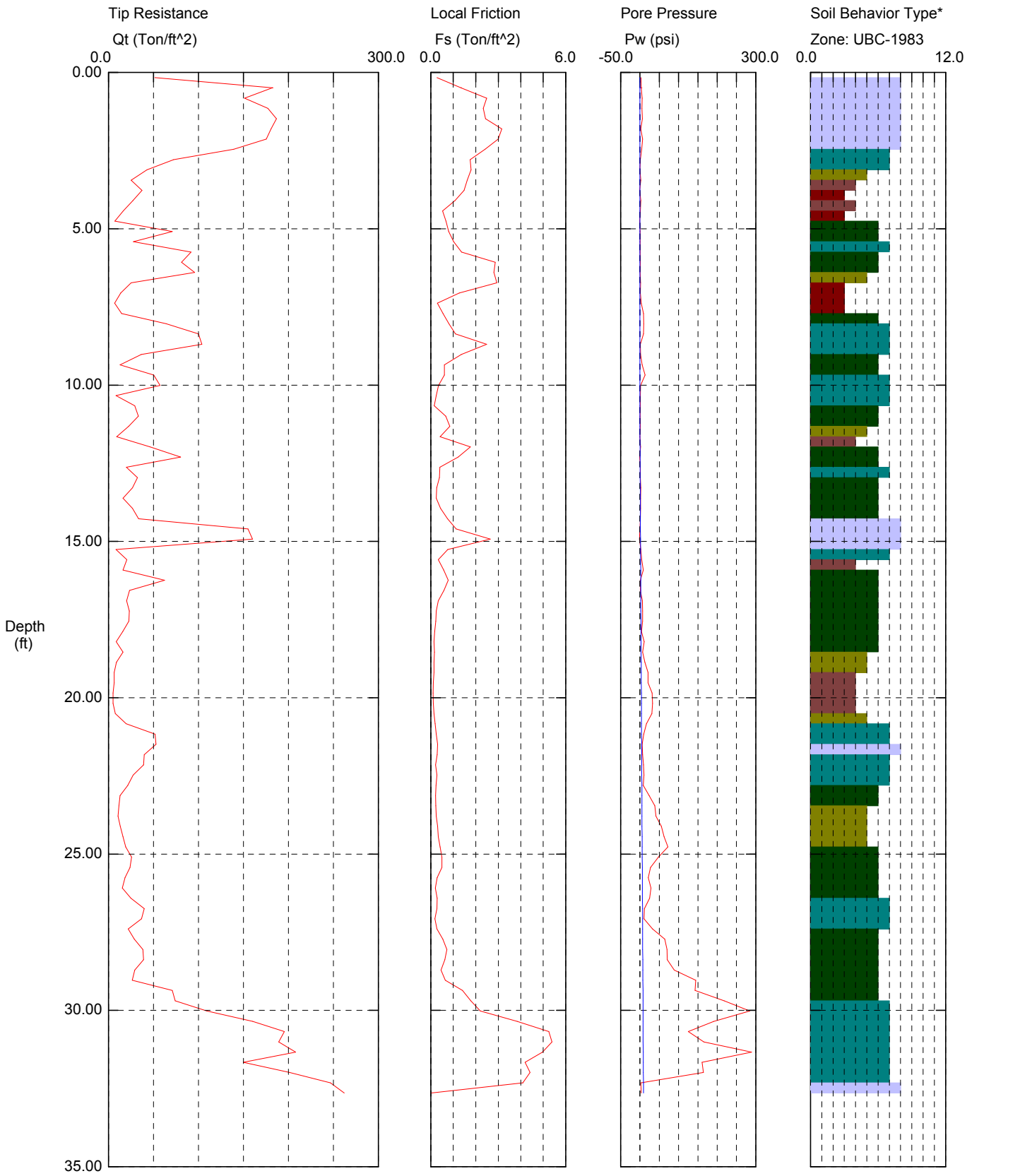
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPT13
Cone Used: 4583.124

CPT Date/Time: 11-20-09 08:20
Location: CP-CPT13
Job Number:



Maximum Depth = 32.64 feet

Depth Increment = 0.33 feet

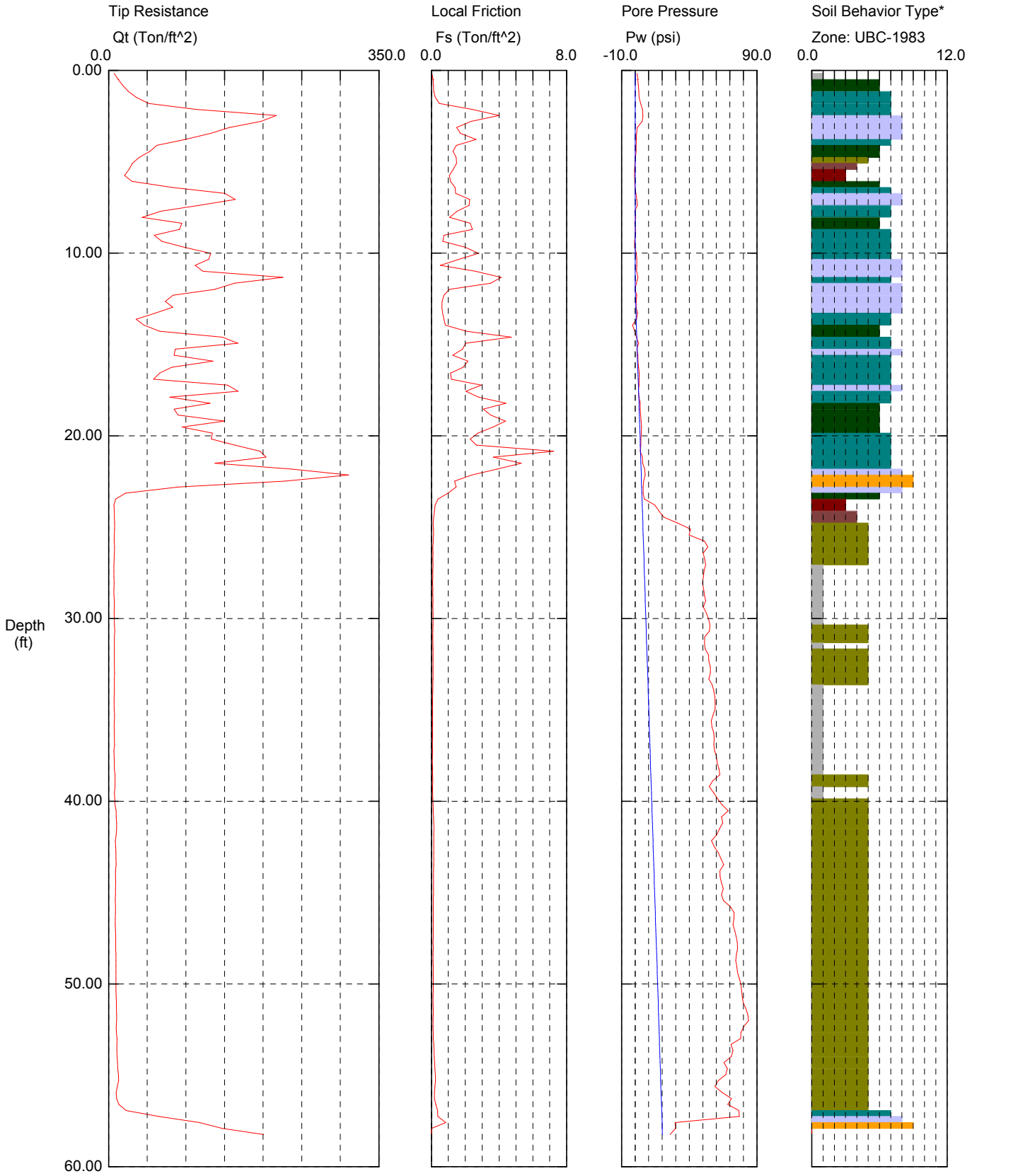
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Candlestick Park CPT

Operator: JT
Sounding: CP-CPTY4
Cone Used: 4583.124

CPT Date/Time: 11-25-09 10:14
Location: CP-CPTY4
Job Number:

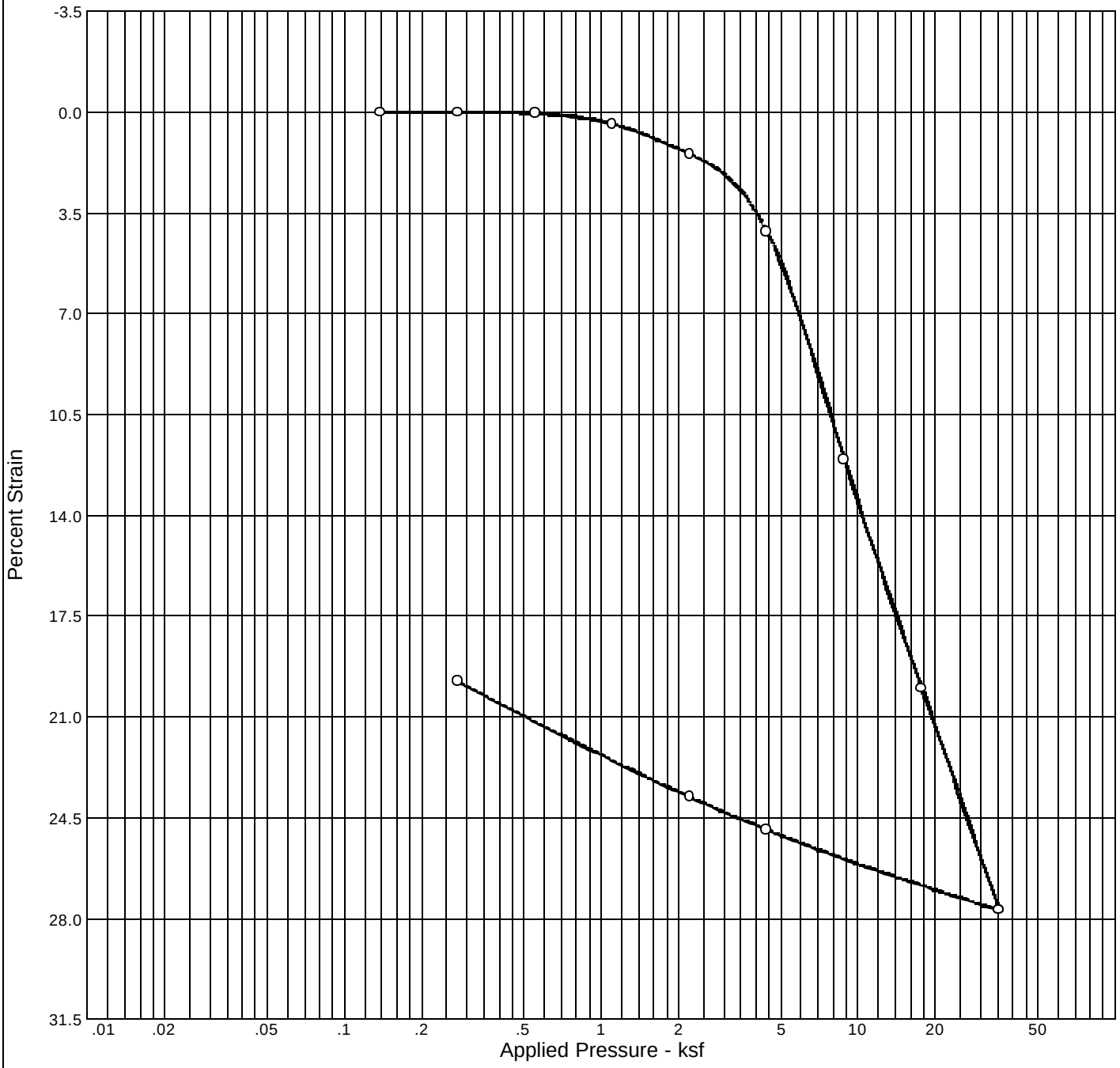


Maximum Depth = 58.23 feet

Depth Increment = 0.33 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.8 %	51.5 %	70.0	62	35	2.66	CH		1.372

MATERIAL DESCRIPTION

Dark greenish gray CLAY.

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

Source: **Sample No.:** B3 @ 32

ENGEO INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Plate

ENGEO Incorporated

Unconsolidated Undrained Triaxial Test (ASTM D2850)

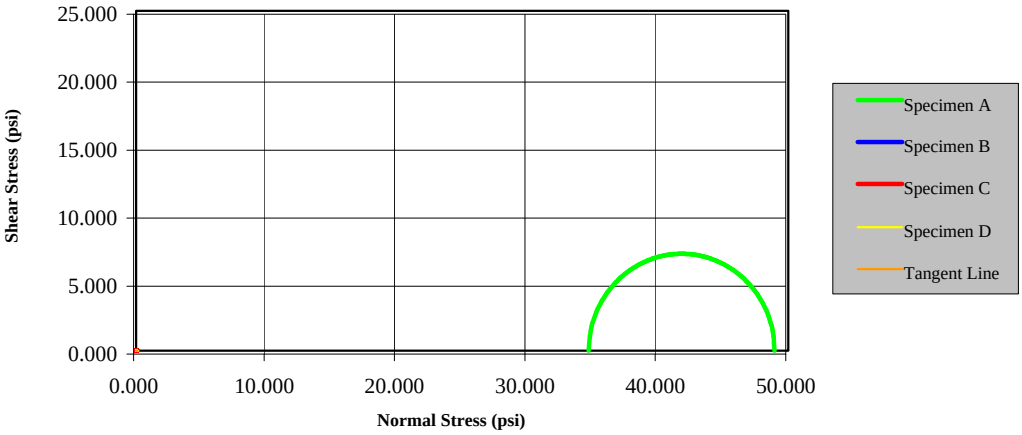
Date:

Checked By:

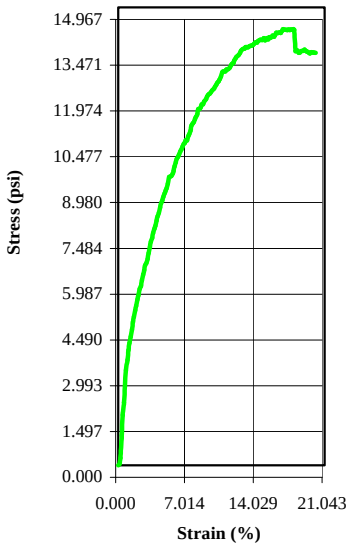
Date:

Tested By:

Mohr Circles



Stress-Strain Curve



Before Test	Specimen A	B	C	D
Water Content (%)	28.06	0.00	0.00	0.00
Dry Density (pcf)	97.29	0.00	0.00	0.00
Saturation (%)	106.17	0.00	0.00	0.00
Void Ratio	0.70	0.00	0.00	0.00
Diameter (in)	2.420	0.000	0.000	0.000
Height (in)	4.900	0.000	0.000	0.000
Liquid Limit				
Plastic Limit				
Specific Gravity	2.650			
After Test	**A**	**B**	**C**	**D**
Water Content (%)	28.06	0.00	0.00	0.00
Test Data	**A**	**B**	**C**	**D**
Strain Rate (in/min)	0.04	0.00	0.00	0.00
Peak Deviator Stress (psi)	14.255	0.000	0.000	0.000
Axial Strain @ Failure (%)	17.837	0.000	0.000	0.000
	Cell Pressure			
Cell (psi)	34.7	0.0	0.0	0.0
Back (psi)	n/a	n/a	n/a	n/a
	Principle Stresses at Failure			
s 1 (psi)	49.0	0.0	0.0	0.0
s 3 (psi)	34.7	0.0	0.0	0.0

Mohr-Coulomb Strength Parameters		Sample Description
C (psi)	0.0	See Boring Log
Friction Angle Ø	0.00	

Project Information			
Project Name:	Candlestick Park		
Project Number:	8742.000.001	Job Number:	8742.000.001
Location:		Boring Number:	B6
Client:		Sample Number:	B6@106.5
Remarks:			

ENGEO Incorporated

Unconsolidated Undrained Triaxial Test (ASTM D2850)

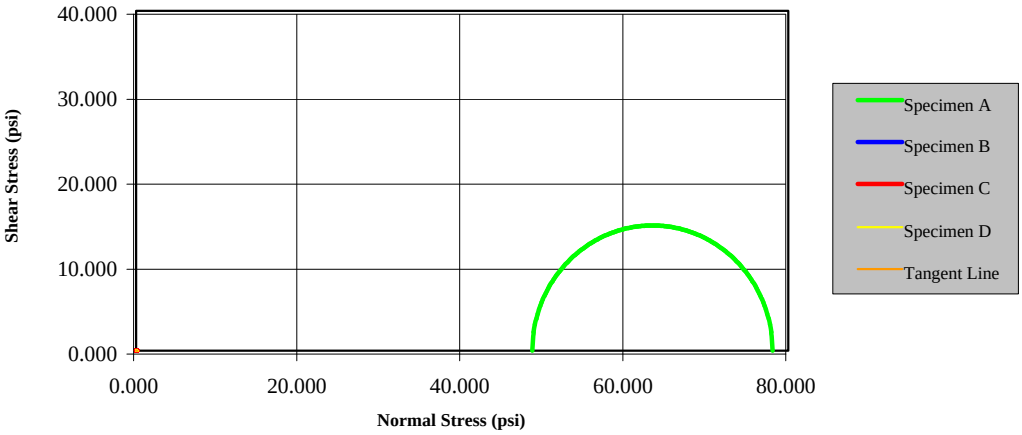
Date:

Checked By:

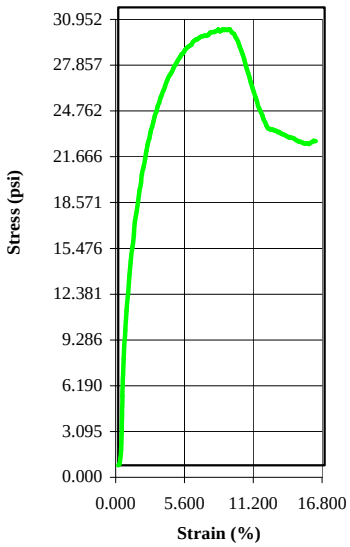
Date:

Tested By:

Mohr Circles



Stress-Strain Curve

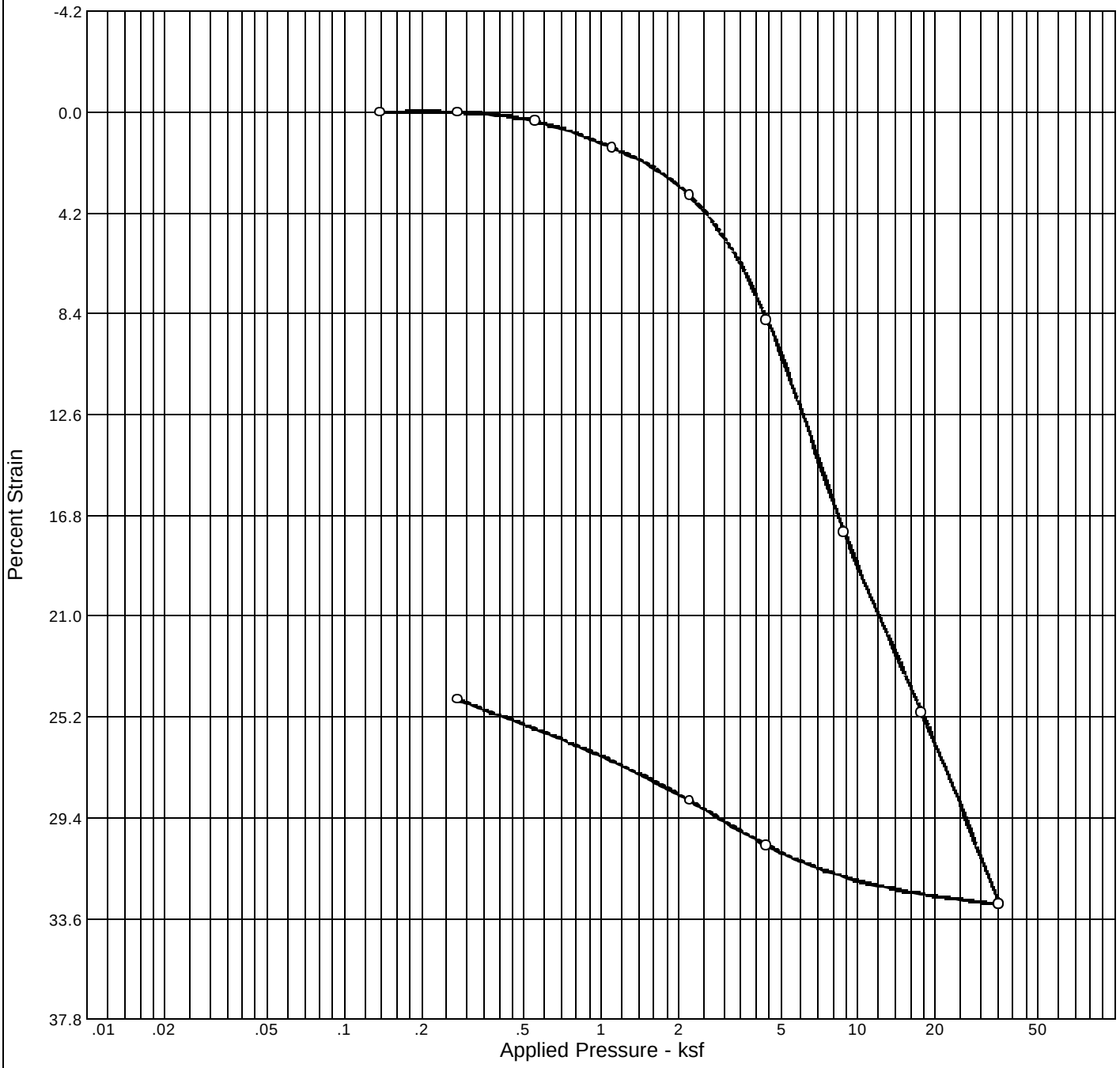


Before Test	Specimen A	B	C	D
Water Content (%)	54.36	0.00	0.00	0.00
Dry Density (pcf)	67.99	0.00	0.00	0.00
Saturation (%)	100.51	0.00	0.00	0.00
Void Ratio	1.43	0.00	0.00	0.00
Diameter (in)	2.420	0.000	0.000	0.000
Height (in)	4.900	0.000	0.000	0.000
Liquid Limit				
Plastic Limit				
Specific Gravity	2.650			
After Test	**A**	**B**	**C**	**D**
Water Content (%)	54.36	0.00	0.00	0.00
Test Data	**A**	**B**	**C**	**D**
Strain Rate (in/min)	0.04	0.00	0.00	0.00
Peak Deviator Stress (psi)	29.478	0.000	0.000	0.000
Axial Strain @ Failure (%)	8.510	0.000	0.000	0.000
	Cell Pressure			
Cell (psi)	48.6	0.0	0.0	0.0
Back (psi)	n/a	n/a	n/a	n/a
	Principle Stresses at Failure			
s 1 (psi)	78.1	0.0	0.0	0.0
s 3 (psi)	48.6	0.0	0.0	0.0

Mohr-Coulomb Strength Parameters		Sample Description
C (psi)	0.0	See Boring Log
Friction Angle Ø	0.00	

Project Information			
Project Name:	Candlestick Park		
Project Number:	8472.000.001	Job Number:	8472.000.001
Location:		Boring Number:	B6
Client:		Sample Number:	B6 @ 151
Remarks:			

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
100.2 %	64.6 %	61.8	88	55	2.73	CH		1.759

MATERIAL DESCRIPTION

Dark greenish gray CLAY.

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

Source: **Sample No.:** B6 @ 47

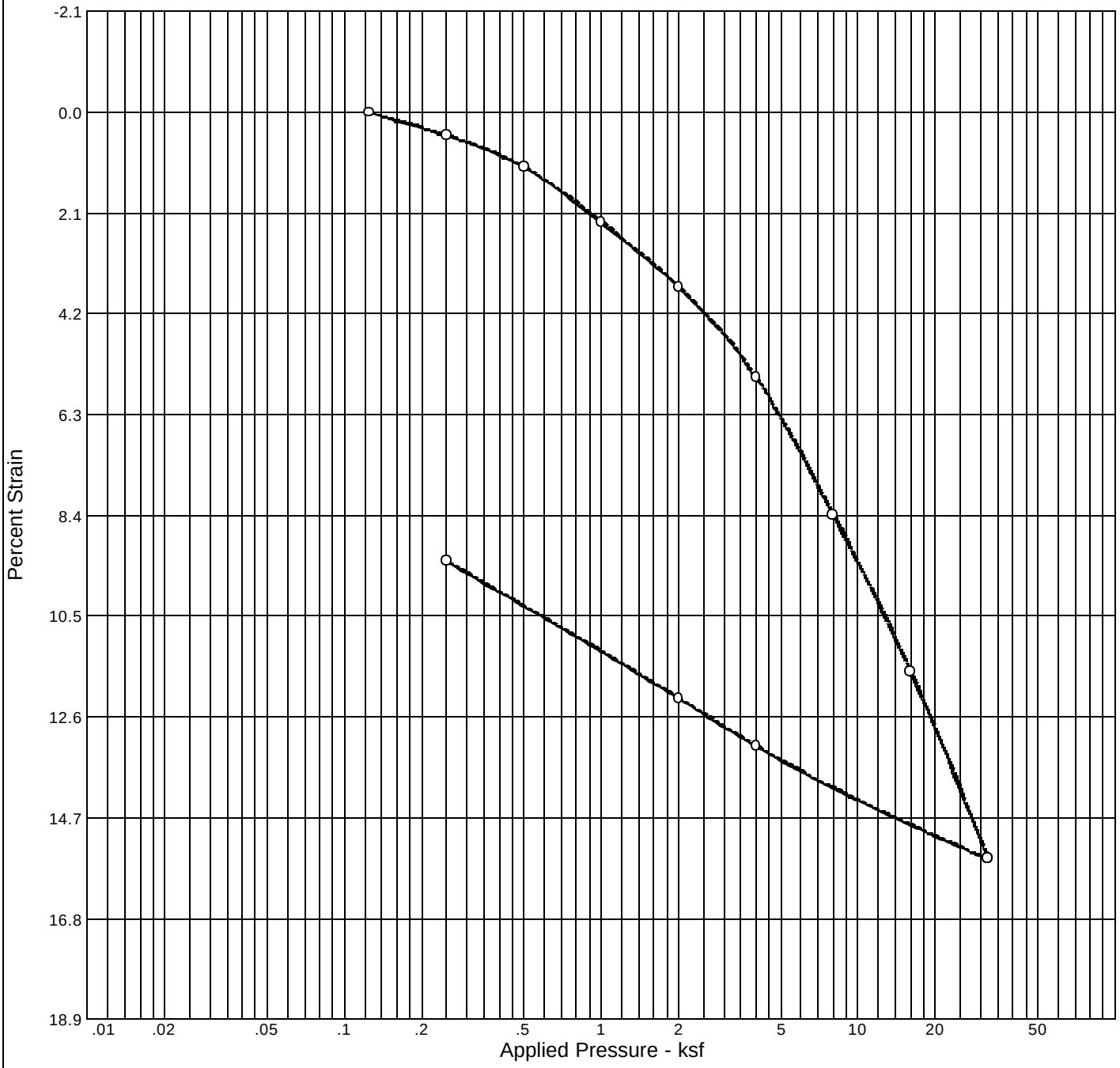
Remarks:

ENGEO INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Plate

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.4 %	22.7 %	101.8	38	23	2.60	CL		0.595

MATERIAL DESCRIPTION

Dark greenish gray silty CLAY.

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

Source: **Sample No.:** B6 @ 66.5

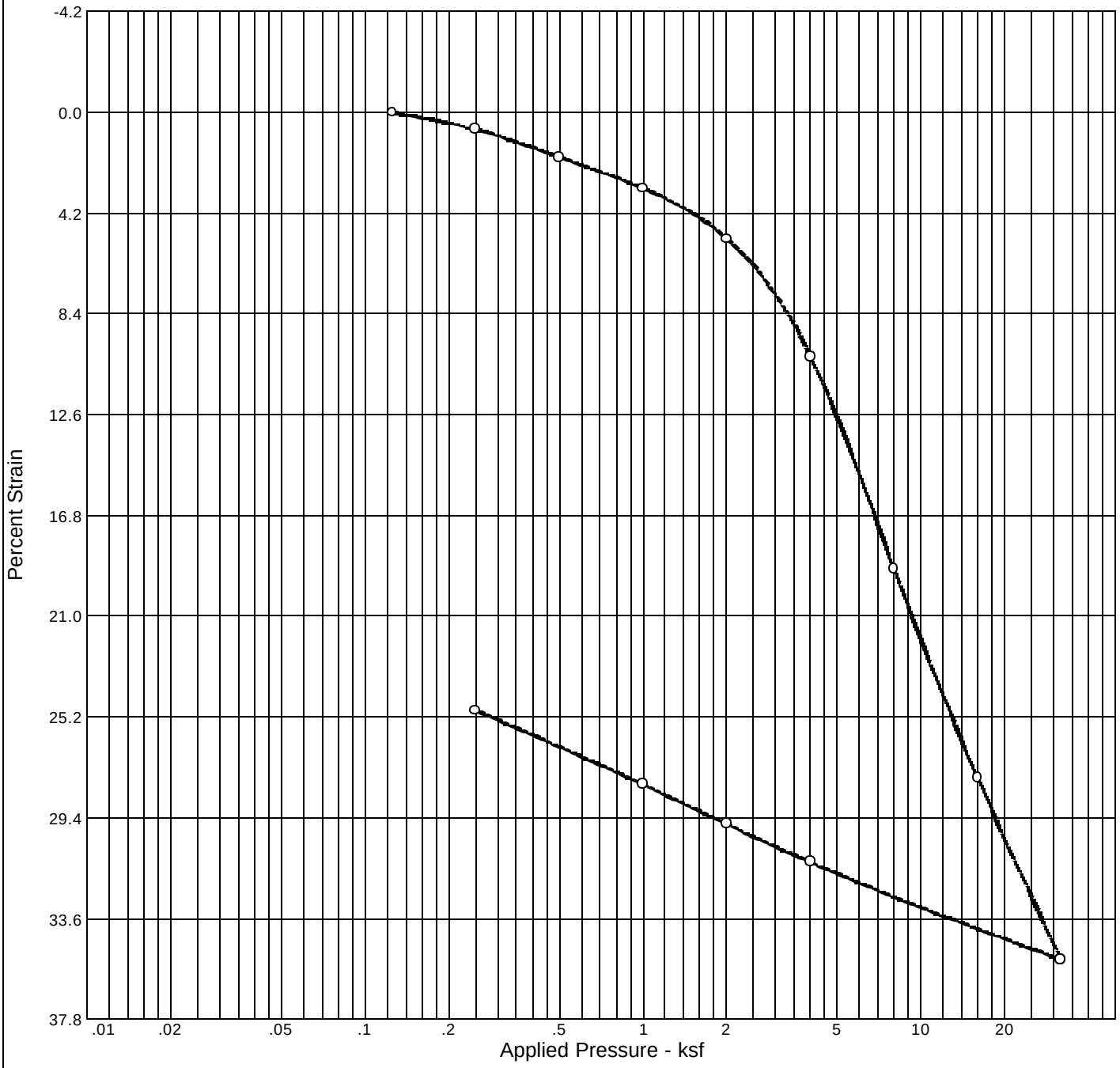
ENGEO INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Plate

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.6 %	74.0 %	55.9			2.67			1.983

MATERIAL DESCRIPTION

Very dark gray CLAY

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

Source: **Sample No.:** B7 @ 26

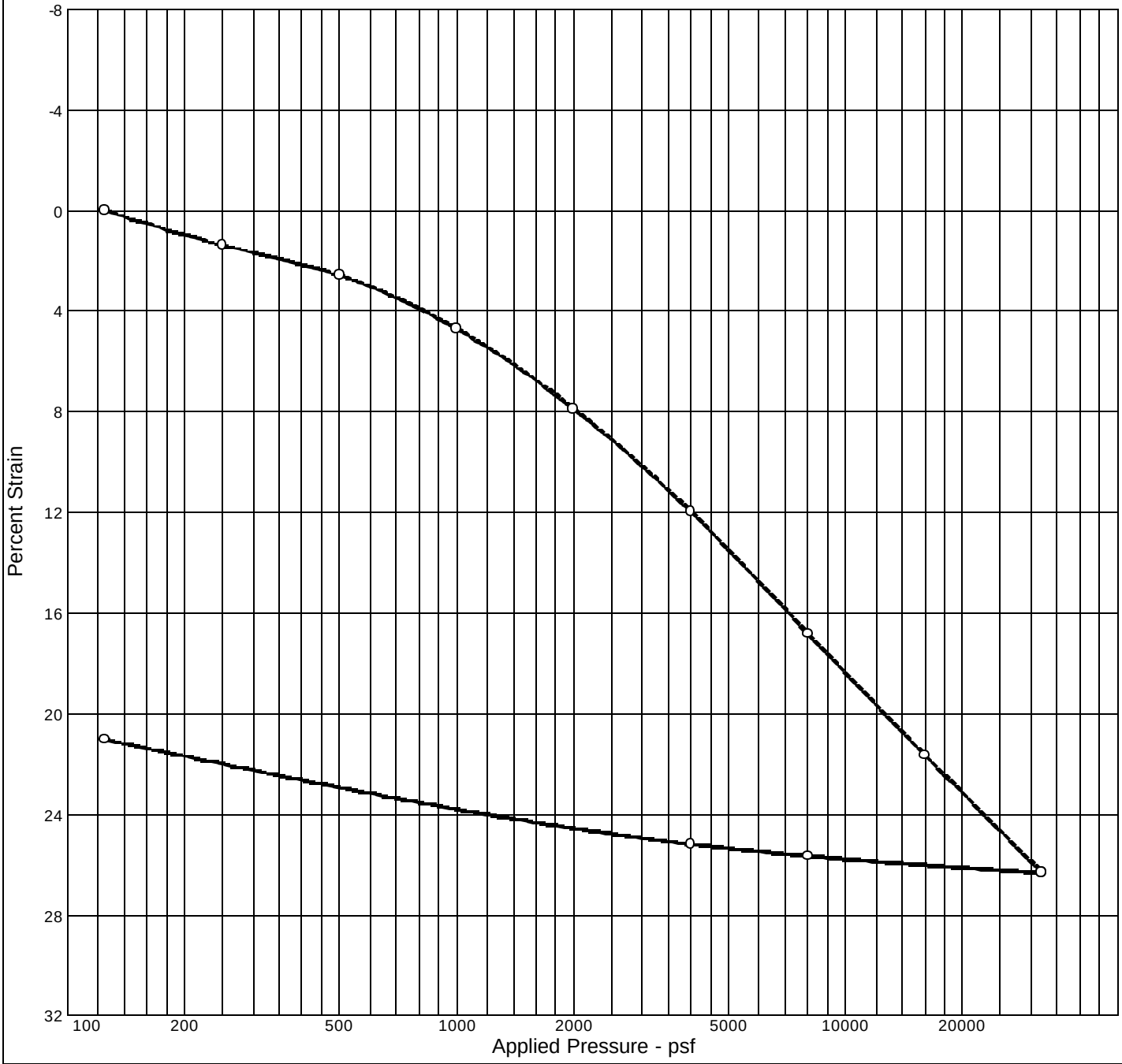
ENGEO INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Plate

CONSOLIDATION TEST REPORT



Natural		Dry Dens.	LL	PI	Sp.	Overburden	P_c	C_c	C_r	Swell Press.	Swell	e_o
Sat.	Moist.	(pcf)			Gr.	(psf)	(psf)			(psf)	%	
			61	38	2.40	125	1075					

MATERIAL DESCRIPTION	USCS	AASHTO
Greenish gray CLAY. (abundant shell fragments)	CH	

Project No. 8742.000.001 **Client:**

Project: Hunters Point, Phase II - San Francisco, CA

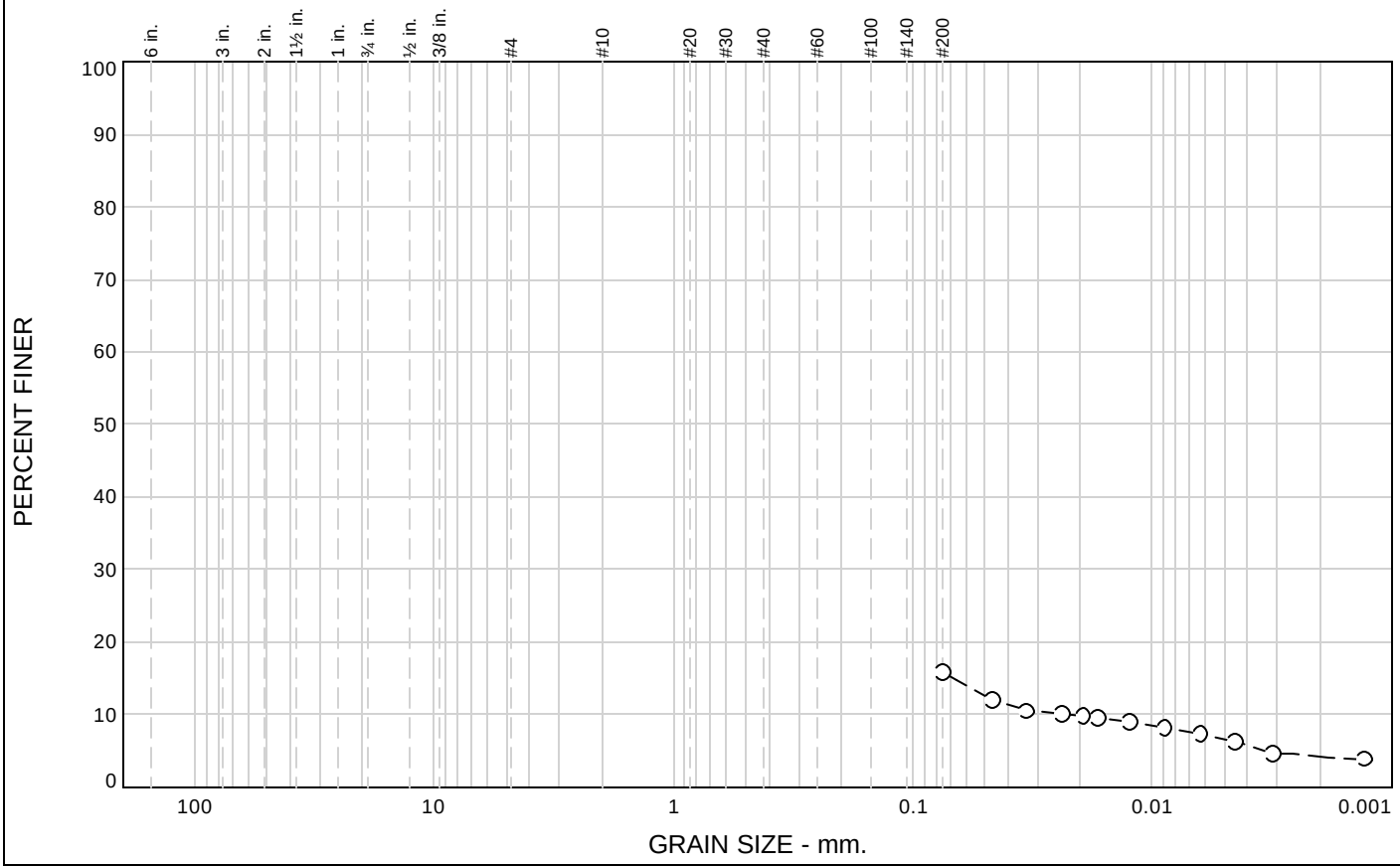
Source: **Sample No.:** B8 @ 43.5

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Plate

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						11.6	4.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	15.8		

* (no specification provided)

Material Description

Brown silty SAND with gravel.

Atterberg Limits

PL= 28 LL= 29 PI= 1

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= 0.0684 D_{10}= 0.0216
C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

28.9% retained on #4 sieve

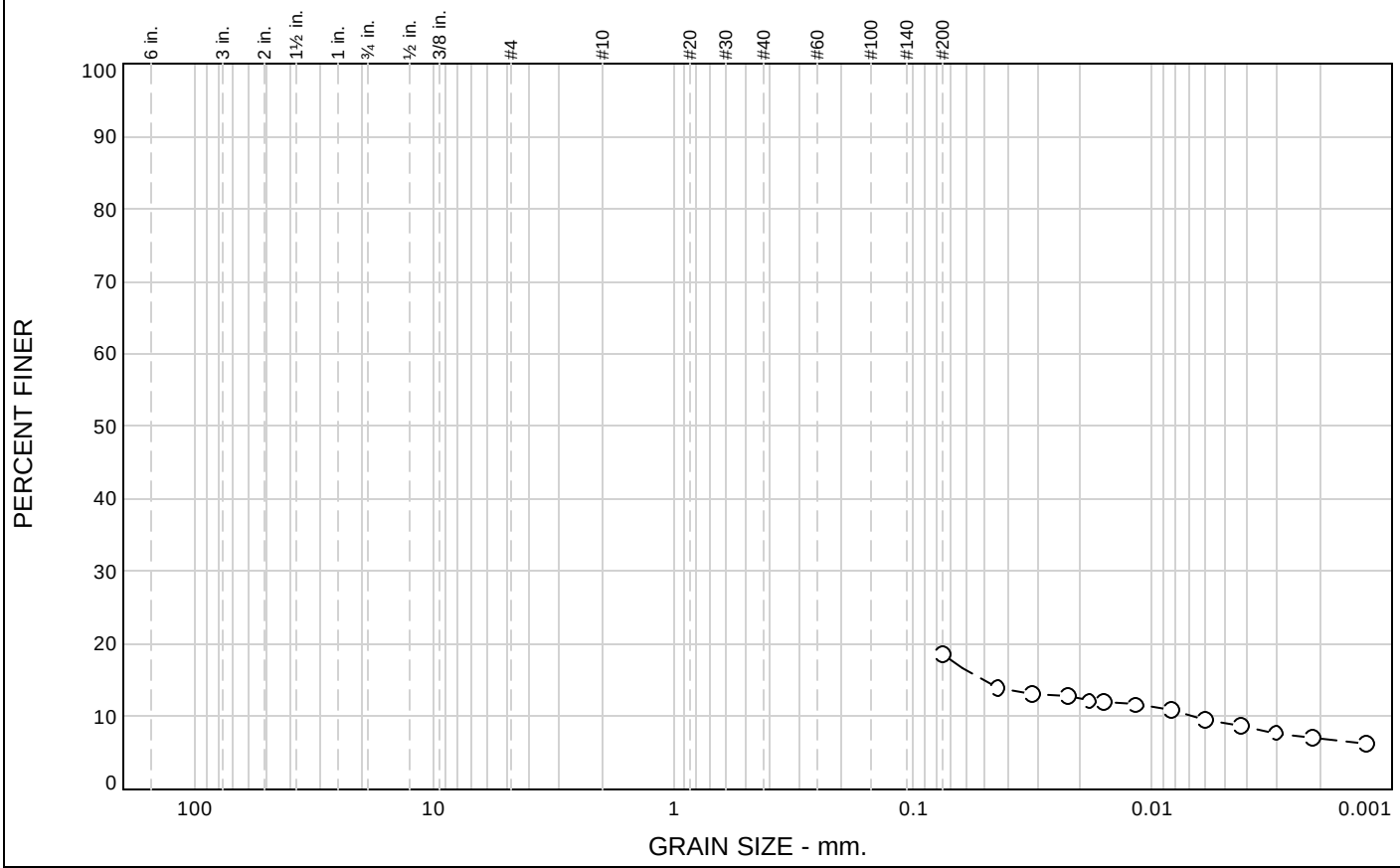
Sample Number: B2 @ 14 **Date:** 02/18/10

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: CandleStick Park
Project No: 8472.000.001 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						11.6	7.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	18.6		

* (no specification provided)

Material Description

Dark brown clayey GRAVEL with sand.

Atterberg Limits

PL= 15 LL= 31 PI= 16

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= 0.0521 D_{10}= 0.0068
C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

42.5% retained on #4 sieve

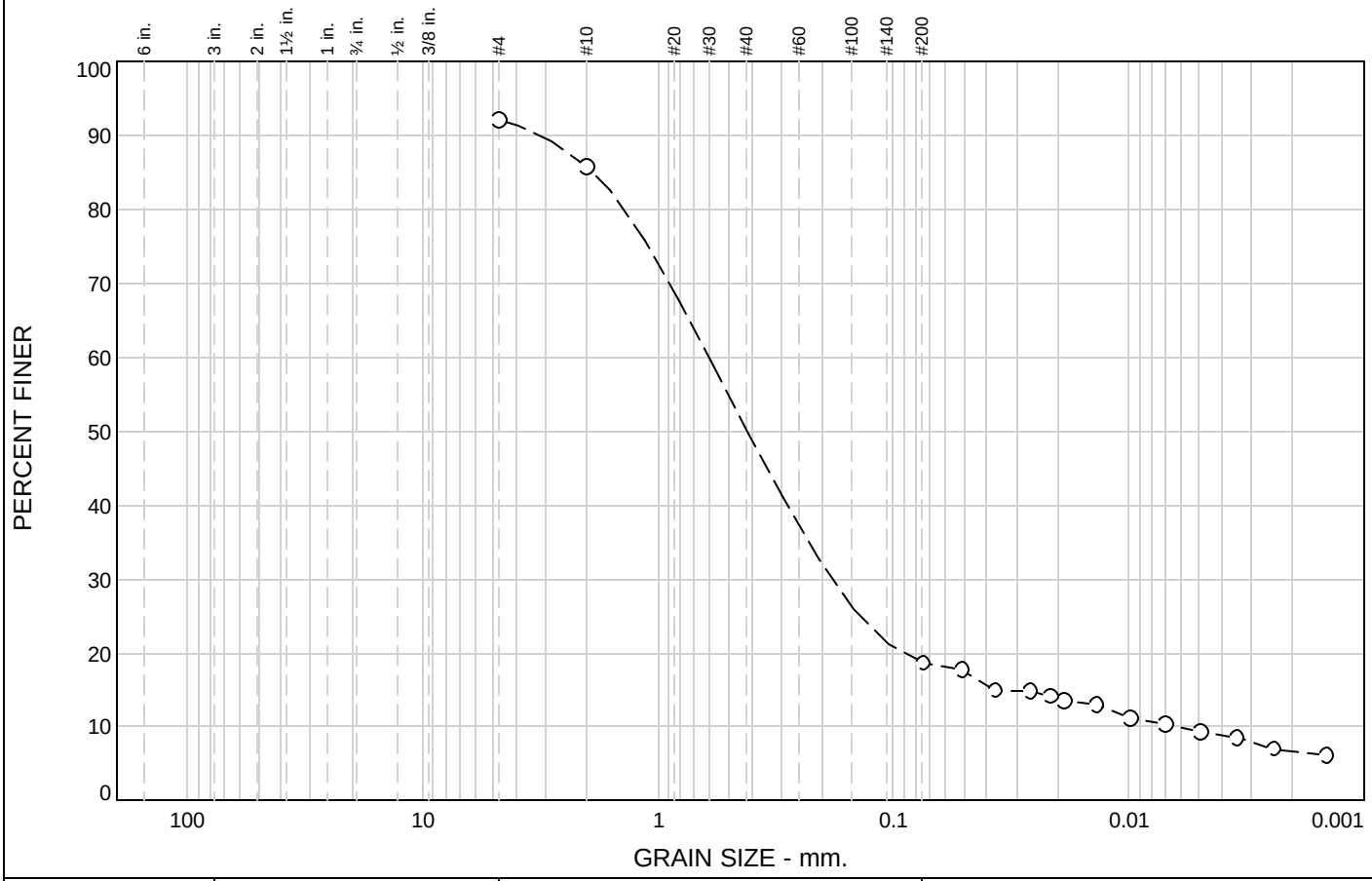
Sample Number: B3 @ 14 **Date:** 02/17/10

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: CandleStick Park
Project No: 8472.000.001 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			6.4	35.1	31.9	12.1	6.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	92.1		
#10	85.7		
#200	18.7		

* (no specification provided)

Material Description

Dark greenish gray silty SAND.

Atterberg Limits

PL= 17 LL= 15 PI= NP

Coefficients

D_{85}= 1.8937 D_{60}= 0.6029 D_{50}= 0.4156
D_{30}= 0.1833 D_{15}= 0.0371 D_{10}= 0.0062
C_u= 97.95 C_c= 9.05

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample Number: B3 @ 62 **Date:** 01/05/10

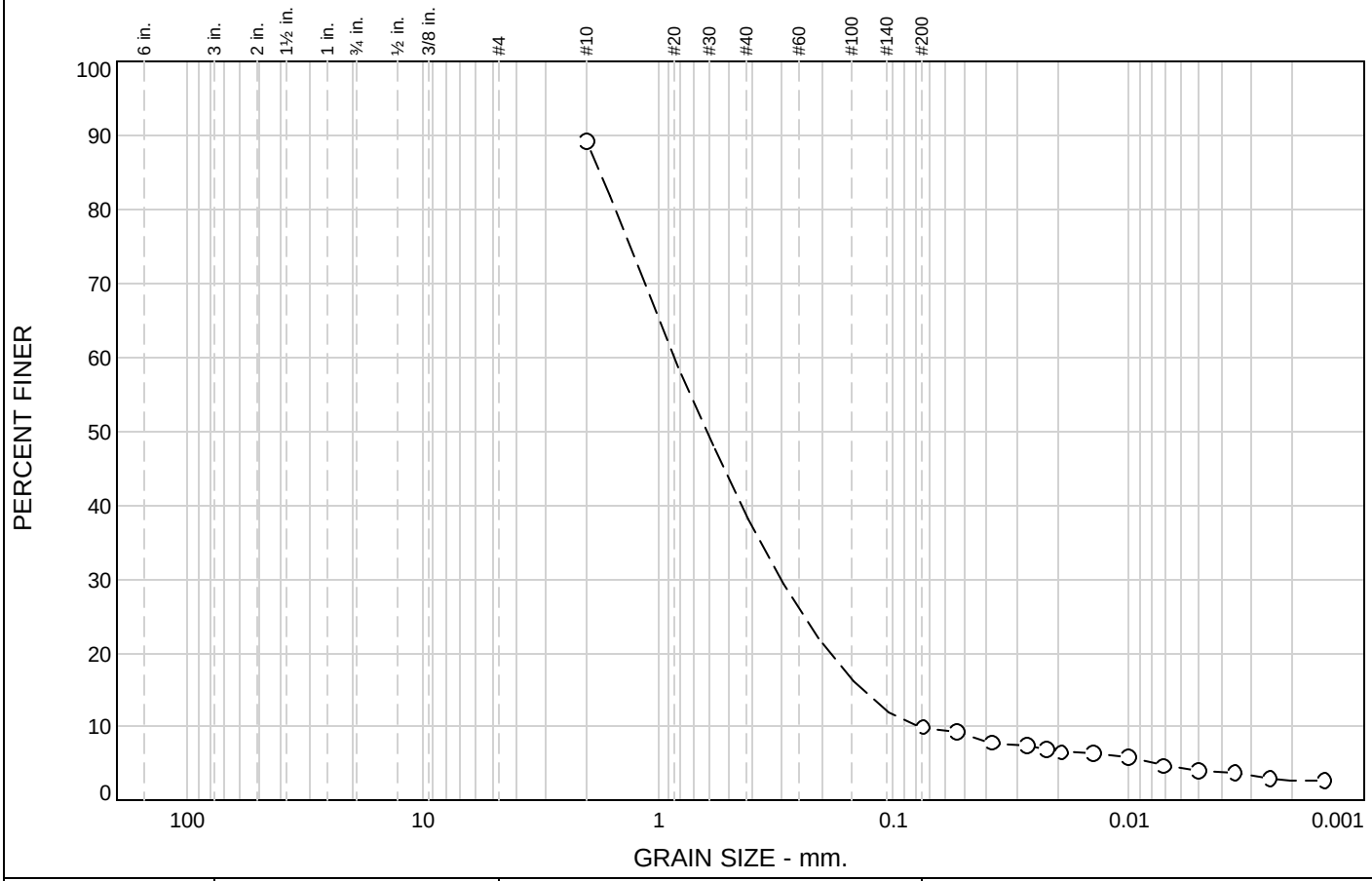
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
				50.3	29.0	7.2	2.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	89.3		
#200	10.0		

* (no specification provided)

Material Description

Dark grayish brown SAND with silt.

Atterberg Limits

PL= 20 LL= 10 PI= NP

Coefficients

D_{85}= 1.7689 D_{60}= 0.8474 D_{50}= 0.6183
D_{30}= 0.3003 D_{15}= 0.1370 D_{10}= 0.0753
C_u= 11.25 C_c= 1.41

Classification

USCS= SW-SM AASHTO= A-1-b

Remarks

Sample Number: B4 @ 121.5 **Date:** 01/04/10

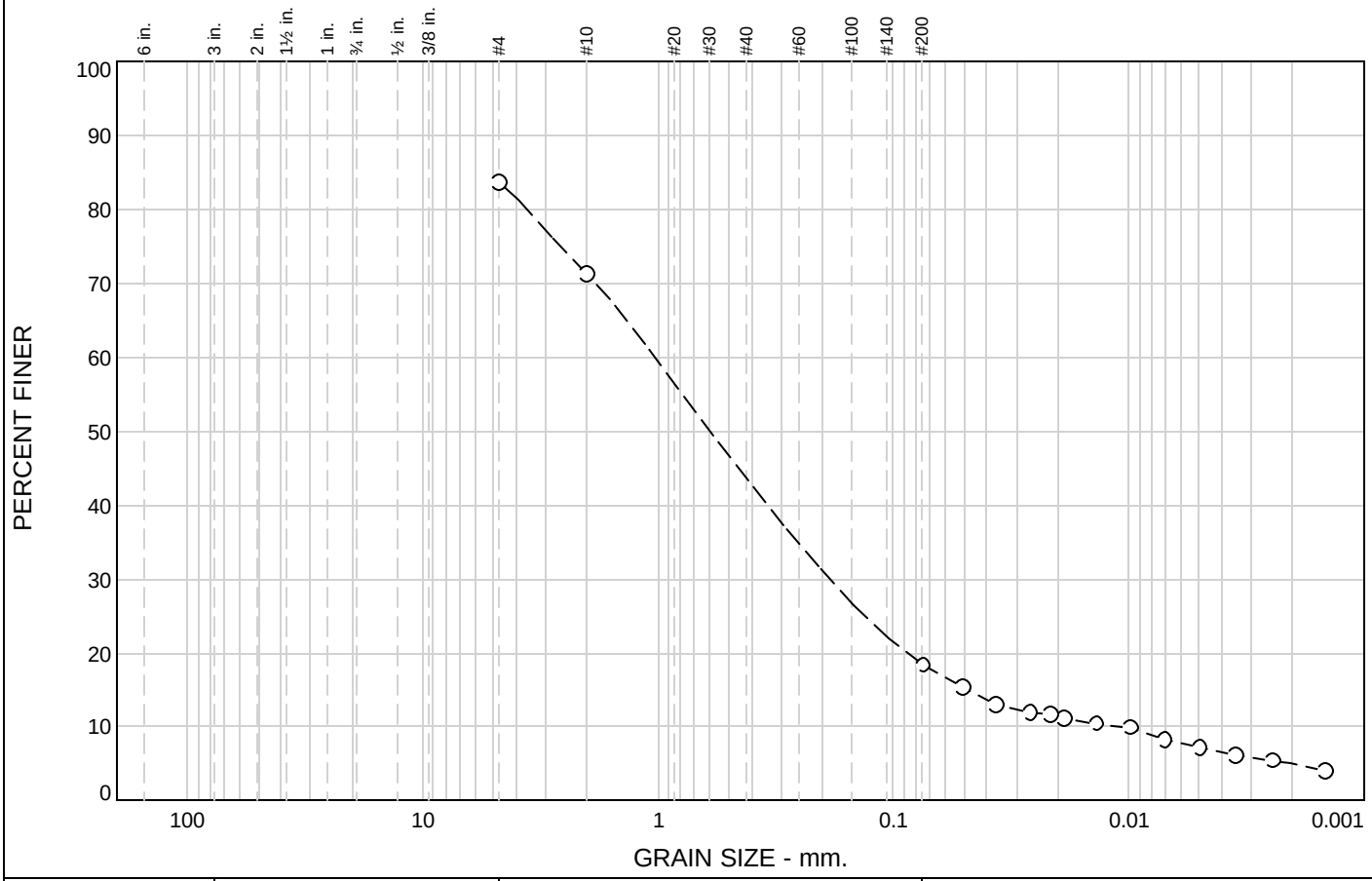
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			12.4	27.5	25.3	13.5	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	83.7		
#10	71.3		
#200	18.5		

* (no specification provided)

Material Description

Dark yellowish brown silty SAND with gravel.

Atterberg Limits

PL= 25 LL= 21 PI= NP

Coefficients

D_{85}= D_{60}= 1.0309 D_{50}= 0.5958
D_{30}= 0.1878 D_{15}= 0.0489 D_{10}= 0.0099
C_u= 104.20 C_c= 3.46

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sample Number: B5 @ 11 **Date:** 01/05/10

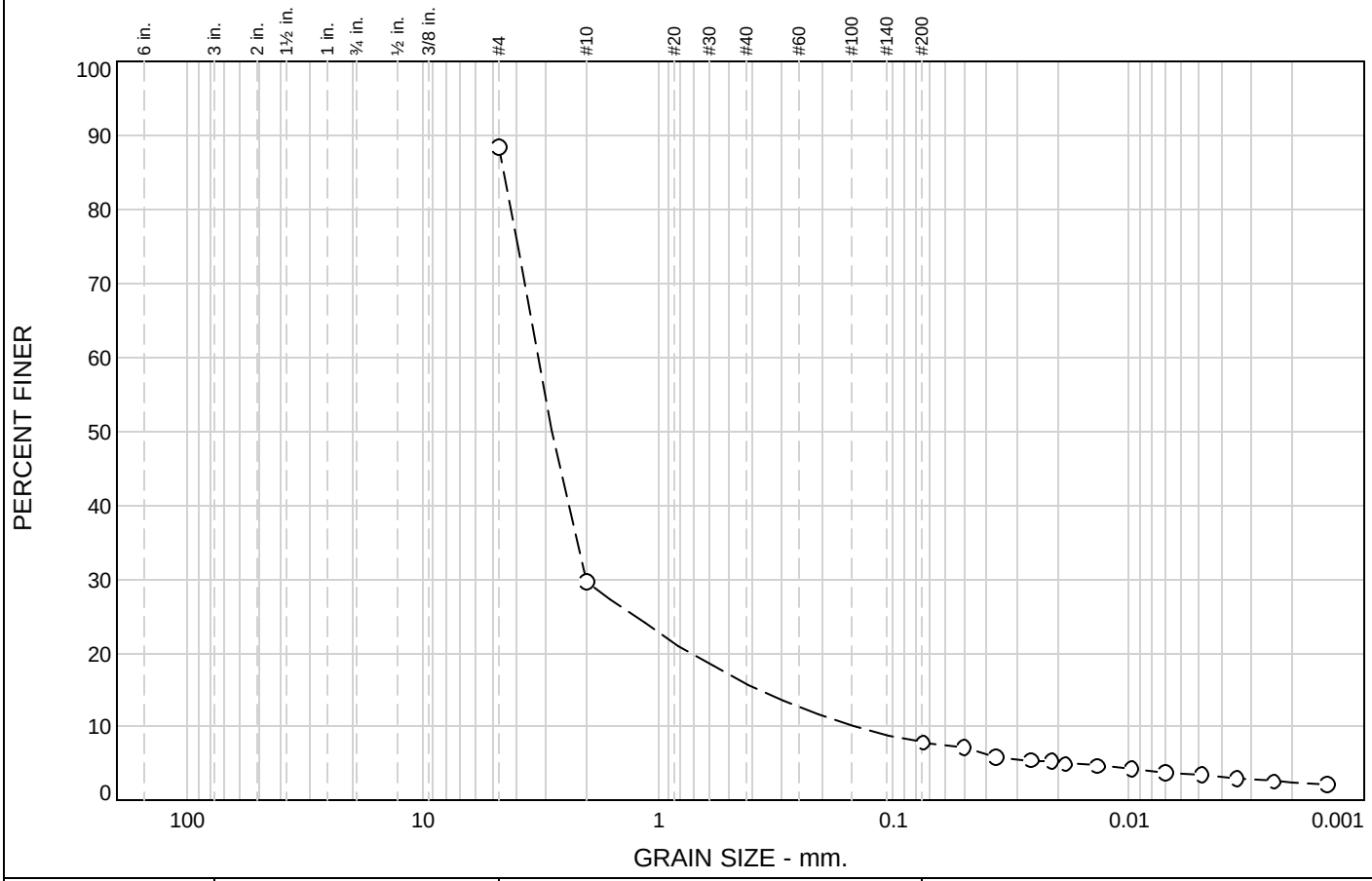
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			58.9	13.7	8.0	5.4	2.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	88.5		
#10	29.6		
#200	7.9		

* (no specification provided)

Material Description

Dark grayish brown silty SAND.

Atterberg Limits

PL= 18 LL= 21 PI= 3

Coefficients

D_{85}= 4.5374 D_{60}= 3.2339 D_{50}= 2.7988
D_{30}= 2.0143 D_{15}= 0.3701 D_{10}= 0.1433
C_u= 22.56 C_c= 8.75

Classification

USCS= SP-SM AASHTO= A-1-a

Remarks

Sample Number: B5 @ 20 **Date:** 01/05/10

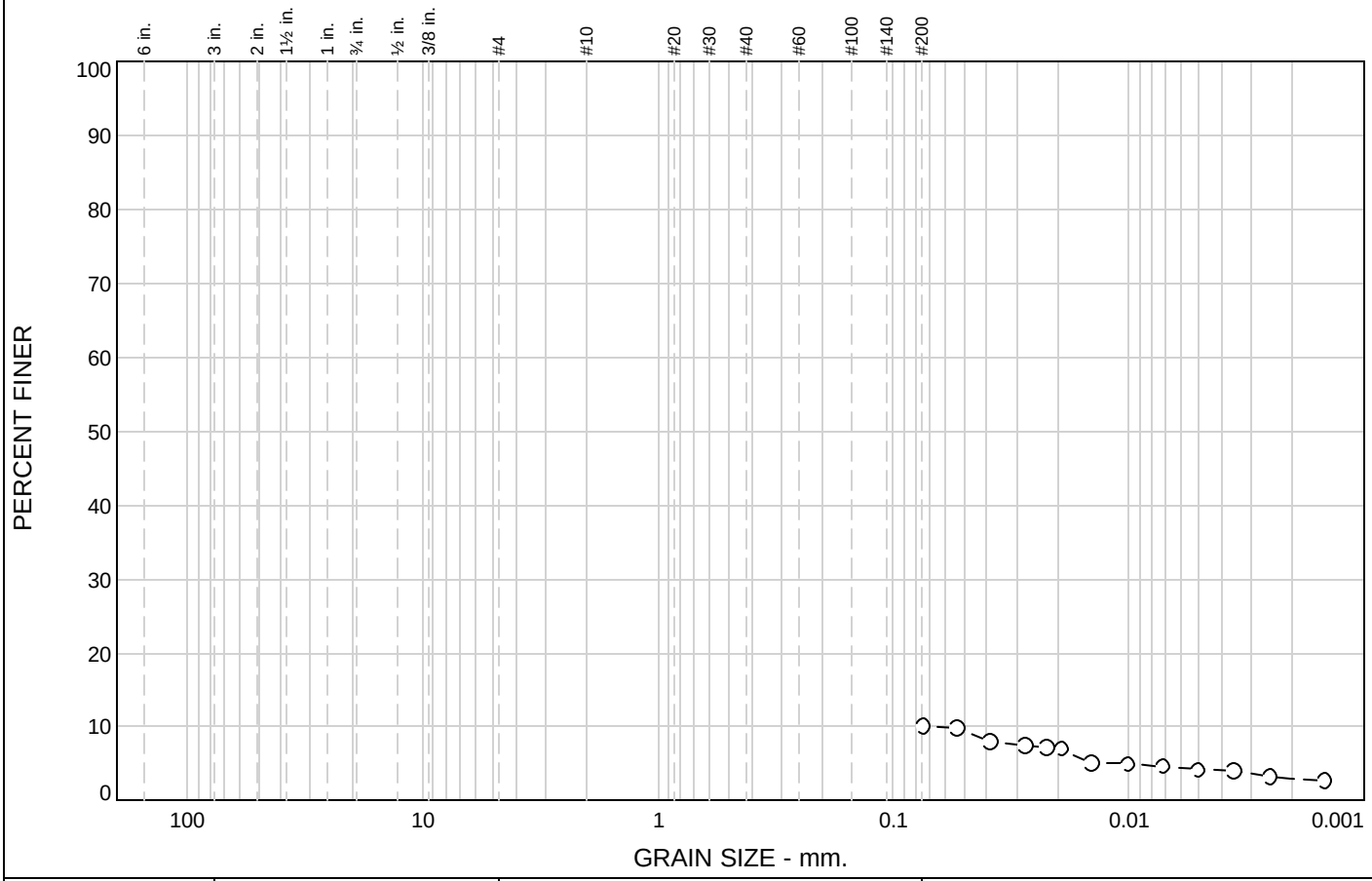
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						7.3	2.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	10.2		

* (no specification provided)

Material Description

Brown SAND with silt.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}= 0.0602
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

Sample Number: B5 @ 23 **Date:** 01/04/10

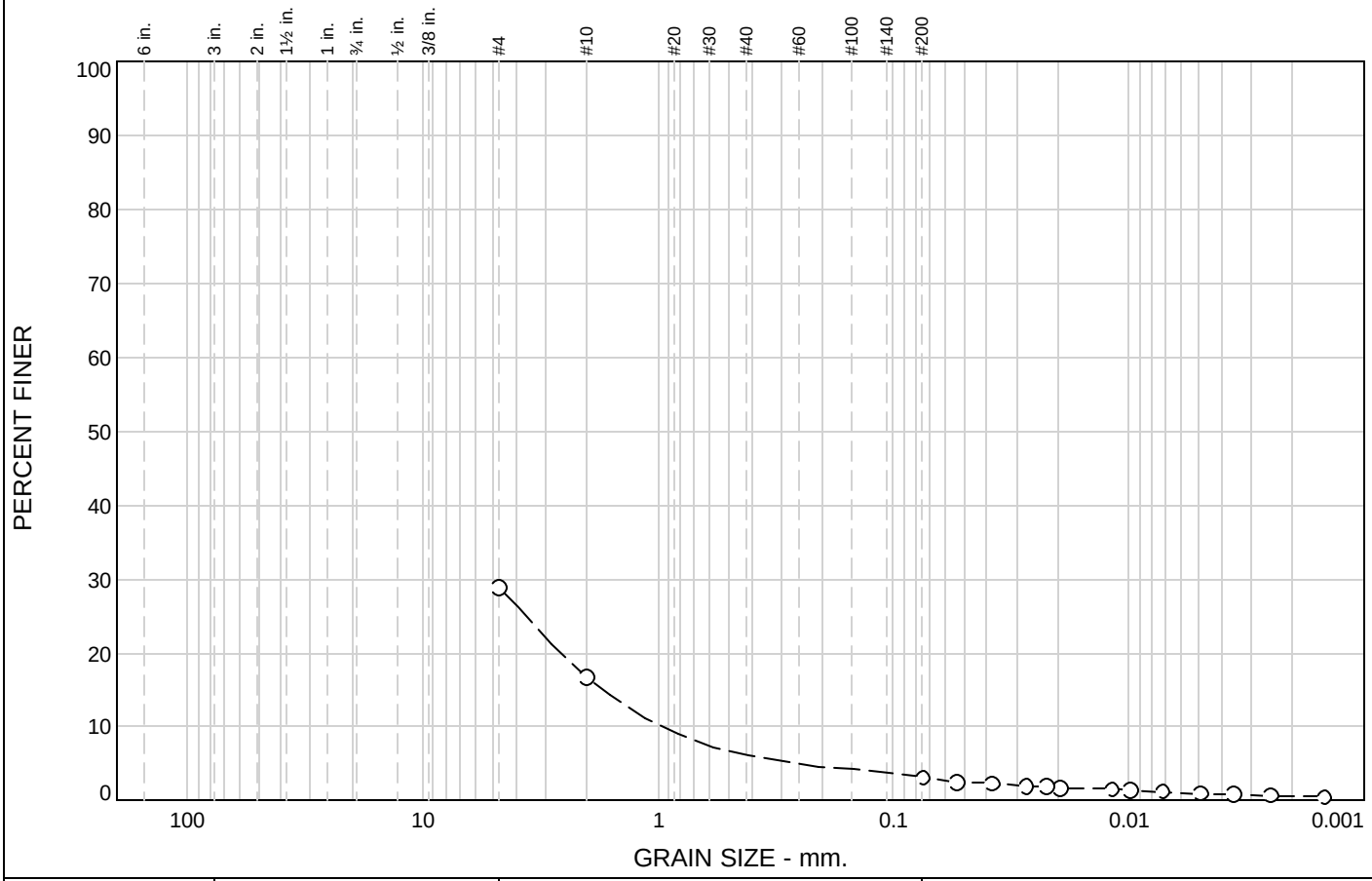
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			12.2	10.5	3.1	2.4	0.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	28.9		
#10	16.7		
#200	3.1		

* (no specification provided)

Material Description

Very dark grayish brown Recycled AB grading to GRAVEL with sand.

Atterberg Limits

PL= 35 LL= 26 PI= NP

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= 1.7206 D_{10}= 0.9592
C_u= C_c=

Classification

USCS= GP AASHTO= A-1-a

Remarks

Hydrometer test performed on gravel portion of sample.

Sample Number: B6 @ 10 **Date:** 01/05/10

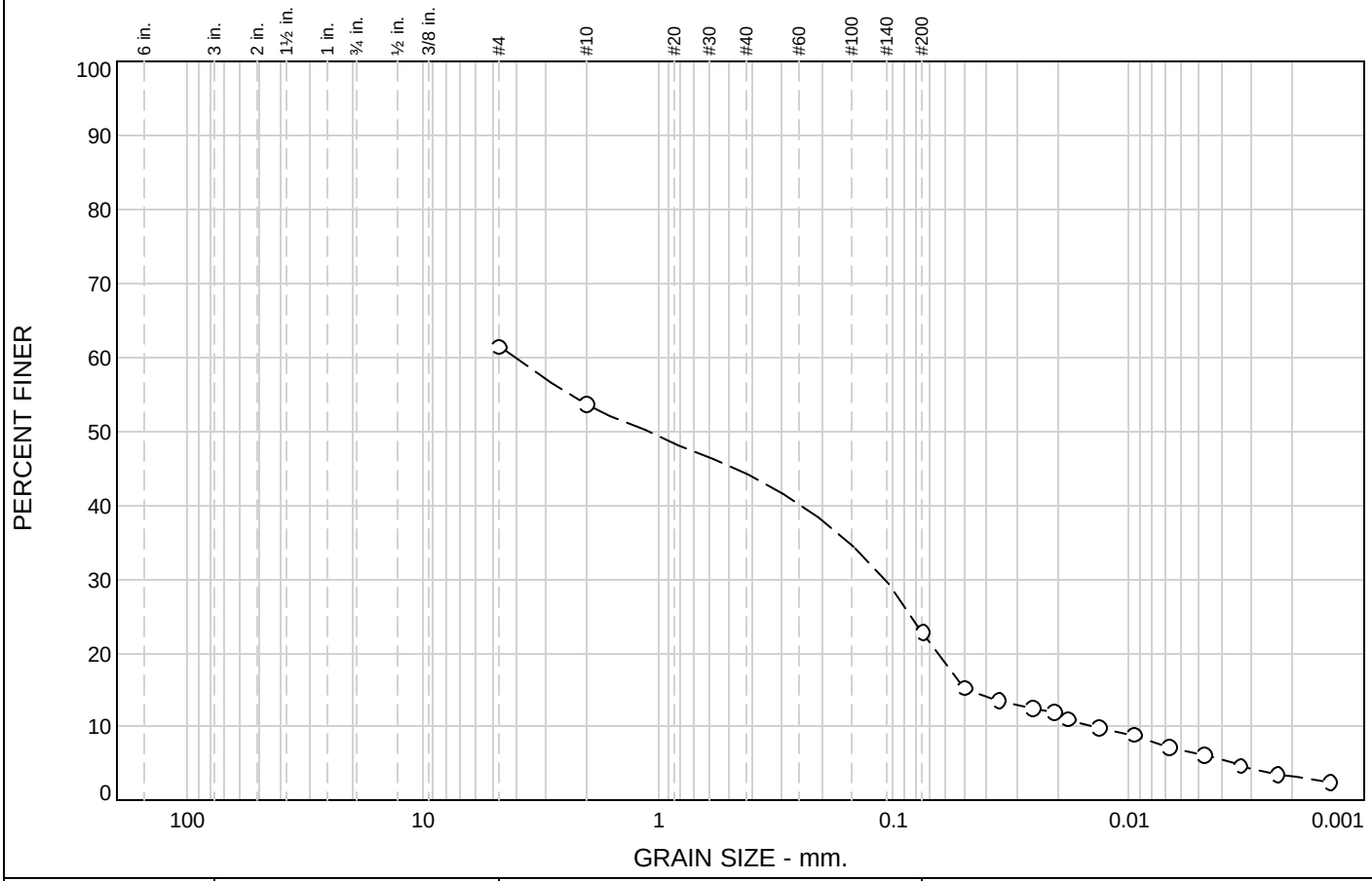
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			7.7	9.3	21.6	19.6	3.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	61.4		
#10	53.7		
#200	22.8		

* (no specification provided)

Material Description

Dark grayish brown clayey GRAVEL with sand.

Atterberg Limits

PL= 18 LL= 26 PI= 8

Coefficients

D_{85}= D_{60}= 4.1068 D_{50}= 1.1338
D_{30}= 0.1104 D_{15}= 0.0487 D_{10}= 0.0143
C_u= 286.56 C_c= 0.21

Classification

USCS= GC AASHTO= A-2-4(0)

Remarks

Sample Number: B7 @ 16 **Date:** 01/05/10

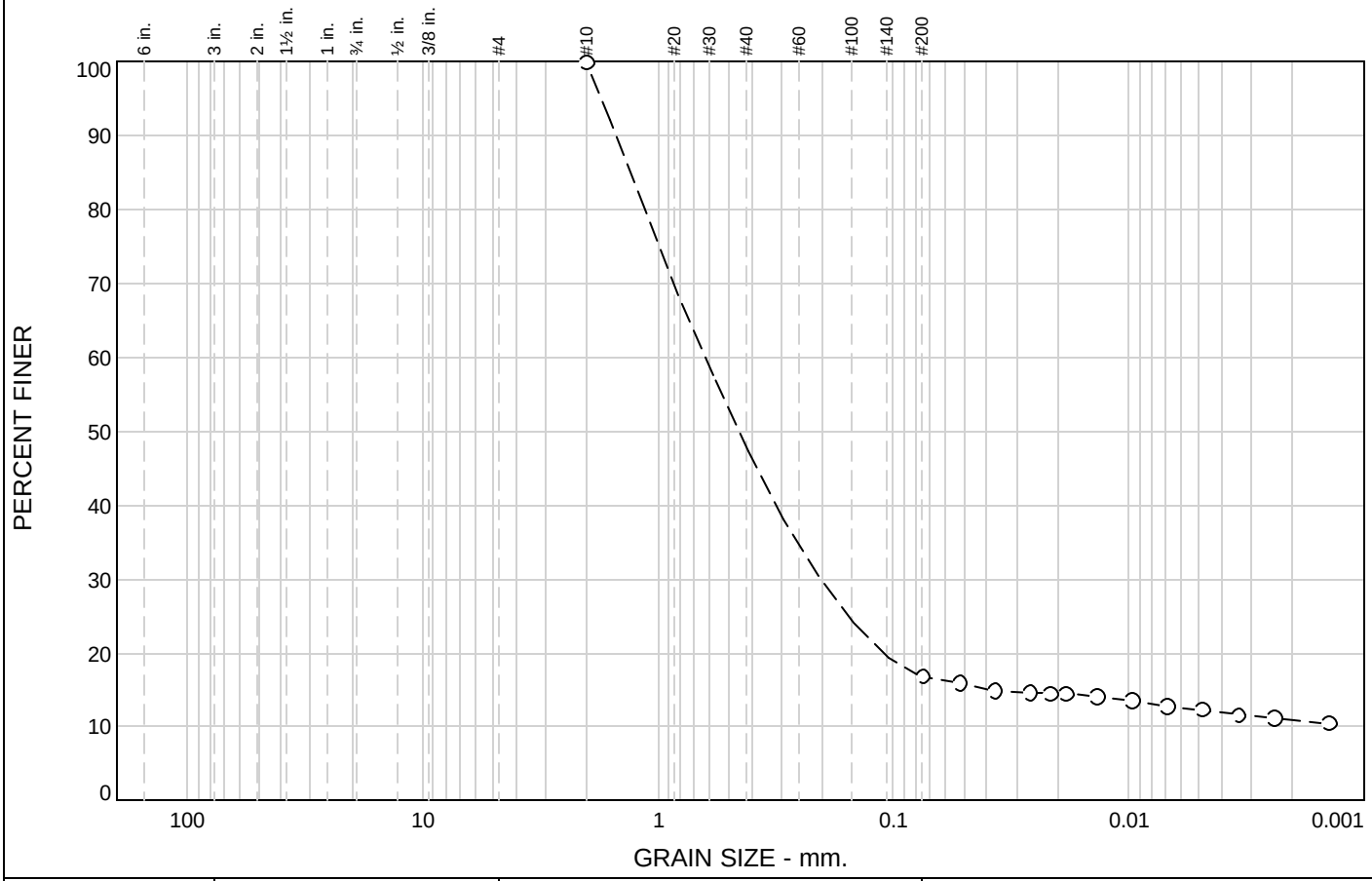
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
				51.7	31.3	5.9	10.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	99.8		
#200	16.8		

* (no specification provided)

Material Description

Dark yellowish brown silty SAND.

Atterberg Limits

PL= 19 LL= 19 PI= NP

Coefficients

D_{85}= 1.3168 D_{60}= 0.6281 D_{50}= 0.4530
D_{30}= 0.2055 D_{15}= 0.0401 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sample Number: B7 @ 39 **Date:** 01/04/10

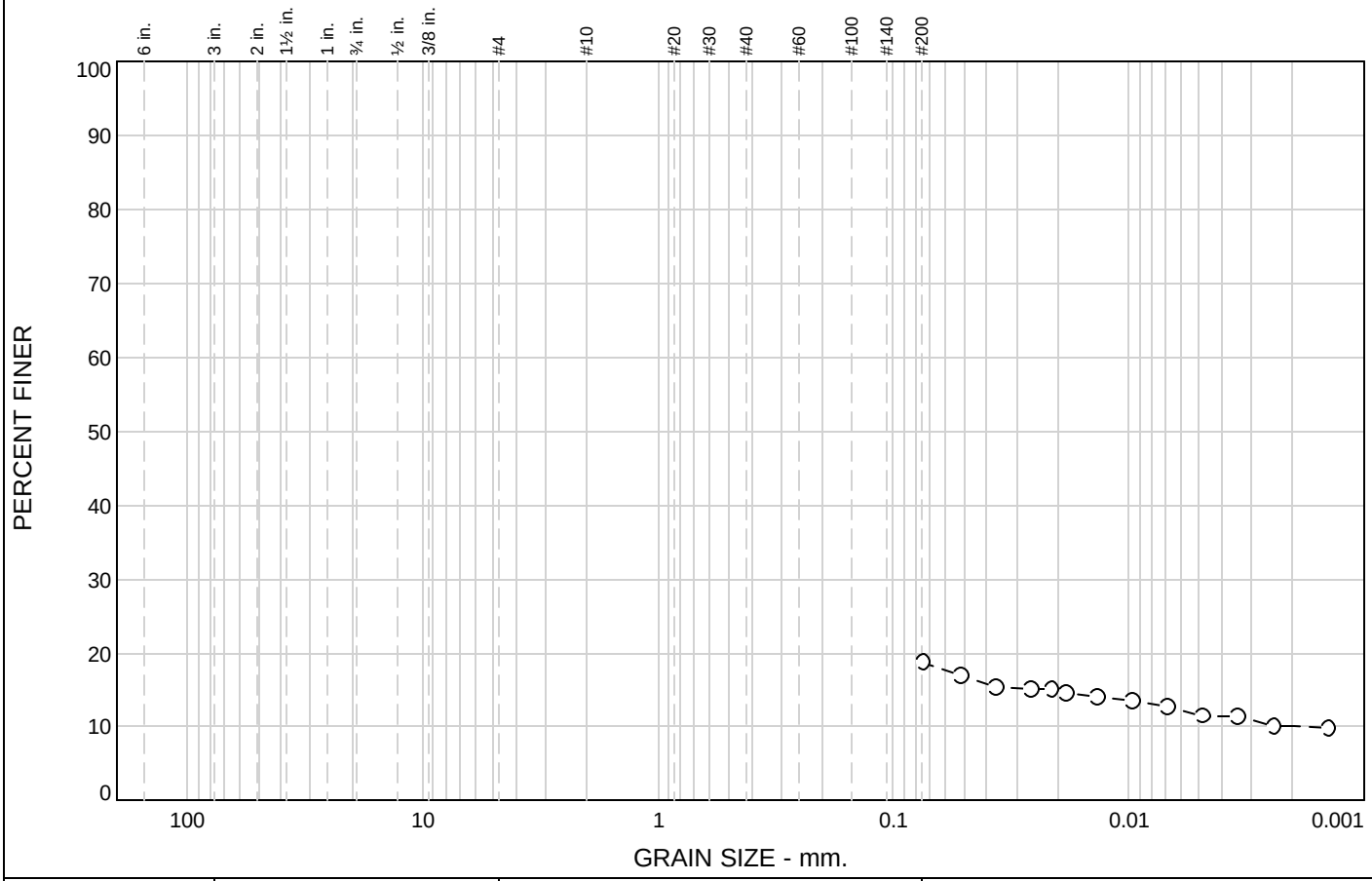
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						8.7	10.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	18.8		

* (no specification provided)

Material Description

Dark yellowish brown silty SAND.

Atterberg Limits

PL= 18 LL= 18 PI= NP

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= 0.0208 D_{10}= 0.0018
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample Number: B7 @ 42 **Date:** 01/04/10

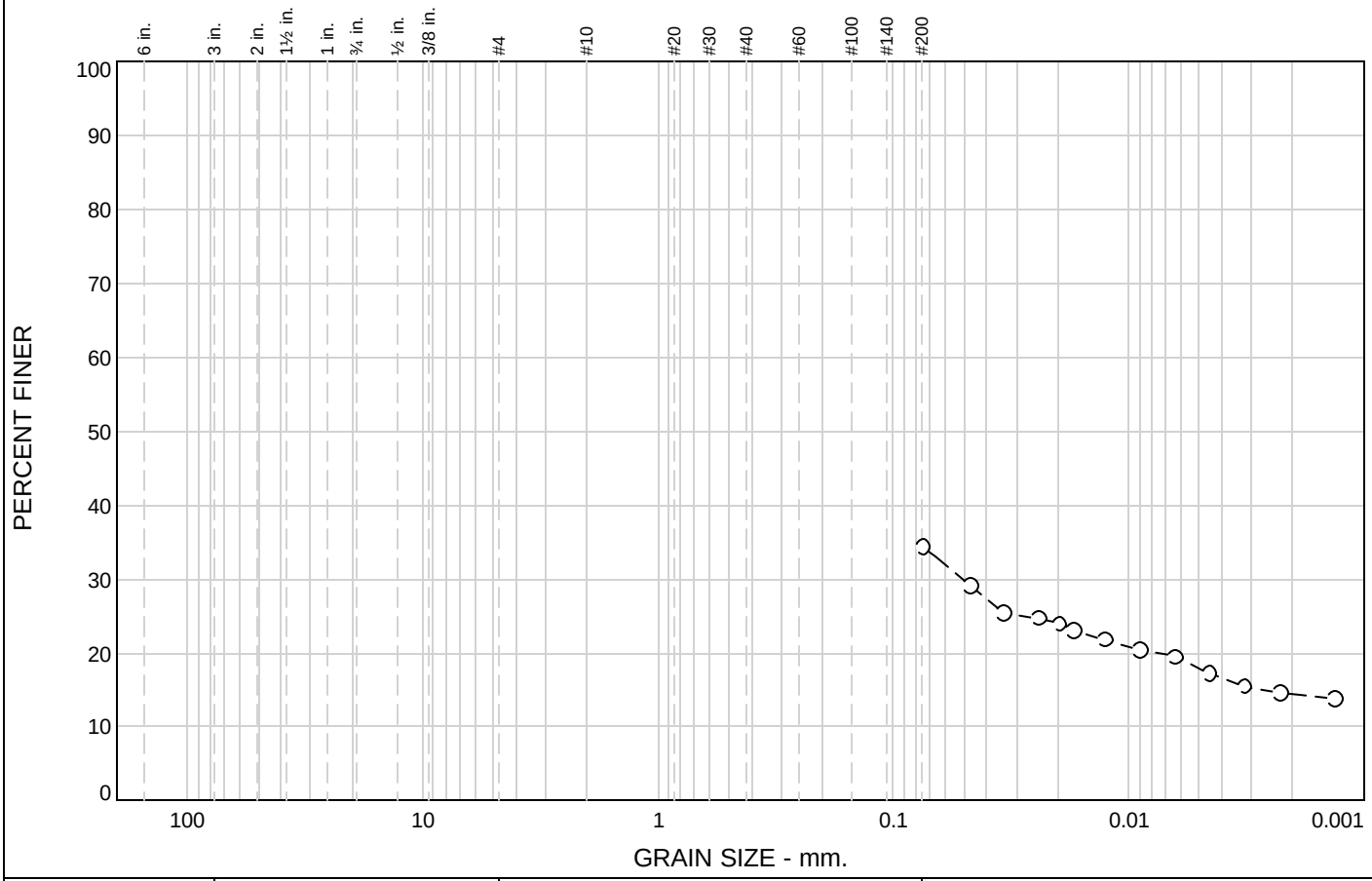
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						20.0	14.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	34.3		

* (no specification provided)

Material Description

Dark grayish brown clayey SAND.

Atterberg Limits

PL= 17 LL= 24 PI= 7

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= 0.0509 D_{15}= 0.0027 D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

Sample Number: B7 @ 45 **Date:** 01/04/10

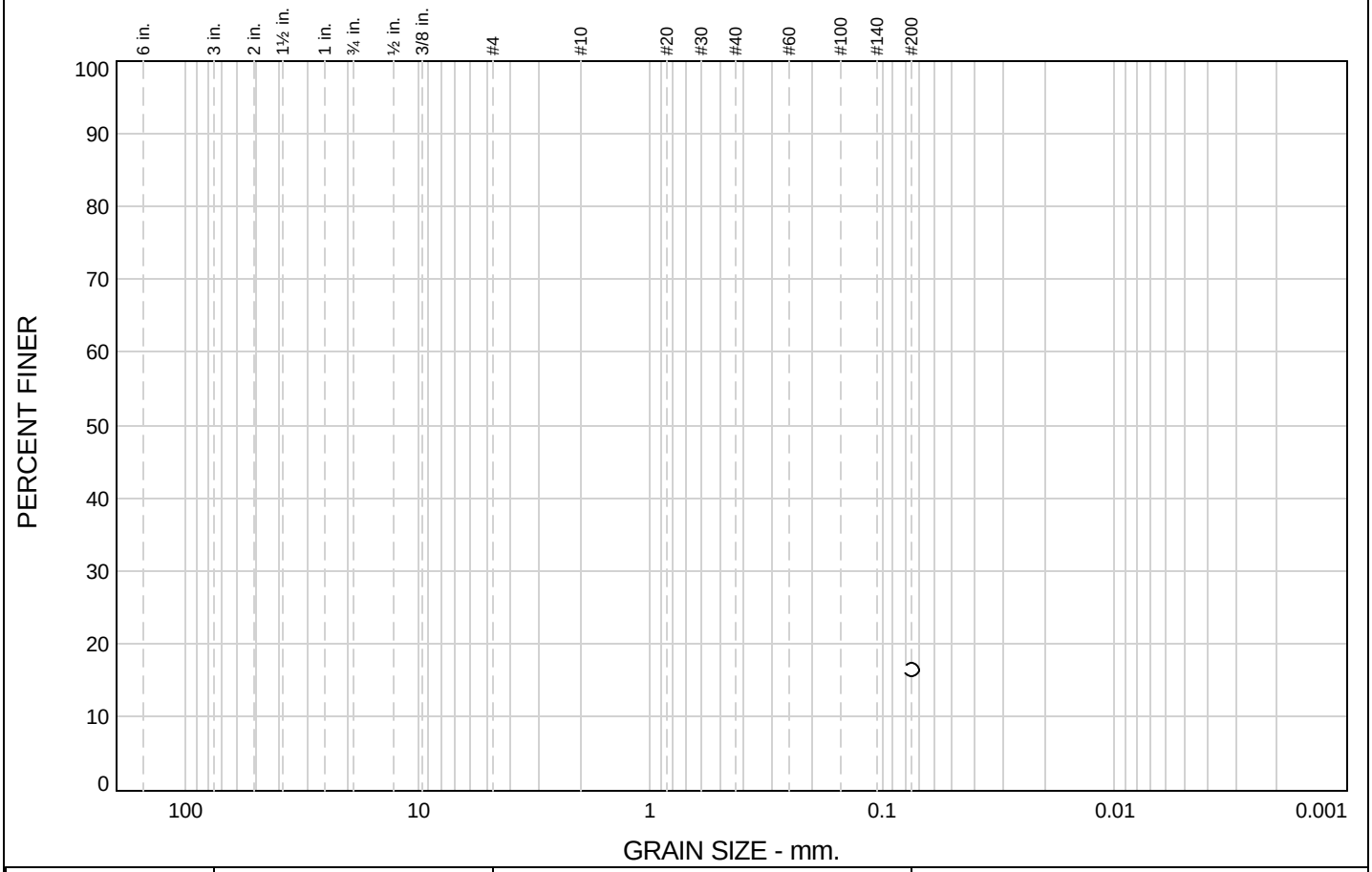
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						16.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	16.5		

* (no specification provided)

Material Description

Reddish brown Gravelwith sand.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

30.2% retained on #4 sieve

Sample Number: B2 @ 29 **Date:** 10/04/10

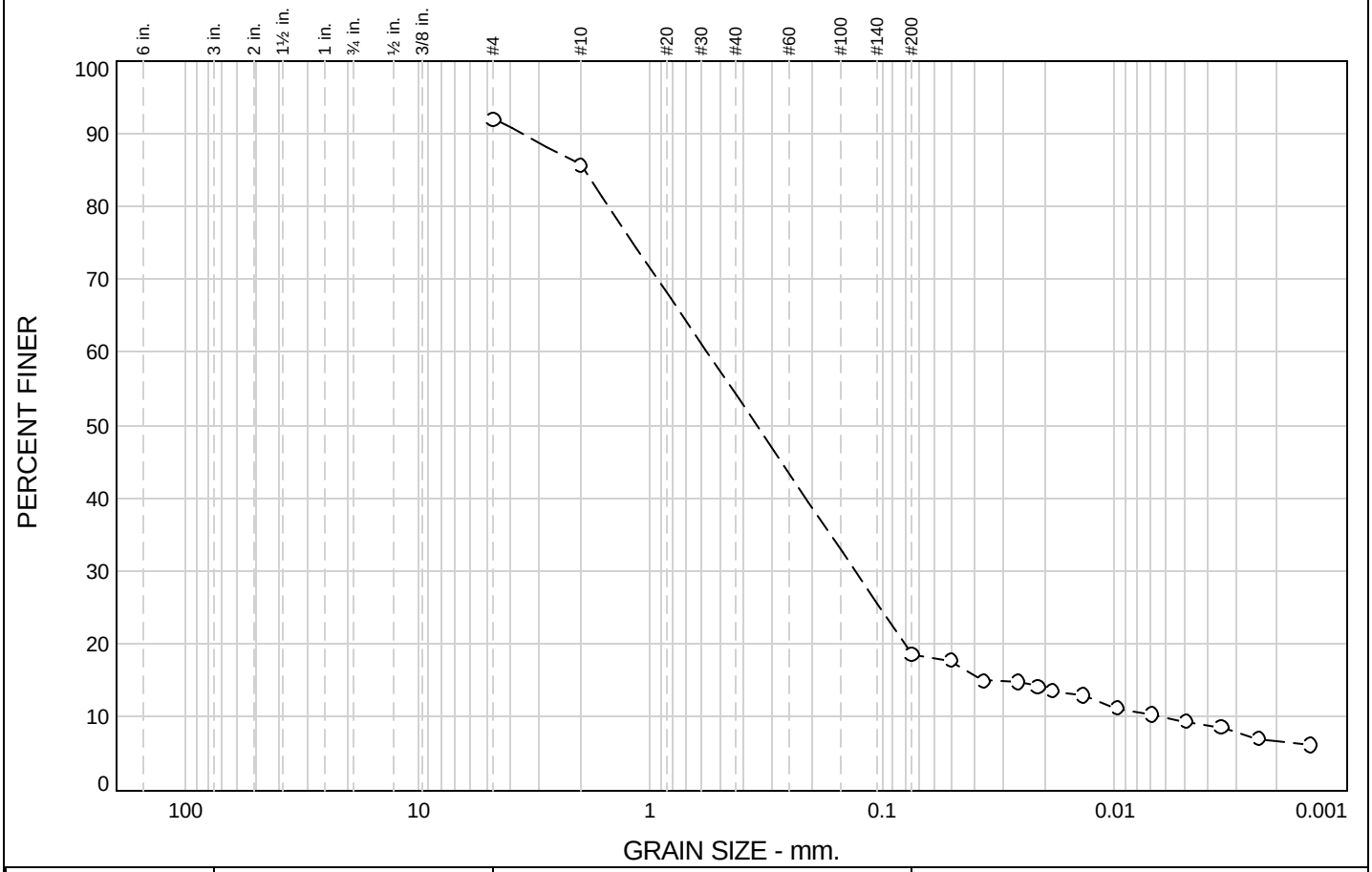
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			6.4	31.6	35.4	12.0	6.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	92.1		
#10	85.7		
#200	18.7		

* (no specification provided)

Material Description

Olive gray SAND.

Atterberg Limits

PL= 17 LL= 15 PI= NP

Coefficients

D_{85}= 1.9290 D_{60}= 0.5670 D_{50}= 0.3474
D_{30}= 0.1304 D_{15}= 0.0371 D_{10}= 0.0062
C_u= 91.73 C_c= 4.86

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample Number: B3 @ 62 **Date:** 01/05/10

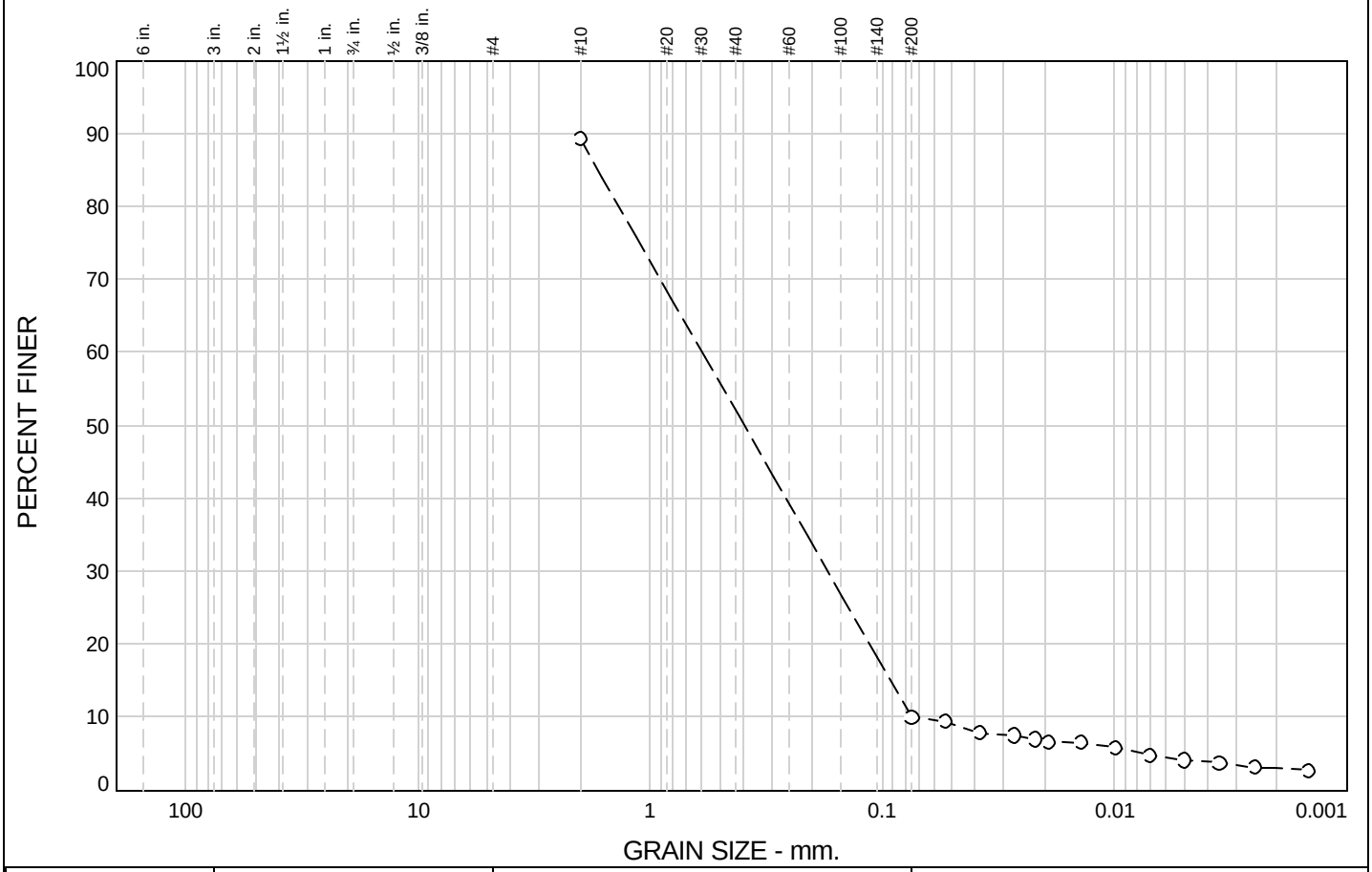
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
				37.4	41.9	7.1	2.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	89.3		
#200	10.0		

* (no specification provided)

Material Description

Brown SAND with silt.

Atterberg Limits

PL= 20 LL= 10 PI= NP

Coefficients

D_{85}= 1.6756 D_{60}= 0.5950 D_{50}= 0.3933
D_{30}= 0.1718 D_{15}= 0.0923 D_{10}= 0.0750
C_u= 7.93 C_c= 0.66

Classification

USCS= SW-SM AASHTO= A-2-4(0)

Remarks

Sample Number: B4 @ 121.5 **Date:** 01/04/10

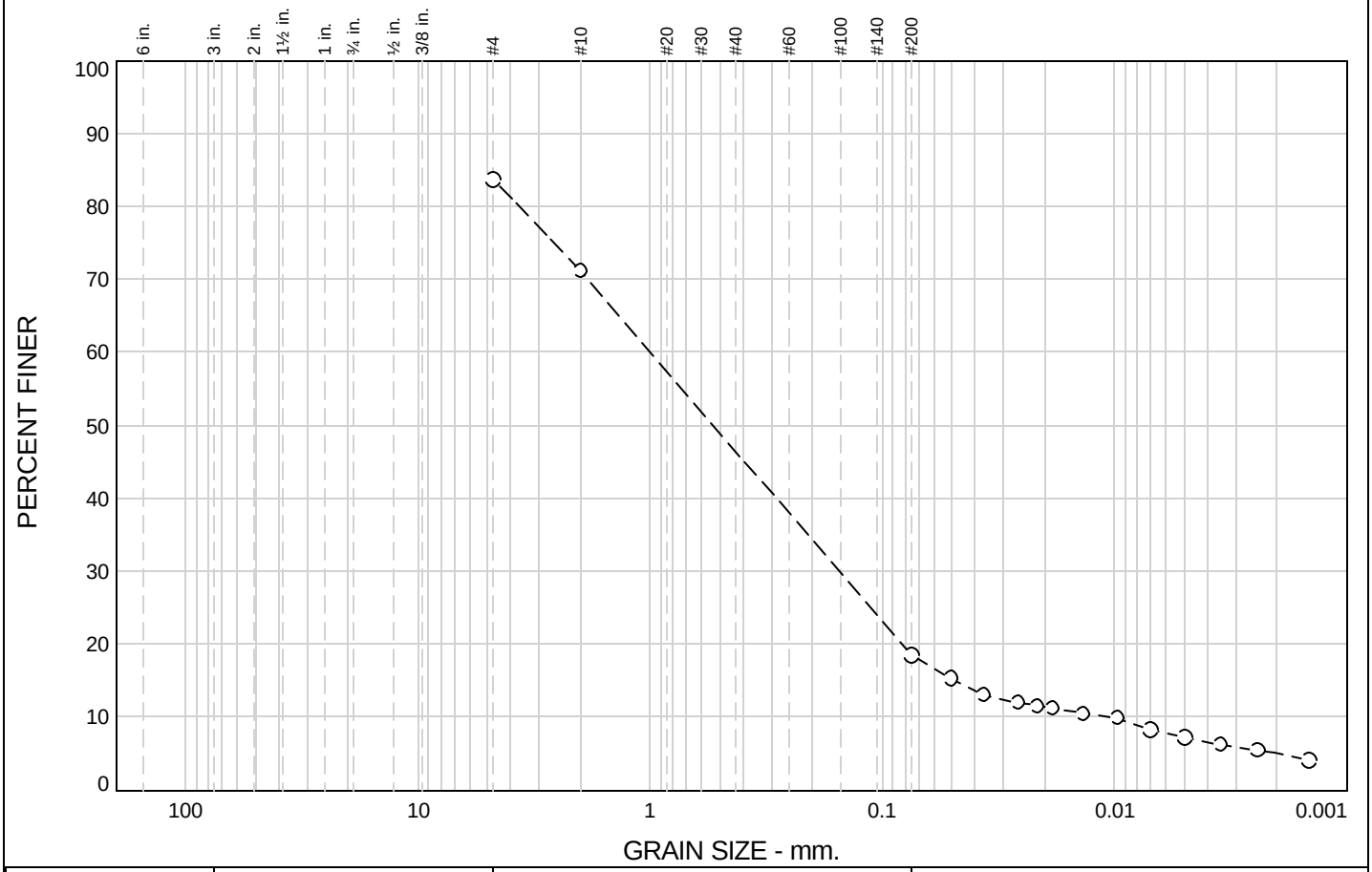
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			12.4	25.0	27.8	13.5	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	83.7		
#10	71.3		
#200	18.5		

* (no specification provided)

Material Description

Brown silty SAND with gravel.

Atterberg Limits

PL= 25 LL= 21 PI= NP

Coefficients

D_{85}= D_{60}= 0.9935 D_{50}= 0.5334
D_{30}= 0.1538 D_{15}= 0.0487 D_{10}= 0.0100
C_u= 99.21 C_c= 2.38

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sample Number: B5 @ 11 **Date:** 01/05/10

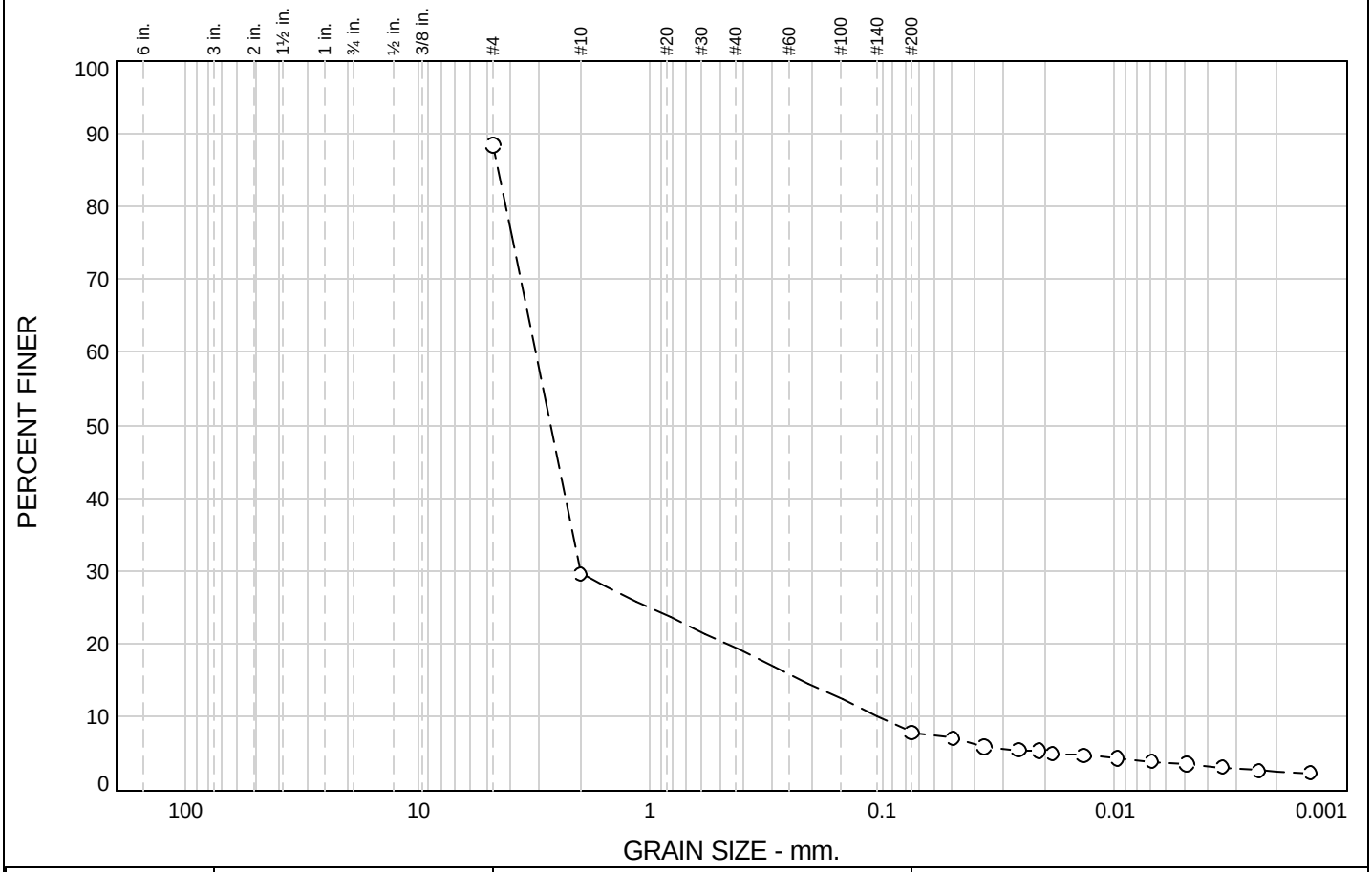
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			58.9	10.2	11.5	5.4	2.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	88.5		
#10	29.6		
#200	7.9		

* (no specification provided)

Material Description

Dark grayish brown SAND.

Atterberg Limits

PL= 18 LL= 21 PI= 3

Coefficients

D_{85}= 4.5147 D_{60}= 3.1261 D_{50}= 2.6987
D_{30}= 2.0112 D_{15}= 0.2190 D_{10}= 0.1028
C_u= 30.42 C_c= 12.59

Classification

USCS= SP-SM AASHTO= A-1-a

Remarks

Sample Number: B5 @ 20 **Date:** 01/05/10

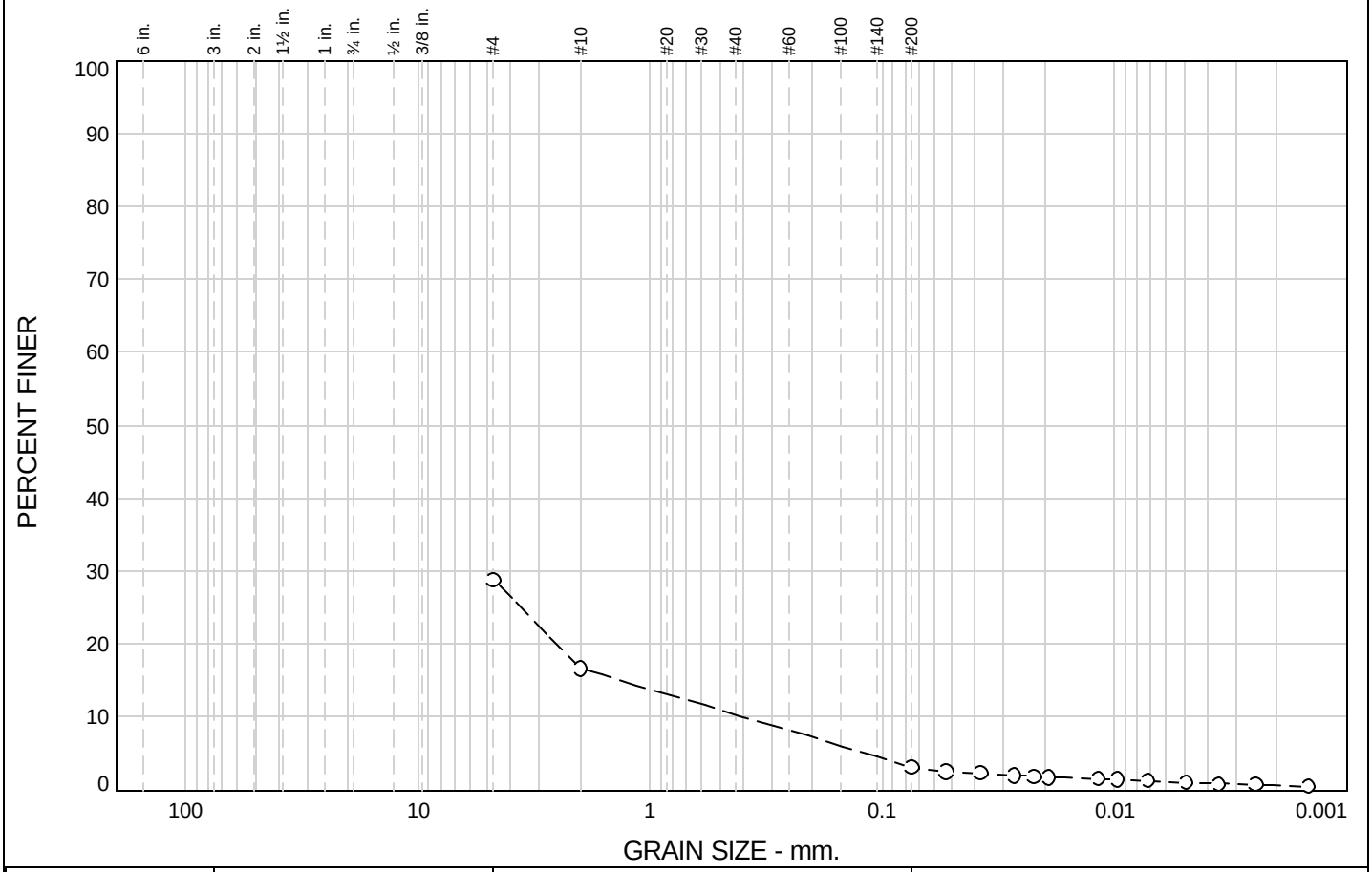
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			12.2	6.4	7.2	2.4	0.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	28.9		
#10	16.7		
#200	3.1		

* (no specification provided)

Material Description

Dark brown Recycled AB grading to GRAVEL with sand.

Atterberg Limits

PL= 35 LL= 26 PI= NP

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= 1.3302 D_{10}= 0.3955
C_u= C_c=

Classification

USCS= GP AASHTO= A-1-a

Remarks

Hydrometer test performed on gravel portion of sample.

Sample Number: B6 @ 10 **Date:** 01/05/10

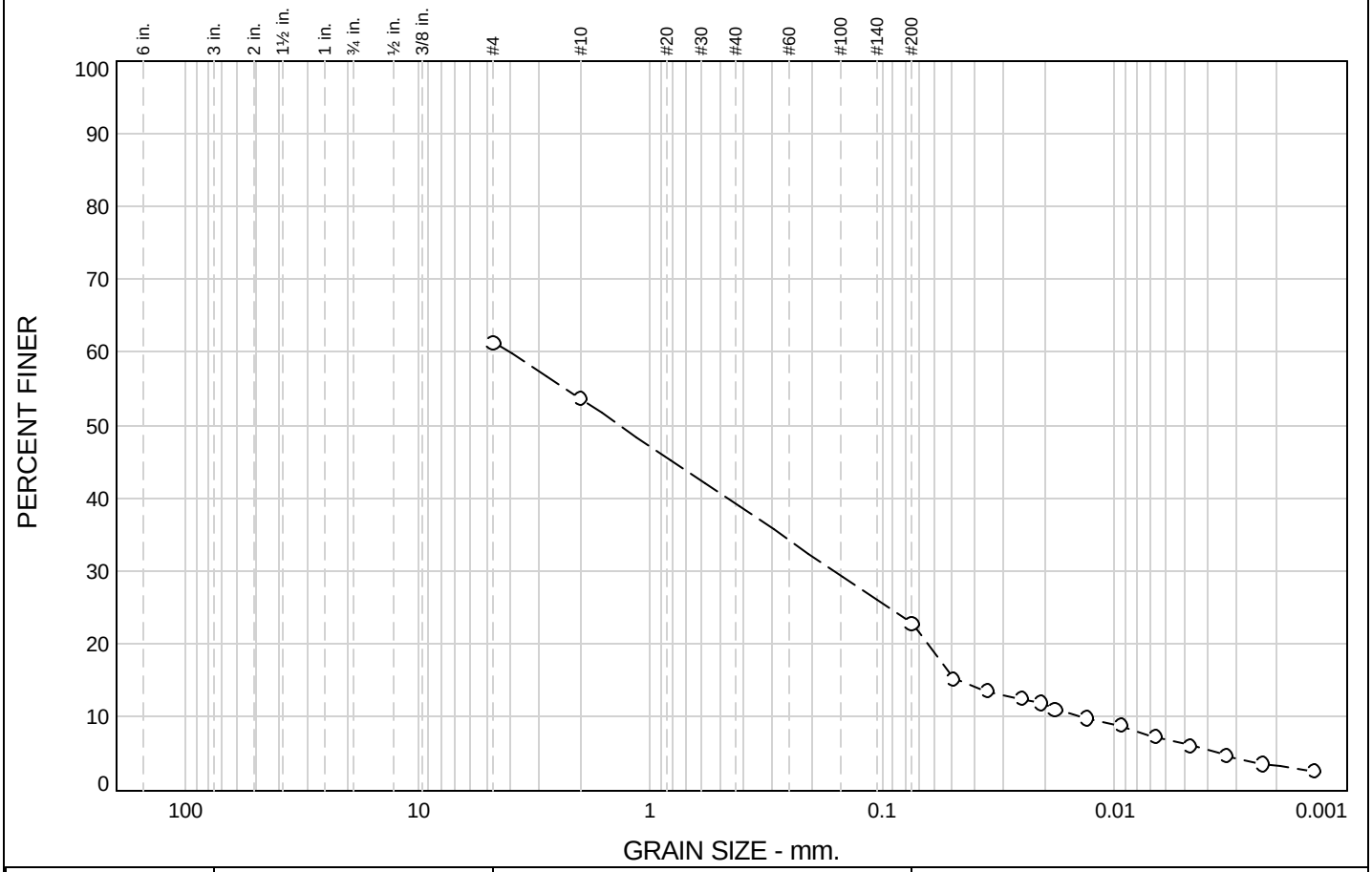
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			7.7	14.6	16.3	19.5	3.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	61.4		
#10	53.7		
#200	22.8		

* (no specification provided)

Material Description

Olive gray to Black silty GRAVEL with sand.

Atterberg Limits

PL= 18 LL= 26 PI= 8

Coefficients

D_{85}= D_{60}= 4.0625 D_{50}= 1.3512
D_{30}= 0.1607 D_{15}= 0.0474 D_{10}= 0.0140
C_u= 290.64 C_c= 0.45

Classification

USCS= GC AASHTO= A-2-4(0)

Remarks

Sample Number: B7 @ 16 **Date:** 01/05/10

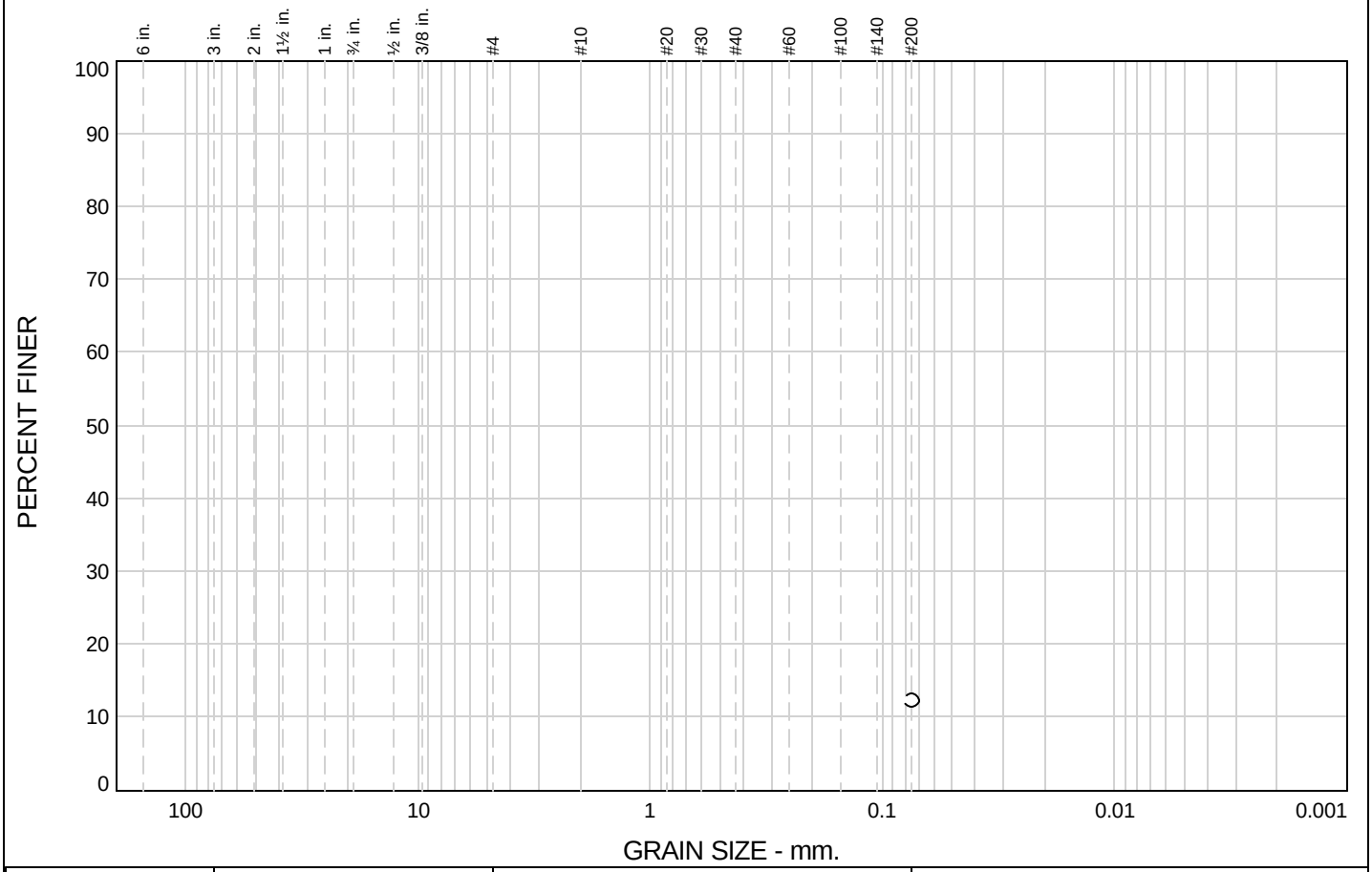
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						12.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	12.3		

* (no specification provided)

Material Description

Very dark grayish brown GRAVEL with silt and sand.

Atterberg Limits

PL= 18 LL= 16 PI= NP

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GM AASHTO=

Remarks

47.5% retained on #4 sieve

Sample Number: Y1 @ 10 **Date:** 01/04/10

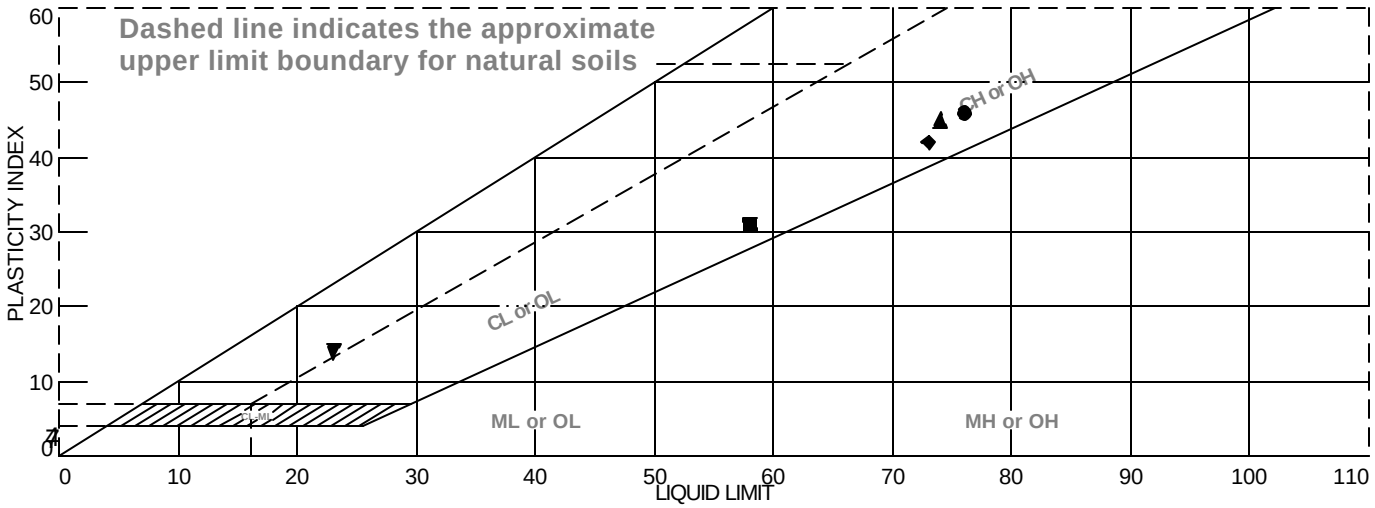
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

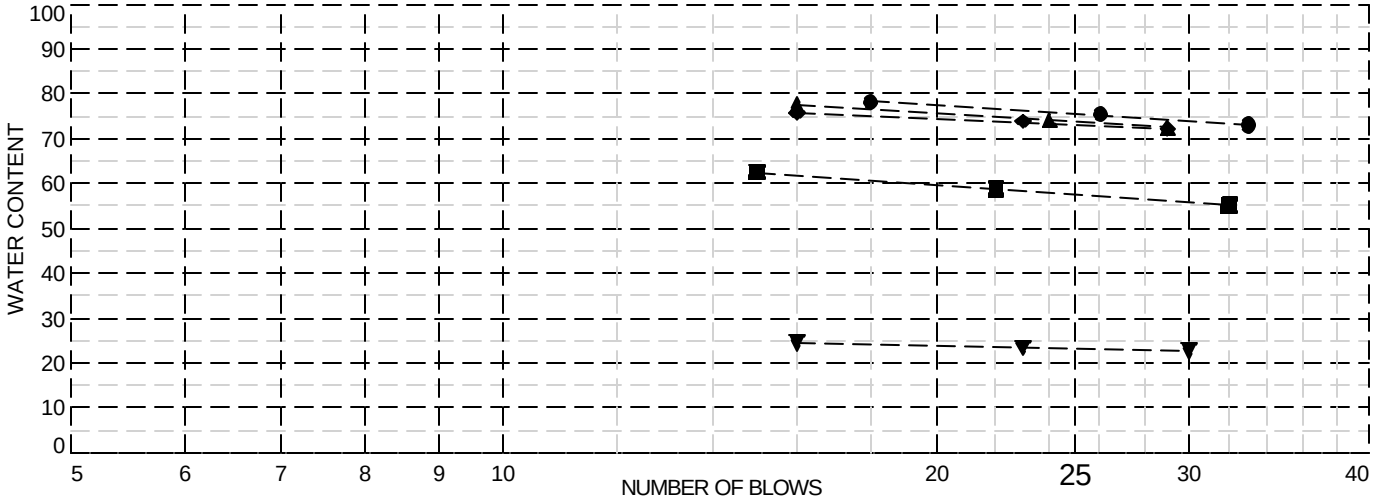
Client:

Project: Candlestick Park - San Francisco,CA

Project No: 8472.000.001 **Plate**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Blueish gray silty CLAY.	76	30	46			CH
■	Blueish gray silty CLAY.	58	27	31			CH
▲	Blueish gray silty CLAY.	74	29	45			CH
◆	Blueish gray silty CLAY.	73	31	42			CH
▼	Greenish gray sandy CLAY.	23	9	14			SC

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

● **Sample Number:** B4 @ 22
■ **Sample Number:** B4 @ 35.5
▲ **Sample Number:** B4 @ 50
◆ **Sample Number:** B4 @ 65
▼ **Sample Number:** B4 @ 80

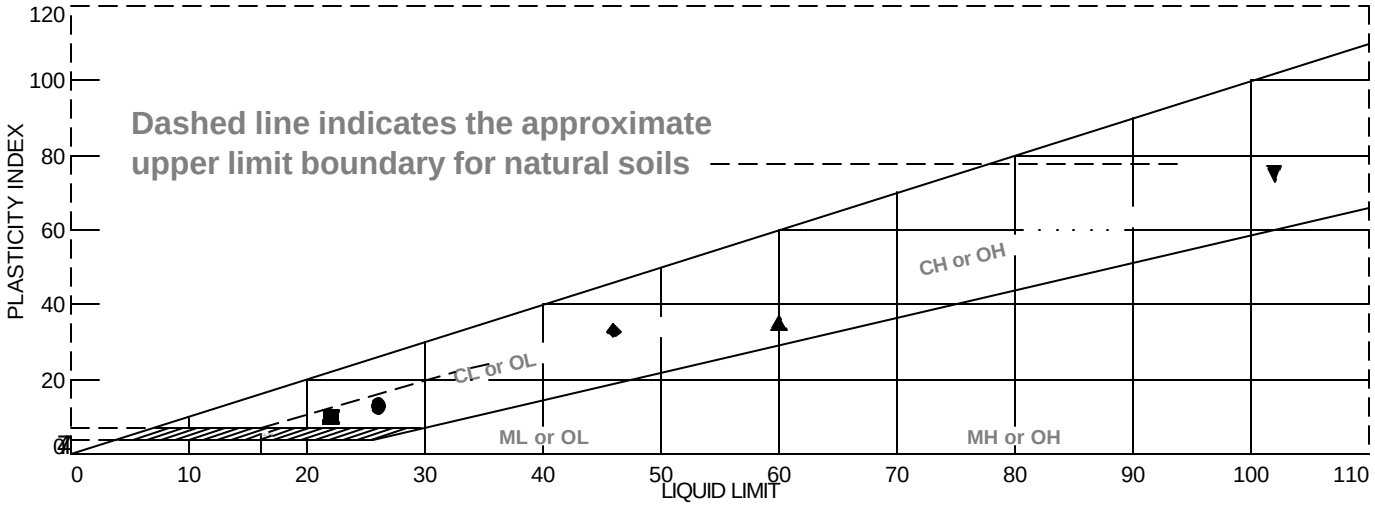
ENGEO INCORPORATED

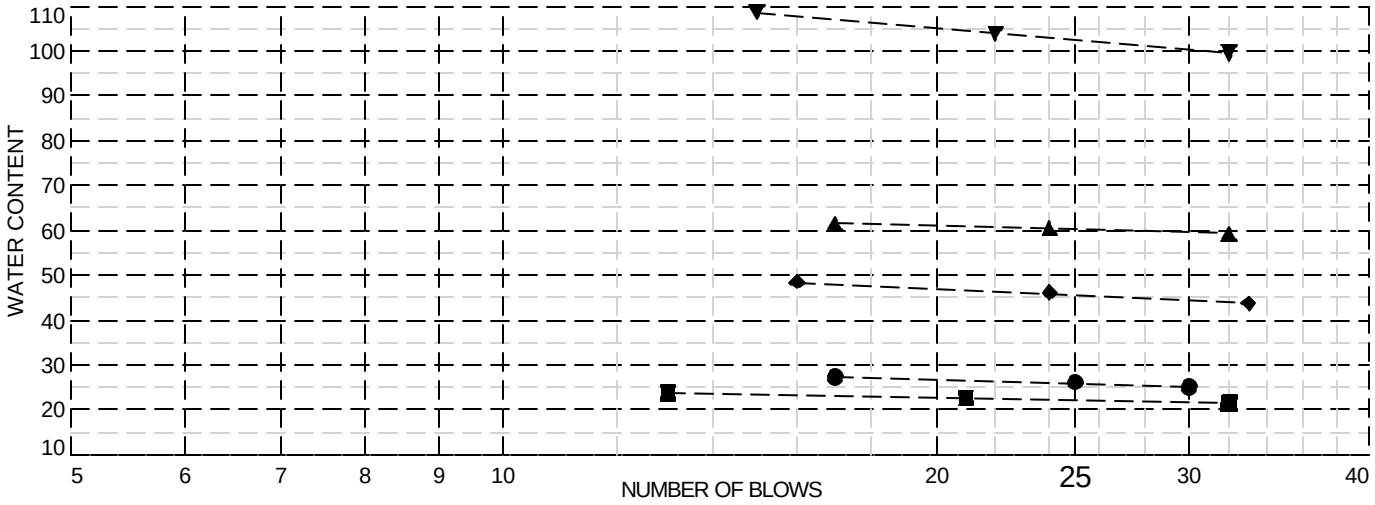
Remarks:

Plate

Tested By: KEL **Checked By:** GC

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark reddish brown silty CLAY.	26	13	13			
■	Dark reddish brown sandy CLAY.	22	12	10			SC
▲	Blueish gray CLAY.	60	25	35			CH
◆	Gray silty CLAY.	46	13	33			CL-CH
▼	Blueish gray fat CLAY.	102	27	75			CH

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

● **Sample Number:** B1 @ 6
■ **Sample Number:** B1 @ 15.5
▲ **Sample Number:** B2 @ 45
◆ **Sample Number:** B2 @ 64
▼ **Sample Number:** B2 @ 116

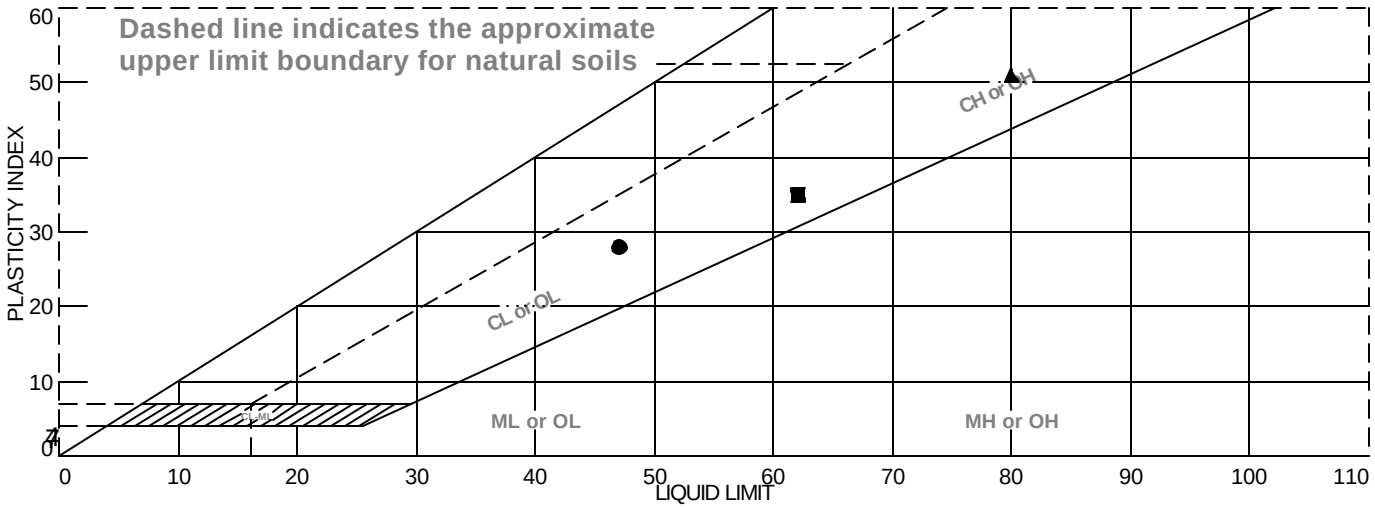
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

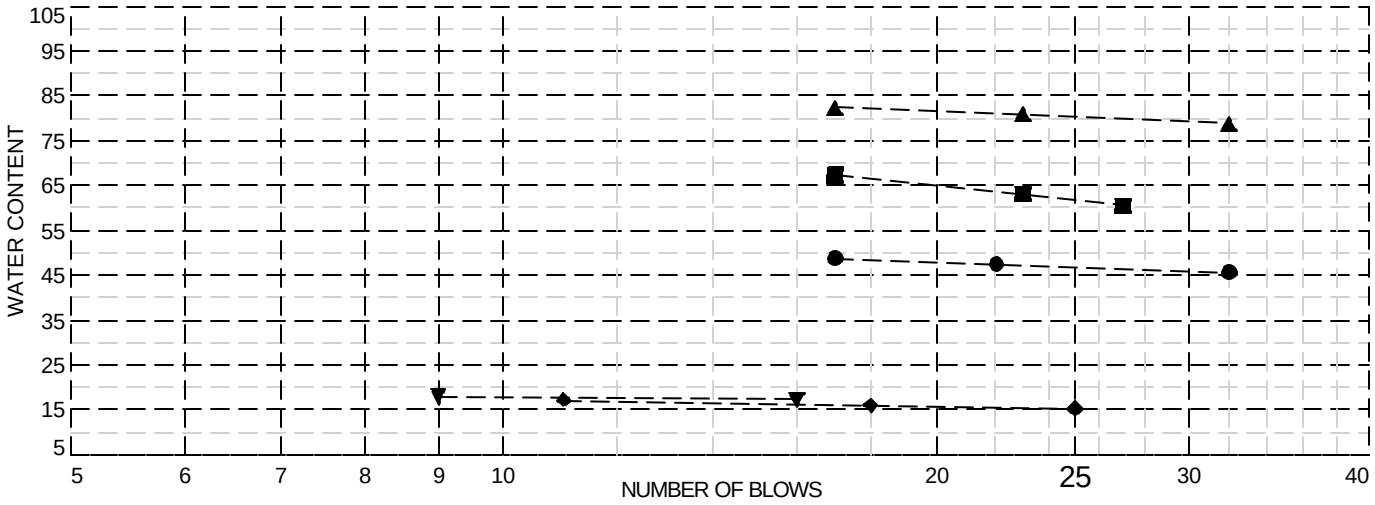
Remarks:

Plate

Tested By: ○ RWS □ DRus △ KEL ◇ RWS ▽ RWS **Checked By:** GC

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark reddish brown silty CLAY.	47	19	28			
■	Blueish gray CLAY.	62	27	35			CH
▲	Dark greenish gray fat CLAY.	80	29	51			
◆	Olive gray silty SAND.	15	17	NP	54.1	18.7	SM
▼	Very dark gray silty SAND.	17	20	NP			SM

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

● **Sample Number:** B2 @ 135.5
■ **Sample Number:** B3 @ 32
▲ **Sample Number:** B3 @ 47
◆ **Sample Number:** B3 @ 62
▼ **Sample Number:** B4 @ 10

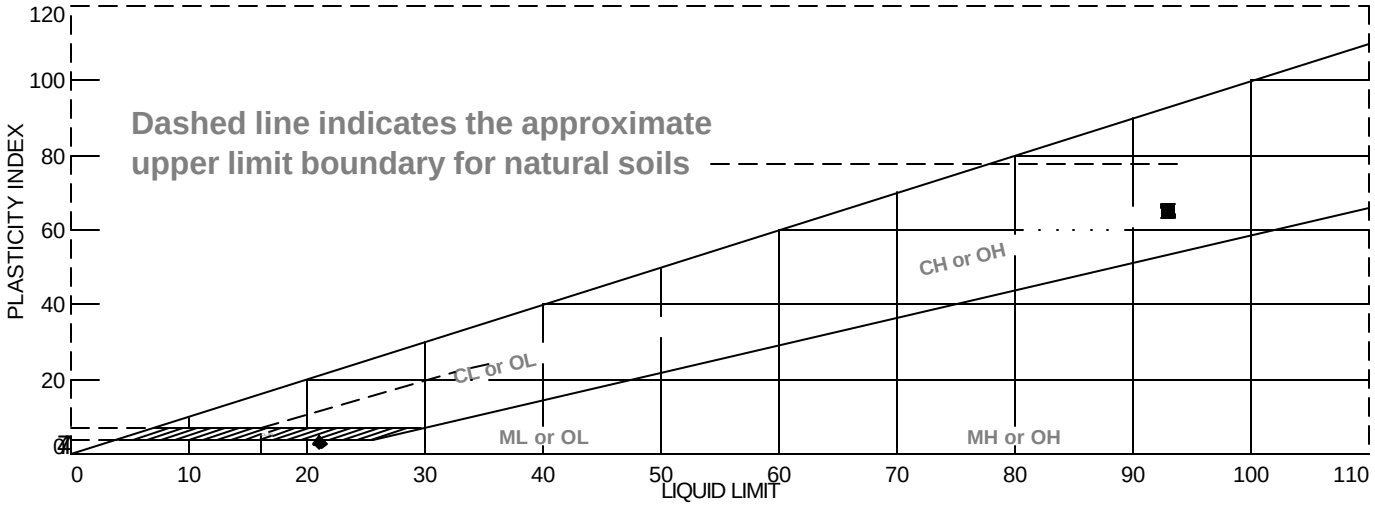
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

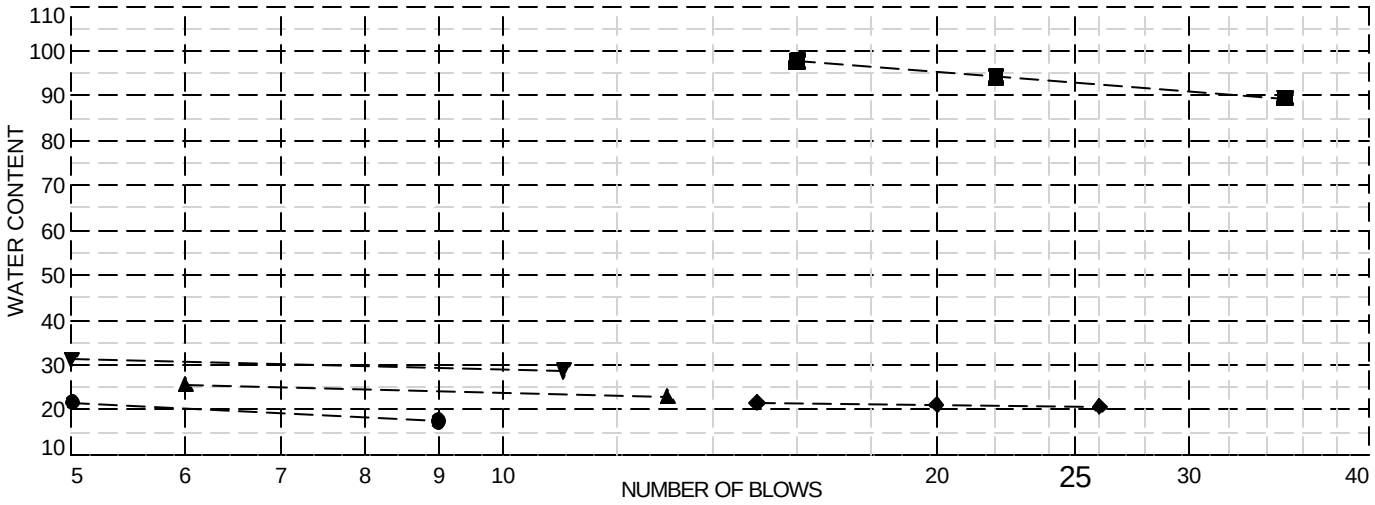
Remarks:

Plate

Tested By: ○ DRus □ DRus △ KEL ◇ DRus ▽ DRus **Checked By:** GC

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown SAND with silt.	10	20	NP	51.9	10.0	SW-SM
■	Gray fat CLAY.	93	28	65			CH
▲	Brown silty SAND.	21	25	NP	46.3	18.5	SM
◆	Dark grayish brown SAND.	21	18	3	19.4	7.9	SP-SM
▼	Dark brown Recycled AB grading to GRAVEL with sand.	26	35	NP	10.3	3.1	GP

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

● **Sample Number:** B4 @ 121.5
■ **Sample Number:** B4 @ 166
▲ **Sample Number:** B5 @ 11
◆ **Sample Number:** B5 @ 20
▼ **Sample Number:** B6 @ 10

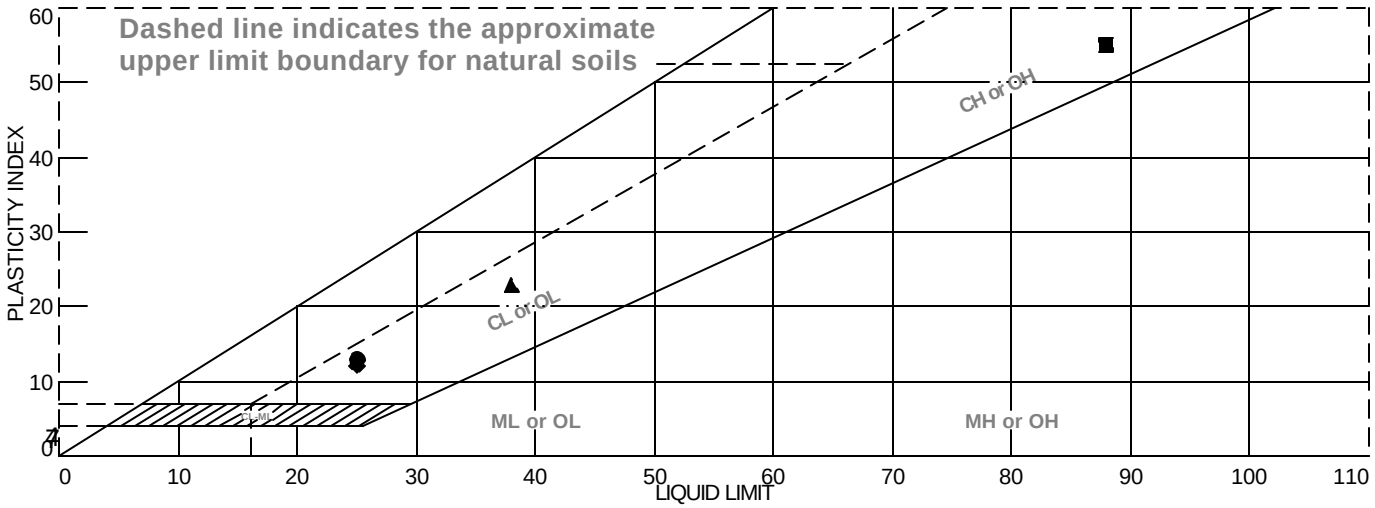
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

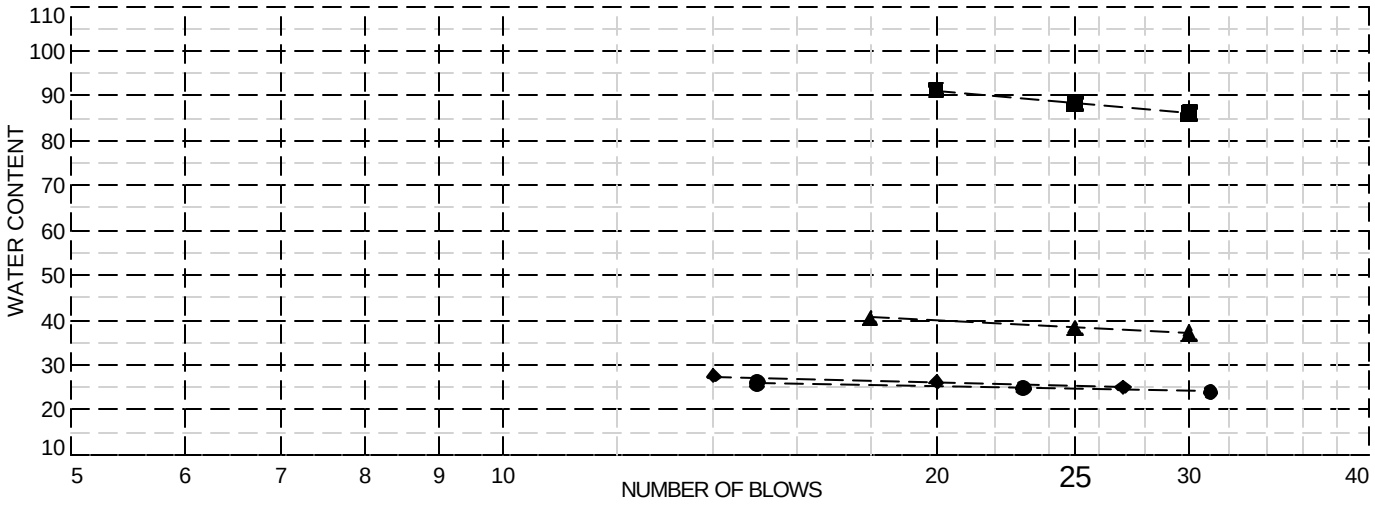
Remarks:

Plate

Tested By: ○ GC □ KEL ▽ GC **Checked By:** GC

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Very dark olive brown sandy CLAY with gravel.	25	12	13			CL
■	Dark greenish gray fat CLAY.	88	33	55			CH
▲	Blueish gray silty CLAY.	38	15	23			CL
◆	Reddish brown silty CLAY with sand.	25	13	12			CL

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

● **Sample Number:** B6 @ 15
■ **Sample Number:** B6 @ 47
▲ **Sample Number:** B6 @ 66.5
◆ **Sample Number:** B7 @ 11

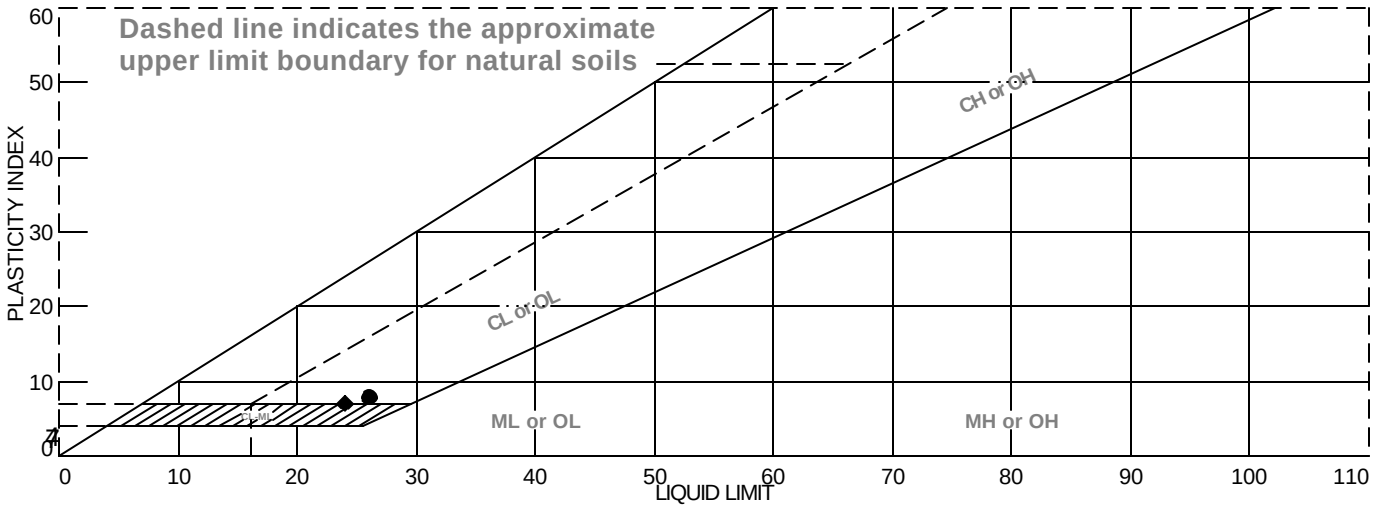
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

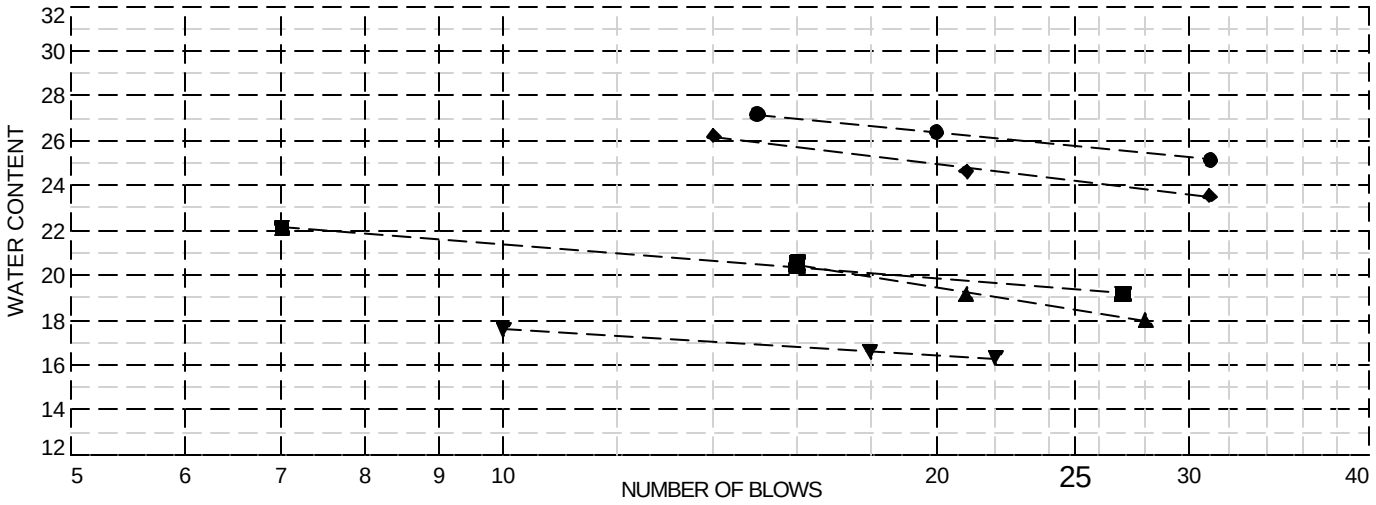
Remarks:

Plate

Tested By: ○ GC □ KEL △ KEL ◇ DRus **Checked By:** GC

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive gray silty GRAVEL with sand.	26	18	8	39.1	22.8	GM
■	Dark yellowish brown silty SAND.	19	19	NP	60.7	16.8	SM
▲	Dark yellowish brown silty SAND.	18	18	NP		18.8	SM
◆	Dark grayish brown clayey SAND.	24	17	7		34.3	SC
▼	Brown silty GRAVEL with sand.	16	18	NP		12.3	GM

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

● **Sample Number:** B7 @ 16
■ **Sample Number:** B7 @ 39
▲ **Sample Number:** B7 @ 42
◆ **Sample Number:** B7 @ 45
▼ **Sample Number:** Y1 @ 10

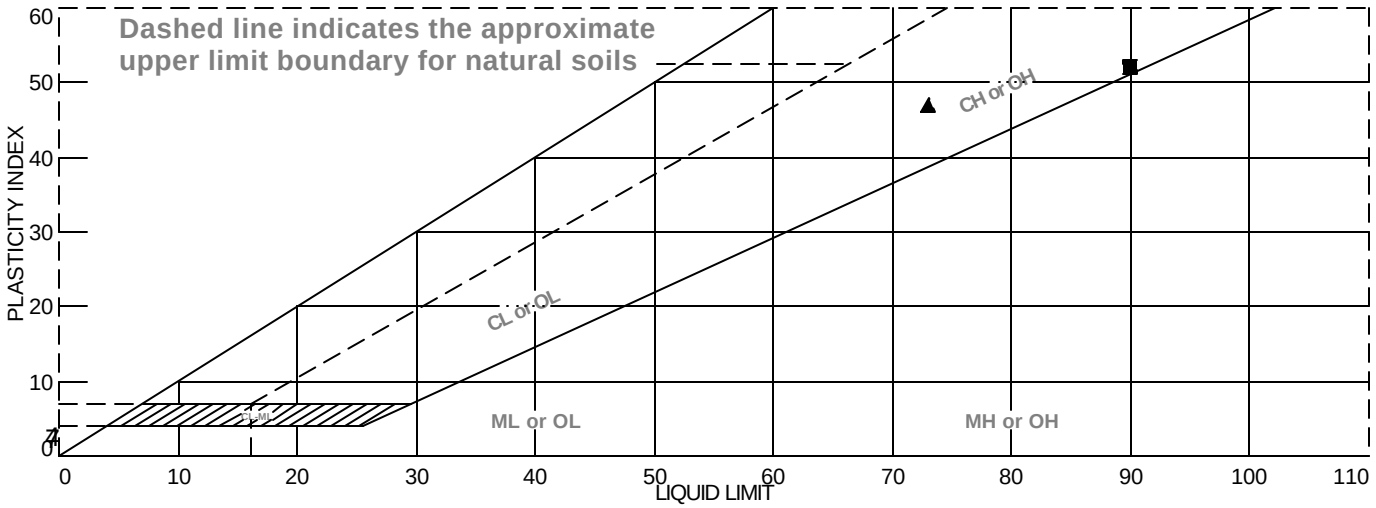
ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

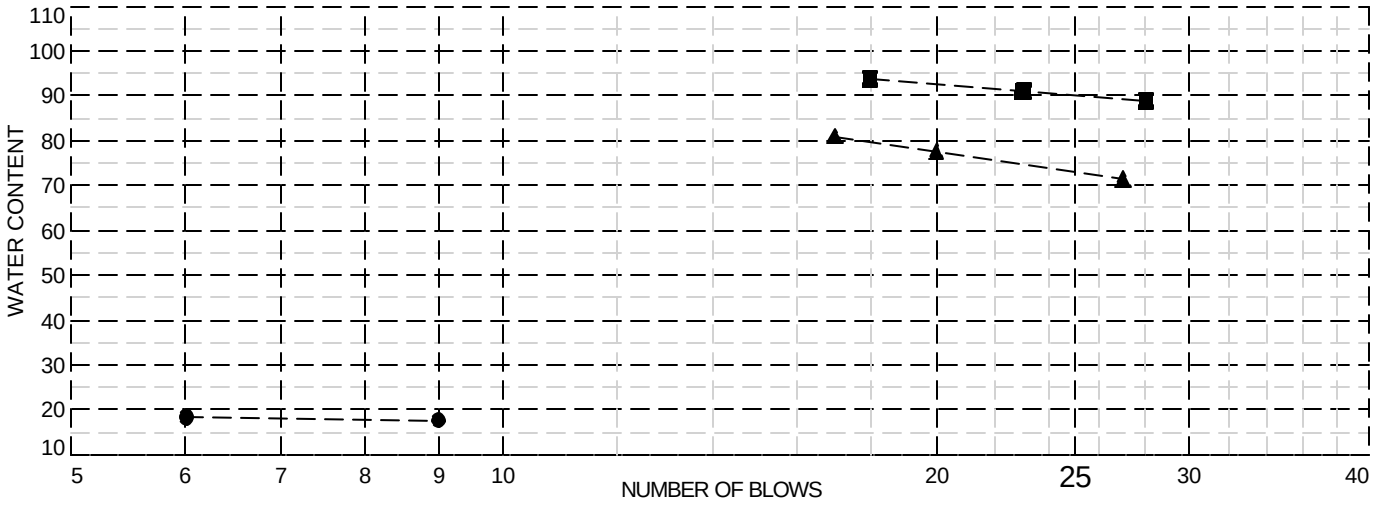
Remarks:

Plate

Tested By: ○ GC □ DRus △ DRus ◇ DRus ▽ GC **Checked By:** GC

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Very dark greenish gray SAND with gravel.	15	17	NP		7.9	SM
■	Dark greenish gray fat CLAY.	90	38	52			CH
▲	Dark greenish gray fat CLAY.	73	26	47			CH

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

● **Sample Number:** Y1 @ 20
■ **Sample Number:** Y1 @ 42
▲ **Sample Number:** Y1 @ 52

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

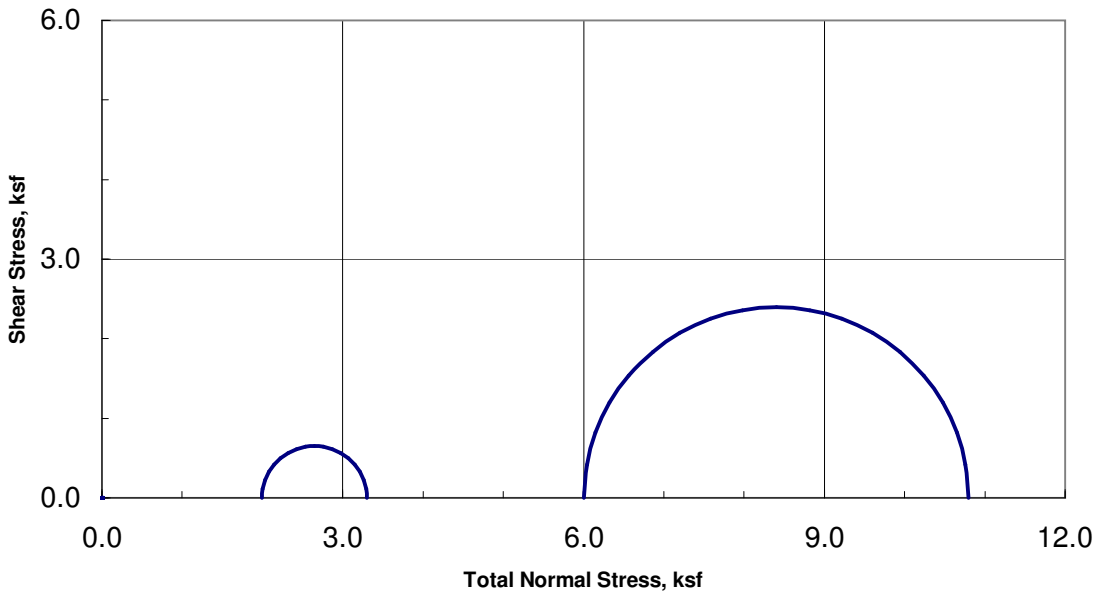
Remarks:

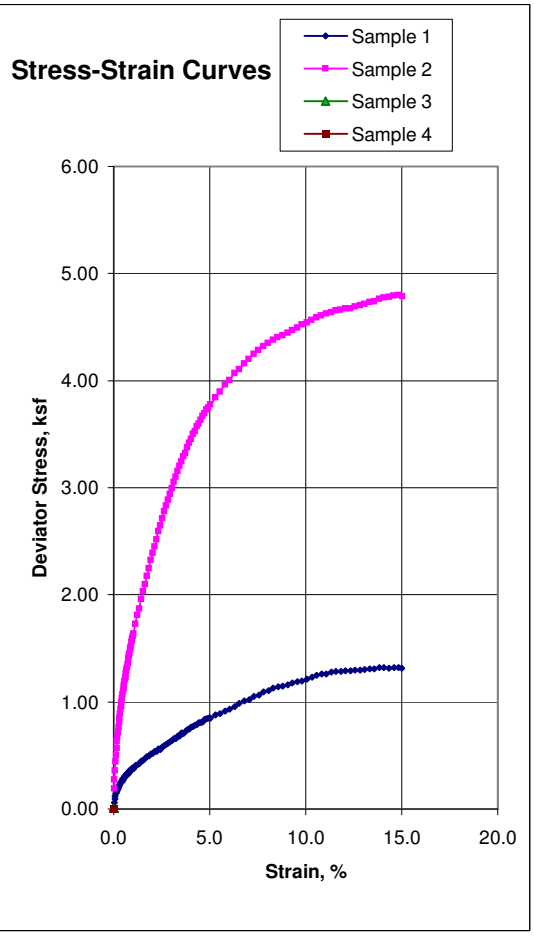
Plate

Tested By: ○ GC □ RWS △ GC **Checked By:** GC

Unconsolidated-Undrained Triaxial Test

ASTM D-2850



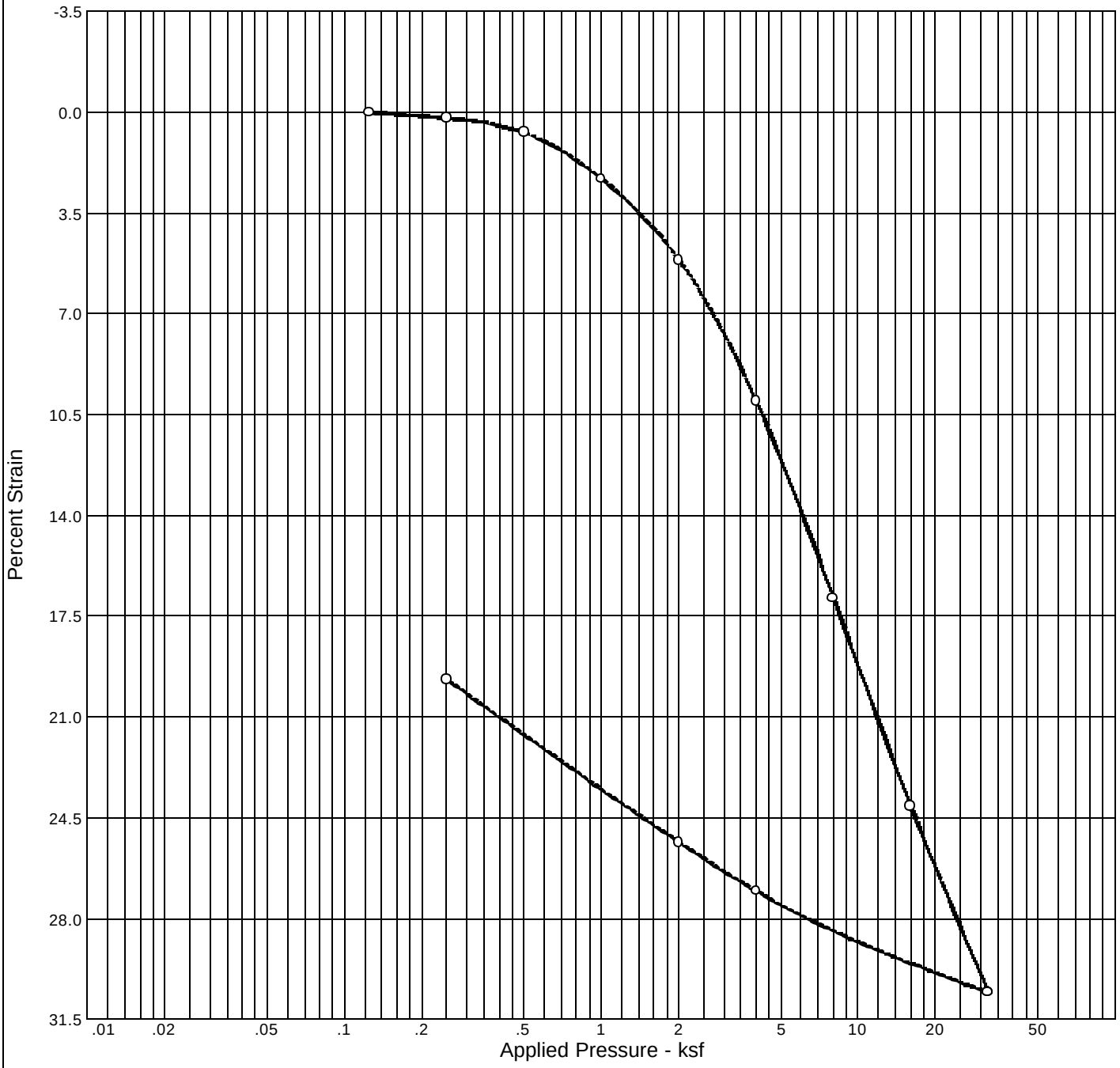


Sample Data				
	1	2	3	4
Moisture %	69.5	19.6		
Dry Den,pcf	58.4	108.5		
Void Ratio	1.885	0.553		
Saturation %	99.6	95.7		
Height in	5.98	5.99		
Diameter in	2.85	2.84		
Cell psi	13.9	41.7		
Strain %	13.80	14.80		
Deviator, ksf	1.324	4.802		
Rate %/min	1.00	1.00		
in/min	0.060	0.060		
Job No.:	414-043			
Client:	Engeo			
Project:	8472.000.001			
Boring:	B7	B4		
Sample:				
Depth ft:	26	80		

Visual Soil Description	
Sample #	
1	Gray & Dark Gr CLAY, tr brn org (Bay Mud)
2	Gray Clayey SAND
3	
4	

Remarks:

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
100.0 %	59.9 %	64.1	73	47	2.67	CH		1.600

MATERIAL DESCRIPTION

Dark greenish gray fat CLAY.

Project No. 8472.000.001 **Client:**

Project: Candlestick Park - San Francisco,CA

Source: **Sample No.:** Y1 @ 52

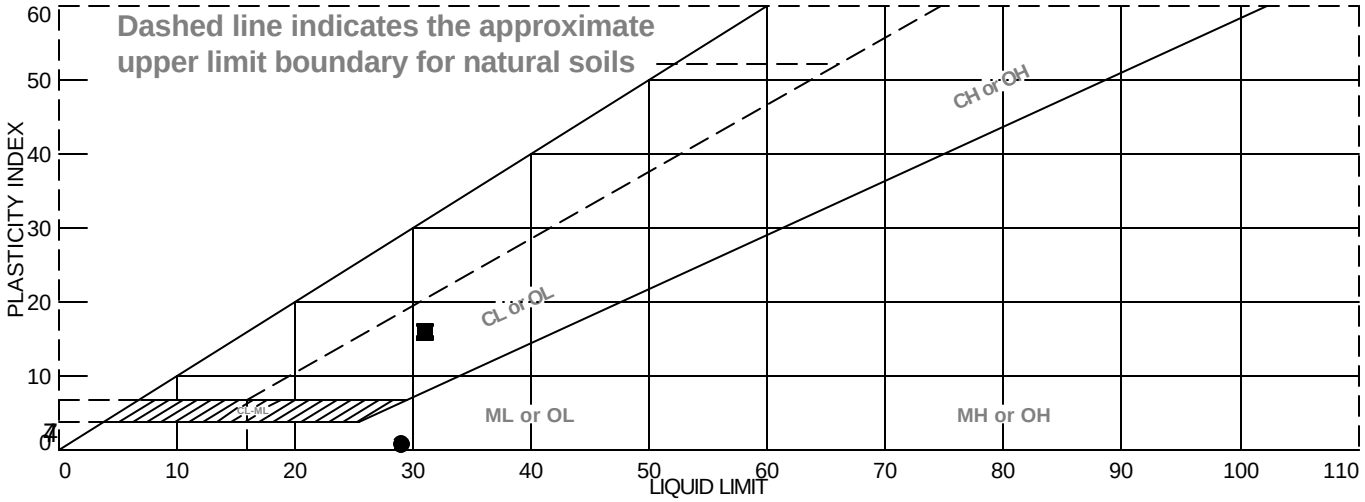
ENGEO INCORPORATED

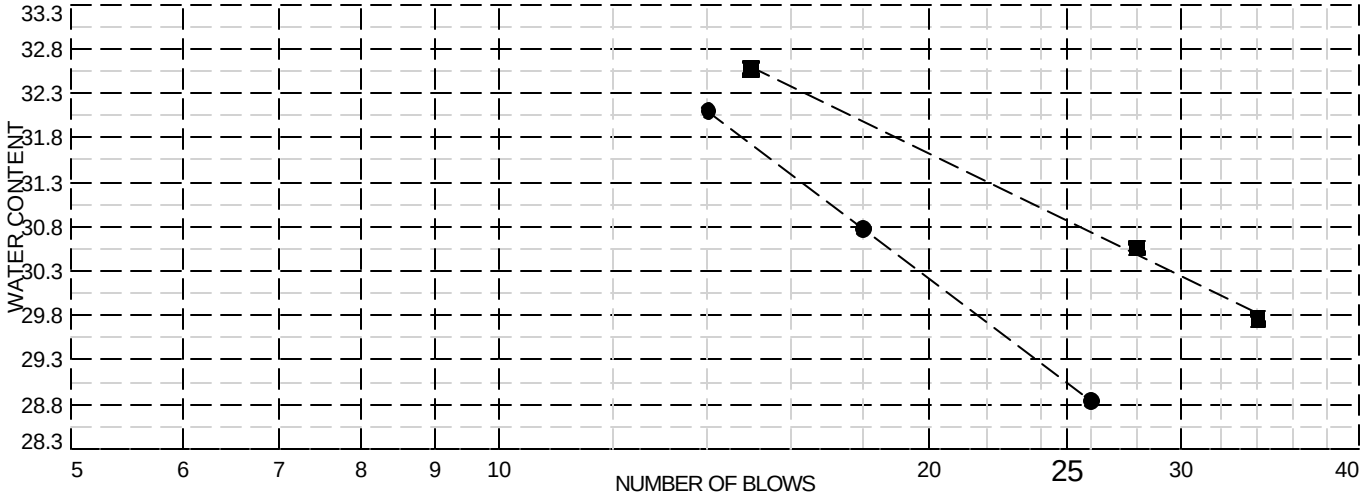
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown silty SAND with gravel.	29	28	1	32.1	15.8	SM
■	Dark brown clayey GRAVEL with sand.	31	15	16	25.7	16.0	GC

Project No. 8472.000.001 **Client:**

Project: CandleStick Park

● **Sample Number:** B2 @ 14

■ **Sample Number:** B3 @ 14

Remarks:

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Plate

Tested By: RC **Checked By:** GC

N

0 FEET 500

0 METERS 250

EXPLANATION

S9 APPROXIMATE LOCATION OF SURFACE SAMPLING

BASE MAP SOURCE: USGS, 2004

ENGEO Expect Excellence

ENVIRONMENTAL SAMPLING

CANDLESTICK PARK

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 8472.000.001		FIGURE NO. 1
DATE: DECEMBER 2009		
DRAWN BY: PC	CHECKED BY: BHBJ	

G:\Drafting\DRAFTING2_Dwg\8472\000\8472000001-1- Environmental Sampling-1209.dwg 1-04-10 10:43:24 AM pcrockett

ORIGINAL FIGURE PRINTED IN COLOR

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

CARB Method 435

ENGEO Incorporated
332 Pine Street, Suite 300
Suite 300
San Francisco CA 94104

Person to contact: C WRIGHT
Contact phone: 925-866-9000
FAX phone: 925-866-0199
Sampled by: C Wright
Sampled on: November 17, 2009
Analyzed on: November 18, 2009 at: 14:03
Corresponding invoice number: 197003

Analyst: JPL (signature)

Laboratory manager: (signature)

Job Number: 8472

Job Description: Candlestick

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
LD197003-1	8472-SP1	**Yes**	0.75% Chrysotile*	Greenstone rock. 400 Point counted Sample Analysis CARB 435 Method.
Greenstone Rock / Geotech		PC*		
LD197003-2	8472-SP2	**N.D**	< 0.25% No Fibers	Greenstone rock. 400 Point counted Sample Analysis CARB 435 Method.
Greenstone Rock / Geotech		PC*		
LD197003-3	8472-SP3	**Yes**	0.25% Chrysotile*	Greenstone rock. 400 Point counted Sample Analysis CARB 435 Method.
Greenstone Rock / Geotech		PC*		

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

CARB Method 435

ENGEO Incorporated
332 Pine Street, Suite 300
Suite 300
San Francisco CA 94104

Person to contact: Ray Skinner/B. Johns
Contact phone: 925-866-9000
FAX phone: 925-866-0199
Sampled by: Craig Wright
Sampled on: 00/00/00
Analyzed on: December 7, 2009 at: 16:14
Corresponding invoice number: 197536

Analyst: _____ JPL (signature)

Laboratory manager: _____ (signature)

Job Number: 8472

Job Description: Candlestick

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
LD197536-1	SP 4	**N.D.**	< 0.25% No Fibers	Brown soil. 400 Point Counted Sample Analysis. CARB 435 Method.
Soil		PC*		
LD197536-2	SP 5	**N.D.**	< 0.25% No Fibers	Brown soil. 400 Point Counted Sample Analysis. CARB 435 Method.
Soil		PC*		
LD197536-3	SP 6	**Yes**	0.25% Chrysotile*	Brown soil. 400 Point Counted Sample Analysis. CARB 435 Method.
Soil		PC*		
LD197536-4	SP 7	**N.D.**	< 0.25% No Fibers	Brown soil. 400 Point Counted Sample Analysis. CARB 435 Method.
Soil		PC*		
LD197536-5	SP 8	**Yes**	0.75% Chrysotile*	Brown soil. 400 Point Counted Sample Analysis. CARB 435 Method.
Soil		PC*		
LD197536-6	SP 9	**N.D.**	< 0.25% No Fibers	Brown soil. 400 Point Counted Sample Analysis. CARB 435 Method.
Soil		PC*		

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

MACS Lab Incorporated
Analytical and Environmental Services
3137 Diablo Avenue, Hayward, Ca 94545-2701 (510) 786-9751 * (510) 786-9625 Fax * www.macslab.com

CAM-17 Bulk Materials Analysis Report - Method: EPA 6010B/3050

EMGEO Incorporated
2010 Crow Canyon Place, suite 250
San Ramon CA, 94583

Contact: Ray Skinner/B. Johns
Phone: (925)-866-9000
Email: Cwright@engeo.com
Job #: 8472

Laboratory Number: 197004
Sampled By: C. Wright
Sampled On: November 17, 2009
Submitted On: November 17, 2009
Analyzed On: November 18, 2009
Reported On: November 19, 2009
SOP: CAM17
Sample Type: Bulk

Job Description: Candlestick

	Lab Sample Number:	197004 -1	197004 -2	197004 -3		
	Client Sample Number:	8472-SP1	8472-SP2	8472-SP3		
	Matrix:	Bulk	Bulk	Bulk		
	Extraction Type:	Acid	Acid	Acid		
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)		
Sb	Antimony	23.23	23.41	19.33		
As	Arsenic	16.57	15.43	13.45		
Ba	Barium	170.78	52.47	18.85		
Be	Beryllium	0.30	0.34	0.51		
Cd	Cadmium	14.53	13.11	16.06		
Cr	Chromium	19.10	34.97	40.02		
Co	Cobalt	25.87	28.33	32.14		
Cu	Copper	31.29	53.87	53.15		
Pb	Lead	596.47	569.86	620.36		
Hg	Mercury	5.44	2.09	2.27		
Mo	Molybdenum	9.56	6.78	6.59		
Ni	Nickel	24.12	24.11	38.98		
Se	Selenium	1,146.47	1,120.89	1,029.45		
Ag	Silver	1.74	1.60	1.45		
Tl	Thallium	16.08	17.24	11.38		
V	Vanadium	92.25	85.92	55.03		
Zn	Zinc	127.76	93.36	75.90		

Analyst: _____ (Signature)

Laboratory Manager: _____ (Signature)

NOTICE

MACS Lab Incorporated
Analytical and Environmental Services
3137 Diablo Avenue, Hayward, Ca 94545-2701
(510) 786-9751 * (510) 786-9625 Fax * www.macslab.com

CAM-17 Bulk Materials Analysis Report - Method: EPA 6010B/3050

ENGEO Incorporated
2010 Crow Canyon Place, Suite 250
San Ramon, Ca 94583

Contact: Craig Wright
Phone: (925)-866-9000
Email: cwright@engeo.com
Job #: 8472

Laboratory Number: 197538
Sampled By: Craig Wright
Sampled On: December 4, 2009
Submitted On: December 4, 2009
Analyzed On: December 7, 2009
Reported On: December 9, 2009
SOP: CAM17
Sample Type: Bulk

Job Description: Candlestick

	Lab Sample Number:	197538 -1	197538 -2	197538 -3	197538 -4	197538 -5
	Client Sample Number:	SP4	SP5	SP6	SP7	SP8
	Matrix:	Bulk	Bulk	Bulk	Bulk	Bulk
	Extraction Type:	Acid	Acid	Acid	Acid	Acid
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)
Sb	Antimony	7.20	6.80	6.40	4.51	4.24
As	Arsenic	5.96	4.93	5.93	3.93	3.71
Ba	Barium	69.20	50.80	65.95	27.72	44.82
Be	Beryllium	0.33	0.24	0.29	0.27	0.15
Cd	Cadmium	4.83	4.32	4.58	3.79	2.99
Cr	Chromium	12.48	35.09	20.36	9.78	25.61
Co	Cobalt	8.46	8.53	8.78	7.51	5.97
Cu	Copper	50.65	8.78	14.29	8.84	14.98
Pb	Lead	207.67	186.58	205.81	146.01	144.56
Hg	Mercury	19.60	4.19	4.31	1.63	1.76
Mo	Molybdenum	4.99	2.86	2.69	1.82	1.65
Ni	Nickel	22.44	22.02	23.26	17.05	23.76
Se	Selenium	467.62	442.41	433.35	317.23	288.96
Ag	Silver	0.39	0.33	0.29	0.22	0.29
Tl	Thallium	4.68	4.93	39.70	2.95	3.16
V	Vanadium	13.41	25.14	18.37	8.76	16.50
Zn	Zinc	51.30	20.20	68.36	32.83	31.41

Analyst: _____ (Signature)

Laboratory Manager: _____ (Signature)

MACS Lab Incorporated
3137 Diablo Avenue, Hayward, Ca 94545-2701

Analytical and Environmental Services
(510) 786-9751 * (510) 786-9625 Fax * www.macslab.com

CAM-17 Bulk Materials Analysis Report - Method: EPA 6010B/3050

ENGEO Incorporated
2010 Crow Canyon Place, Suite 250
San Ramon, Ca 94583

Contact: Craig Wright
Phone: (925)-866-9000
Email: cwright@engeo.com
Job #: 8472

Laboratory Number: 197538
Sampled By: Craig Wright
Sampled On: December 4, 2009
Submitted On: December 4, 2009
Analyzed On: December 7, 2009
Reported On: December 9, 2009
SOP: CAM17
Sample Type: Bulk

Job Description: Candlestick

	Lab Sample Number:	197538 -6				
	Client Sample Number:	SP9				
	Matrix:	Bulk				
	Extraction Type:	Acid				
	Units:	mg/kg (PPM)				
Sb	Antimony	3.07				
As	Arsenic	2.51				
Ba	Barium	20.31				
Be	Beryllium	0.10				
Cd	Cadmium	1.85				
Cr	Chromium	23.33				
Co	Cobalt	3.89				
Cu	Copper	5.17				
Pb	Lead	86.63				
Hg	Mercury	1.57				
Mo	Molybdenum	1.18				
Ni	Nickel	16.15				
Se	Selenium	203.42				
Ag	Silver	0.16				
Tl	Thallium	2.29				
V	Vanadium	12.83				
Zn	Zinc	16.67				

Analyst: _____ (Signature)

Laboratory Manager: _____ (Signature)

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

Kellco Services, Inc.	Client Project ID: #8472; Candlestick	Date Sampled: 12/04/09
		Date Received: 12/07/09
3137 Diablo Avenue	Client Contact: Tara Dubey	Date Extracted: 12/07/09
Hayward, CA 94545	Client P.O.:	Date Analyzed: 12/09/09

TTLC Hexachrome by Alkaline Digestion and IC-UV Analysis*

Extraction method: SW3060A Analytical methods: E218.6m Work Order: 0912196

Lab ID	Client ID	Matrix	Extraction Type	Hexachrome	DF	% SS	Comments
0912196-001A	SP8	S	TOTAL	ND<4.0	1	N/A	a1

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	TOTAL	NA	µg/L
	S	TOTAL	0.8	mg/Kg

* All samples are reported in mg/kg unless otherwise requested. All samples and QC were cleaned up prior to analysis.

a1) sample diluted due to matrix interference

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

QC SUMMARY REPORT FOR E218.6m

W.O. Sample Matrix: Solid | QC Matrix: Solid | BatchID: 47358 | WorkOrder 0912196

EPA Method E218.6m | **Extraction SW3060A** | **Spiked Sample ID: 0912012-001a**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Hexachrome	ND	40	104	103	1.52	104	107	3.22	80 - 120	20	80 - 120	10

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 47358 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
0912196-001A	12/04/09	12/07/09	12/09/09 2:06 PM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS ELAP Certification 1644

QA/QC Officer

APPENDIX D

APPENDIX D – Previous Explorations (Other Consultants)

APPENDIX D

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-5

Boring location: See Figure 2
Date started: 8/20/97 | Date finished: 8/20/97
Drilling method: Rotary wash
Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer
Sampler: SPT, S&H, D&M piston

Logged by
M. McKee

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0.5 feet, SFCD						
0					4 inches asphalt concrete						
1											
2				CL	SANDY CLAY (CL), dark reddish-brown, very stiff, moist, with gravel (chert and serpentinite fragments)						
3											
4											
5											
6	S&H		13	SW-SM	SAND with SILT and GRAVEL (SW-SM), dark reddish-brown, medium dense, moist, with shale fragments						
7					▼ 8:40 am 8/20/97					10.5	115
8					▼ 8:30 am 8/20/97						
9											
10											
11	S&H		13		grades olive-gray						
12					FILL				7.8	10.8	
13											
14											
15					grades gray and red mottled						
16	S&H		23								
17											
18											
19											
20	S&H										
21			4		CLAY (CH), dark gray, soft, wet, with some shell fragments						
22											
23											
24				CH							
25					grades dark greenish-gray, trace shell fragments						
26	D&M		125 psi		BAY MUD	TV		540		68.9	59
27											
28											
29											
30					trace shells at 30 feet						

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
31–60					CLAY (CH), continued						
40					trace shells at 40 feet						
43				CH							
45–46	D&M		175 psi		Cec = 0.31; Cer = 0.04; Cv = 14 ft^2/yr LL = 71; PI = 40 BAY MUD					63.3	63

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
61					CLAY (CH) continued						
62					grades with peat						
63	D&M		150 psi		Cec = 0.34; Cer = 0.07; Cv = 9 ft^2/yr					66.1	61
64					LL = 84; PI = 49						
65				CH							
66					BAY MUD						
67											
68											
69											
70											
71				SC	CLAYEY SAND (SC), black						
72											
73	S&H		30/5"	CL	SANDY CLAY (CL), greenish-gray, hard, moist	TXUU	2000	2710		15.1	120
74											
75											
76											
77					CLAY (CH), greenish-gray with white carbonate nodules, moist						
78											
79											
80											
81											
82											
83				CH	grades grayish-brown and gray mottled, very stiff, moist						
84											
85											
86											
87											
88	S&H		21								
89											
90											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
91–94				CH	CLAY (CH), continued						
93–94				SC	CLAYEY SAND (SC), DARK OLIVE						
94–102		X		CH	CLAY (CH), dark greenish-gray, moist grades greenish-gray with yellowish-brown mottles, moist						
102–103	SPT		60	SM	SILTY SAND (SM), olive, very dense, moist, fine-grained						
115–118	S&H		33	CL	SANDY CLAY (CL), black, hard, moist, with shell fragments, with minor fine rock fragments, sand pockets	TXUU	4000	1090		26.9	99

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
121				CL	SANDY CLAY (CL), continued						
122											
123											
124											
125											
126											
127					FRANCISCAN MELANGE, shale and greenstone, dark olive, deeply weathered, closely fractured, with clay seams						
128											
129					BEDROCK						
130											
131											
132	SPT		93/6"								
133					Boring terminated at a depth of 132.5 feet. Groundwater encountered at a depth of 8 feet during drilling and rose to 6-1/2 feet 10 minutes later. Boring backfilled with grout.						
134											
135											
136											
137											
138											
139											
140											
141											
142											
143											
144											
145											
146											
147											
148											
149											
150											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-8

Boring location: See Figure 2

Date started: 8/21/97 | Date finished: 8/21/97

Drilling method: Rotary wash

Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer

Sampler: SPT, S&H, D&M piston

Logged by: M. McKee

LABORATORY TEST DATA

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0.5 feet, SFCD						
1					2 inches asphalt concrete						
2				GC	CLAYEY GRAVEL (GC), dark reddish-brown, medium dense, moist						
3					8:10 am 8/21/97						
4											
5											
6	S&H		18	SC	CLAYEY SAND WITH GRAVEL (SC), dark grayish-brown and reddish brown mottled, medium dense, moist						
7											
8											
9				GP	SANDY GRAVEL (GP), dark gray, loose, wet, sand is coarse-grained, gravel consists of sandstone and shale fragments up to 2-1/2"						
10	S&H										
11			6								
12											
13											
14											
15											
16	SPT		16	SC	CLAYEY SAND (SC), dark gray to black, medium dense, wet, with gravel up to 1/2"						
17											
18											
19				CH	CLAY (CH), dark greenish-gray, soft, wet						
20											
21											
22											
23											
24					BAY MUD						
25											
26											
27											
28											
29	D&M		100 psi		grades with trace shells	TV		700		66.8	60
30											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-8

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
31–60				CH	CLAY (CH), continued						
43					grades with no shells						
45					BAY MUD						
48–49	D&M		125 psi			TV		700		65.3	60

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-8

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
61–72				CH	CLAY (CH), continued BAY MUD						
73–74	D&M		110 psi	CH	CLAY (CH), olive-gray to dark gray, soft to medium stiff, wet, with peat, sand	PP		2100			
75–79				CL	SANDY CLAY (CL), dark olive, very stiff, very moist						
80–81	S&H		54	CL	CLAY (CL), olive, stiff, moist, with trace fine sand grades yellowish-brown at 81 feet	TXUU	2000	2940		17.7	115
82–89				CL	grades sandy at 89 feet						
90											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-8

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
91–120	SPT		22	CL	CLAY (CL), continued						
106–113				SM	SILTY SAND (SM), dark gray to bluish-gray, fine-grained						
113–114				CH	CLAY (CH), gray, hard, moist						
115–116	S&H		28	SM	SILTY SAND (SM), dark olive, medium dense, wet, fine-grained	PP		3000		31.3	93
116–120				CH	CLAY (CH), dark greenish-gray with yellowish-brown mottles, very stiff, moist						

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-8

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
121–125				CH	CLAY (CH), continued						
126–129				CL-SC	SANDY CLAY-CLAYEY SAND (CL/SC), dark bluish-gray, interbedded lenses of coarse sand						
130				SM	SILTY SAND (SM), dark olive, fine- to medium-grained, wet						
131	SPT		18		CLAY (CH), dark greenish-gray, very stiff, moist						
132–139				CH							
140–143					grades with black and white mottling, trace peat						
144–145											
146	S&H		25		at 146-1/2 feet: greenish gray, gray and bluish-gray mottled clay, disrupted, with slickensides, sharp contact	TXUU	4500	2250		34.3	89
147–150											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-8

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
151–158				CH	CLAY (CH), continued						
159–161	S&H		30/4"	CL	SANDY CLAY (CL), dark grayish-brown, hard, moist, with trace angular gravel						
162–168				CL							
169		⊠		CL	grades brown to reddish-brown, with some chert fragments						
170–173				CL							
174–176				GC	CLAYEY GRAVEL (GC), light olive-brown to grayish-brown, very dense						
177					SANDSTONE, yellowish- and reddish-brown, moderate to deeply weathered, closely fractured — BEDROCK						
178–180					Boring terminated at a depth of 176.5 feet. Groundwater encountered at a depth of 3-1/4 feet during drilling. Boring backfilled with grout.						

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-10

Boring location: See Figure 2

Date started: 8/19/97 | Date finished: 8/19/97

Logged by: M. McKee

Drilling method: Rotary wash

Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer

Sampler: SPT, S&H, D&M piston

LABORATORY TEST DATA

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 7.0 feet, SFCD						
0					4 inches asphalt concrete over 2 inches aggregate base						
1–5				CL	SANDY CLAY (CL), grayish-brown to reddish-brown, medium stiff, moist, with chert fragments						
6–9	S&H		32	SP-SM	SAND with SILT and GRAVEL (SP-SM), reddish-brown, dense, moist, some shale fragments, with clay				8.5	6.1	
10–13	S&H		22	SC	CLAYEY SAND (SC), reddish-brown, dense, moist, with gravel						
14–15				GP	GRAVEL (GP), reddish-brown to yellowish-brown, medium dense, wet, with sand and clay FILL						
16	S&H		13	SC	CLAYEY SAND with GRAVEL (SC), reddish-brown, loose to medium dense, wet						
17	SPT		11								
18–20	S&H		10								
21–24					grades with less gravel						
25	S&H		9	SP-SM	SAND with SILT and GRAVEL (SP-SM)					16.2	122
26–30											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-10

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
31	S&H		11	SC	CLAYEY SAND (SC), continued						
32					FILL						
33											
34											
35											
36	S&H		13								
37											
38					SANDY CLAY (CL), dark gray, stiff, wet, with some shell fragments						
39											
40					grades less sandy						
41	D&M		250 psi								
42											
43				CL							
44											
45					grades rocky, hard drilling encountered, with chert and shale fragments						
46											
47											
48											
49	S&H		60/2"		SHALE, black, deeply weathered, intensely fractured						
50					BEDROCK						
51											
52											
53	SPT		50/4"								
54					Boring terminated at a depth of 53.5 feet. Groundwater obscured by drilling method. Boring backfilled with grout.						
55											
56											
57											
58											
59											
60											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-11

Boring location: See Figure 2

Date started: 8/19/97 | Date finished: 8/19/97

Drilling method: Rotary wash

Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer

Sampler: SPT, S&H, D&M piston

Logged by: M. McKee

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 2.5 feet, SFCD						
1					1 inch asphalt concrete						
2					CLAYEY SAND with GRAVEL (SC), reddish-brown, loose to medium dense, moist						
3											
4											
5				SC							
6	S&H		9								
7											
8											
9					1:15 pm 8/19/97						
10					CLAYEY GRAVEL (GC), dark reddish-brown to brown, medium dense, wet, with sand						
11	S&H		14								
12											
13											
14				GC	FILL						
15					grades reddish-brown						
16	SPT		21								
17											
18											
19											
20	S&H				SILTY SAND with GRAVEL (SM), reddish-brown, medium dense, wet, sand is coarse-grained						
21			17								
22					clay lens at 22 feet						
23					gravel lens at 23 feet						
24											
25	S&H			SM							
26			21		grades less silty with shale fragments					16.1	124
27											
28											
29					grades more gravelly, up to 2" in diameter						
30											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-11

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
31	S&H		28	SC	CLAYEY SAND with GRAVEL (SC), continued — FILL						
32–36					CLAY (CH), dark greenish-gray, soft to medium stiff, wet, with shells, some gravel						
37–38	D&M		450 psi	CH	BAY MUD					60.6	64
39–56											
57	D&M		400 psi	CH	CLAY (CH), bluish-gray, stiff, moist, with minor gravel (chert fragments)						
58–59				CH	CLAY (CH), light olive-brown with yellowish-brown mottling, very stiff, moist						
60											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-11

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
61	S&H		28		CLAY (CH), continued					27.4	99
62–69				CH	grades greenish-gray with white carbonate nodules, with fine chert fragments						
70											
71	S&H		24			TXUU	2500	1540		29.6	95
72–74					grades slightly sandy						
75–79					grades olive						
80											
81	S&H		40								
82					SERPENTINITE, dark olive and dark gray, deeply weathered, closely fractured						
83–85					SHALE, black, deeply weathered, intensely fractured — BEDROCK						
86	SPT		70								
87					Boring terminated at a depth of 86.5 feet. Groundwater encountered at a depth of 9-1/3 feet during drilling. Boring backfilled with grout.						
88–90											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-12

Boring location: See Figure 2

Date started: 8/6/97 | Date finished: 8/6/97

Logged by: M. McKee

Drilling method: Rotary wash

Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer

Sampler: SPT, S&H

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 7.5 feet, SFCD						
1					3 inches asphalt concrete over 3 inches clayey sand						
2					SILTY SAND (SM), dark reddish-brown, medium dense, moist, with fine gravel (shale fragments)						
3											
4											
5				SM							
6	S&H		21							9.8	121
7					grades brown, dry to moist, fine- to coarse-grained sand						
8											
9					FILL						
10											
11	S&H		9		GRAVELLY SAND with SILT (SW-SM), brown, medium dense, wet, with clay, rock fragments up to 4" (shale)				11.1	17.8	
12											
13				SW-SM							
14											
15											
16	SPT		18								
17											
18				CH	SILTY CLAY (CH), olive-gray, very soft, wet — BAY MUD						
19				GP	SANDY GRAVEL (GP), olive-brown and brown mottled, dense, wet, gravel up to 1"						
20											
21	S&H		30/4"		SERPENTINITE, dark yellowish-brown, crushed, deeply weathered						
22											
23					BEDROCK						
24											
25	SPT		50/3"								
26					Boring terminated at a depth of 25.75 feet. Groundwater obscured by drilling method. Boring backfilled with grout.						
27											
28											
29											
30											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-13

Boring location: See Figure 2

Date started: 8/5/97 | Date finished: 8/6/97

Logged by: M. McKee

Drilling method: Rotary wash

Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer

Sampler: SPT, S&H, D&M piston

Ground Surface Elevation: 2.5 feet, SFCD

DEPTH (feet)	Sampler Type	Sample	Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
1				SC	3 inches asphalt concrete over 3 inches clayey gravel CLAYEY SAND (SC), dark yellowish-brown, medium dense to dense, moist, with gravel						
2											
3											
4											
5											
6	S&H		30								
7											
8				CL	SANDY CLAY (CL), dark reddish-brown, moist						
9											
10				GP	SANDY GRAVEL (GP), olive-brown, loose, wet						
11	S&H		2		FILL						
12				SC	CLAYEY SAND with GRAVEL (SC), reddish-brown, loose to medium dense, wet						
13											
14											
15											
16	SPT		18								
17											
18											
19											
20				CH	SANDY CLAY (CH), dark reddish-brown, stiff, moist					22.0	107
21	S&H		11								
22											
23											
24				CH	CLAY (CH), dark bluish-gray, soft, wet						
25											
26					BAY MUD						
27				CL	SANDY CLAY (CL), dark bluish-gray, medium stiff, wet, with clayey fine sand lenses, with shells						
28											
29	D&M		190 psi			TV		700		28.3	97
30											

LABORATORY TEST DATA

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-13

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
31				CL	SANDY CLAY (CL), continued — BAY MUD						
32–38	S&H		7	CL	SANDY CLAY (CL), reddish-brown, with dark reddish-brown and black specks, medium stiff, moist						
39–46	SPT		11	CL	SANDY CLAY (CL), dark greenish-gray, stiff, moist, sand is very fine-grained						
47–53	S&H		25	CL	CLAY (CL), dark olive-gray and gray mottled, very stiff, moist, with chert fragments to 1/8" coarse sand encountered at 57 feet	TXUU	2000	2340		20.5	110
59–60	S&H		31	CL	CLAY (CL), reddish-brown, hard, moist, with chert fragments LL = 36; PI = 18					19.5	110

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-13

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
61–67				CL	CLAY (CL), continued						
67–69				CL	grades light olive-brown, with angular and well-rounded gravel						
69	SPT		35								
70–71				GC	CLAYEY GRAVEL (GC), olive and reddish-brown mottled, dense, moist						
72–78				CH	CLAY (CH), grayish-brown, stiff, moist, with some chert fragments						
79	SPT		38								
80–84				GC	CLAYEY GRAVEL (GC), yellowish-brown, dense, wet, gravel is angular						
85–88				CH	CLAY (CH), grayish-brown						
89	S&H		48/6"		SHALE, reddish-brown and yellow mottled, deeply weathered, crushed — BEDROCK						
90											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-13

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
91					SHALE, continued						
92											
93					BEDROCK						
94											
95											
96					Boring terminated at a depth of 95.5 feet. Groundwater obscured by drilling method. Boring backfilled with grout.						
97											
98											
99											
100											
101											
102											
103											
104											
105											
106											
107											
108											
109											
110											
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-14

Boring location: See Figure 2

Date started: 8/22/97 | Date finished: 8/22/97

Logged by: M. McKee

Drilling method: Rotary wash

Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer

Sampler: SPT, S&H, D&M piston

LABORATORY TEST DATA

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 2.0 feet, SFCD						
					3-1/2 inches asphalt concrete						
1					CLAYEY SAND with GRAVEL (SC), dark reddish-brown, medium dense, moist, sand is coarse-grained						
2											
3											
4											
5					grades more gravelly						
6	S&H		16		▼ 8:55 am 8/22/97						
7											
8				SC	FILL						
9					▼ 8:45 am 8/22/97						
10					grades less gravelly, wet						
11	S&H		6						28.0	20.9	106
12											
13											
14											
15											
16	SPT		11								
17					Boring terminated at a depth of 16.5 feet.						
18					Groundwater encountered at a depth of 9-1/2 feet during drilling and rose to 6 feet 10 minutes later.						
19					Boring backfilled with grout.						
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-14A

Boring location: See Figure 2

Date started: 8/22/97 | Date finished: 8/22/97

Logged by: M. McKee

Drilling method: Rotary wash

Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer

Sampler: SPT, S&H, D&M piston

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot 1	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 2.0 feet, SFCD						
1					3-1/2 inches asphalt concrete						
2					CLAYEY SAND and GRAVEL (GC), reddish-brown, with some chert and serpentinite fragments						
3											
4											
5											
6											
7											
8											
9					▼ 11:00 am 8/22/97						
10											
11											
12											
13				GC	FILL						
14											
15					grades less clayey, more gravelly						
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28				CH	CLAY (CH), dark greenish-gray, soft, wet, trace shells						
29					BAY MUD						
30											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-14A

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
31				CH	CLAY (CH), continued						
					BAY MUD						
32											
33	D&M		400 psi		CLAY (CL), yellowish-red with black and gray mottling, very stiff, moist, with some chert fragments to 1/8", with sand						
34											
35											
36	S&H		13		LL = 45; PI = 24					26.1	100
37											
38											
39											
40											
41											
42											
43											
44				CL							
45					grades dark reddish-brown						
46											
47											
48											
49											
50					grades yellowish-brown with trace black organics and chert fragments to 1/16", with trace sand						
51	S&H		20			TXUU	2000	1540		25.8	100
52											
53											
54											
55											
56					CLAY (CH), bluish-gray, very stiff to hard, moist						
57											
58				CH							
59											
60											

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-14A

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
61–64				CH	CLAY with GRAVEL (CH), greenish-gray, hard, moist, with angular chert fragments to 3/4"						
65–66	SPT		36	CH							
67–69				CH							
70–76				SM	SILTY SAND and GRAVEL (SM), grayish- to reddish-brown, gravel consists of angular chert and serpentinite fragments						
77–80				CL	CLAY (CL), reddish-brown, hard, wet, with some chert and serpentinite fragments to 1/8"						
81	S&H		42	CL		TXUU	3000	1550		21.5	110
82–90				CL	grades gravelly at 90 feet						

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-14A

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
91–94				CL	CLAY (CL), continued						
95–105	SPT		50	CL-CH	CLAY (CL-CH), greenish-gray and brown mottled, hard, moist, with coarse angular sand						
105–109				CL	SANDY CLAY (CL), yellowish-brown, hard, moist RESIDUAL SOIL						
110–111	SPT		66		SERPENTINITE, olive and yellowish-brown, deeply weathered, crushed BEDROCK						
112–120					Boring terminated at a depth of 111.5 feet. Groundwater encountered at a depth of 9-1/2 feet during drilling. Boring backfilled with grout.						

PROJECT: **SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS**
San Francisco, California

Log of Boring DB-15

Boring location: See Figure 2
Date started: 9/3/97 | Date finished: 9/3/97
Drilling method: Rotary wash
Hammer weight/drop: 140 lbs/30 in | Hammer type: Safety hammer
Sampler: SPT, S&H, D&M piston

Logged by: M. McKee

LABORATORY TEST DATA

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Test Surcharge Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 3.0 feet, SFCD						
1					1 inch asphalt concrete						
2				SM	SILTY SAND (SM), dark brown, medium dense, moist, with trace fine gravel, with clay						
3											
4											
5					trace asphalt, glass, chert fragments 4 to 5-1/2 feet						
6	S&H		17	SC	CLAYEY SAND (SC), dark orange-brown, very stiff, moist, with some sand lenses					13.4	117
7											
8											
9					▼ 7:45 am 9/3/97						
10				SM	SILTY SAND with GRAVEL (SM), dark gray, loose, wet, with some creosote wood debris, and serpentinite fragments						
11	S&H		5						13.0	19.5	
12					FILL						
13											
14				GC	CLAYEY GRAVEL (GC), gray, medium dense, wet, with serpentinite fragments						
15											
16	SPT		18	SC	CLAYEY SAND with GRAVEL (SC), yellowish-brown, medium dense, wet, medium- to coarse-grained						
17											
18											
19											
20					grades loose at 20 feet						
21	SPT		7						18.9		
22											
23											
24											
25					grades medium dense						
26	SPT		15								
27											
28											
29				CH	CLAY (CH), bluish-gray, soft, wet, with some white shell fragments						
30					BAY MUD						

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

GRAIN SIZE CHART		
Classification	**Range of Grain Sizes**	
	U.S. Standard Sieve Size	**Grain Size in Millimeters**
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

SAMPLE DESIGNATIONS/SYMBOLS


Sample taken with split-barrel sampler other than Standard Penetration Test sampler. Darkened area indicates sample obtained


Classification sample taken with Standard Penetration Test sampler


Undisturbed sample taken with thin-walled tube


Disturbed sample


Sampling attempted with no recovery


Core sample


Groundwater level at the time and date indicated

SAMPLER TYPE

C Core barrel

CA California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter

D&M Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube

O Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube

PT Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube

S&H Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter

SPT Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter

ST Shelby tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

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CLASSIFICATION CHART

Project No. 2149.02 | Figure A-20

I CONSOLIDATION OF SEDIMENTARY ROCKS: usually determined from unweathered samples. Largely dependent on cementation.

U = unconsolidated
P = poorly consolidated
M = moderately consolidated
W = well consolidated

II BEDDING OF SEDIMENTARY ROCKS

Splitting Property	Thickness	Stratification
Massive	Greater than 4.0 ft.	very thick-bedded
Blocky	2.0 to 4.0 ft.	thick bedded
Slabby	0.2 to 2.0 ft.	thin bedded
Flaggy	0.05 to 0.2 ft.	very thin-bedded
Shaly or platy	0.01 to 0.05 ft.	laminated
Papery	less than 0.01	thinly laminated

III FRACTURING

Intensity	Size of Places in Feet
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

IV HARDNESS

1. **Soft** - reserved for plastic material alone.
2. **Low hardness** - can be gouged deeply or carved easily with a knife blade.
3. **Moderately hard** - can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visibly after the powder has been blown away.
4. **Hard** - can be scratched with difficulty; scratch produced a little powder and is often faintly visible.
5. **Very hard** - cannot be scratched with knife blade; leaves a metallic streak.

V STRENGTH

1. **Plastic** or very low strength.
2. **Friable** - crumbles easily by rubbing with fingers.
3. **Weak** - an unfractured specimen of such material will crumble under light hammer blows.
4. **Moderately strong** - specimen will withstand a few heavy hammer blows before breaking.
5. **Strong** - specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.
6. **Very strong** - specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

VI WEATHERING - The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing .

D. Deep - moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates and/or clay or silt.
M. Moderate - slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures.
L. Little - no megascopic decomposition of minerals; little of no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces.
F. Fresh - unaffected by weathering agents. No disintegration of discoloration. Fractures usually less numerous than joints.

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS

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Project No. 2149.02 | Figure A-21

APPENDIX B

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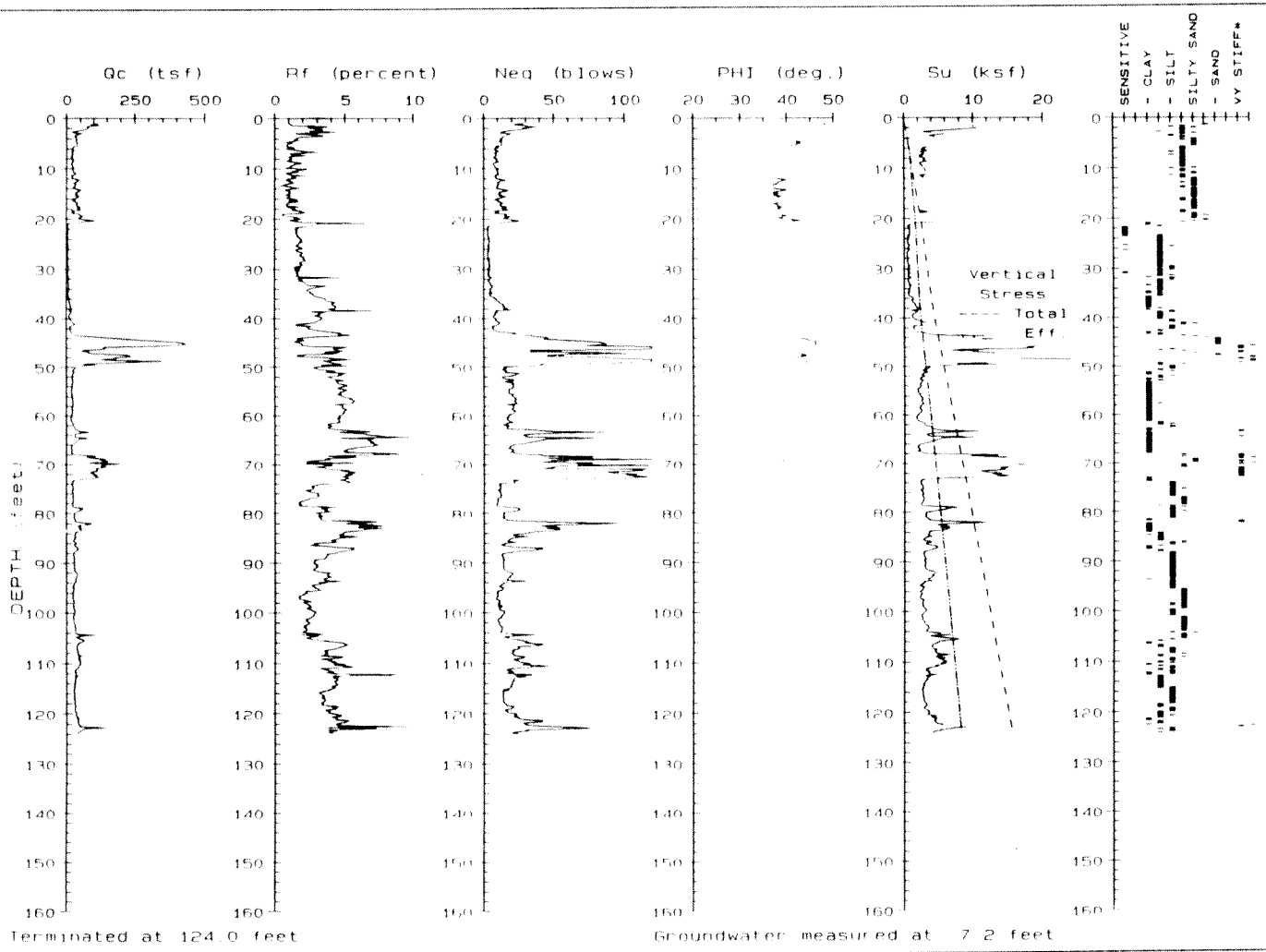
APPENDIX B
Cone Penetration Test Results

APPENDIX B
Cone Penetration Test Results

To further characterize the subsurface conditions, 17 cone penetration tests (CPTs) were performed on 7 through 28 August 1997. The CPTs, designated CPT-1 and CPT-3 through CPT-18 (there is no CPT-2) were advanced to depths ranging from 33½ to 160 feet below the existing ground surface. The CPT logs, showing tip resistance, local friction, friction ratio, and pore pressure by depth are presented on Figures C-1 through C-17.

The CPTs were performed by hydraulically pushing a 1.4-inch diameter (ten square centimeters), cone-tipped probe into the ground. The cone on the end of the probe measures tip resistance, and the friction sleeve above the cone tip measures frictional resistance. Electrical strain gauges within the cone measure soil parameters continuously for the entire depth advanced. Soil data, including tip resistance and frictional resistance, were transferred to a computer while conducting each test. Accumulated data was processed by computer to provide engineering information, such as the types and approximate strength characteristics of the soil encountered, which are shown on the figures, also.



Date: 8/26/97

Elevation of ground surface (approximate, SFCD): 1.0

SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS

San Francisco, California

CONE PENETRATION TEST RESULTS

CPT-1

Project No. 2149.02 | Figure B-1

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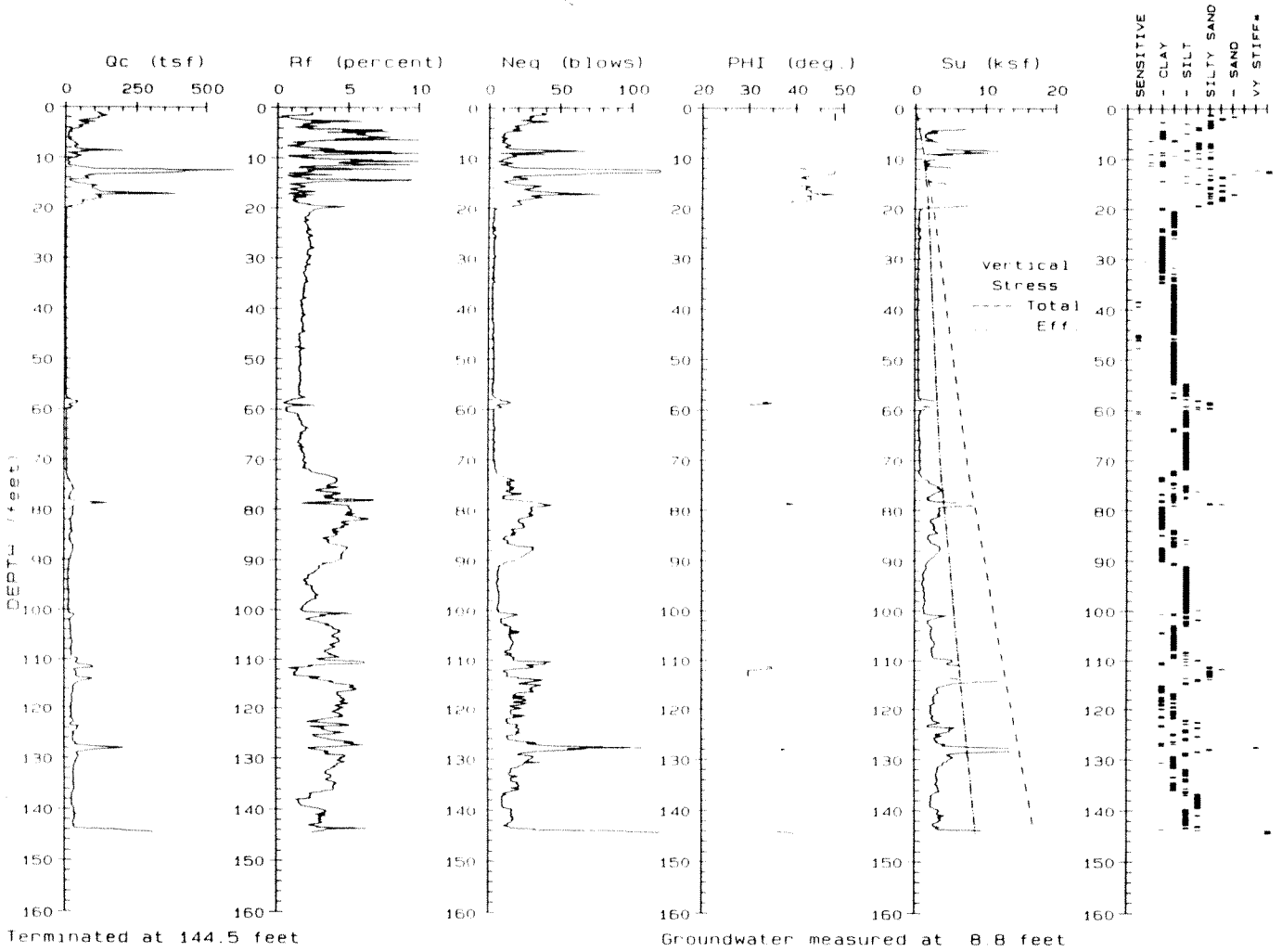

SAN FRANCISCO 49ERS STADIUM
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San Francisco, California

CONE PENETRATION TEST RESULTS
CPT-4

Project No. 2149.02 | Figure B-3

Date: 8/8/97

Elevation of ground surface (approximate, SFCD): -3.5

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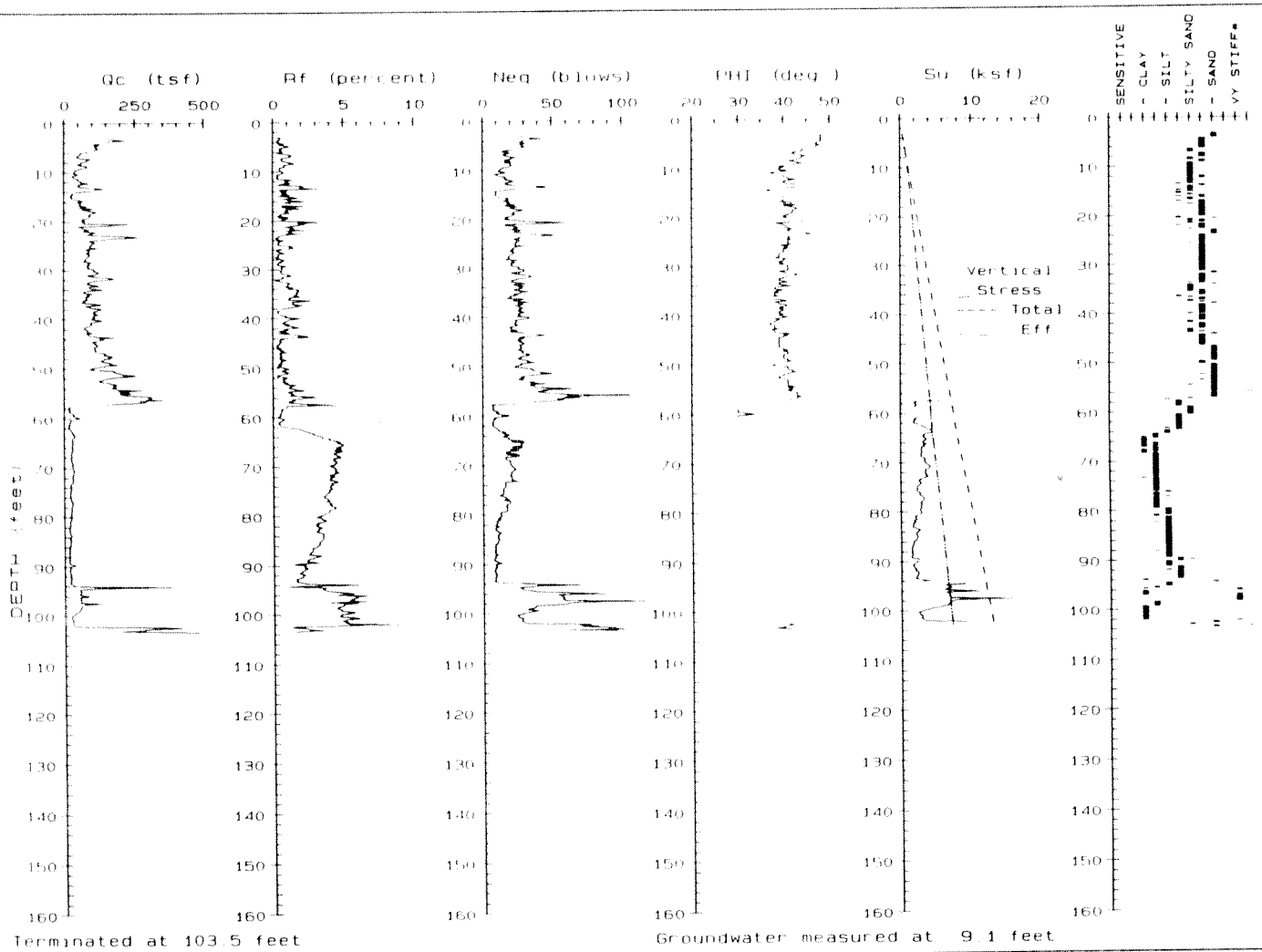

Date: 8/7/97

Elevation of ground surface (approximate, SFCD): 2.5

SAN FRANCISCO 49ERS STADIUM
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San Francisco, California

CONE PENETRATION TEST RESULTS
CPT-6

Project No. 2149.02 | Figure B-5

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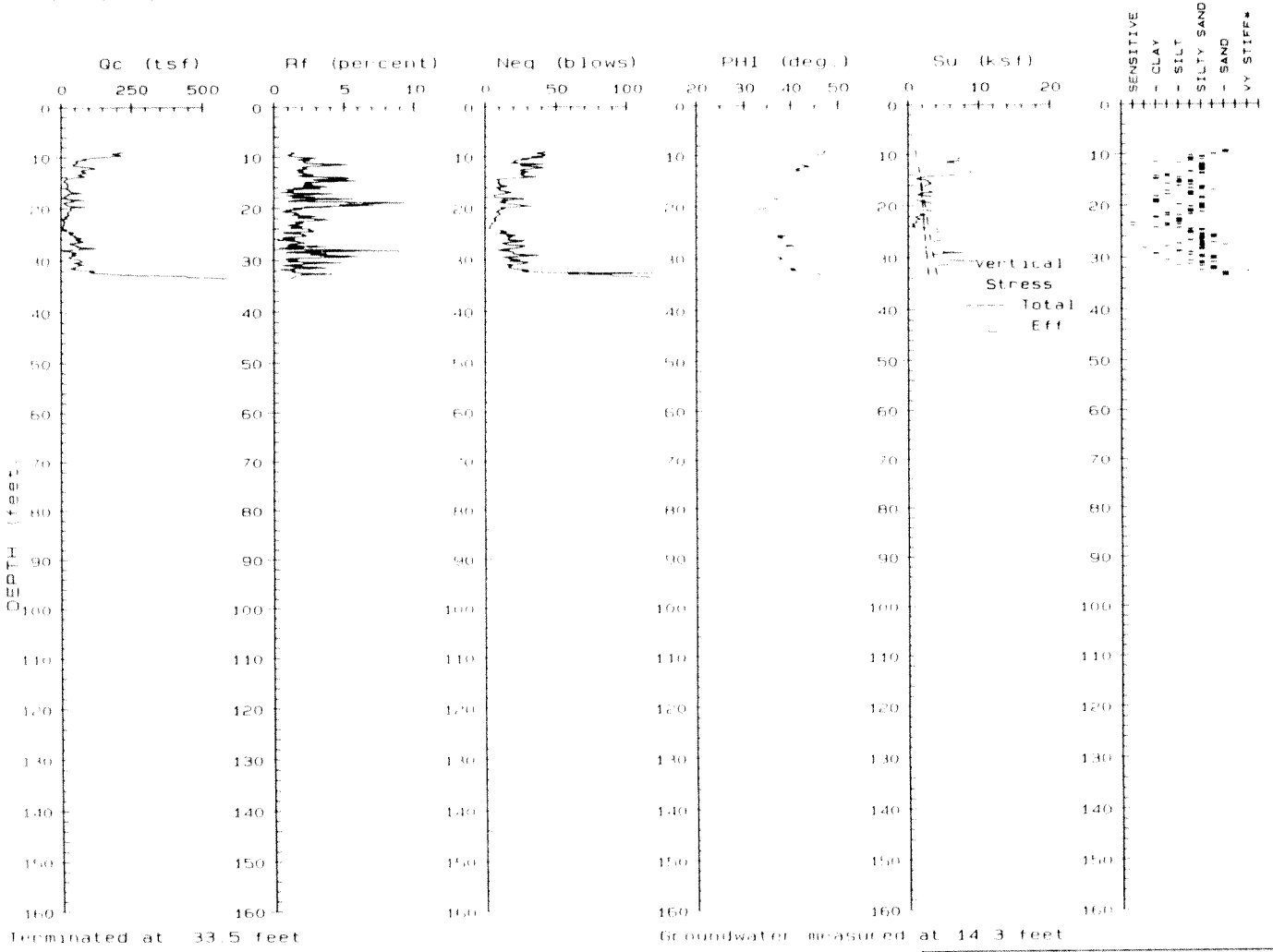


SAN FRANCISCO 49ERS STADIUM
AND CANDLESTICK MILLS
San Francisco, California

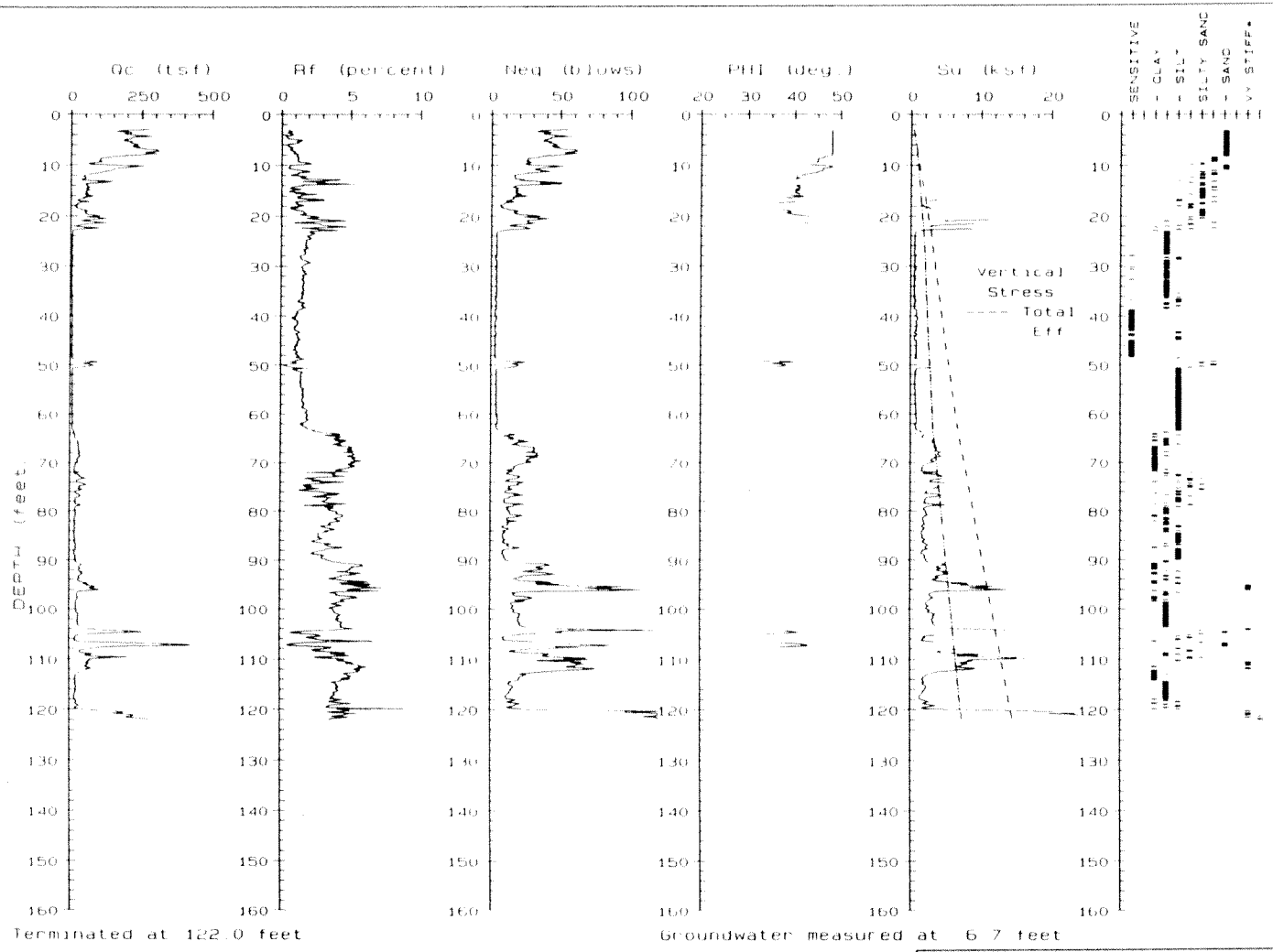
CONE PENETRATION TEST RESULTS
CPT-9

Project No. 2149.02 | Figure B-8

Date: 8/7/97

Elevation of ground surface (approximate, SFCD): 9.0

Treadwell&Rollo



Date: 8/8/97

Elevation of ground surface (approximate, SFCD): 0.0

SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS

San Francisco, California

CONE PENETRATION TEST RESULTS CPT-10

Project No. 2149.02 | Figure B-9

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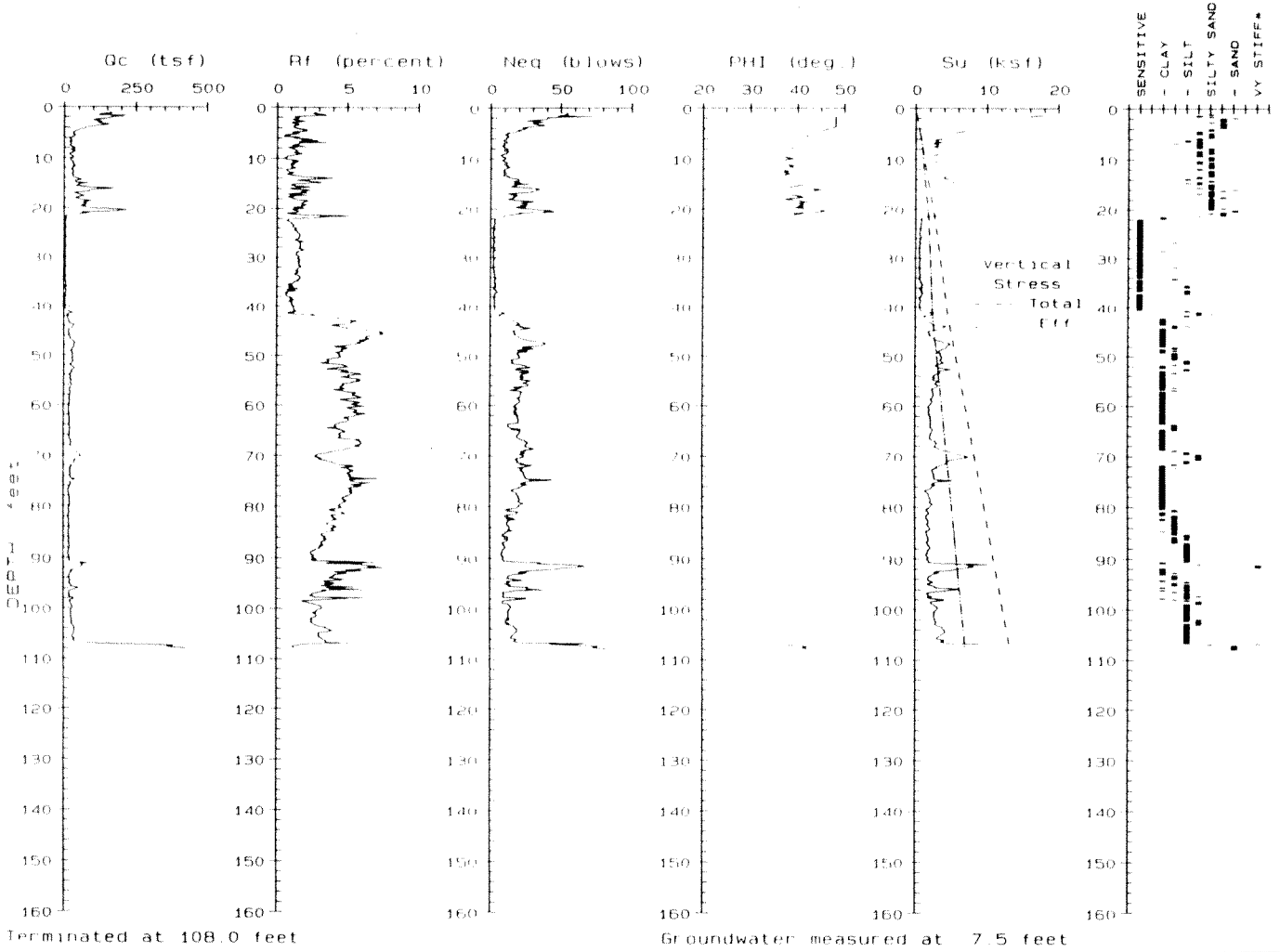

SAN FRANCISCO 49ERS STADIUM
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San Francisco, California

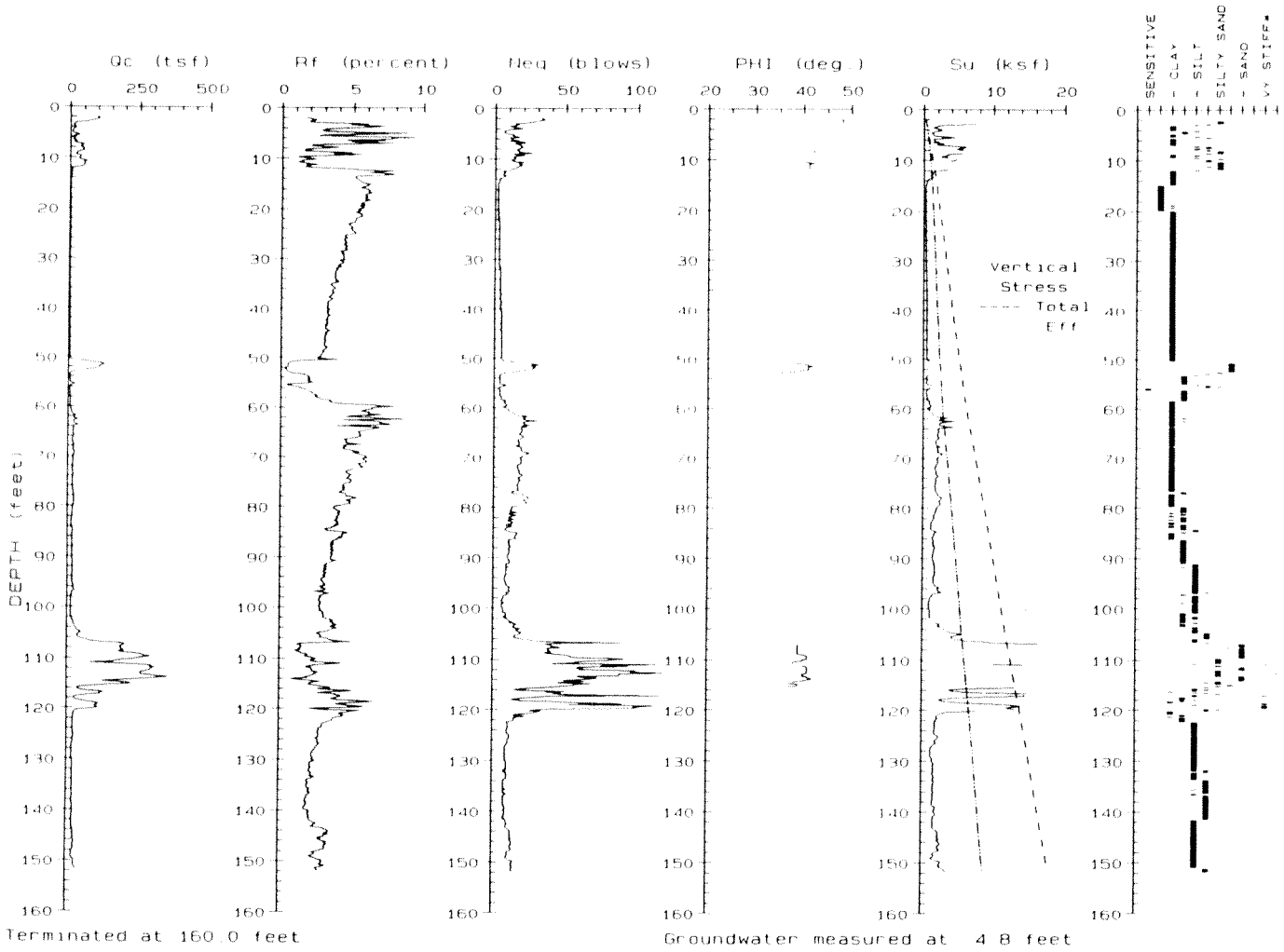
CONE PENETRATION TEST RESULTS
CPT-11

Project No. 2149.02 | Figure B-10

Date: 8/8/97

Elevation of ground surface (approximate, SFCD): 1.0

Treadwell&Rollo



Date: 8/28/97

Elevation of ground surface (approximate, SFCD): -2.0

SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS

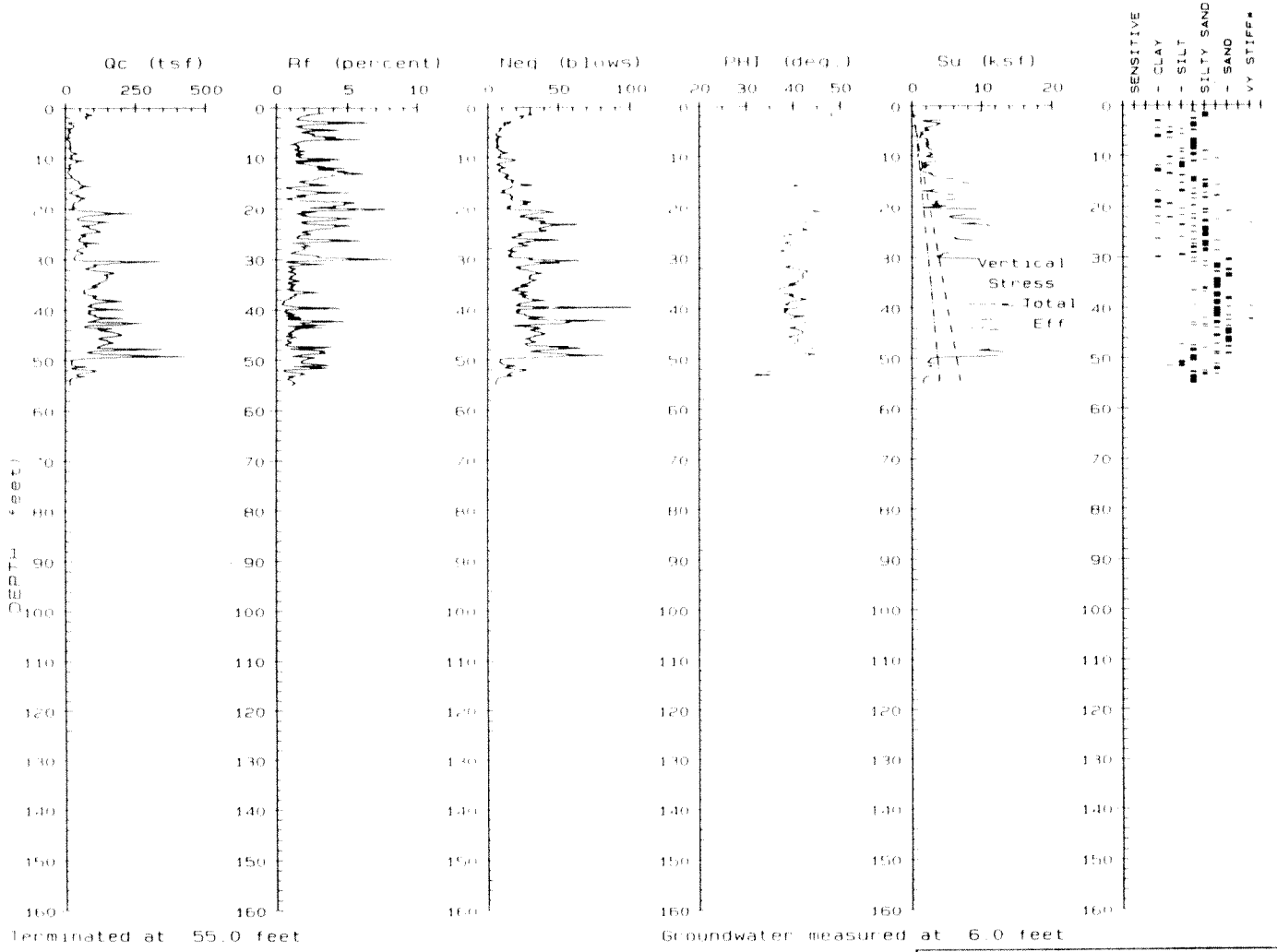
San Francisco, California

CONE PENETRATION TEST RESULTS

CPT-12

Project No. 2149.02 | Figure B-11

Treadwell&Rollo



Date: 8/27/97

Elevation of ground surface (approximate, SFCD): -1.0

SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS

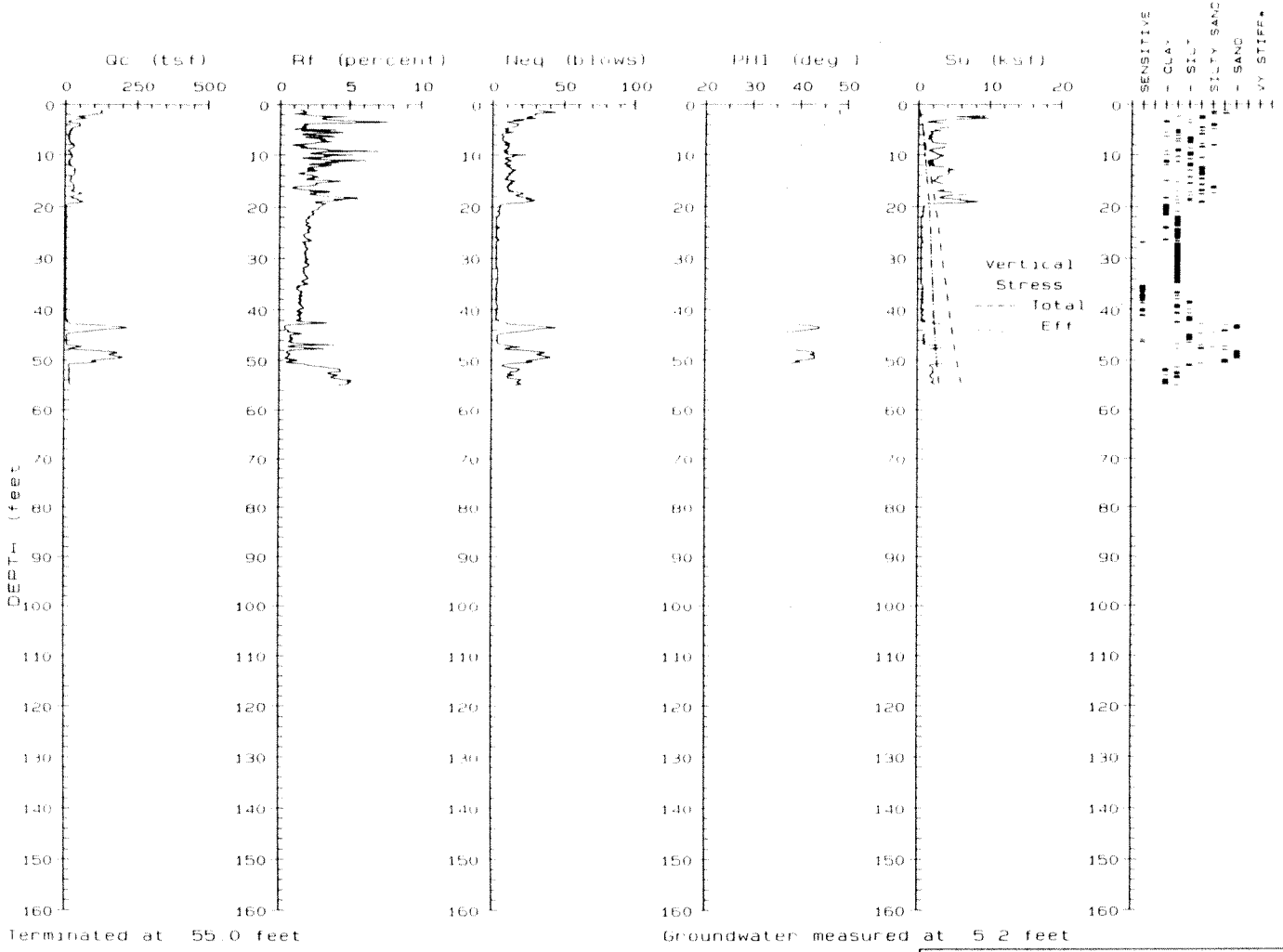
San Francisco, California

CONE PENETRATION TEST RESULTS

CPT-13

Project No. 2149.02 | Figure B-12

Treadwell&Rollo



Date: 8/27/97

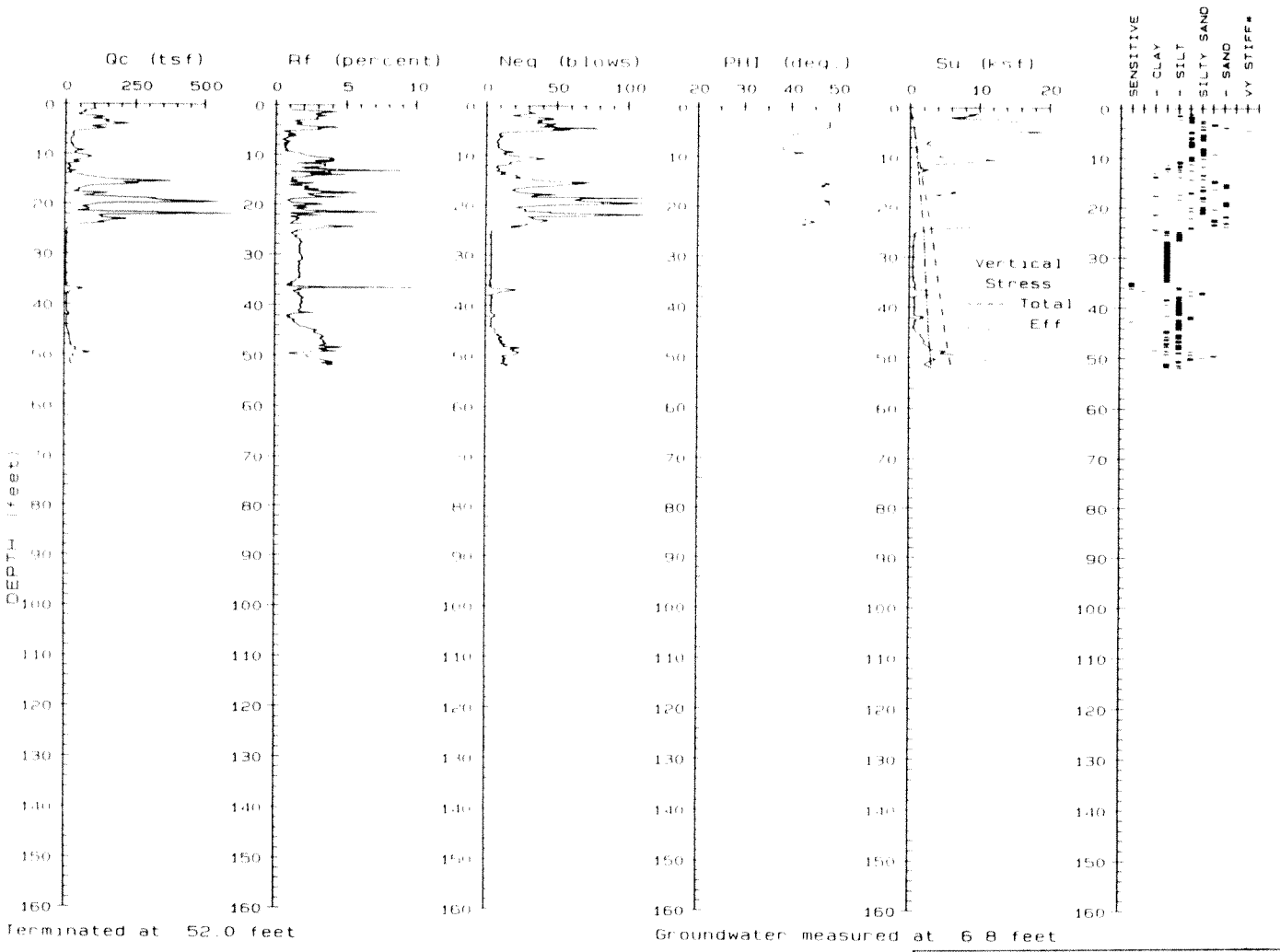
Elevation of ground surface (approximate, SFCD): -1.5

SAN FRANCISCO 49ERS STADIUM
AND CANDLESTICK MILLS
San Francisco, California

CONE PENETRATION TEST RESULTS
CPT-14

Project No. 2149.02 | Figure B-13

Treadwell&Rollo



SAN FRANCISCO 49ERS STADIUM
AND CANDLESTICK MILLS
San Francisco, California

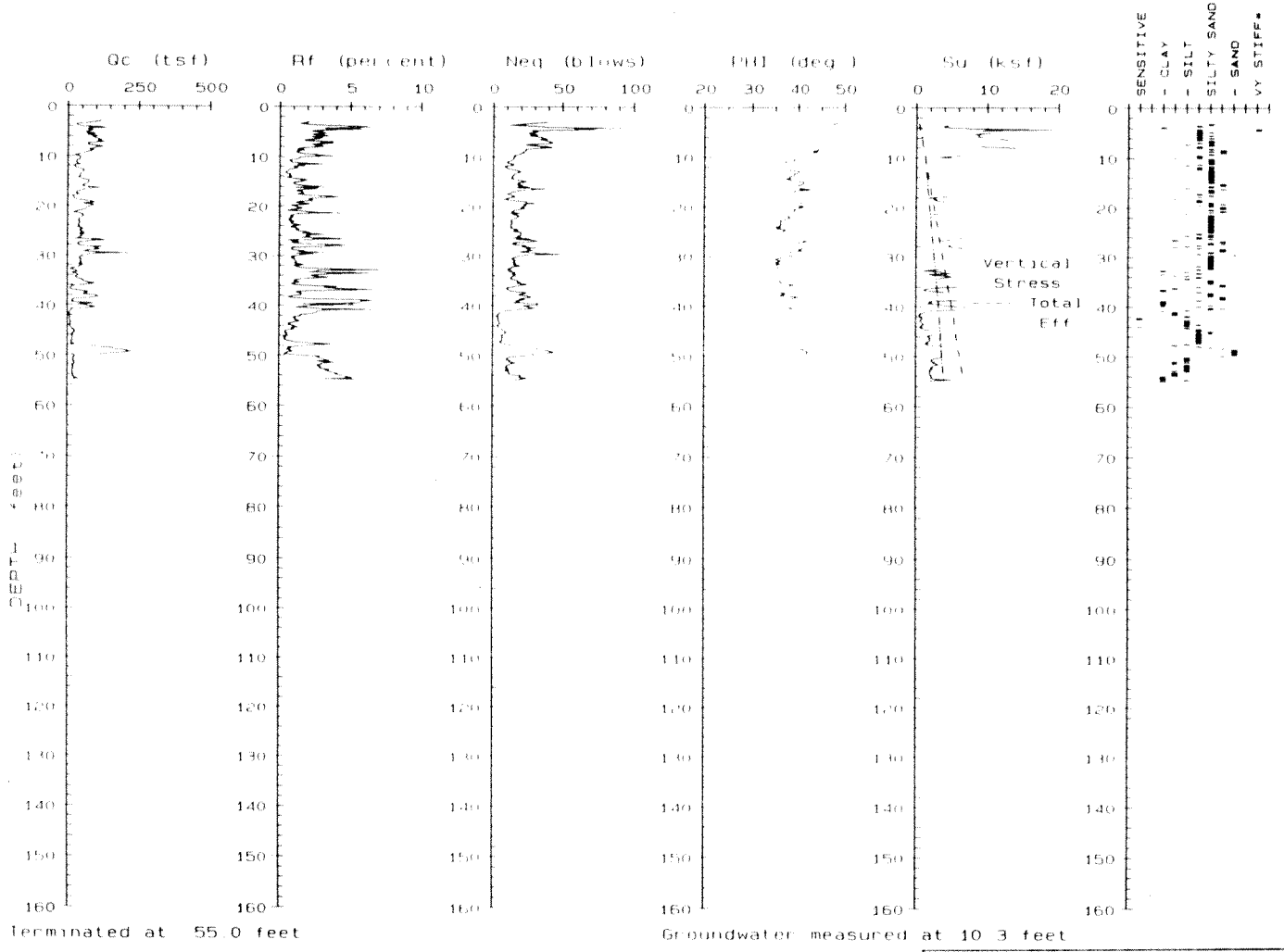
CONE PENETRATION TEST RESULTS
CPT-15

Project No. 2149.02 | Figure B-14

Date: 8/27/97

Elevation of ground surface (approximate, SFCD): 0.5

Treadwell&Rollo



Date: 8/27/97

Elevation of ground surface (approximate, SFCD): 4.5

SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS

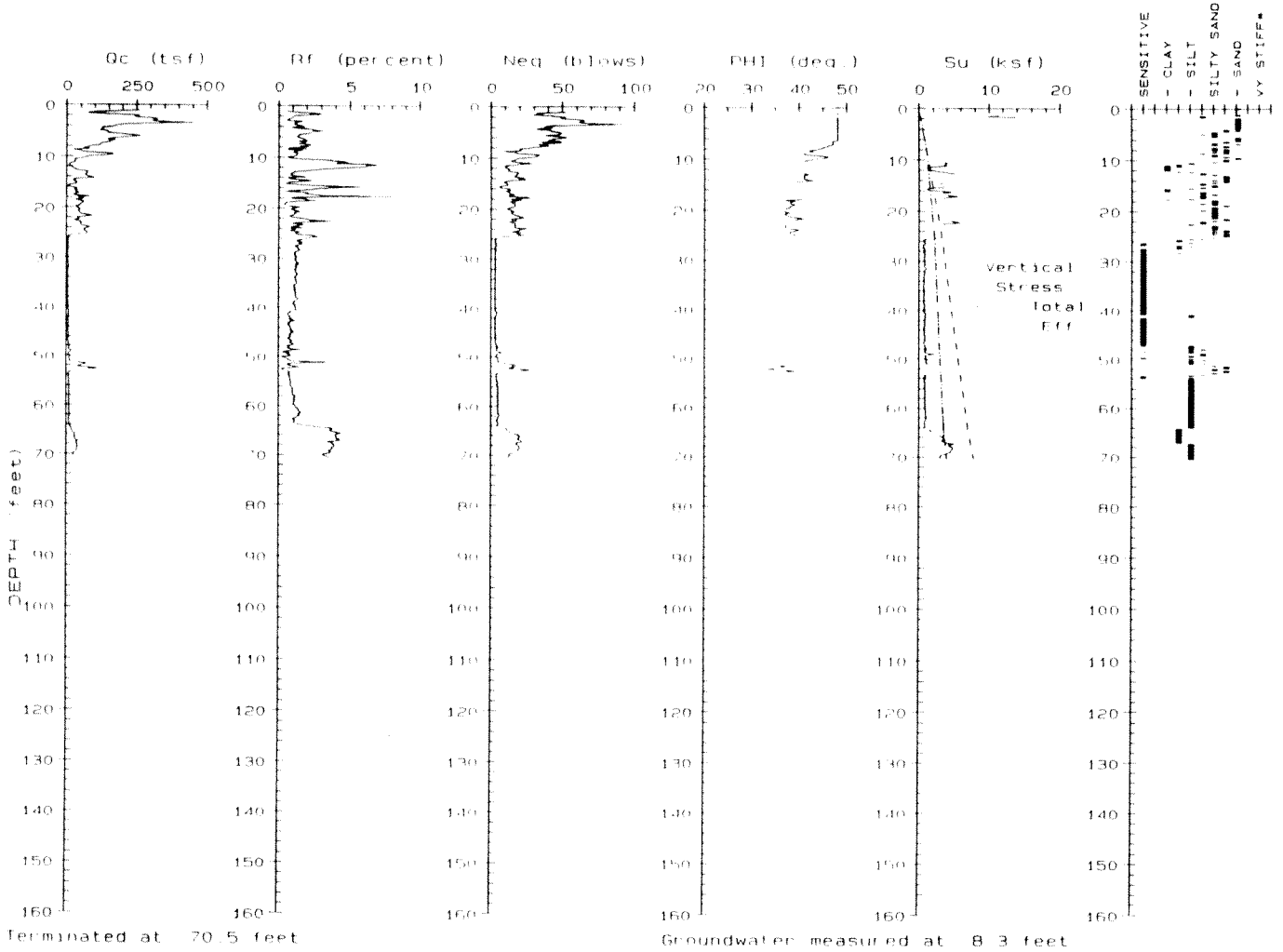
San Francisco, California

CONE PENETRATION TEST RESULTS

CPT-16

Project No. 2149.02	Figure B-15

Treadwell&Rollo



Date: 8/27/97

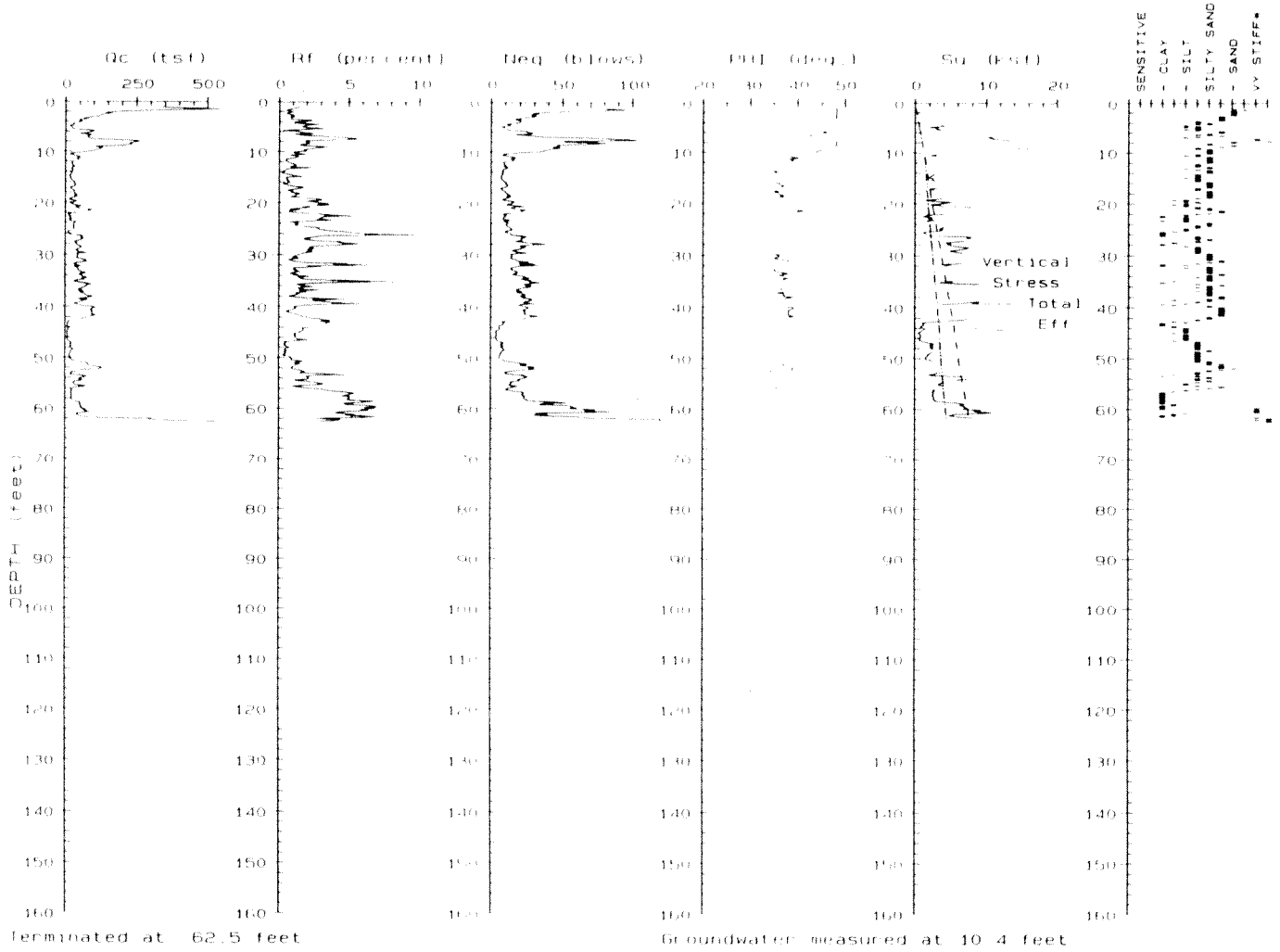
Elevation of ground surface (approximate, SFCD): 2.5

SAN FRANCISCO 49ERS STADIUM
AND CANDLESTICK MILLS
San Francisco, California

CONE PENETRATION TEST RESULTS
CPT-17

Project No. 2149.02 | Figure B-16

Treadwell&Rollo



Date: 8/27/97

Elevation of ground surface (approximate, SFCD): 3.5

SAN FRANCISCO 49ERS STADIUM AND CANDLESTICK MILLS

San Francisco, California

CONE PENETRATION TEST RESULTS

CPT-18

Project No. 2149.02 | Figure B-17

Treadwell&Rollo

APPENDIX C

NORCAL GEOPHYSICAL CONSULTANTS INC.

September 24, 1997

Ms. Lori Simpson
Treadwell and Rollo
555 Montgomery Street, Suite 1300
San Francisco, CA 94111

Subject: Seismic Refraction Survey,
49er Stadium and Mall,
Candlestick Point, San Francisco, CA

Dear Ms. Simpson:

This letter presents the findings of a seismic refraction survey performed by NORCAL Geophysical Consultants, Inc. at the subject project. The seismic refraction survey was performed on September 16,1997 by NORCAL geophysicist Kenneth Blom and geophysical technician Travis Black. This work was conducted in accordance with our cost proposal dated August 20, 1997 and taking into account specific site conditions.

PROJECT DESCRIPTION

The survey area, as delineated on a site map provided by you, is approximately 800 feet by about 150 feet along the west side of 3Com Park Stadium and adjacent to Candlestick Point. The western boundary of this area is a steep cut that exposes Franciscan formation bedrock. The rock is variable in composition and degrees of hardness and weathering. The area of interest is along the roadway immediately east of the cut as well as the parking area between the roadway and the stadium.

At the time of the survey, there were numerous parked cars along the east side of the roadway as well as within the parking area. This limited the survey access to an alignment between the east side of the roadway and parking area and the west side of the road.

1350 INDUSTRIAL AVENUE SUITE A • PETALUMA, CA 94952
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

PURPOSE

The purpose of the seismic refraction survey is to measure seismic refraction compressional (P) wave velocities and the respective depth intervals within the upper 25 feet of the subsurface. This information will aid in assessing the depth to rock and the general excavation characteristics of the substrata.

SCOPE OF WORK

Our scope of work consisted of obtaining seismic refraction data along five (5) profiles within the survey area as access allowed. Our scope of work also consisted of analyzing and interpreting the data, and presenting our findings in a written report.

METHODOLOGY

There is a general correlation between seismic velocity and bedrock hardness and degree of weathering and fracturing. As a general rule, as velocities increase, the degree of weathering and/or fracturing decreases. Conversely, highly weathered and/or fractured rock, fill material or alluvial sediments will have noticeably lower velocities. The velocities of fill and sediments can be affected by compaction, consolidation, and saturation.

The seismic refraction method is used to determine the seismic velocity structure of the subsurface. Compressional (P) wave energy generated by an impulsive source at the surface propagates into the earth. The P-waves are refracted along interfaces representing an increase in velocity, and back to the surface where they are detected by a collinear array of geophones. The detected signals are recorded on a multi-channel seismograph and are analyzed to determine the shot point-to-geophone travel times. These data can be used along with the corresponding shot point-to-geophone distances to determine the depth, thickness, and seismic velocity of subsurface layers or zones.

DATA ACQUISITION

We obtained seismic refraction data along Profiles A, B, C, D and E as shown on Plate 1. Each of these profiles is 120 feet long and consists of 12 geophones distributed at 10 foot intervals in a colinear array. Shotpoints were located at both

ends of each array, 5 feet beyond the end geophones. In paved areas, the geophones are coupled to the ground surface with the use of bricks. Seismic energy at each shotpoint was provided by striking a 12-pound sledge hammer on a steel plate placed on the ground surface.

The resulting seismic data were recorded and printed using a Geometrics ES-1225 12-channel engineering seismograph and Mark Products geophones with a natural frequency of 4.5 Hz. The printed seismic data (seismograms) display the amount of time it takes for a compressional (P) wave to travel from a given shot point to each geophone in a profile.

DATA ANALYSIS

We plotted the shot point to geophone travel times versus the respective geophone distances to form time vs. distance graphs. By fitting straight line segments to the plotted data points, we determined the number of seismic velocity layers for each profile. These values, the travel times, and the location of each shot point and geophone were entered into a computer program (SIPT2 by Rimrock Geophysics). This computer program uses a variation of the time-delay method and a ray tracing routine to compute a model that best fits the observed data. The final output consists of cross-sections showing the ground surface and the depth and configuration of the seismic layer interfaces below the ground surface. The sections also show the velocity of each layer and the locations of the shot points.

RESULTS

The location of the seismic refraction profiles are shown on the Location Map, Plate 1. The seismic velocity cross-sections (Profiles A through E) are shown on Plates 2 through 4.

Our interpretation of the seismic refraction data resolves the subsurface at each of the profile locations into two or three seismic velocity layers. The layers are referred to as V1, V2, and V3, respectively. It should be noted that the layer designations are a means for correllating the various velocity layers between profiles. Only Profiles A and C show all three layers. The remaining profiles show only two layers with the missing layer either too thin to define or too deep to detect. The velocity in feet per second (fps), layer thickness in feet (ft), and

descriptions of these layers are summarized in the following table. The description is based solely on field observations, our experience regarding the seismic velocity of various soil and rock types, and our general knowledge of the regional geology.

Velocity Layer	Velocity (fps)	Thickness (ft)	Description
V1	4150-5750	0-19	variable from fill to highly weathered and fractured rock
V2	6350-9200	7-40	highly to moderately weathered and fractured rock
V3	11,500 or more	-	little weathered and fractured bedrock

The computed velocities are an average for each layer. There may be localized zones within each layer where the velocities are higher or lower than indicated. Also, the data analysis routine must assume that each layer is continuous along the entire length of the respective profile. Due to the pavement at the ground surface, it was not possible to accurately determine the velocity of the material within 2 to 3 feet of the surface. Due to these and other limitations inherent to the seismic refraction method, the cross-sections should be considered only as an approximation of the subsurface conditions. The actual conditions may vary locally.

RIPPABILITY

Based on the seismic velocity, a general assessment of rippability of various types of rock can be made. Tables published by Caterpillar Tractor Company indicate the rippability of material by different types of rippers. Sedimentary rocks (shale, sandstone, siltstone) with velocities less than about 7500 fps are considered rippable with a D8L Ripper; marginally rippable when the velocities are about 7500 to 9500 fps; and non rippable for rock with velocities greater than about 9500. As the size of the ripper increases, this range will also increase. For a D9 ripper, about 1000 fps can be added to these ranges. This published information should only be used as a general guide to assessing rippability. Other factors that should be taken into consideration should be the amount and trend of fracturing and bedding, as well as the specific equipment and ripping technique used.

We are pleased to provide our services to Treadwell and Rollo on this project. If you have any questions, or if we can be of further service, please do not hesitate calling.

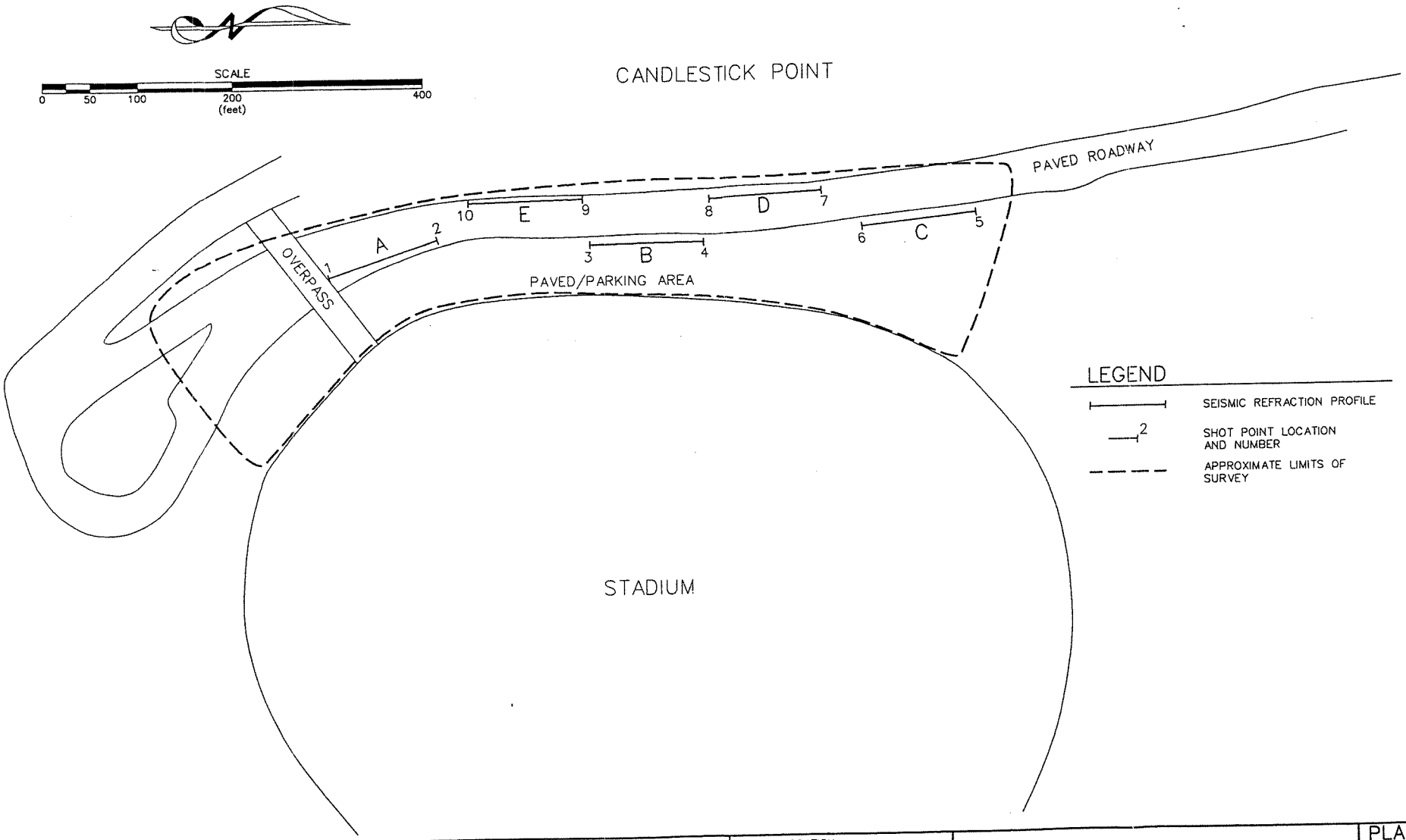
Yours very truly,

NORCAL Geophysical Consultants, Inc.

Kenneth G. Blom
Geophysicist - GP 887

KGB/jh

Enclosures: Plates 1, 2, 3 and 4



NORCAL GEOPHYSICAL CONSULTANTS INC.

NORCAL

JOB #: 97-243.22
DATE: 9/25/97

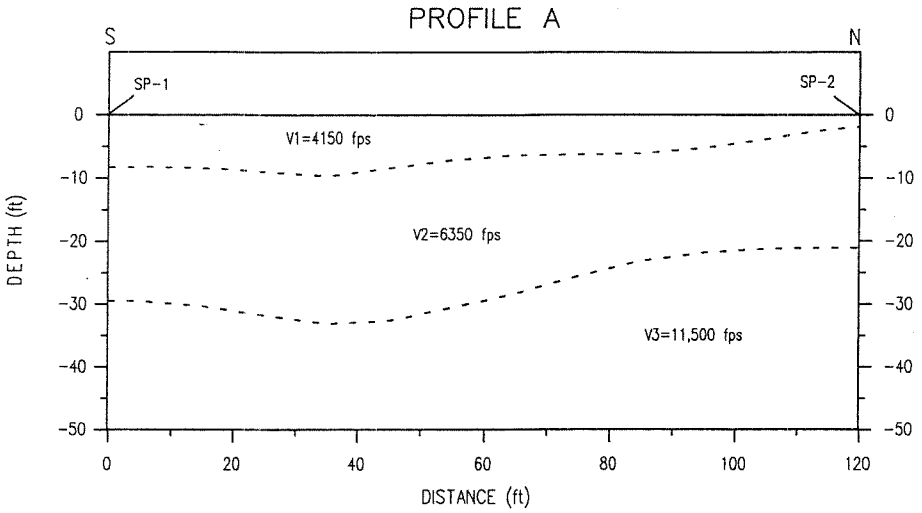
DRAWN BY: SPD
APPROVED: KLD

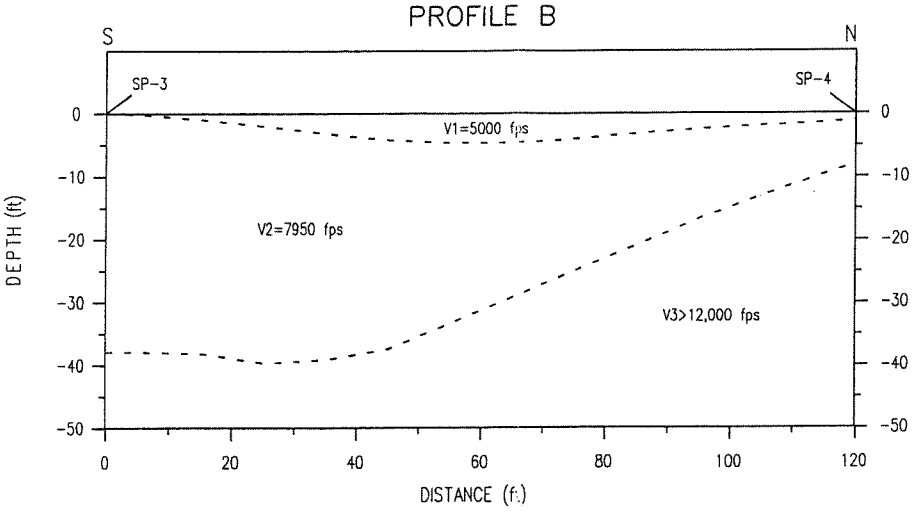
SURVEY LOCATION:
49er Stadium & Mall
San Francisco, California

CLIENT: TREADWELL & ROLLO

SITE LOCATION MAP
SEISMIC REFRACTION SURVEY

PLATE 1





Legend

SP – shot point
V2 – velocity layer designation
fps – feet per second

——— ground surface

- - - - seismic velocity interface

NORCAL GEOPHYSICAL CONSULTANTS INC.

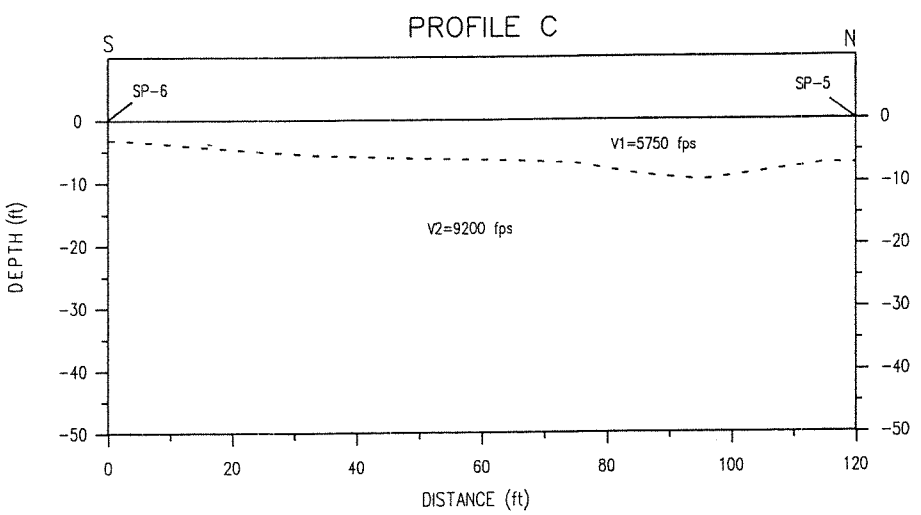
JOB #: 97-243.22
DATE: 9/25/97
DRAWN BY: SPD
APPROVED: KLD

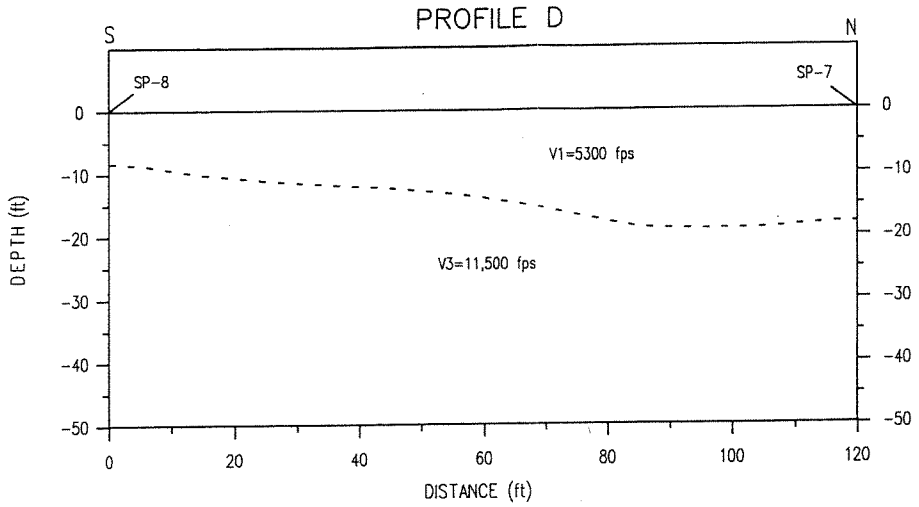
SURVEY LOCATION:
49er Stadium & Mall
San Francisco, California

CLIENT: TREADWELL & ROLLO

PROFILES A & B
SEISMIC REFRACTION SURVEY

PLATE 2





Legend

SP – shot point
V2 – velocity layer designation
fps – feet per second

ground surface

seismic velocity interface

NORCAL GEOPHYSICAL CONSULTANTS INC.

JOB #: 97-243.22
DATE: 9/25/97

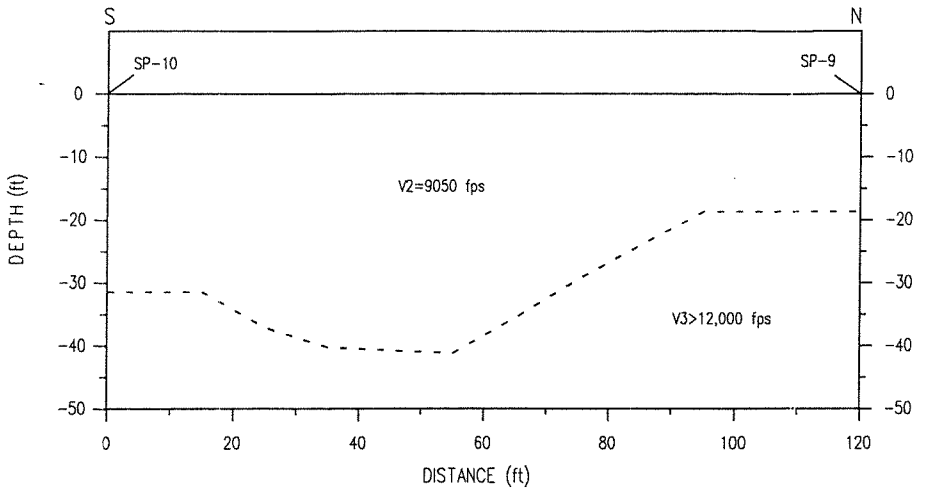
DRAWN BY: SPD
APPROVED: KB

SURVEY LOCATION:
49er Stadium & Mall
San Francisco, California

CLIENT: TREADWELL & ROLLO

PROFILES C & D
SEISMIC REFRACTION SURVEY

PLATE 3



Legend

SP – shot point
V2 – velocity layer designation
fps – feet per second

ground surface

seismic velocity interface

NORCAL GEOPHYSICAL CONSULTANTS INC.

JOB #: 97-243.22
DATE: 9/25/97
DRAWN BY: SPB
APPROVED:

SURVEY LOCATION:
49er Stadium & Mall
San Francisco, California

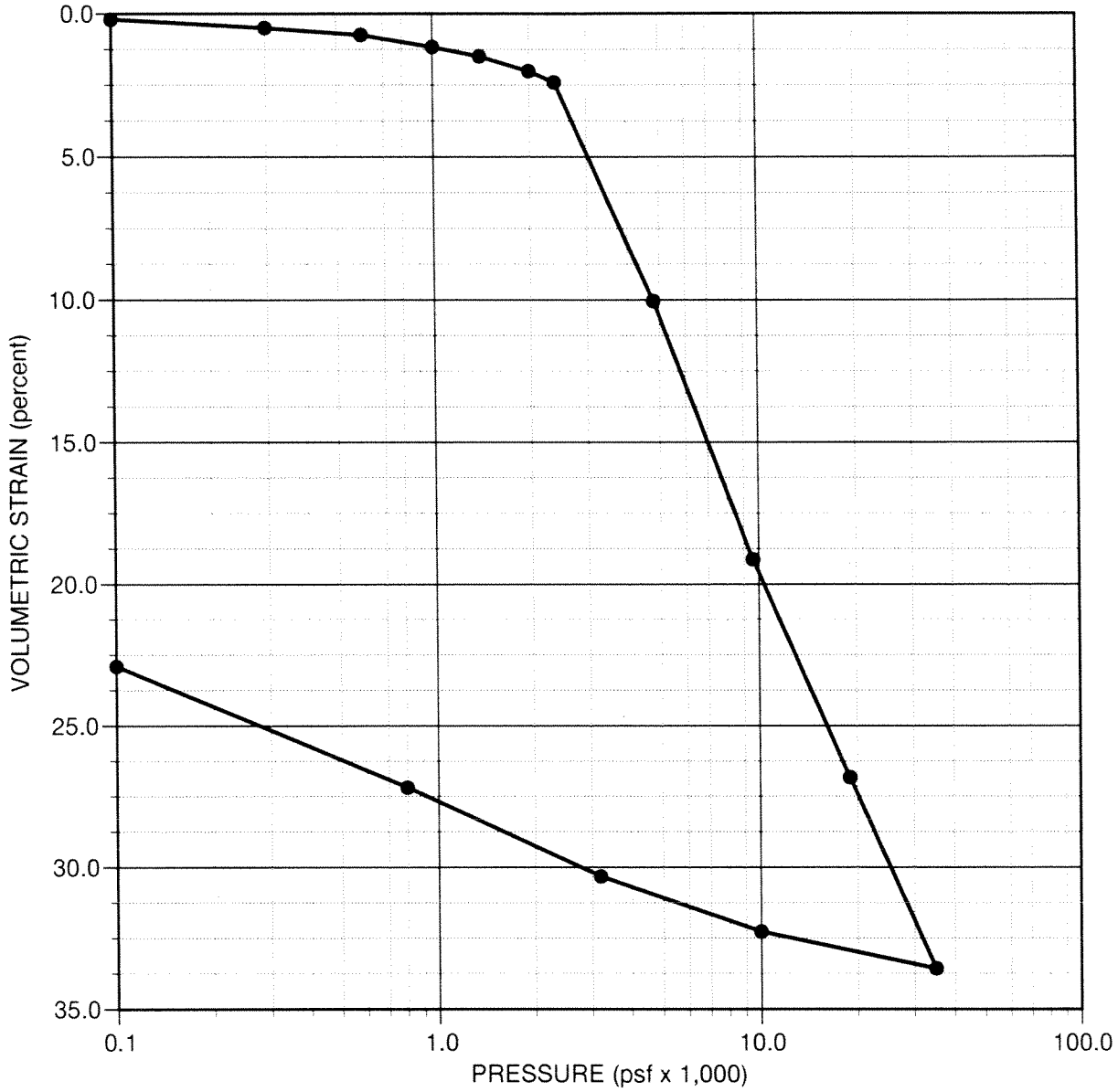
CLIENT: TREADWELL & ROLLO

PROFILE E
SEISMIC REFRACTION SURVEY

PLATE 4

APPENDIX D

APPENDIX D
Laboratory Test Results



Diameter (in) 2.42	Height (in) 1.00	Condition		Before test		After test	
Overburden Pressure, P_o	2,600 psf	Water Content	w_o	63.3 %	w_f	42.1 %	
Preconsol. Pressure, P_c	3,200 psf	Void Ratio	e_o	1.75	e_f	1.12	
Compression Ratio, C_{ec}	0.31	Saturation	S_o	99.7 %	S_f	103.6 %	
Recompression Ratio, C_{er}	0.04	Dry Density	γ_d	63 pcf	γ_d	81 pcf	

LL 71	PL 31	PI 40	G_s 2.75 (assumed)

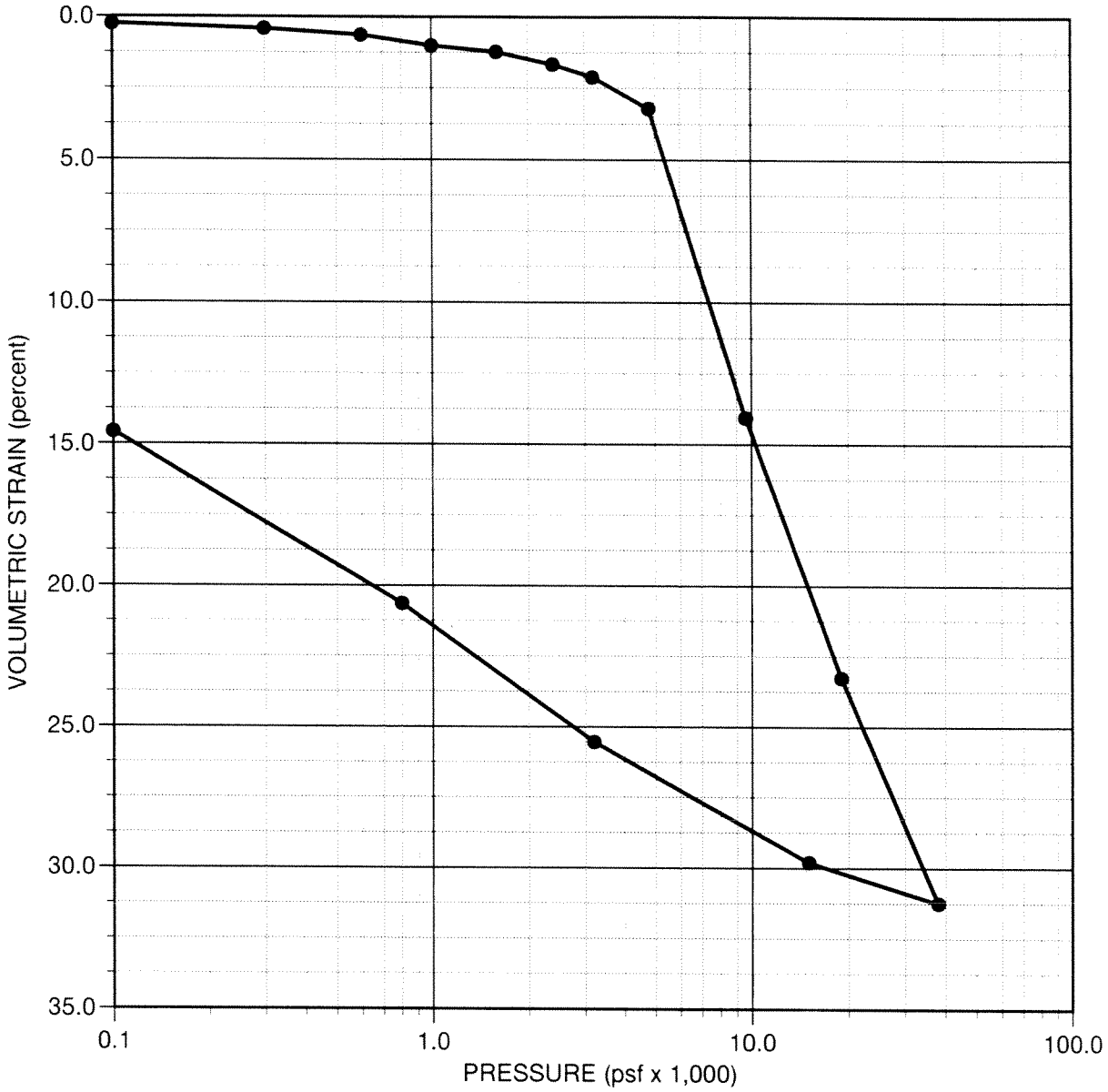
Classification CLAY (CH), dark greenish gray | Source DB-5 at 45 feet

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Project No. 2149.02 | Figure D-3



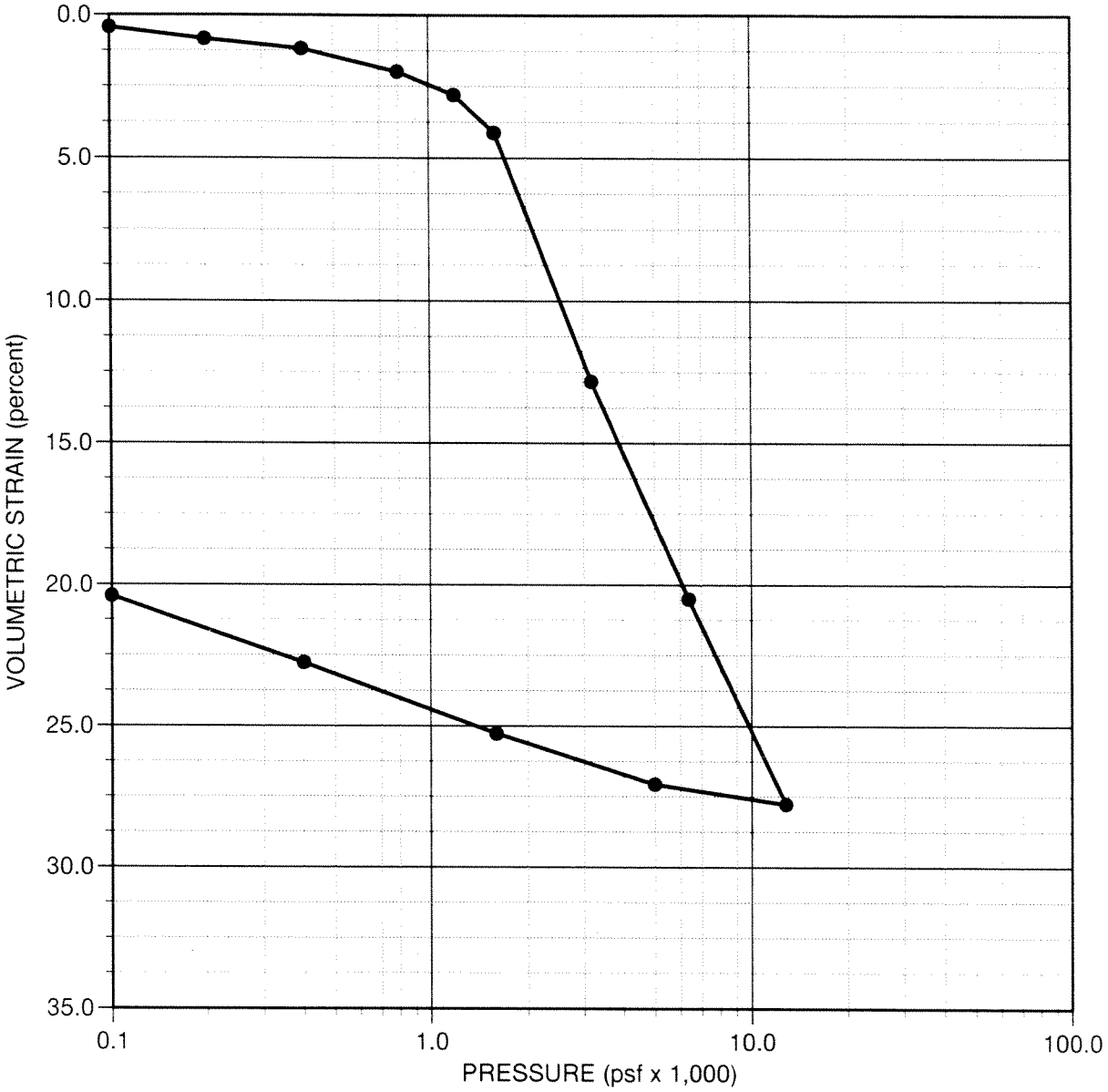
Diameter (in) 2.42	Height (in) 1.00	Condition		Before test		After test	
Overburden Pressure, P_o	3,235 psf	Water Content	w_o	66.1 %	w_f	52.5 %	
Preconsol. Pressure, P_c	6,000 psf	Void Ratio	e_o	1.84	e_f	1.42	
Compression Ratio, C_{ec}	0.34	Saturation	S_o	99.0 %	S_f	101.5 %	
Recompression Ratio, C_{er}	0.07	Dry Density	γ_d	61 pcf	γ_d	71 pcf	
LL 84	PL 35	PI 49		G_s 2.75 (assumed)			
Classification CLAY (CH), dark greenish gray				Source DB-5 at 62 feet			

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

Treadwell&Rollo

CONSOLIDATION TEST REPORT

Project No. 2149.02 | Figure D-4



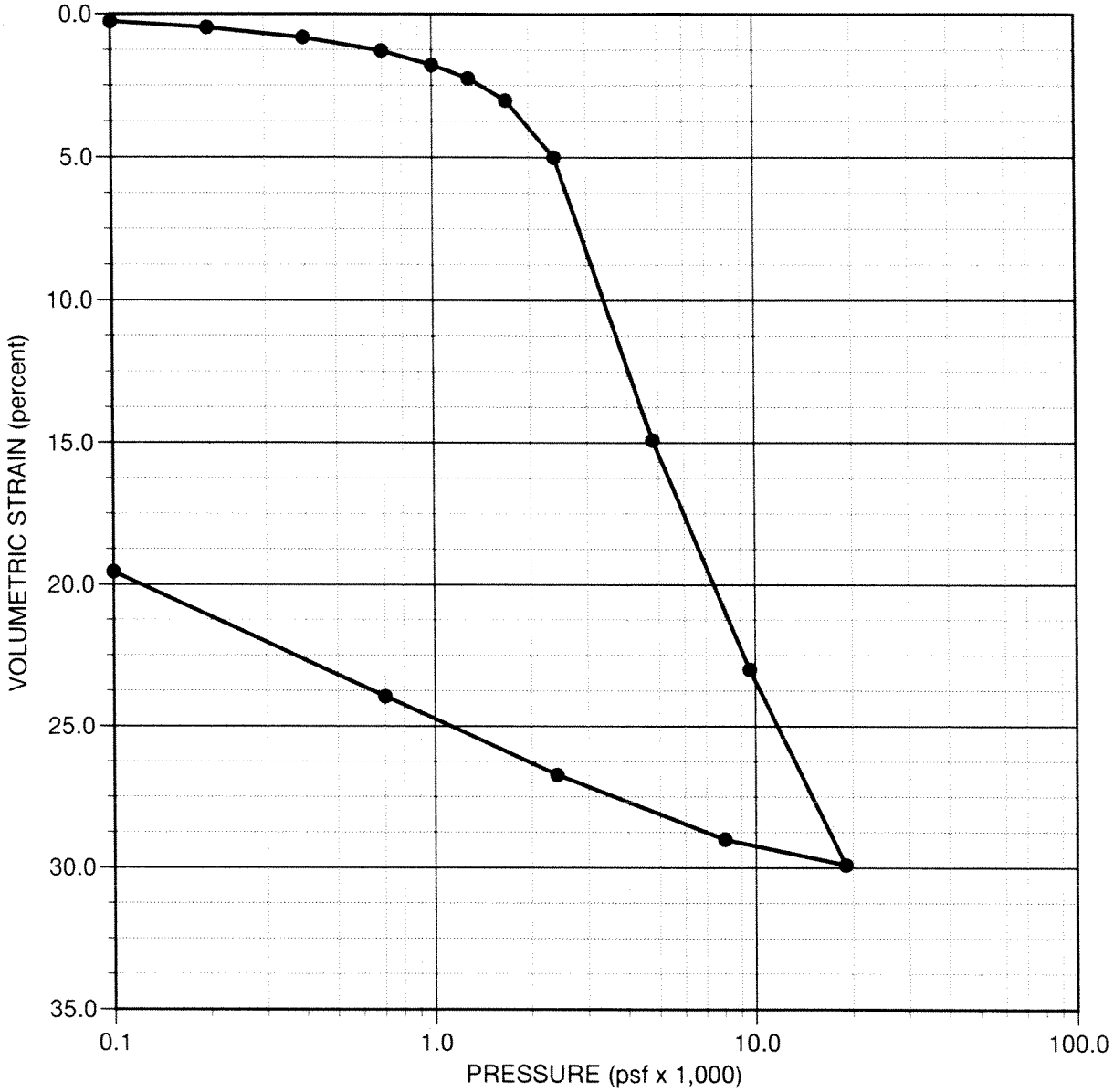
Diameter (in) 2.42	Height (in) 1.00	Condition		Before test		After test	
Overburden Pressure, P_o	1,700 psf	Water Content	w_o	67.9 %	w_f	47.7 %	
Preconsol. Pressure, P_c	1,700 psf	Void Ratio	e_o	1.88	e_f	1.29	
Compression Ratio, C_{ec}	0.31	Saturation	S_o	99.4 %	S_f	101.6 %	
Recompression Ratio, C_{er}	0.04	Dry Density	γ_d	60 pcf	γ_d	75 pcf	
LL 68	PL 29	PI 39		G_s 2.75 (assumed)			
Classification CLAY (CH), dark greenish gray				Source DB-7 at 28.5 feet			

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Project No. 2149.02 | Figure D-5



Diameter (in) 2.42	Height (in) 1.00	Condition		Before test		After test	
Overburden Pressure, P_o	2,450 psf	Water Content	w_o	67.0 %	w_f	48.8 %	
Preconsol. Pressure, P_c	2,450 psf	Void Ratio	e_o	1.87	e_f	1.31	
Compression Ratio, C_{ec}	0.31	Saturation	S_o	98.7 %	S_f	102.7 %	
Recompression Ratio, C_{er}	0.05	Dry Density	γ_d	60 pcf	γ_d	74 pcf	

LL 69	PL 30	PI 39	G_s 2.75 (assumed)

Classification CLAY (CH), dark greenish gray

Source DB-7 at 48.5 feet

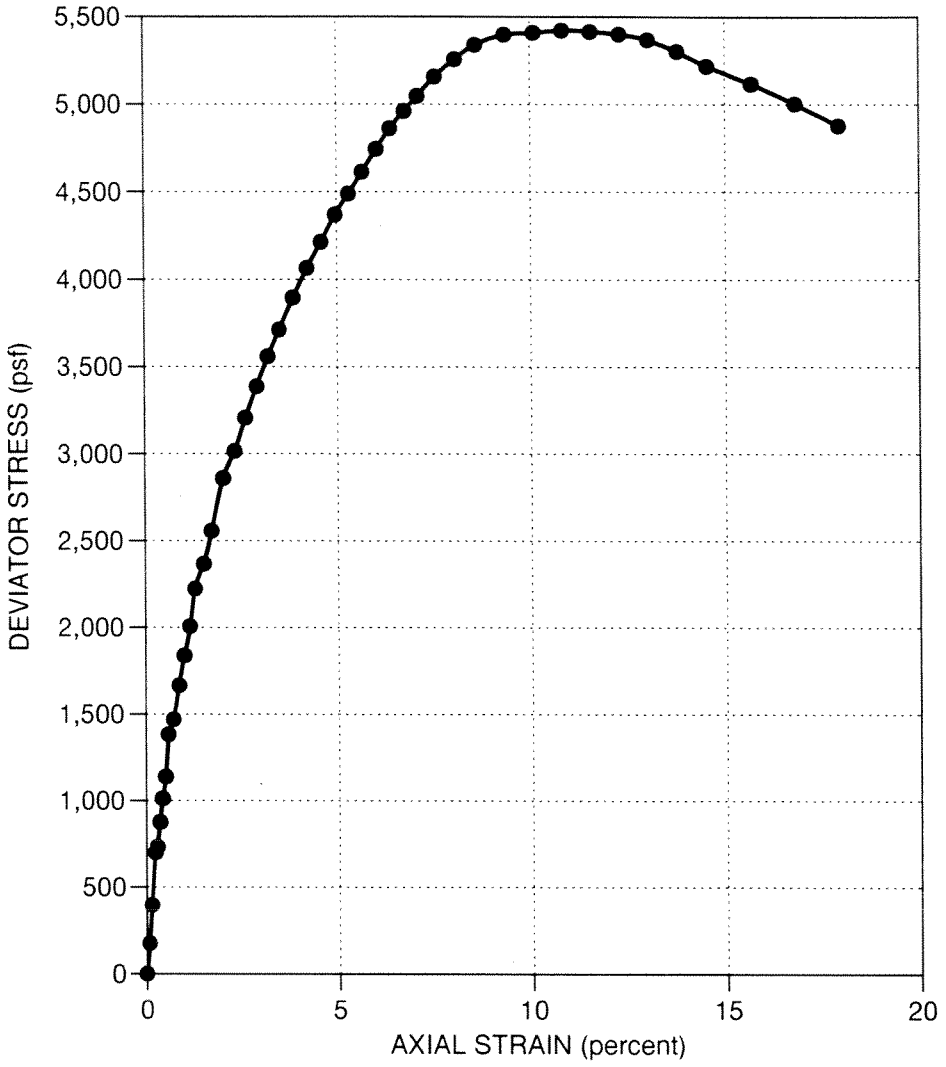
SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Project No. 2149.02

Figure D-6



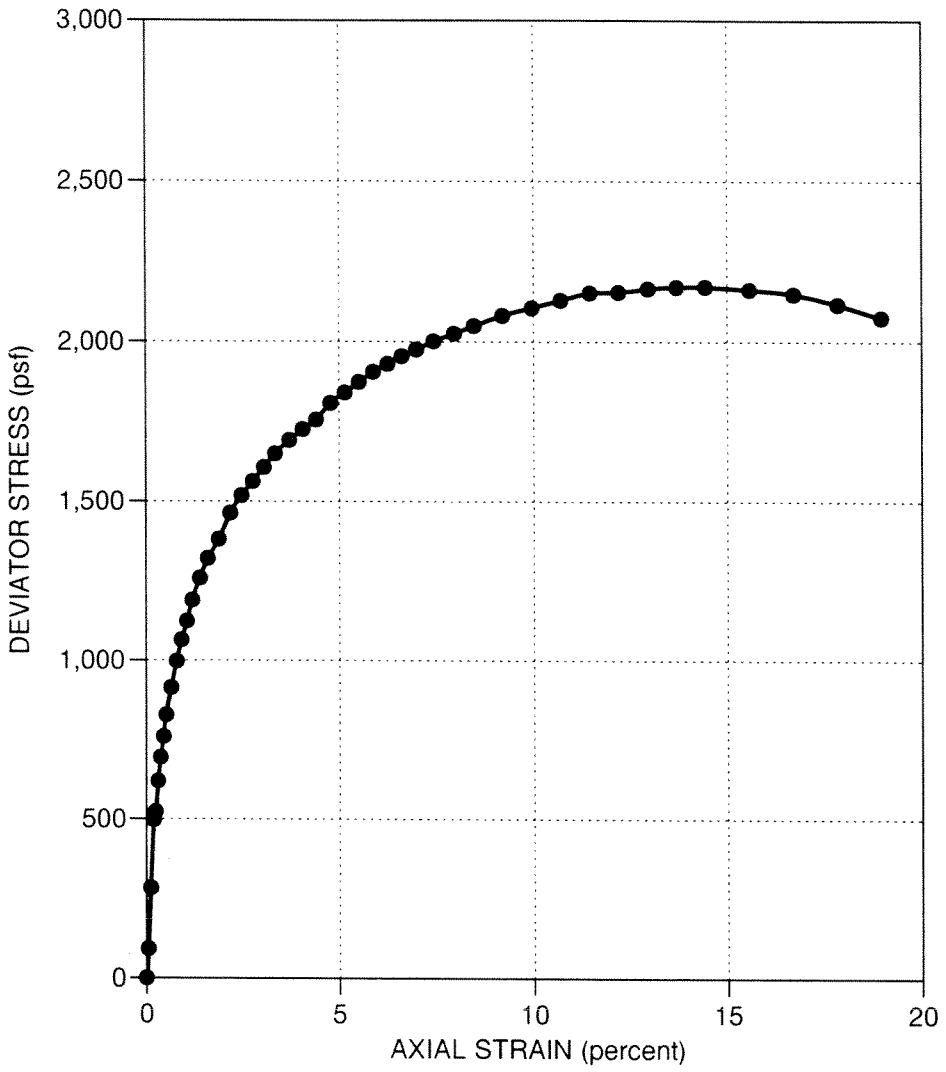
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	2,710 psf
DIAMETER (in) 2.43	HEIGHT (in) 5.65	STRAIN AT FAILURE	10.8 %
MOISTURE CONTENT	15.1 %	CONFINING PRESSURE	2,000 psf
DRY DENSITY	120 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION SANDY CLAY (CL), greenish gray		SOURCE DB-5 at 73 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-20



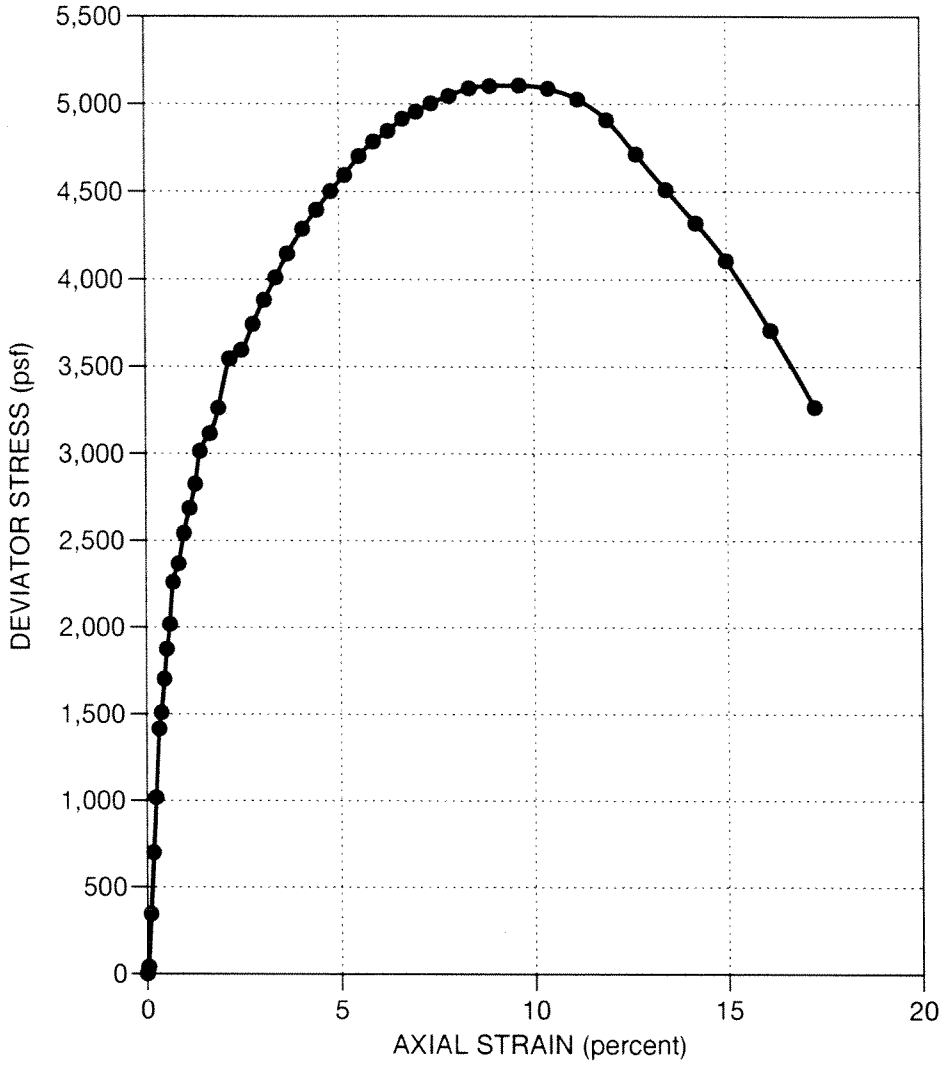
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	1,090 psf
DIAMETER (in) 2.43	HEIGHT (in) 5.91	STRAIN AT FAILURE	14.4 %
MOISTURE CONTENT	26.9 %	CONFINING PRESSURE	4,000 psf
DRY DENSITY	99 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION SANDY CLAY (CL), black		SOURCE DB-5 at 118 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-21



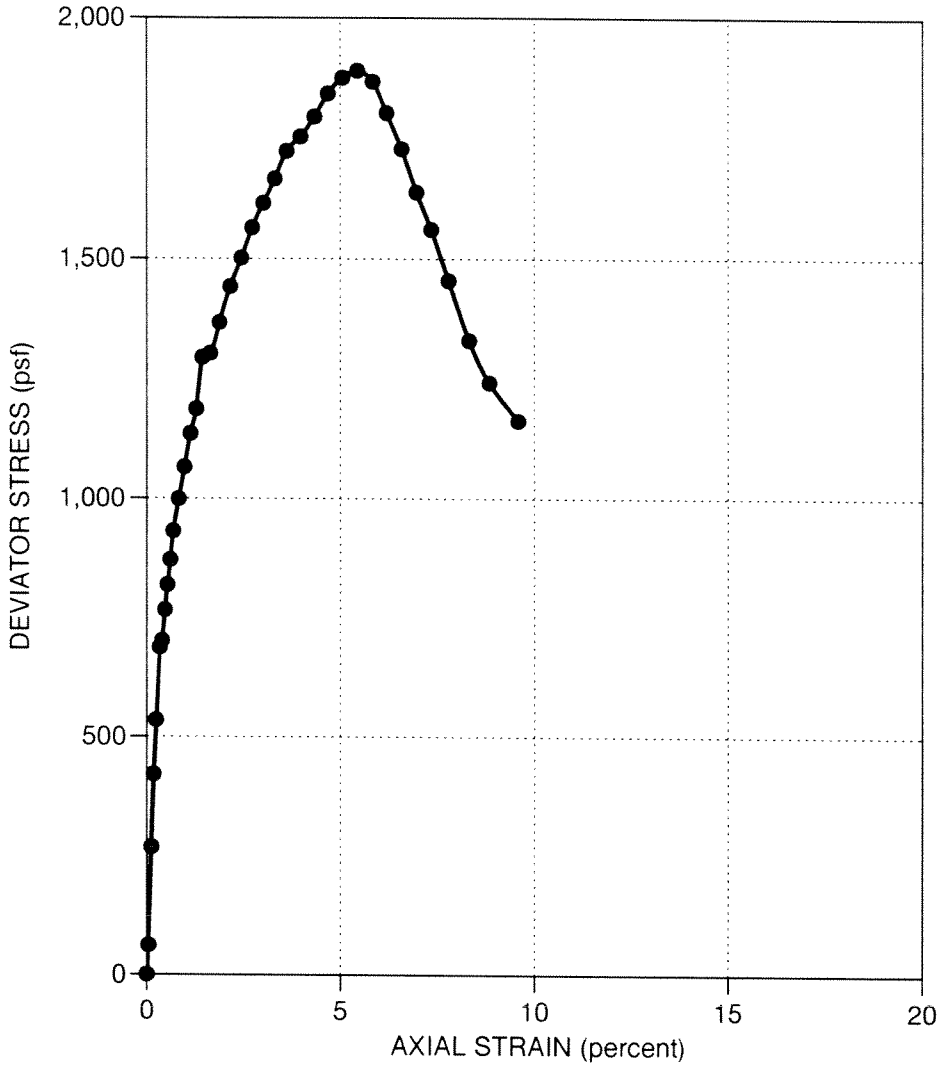
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	2,550 psf
DIAMETER (in) 2.43	HEIGHT (in) 5.38	STRAIN AT FAILURE	9.7 %
MOISTURE CONTENT	25.3 %	CONFINING PRESSURE	2,500 psf
DRY DENSITY	102 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION SANDY CLAY (CH), yellowish brown with gray mottling		SOURCE DB-7 at 96 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-24



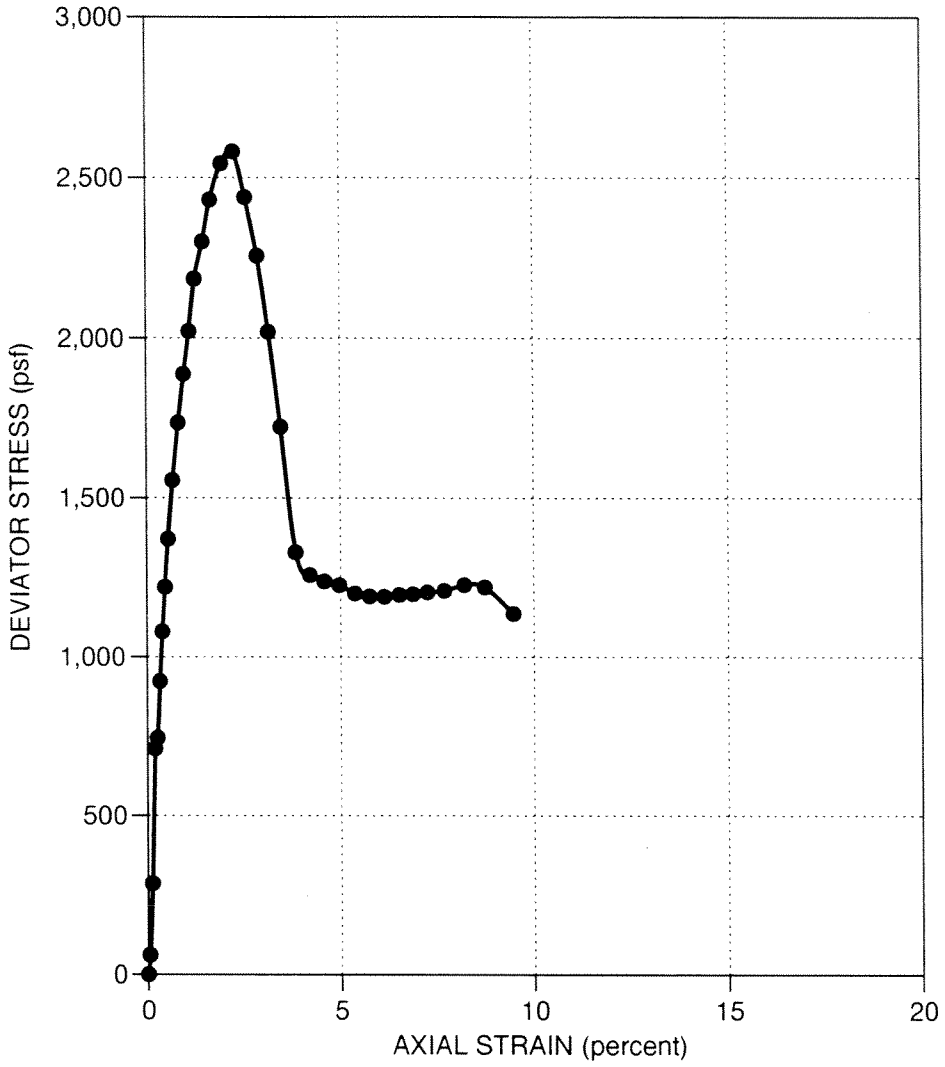
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	940 psf
DIAMETER (in) 2.44	HEIGHT (in) 5.53	STRAIN AT FAILURE	5.4 %
MOISTURE CONTENT	52.7 %	CONFINING PRESSURE	3,500 psf
DRY DENSITY	70 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION CLAY (CH), dark gray		SOURCE DB-7 at 126 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-25



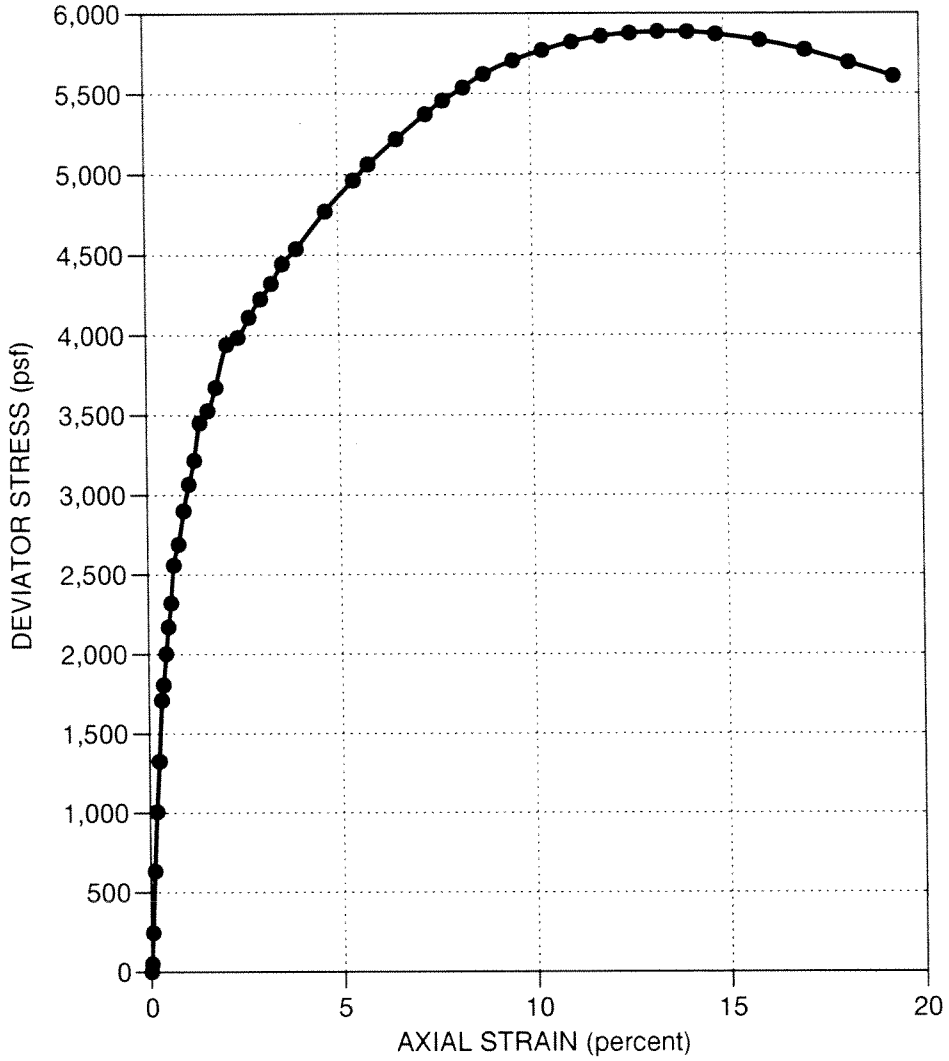
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	1,290 psf
DIAMETER (in) 2.44	HEIGHT (in) 5.44	STRAIN AT FAILURE	2.3 %
MOISTURE CONTENT	52.2 %	CONFINING PRESSURE	5,000 psf
DRY DENSITY	70 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION CLAY (CH), dark bluish gray		SOURCE DB-7 at 155 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-26



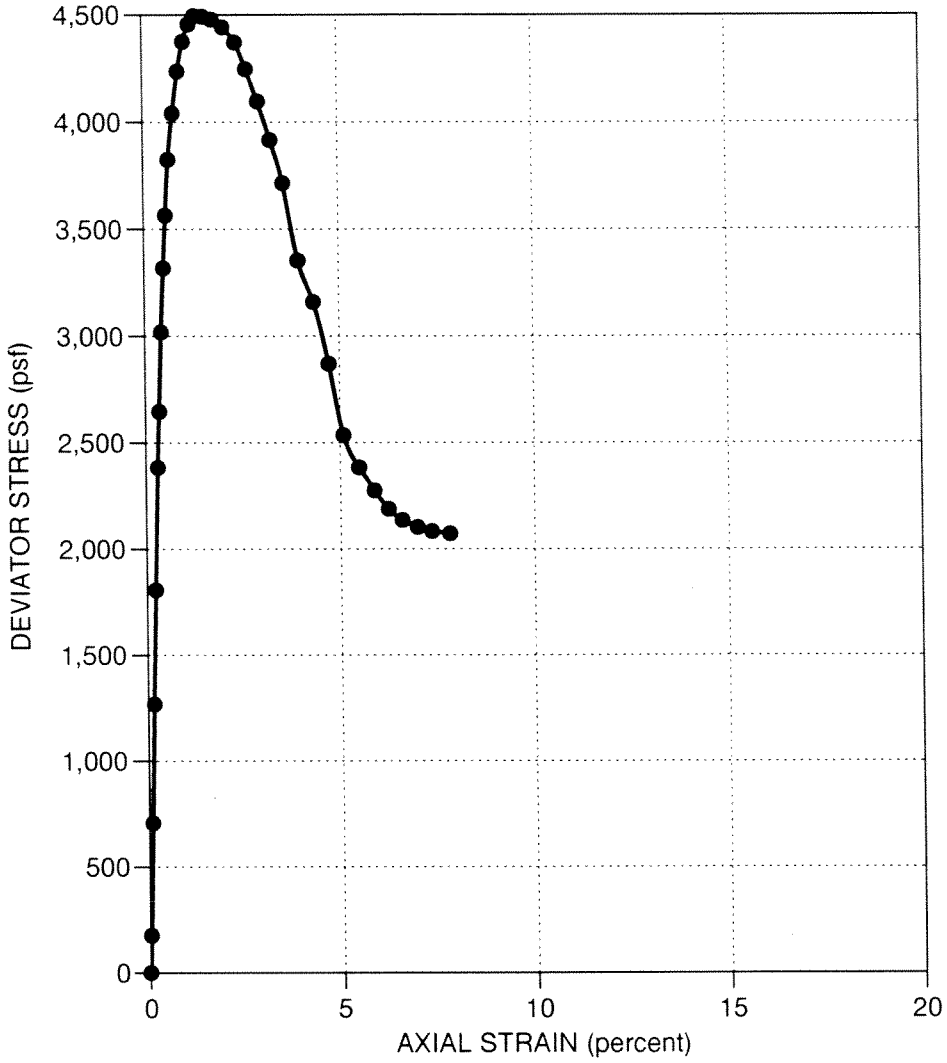
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	2,940 psf
DIAMETER (in) 2.43	HEIGHT (in) 5.12	STRAIN AT FAILURE	13.3 %
MOISTURE CONTENT	17.7 %	CONFINING PRESSURE	2,000 psf
DRY DENSITY	115 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION CLAY (CL), olive		SOURCE DB-8 at 81 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-27



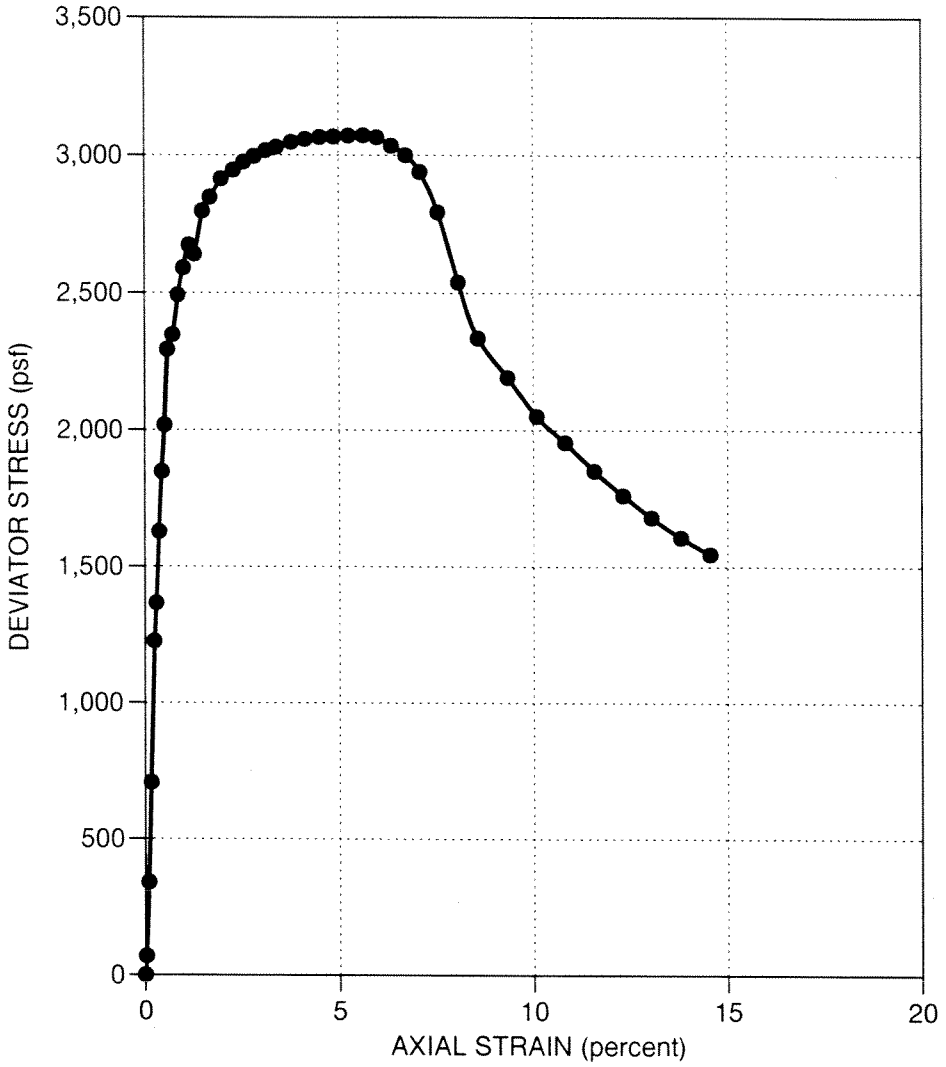
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	2,250 psf
DIAMETER (in) 2.43	HEIGHT (in) 5.44	STRAIN AT FAILURE	1.4 %
MOISTURE CONTENT	34.3 %	CONFINING PRESSURE	4,500 psf
DRY DENSITY	89 pcf	STRAIN RATE	0.75 %/min
DESCRIPTION CLAY (CH), dark greenish gray with black and white mottling		SOURCE DB-8 at 146 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-28



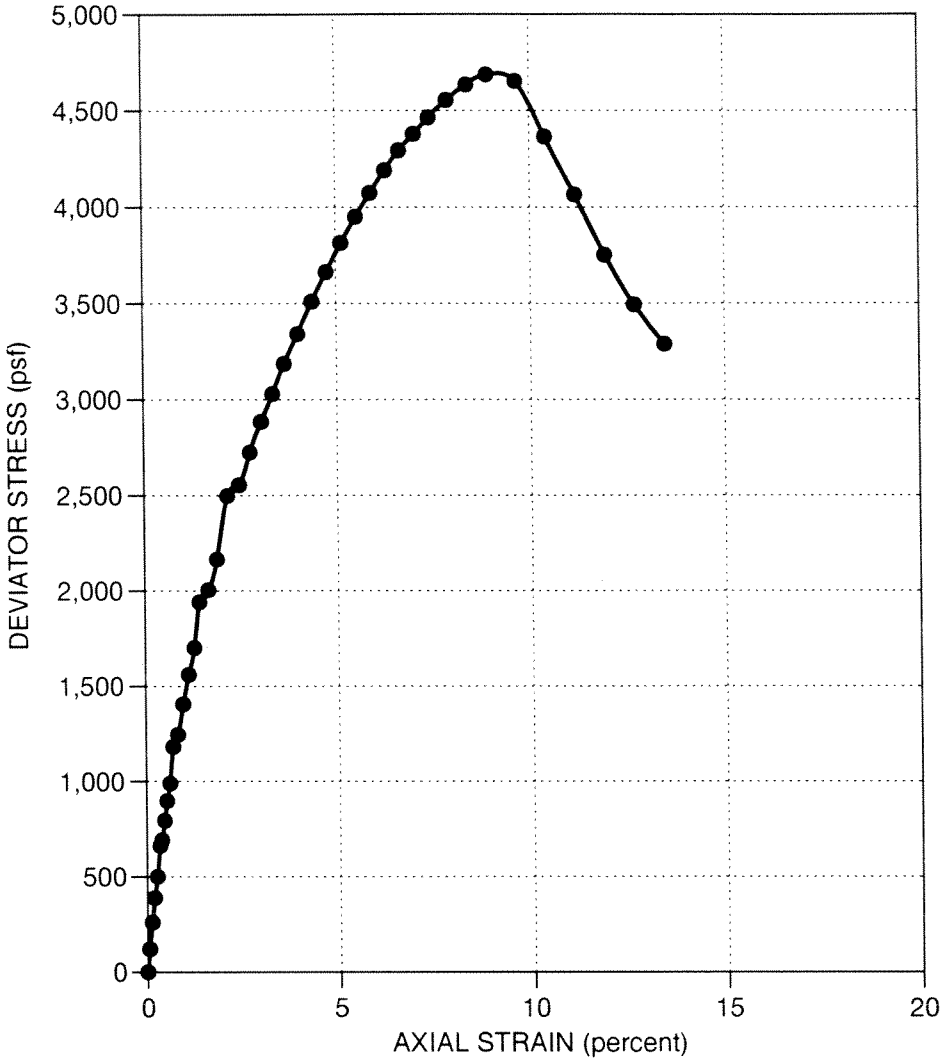
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	1,540 psf
DIAMETER (in) 2.44	HEIGHT (in) 5.61	STRAIN AT FAILURE	5.6 %
MOISTURE CONTENT	29.6 %	CONFINING PRESSURE	2,500 psf
DRY DENSITY	95 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION CLAY (CH), greenish gray with white carbonate nodules		SOURCE DB-11 at 71 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-29



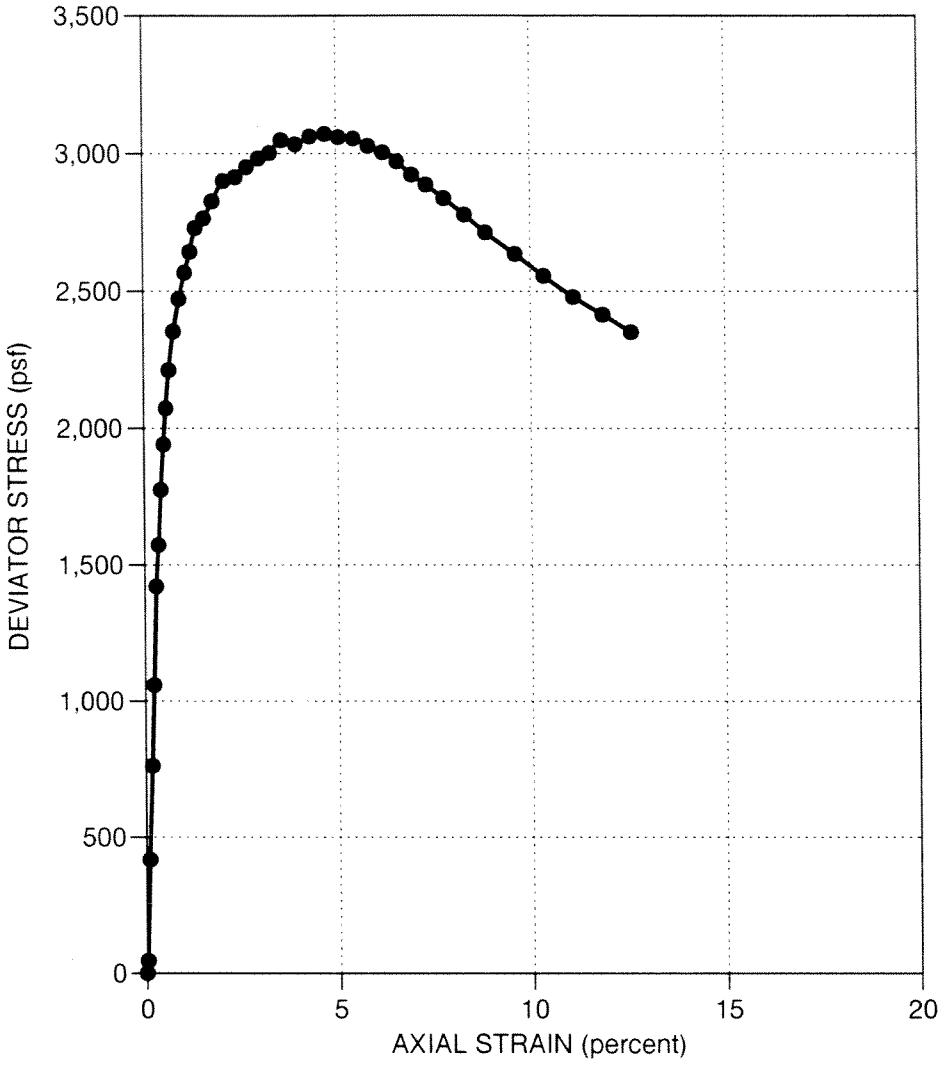
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	2,340 psf
DIAMETER (in) 2.42	HEIGHT (in) 5.44	STRAIN AT FAILURE	8.9 %
MOISTURE CONTENT	20.5 %	CONFINING PRESSURE	2,000 psf
DRY DENSITY	110 pcf	STRAIN RATE	6.75 % /min
DESCRIPTION CLAY (CL), dark olive gray		SOURCE DB-13 at 49.5 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-30



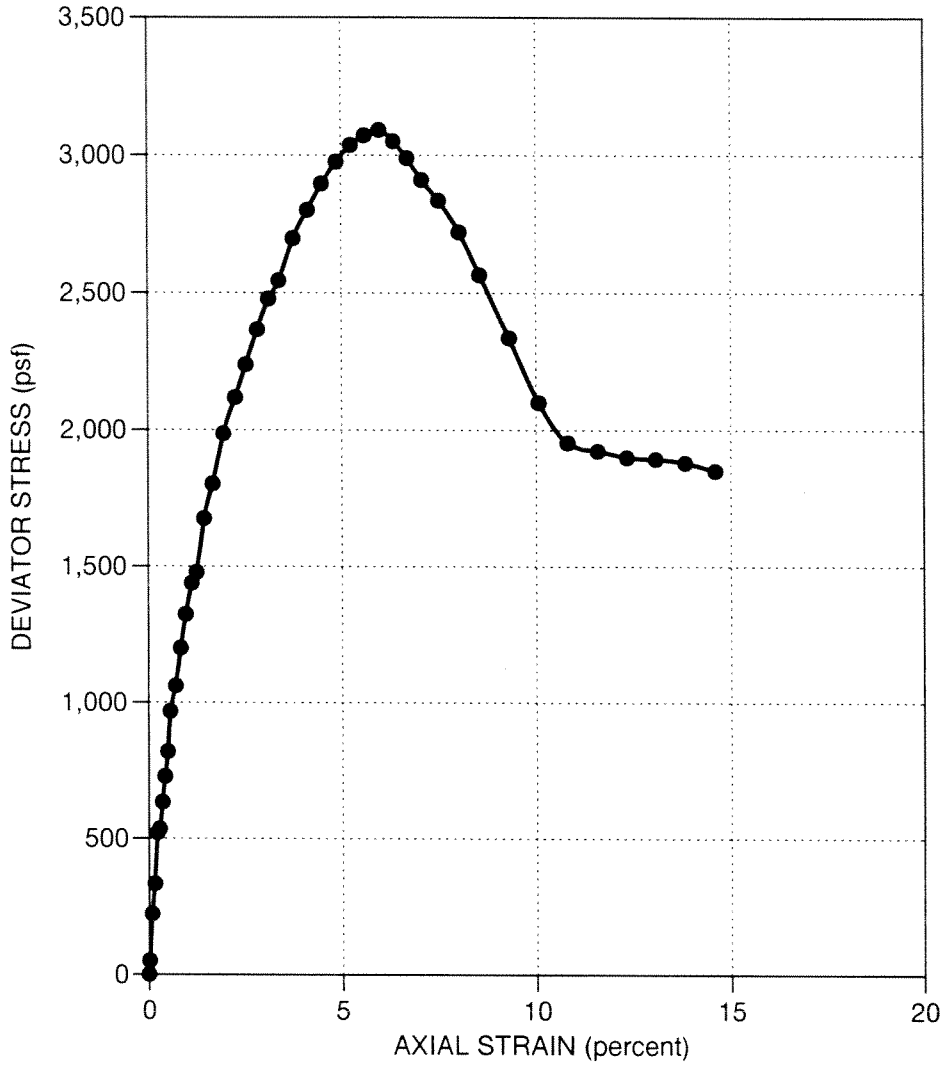
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	1,540 psf
DIAMETER (in) 2.43	HEIGHT (in) 5.20	STRAIN AT FAILURE	4.7 %
MOISTURE CONTENT	25.8 %	CONFINING PRESSURE	2,000 psf
DRY DENSITY	100 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION CLAY (CL), yellowish red with black and gray mottling		SOURCE DB-14A at 51 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-31



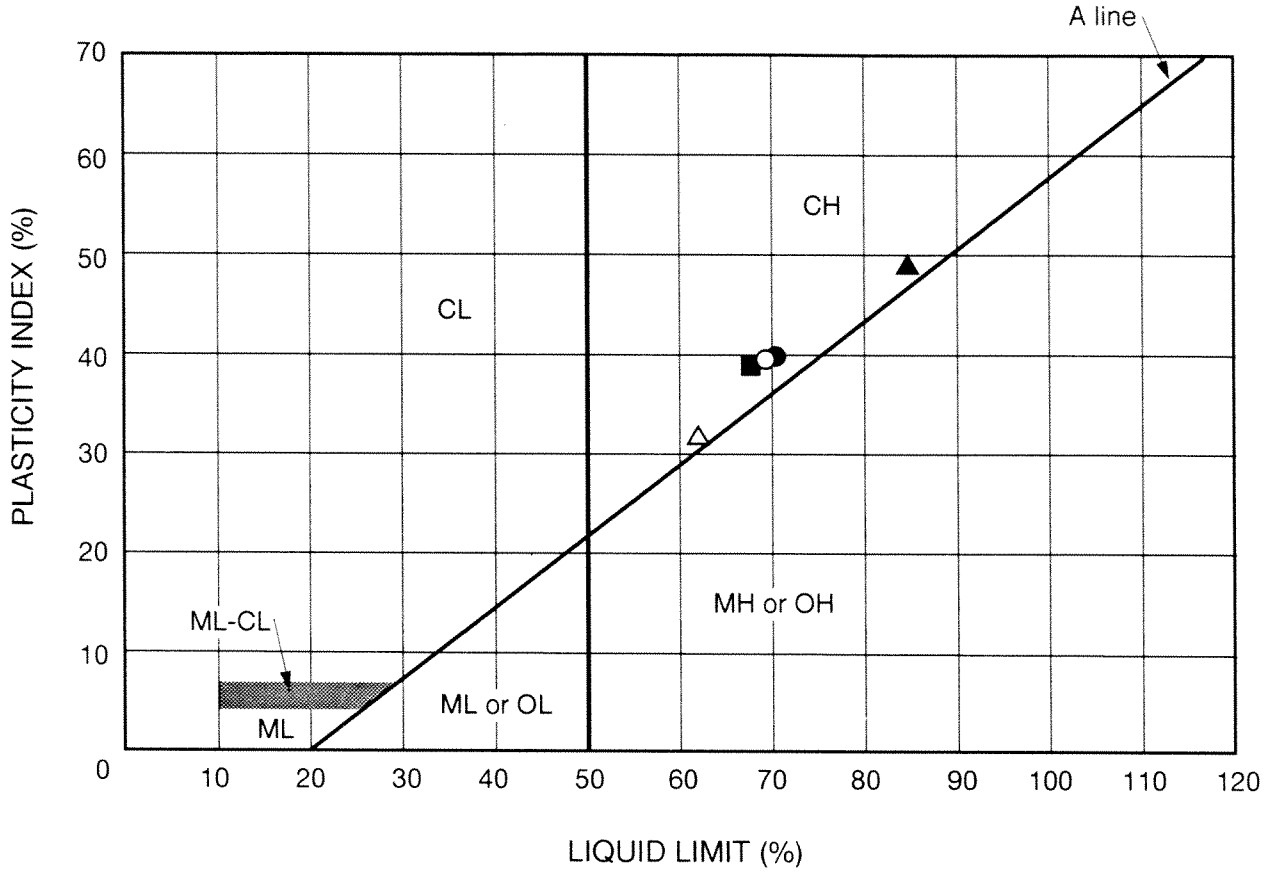
SPECIMEN TYPE Undisturbed		SHEAR STRENGTH	1,550 psf
DIAMETER (in) 2.44	HEIGHT (in) 5.68	STRAIN AT FAILURE	6.0 %
MOISTURE CONTENT	21.5 %	CONFINING PRESSURE	3,000 psf
DRY DENSITY	110 pcf	STRAIN RATE	0.75 % /min
DESCRIPTION CLAY (CL), reddish brown		SOURCE DB-14A at 81 feet	

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Treadwell&Rollo

Project No. 2149.02 | Figure D-32



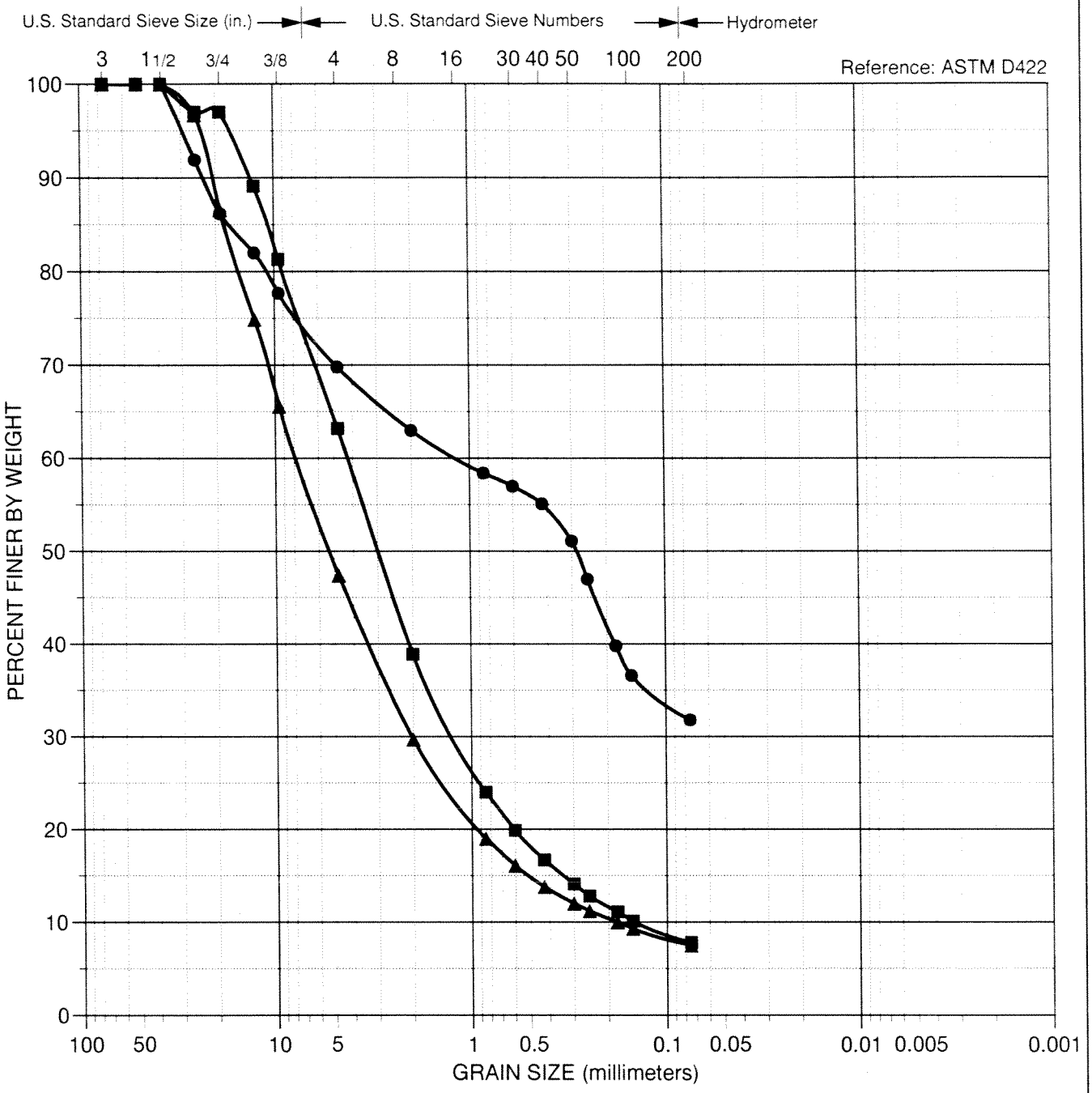
Symbol	Source	Description and Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
●	DB-5 at 45 ft.	CLAY (CH), dark greenish gray	63.3	71	40	---
▲	DB-5 at 62 ft.	CLAY (CH), dark greenish gray	66.1	84	49	---
■	DB-7 at 28.5 ft.	CLAY (CH), dark greenish gray	67.9	68	39	---
○	DB-7 at 48.5 ft.	CLAY (CH), dark greenish gray	67.0	69	39	---
△	DB-9 at 53.5 ft.	CLAY (CH), dark greenish gray	61.7	62	32	---

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

PLASTICITY CHART

Treadwell&Rollo

Project No. 2149.02 | Figure D-36



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Sample Source	Classification
●	DB-2 at 6 feet	SILTY SAND with GRAVEL (SM), yellowish brown
■	DB-5 at 11 feet	SAND with GRAVEL and SILT (SW-SM), dark reddish brown
▲	DB-9 at 16 feet	GRAVEL with SAND and SILT (GW-GM), brown

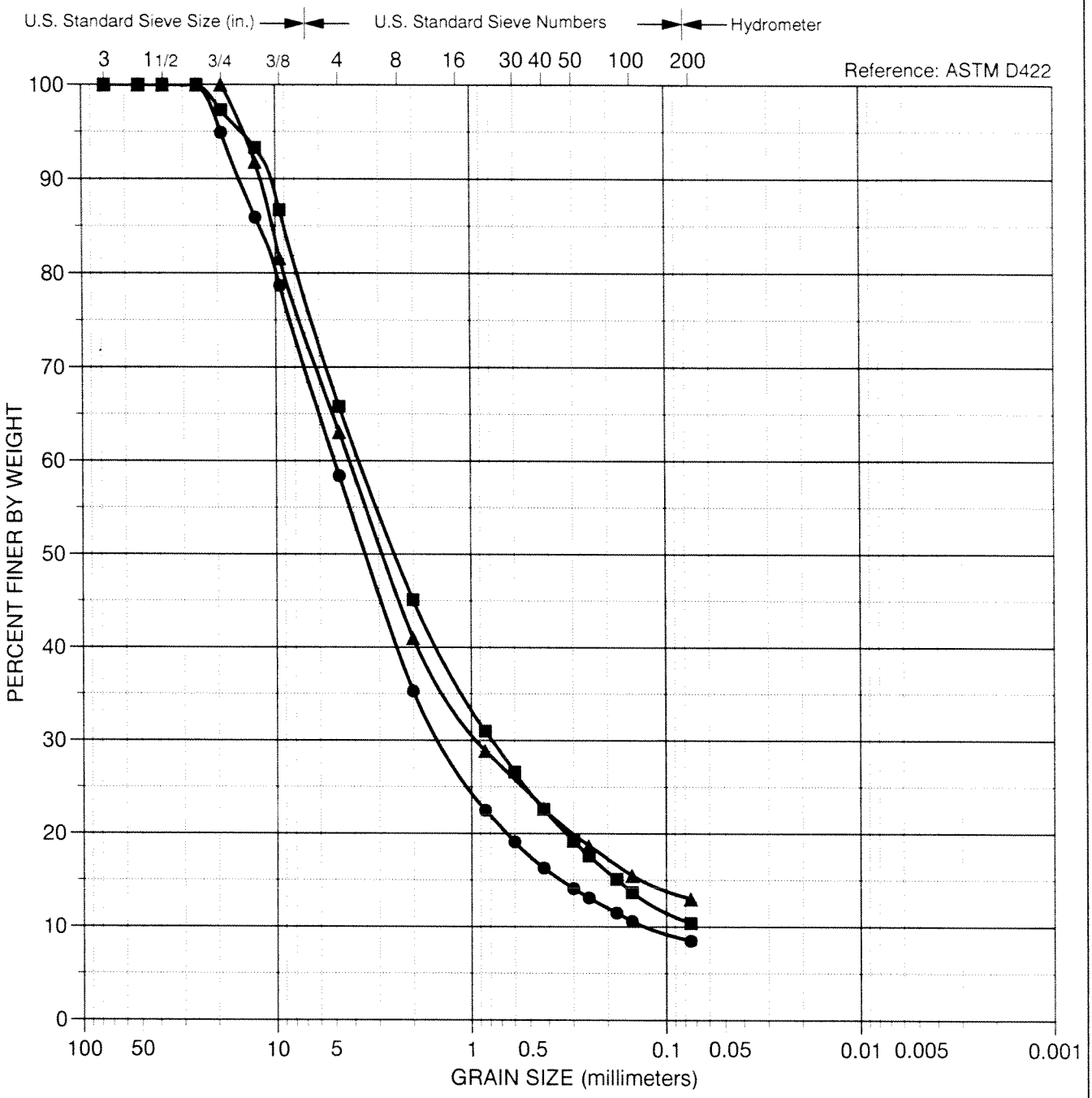
SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

PARTICLE SIZE ANALYSIS

Treadwell&Rollo

Project No. 2149.02

Figure D-37



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Sample Source	Classification
●	DB-10 at 6 feet	SAND with GRAVEL and SILT (SP-SM), reddish brown
■	DB-12 at 11 feet	GRAVELLY SAND with SILT (SW-SM), brown
▲	DB-15 at 11 feet	SILTY SAND with GRAVEL (SM), dark gray

SAN FRANCISCO 49ers STADIUM AND CANDLESTICK MILLS
San Francisco, California

PARTICLE SIZE ANALYSIS

Treadwell&Rollo

Project No. 2149.02

Figure D-38

APPENDIX E

APPENDIX E – Updated Liquefaction Analyses

APPENDIX E

ENGEO
332 Pine St #300 San Francisco, CA 94104

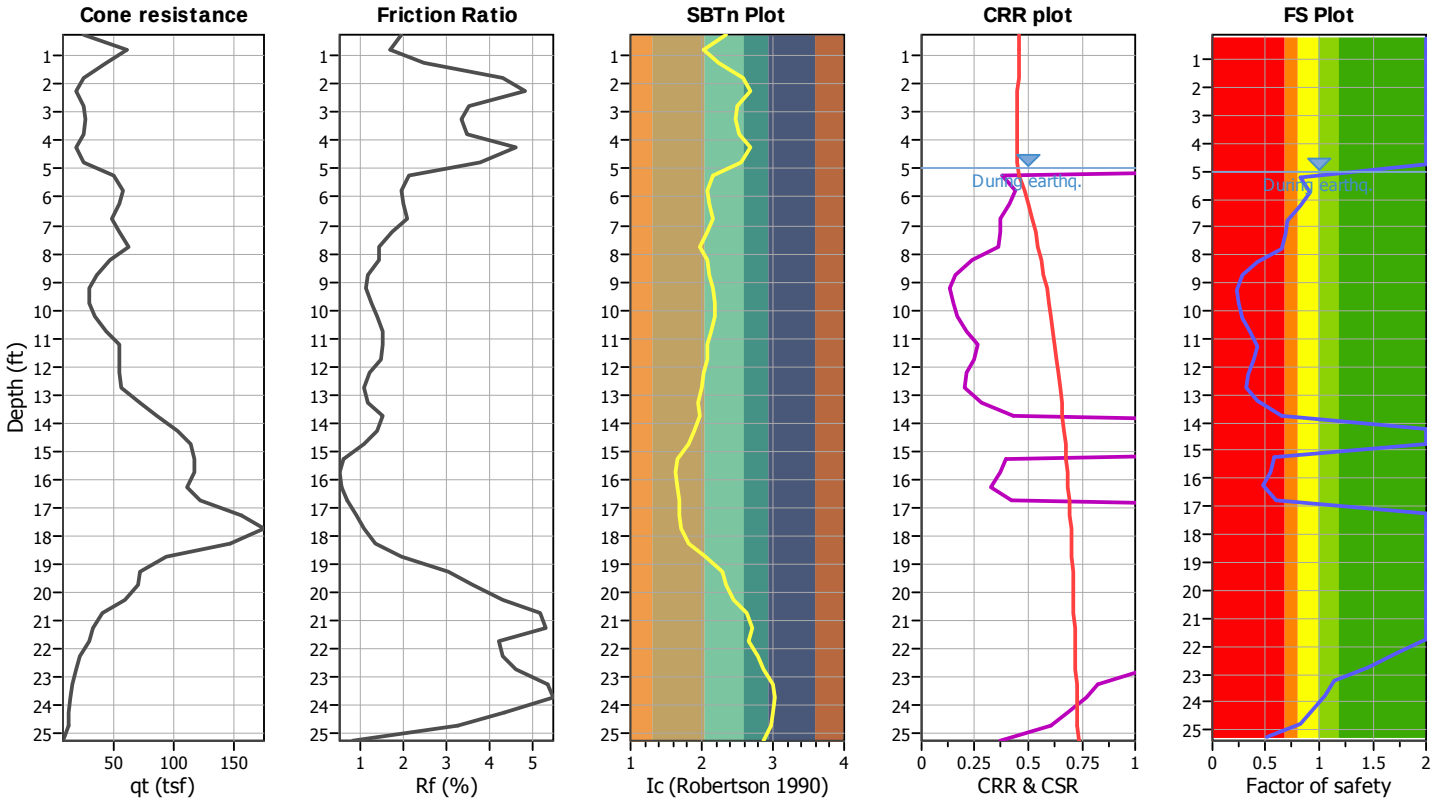
LIQUEFACTION ANALYSIS REPORT

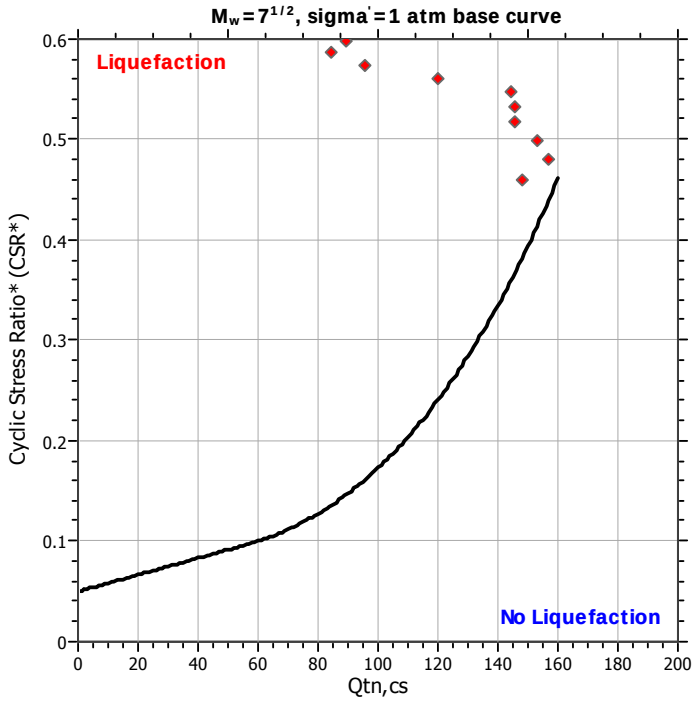
Project title : Candlestick Point **Location : San Francisco, CA**

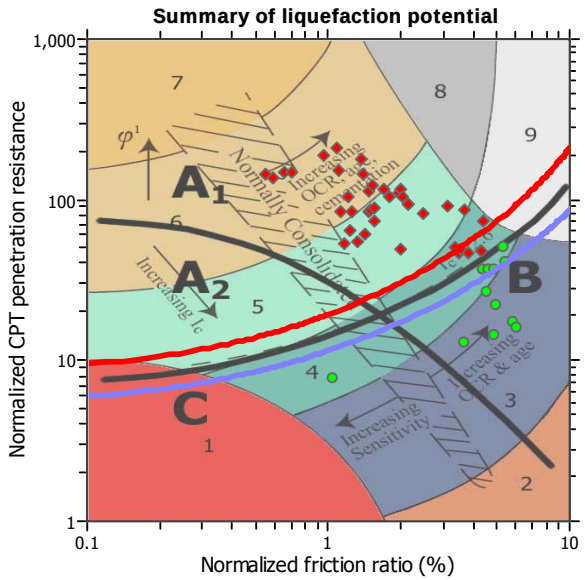
CPT file : CPT-01

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

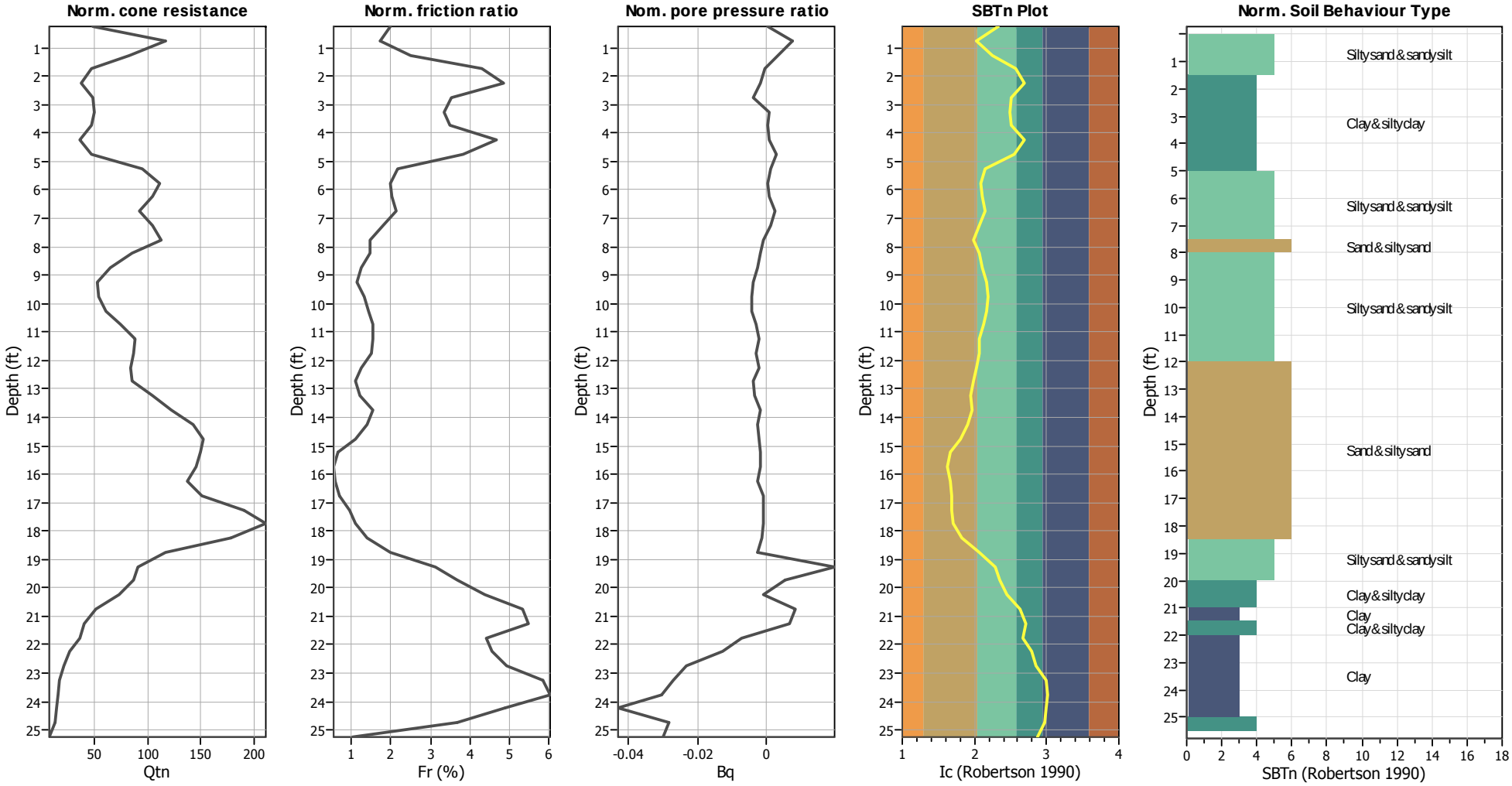






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



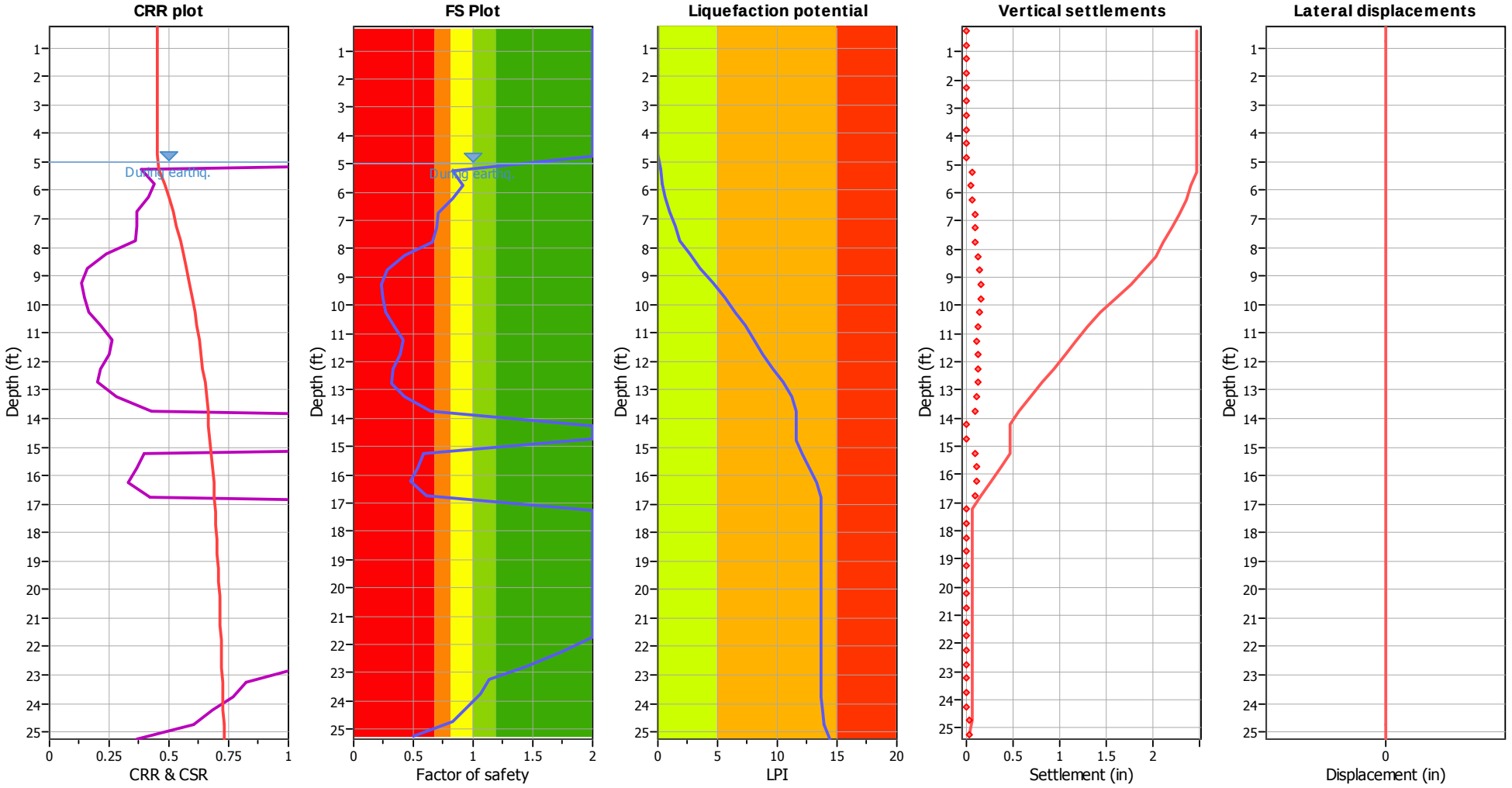
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

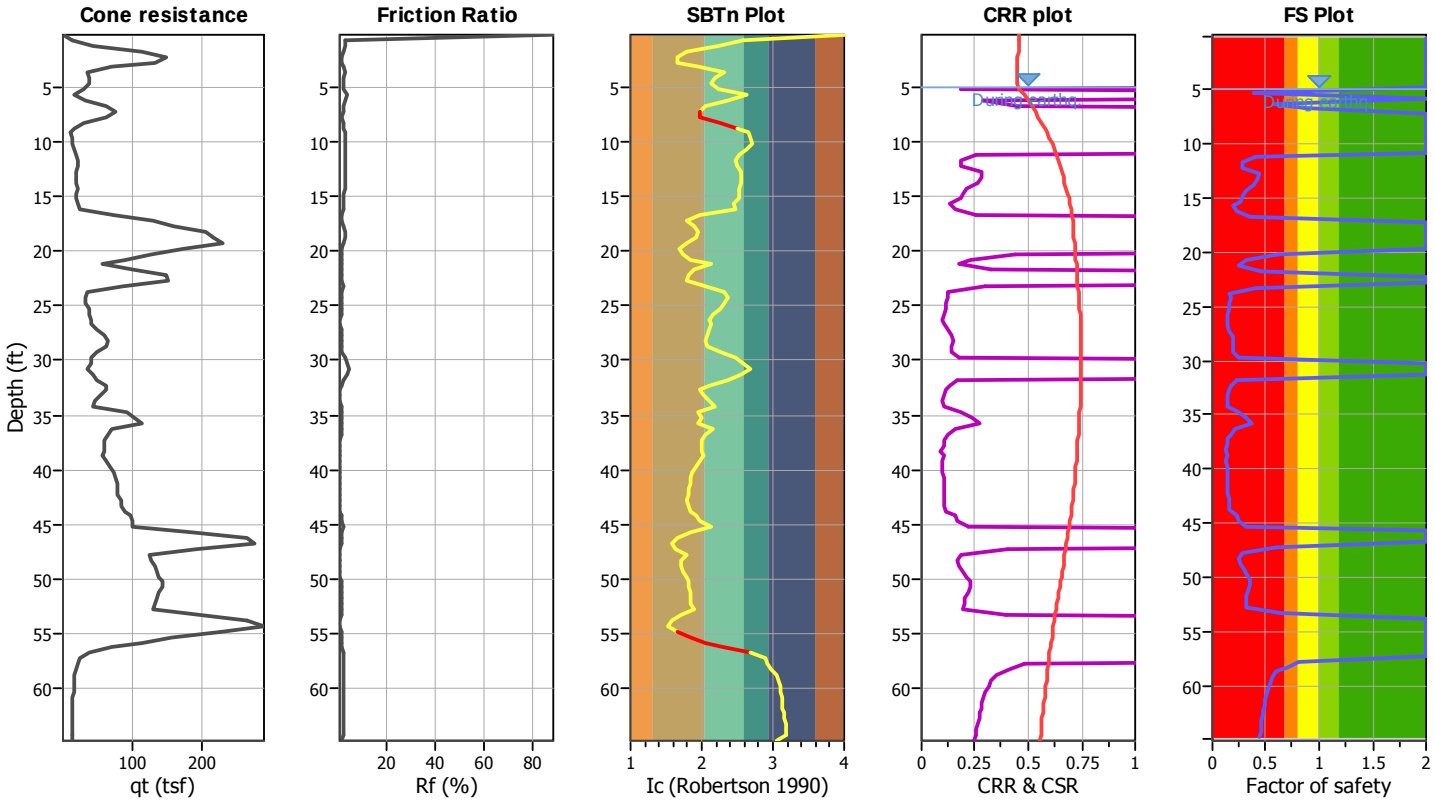
LIQUEFACTION ANALYSIS REPORT

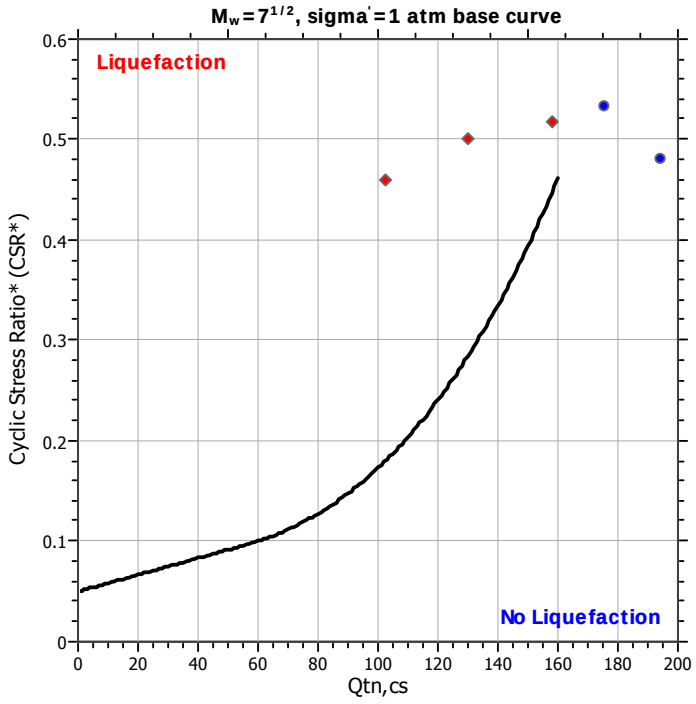
Project title : Candlestick Point **Location : San Francisco, CA**

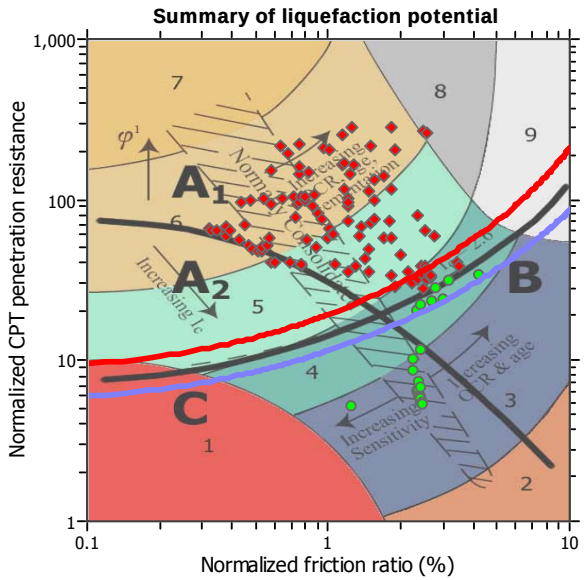
CPT file : CPT-02

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

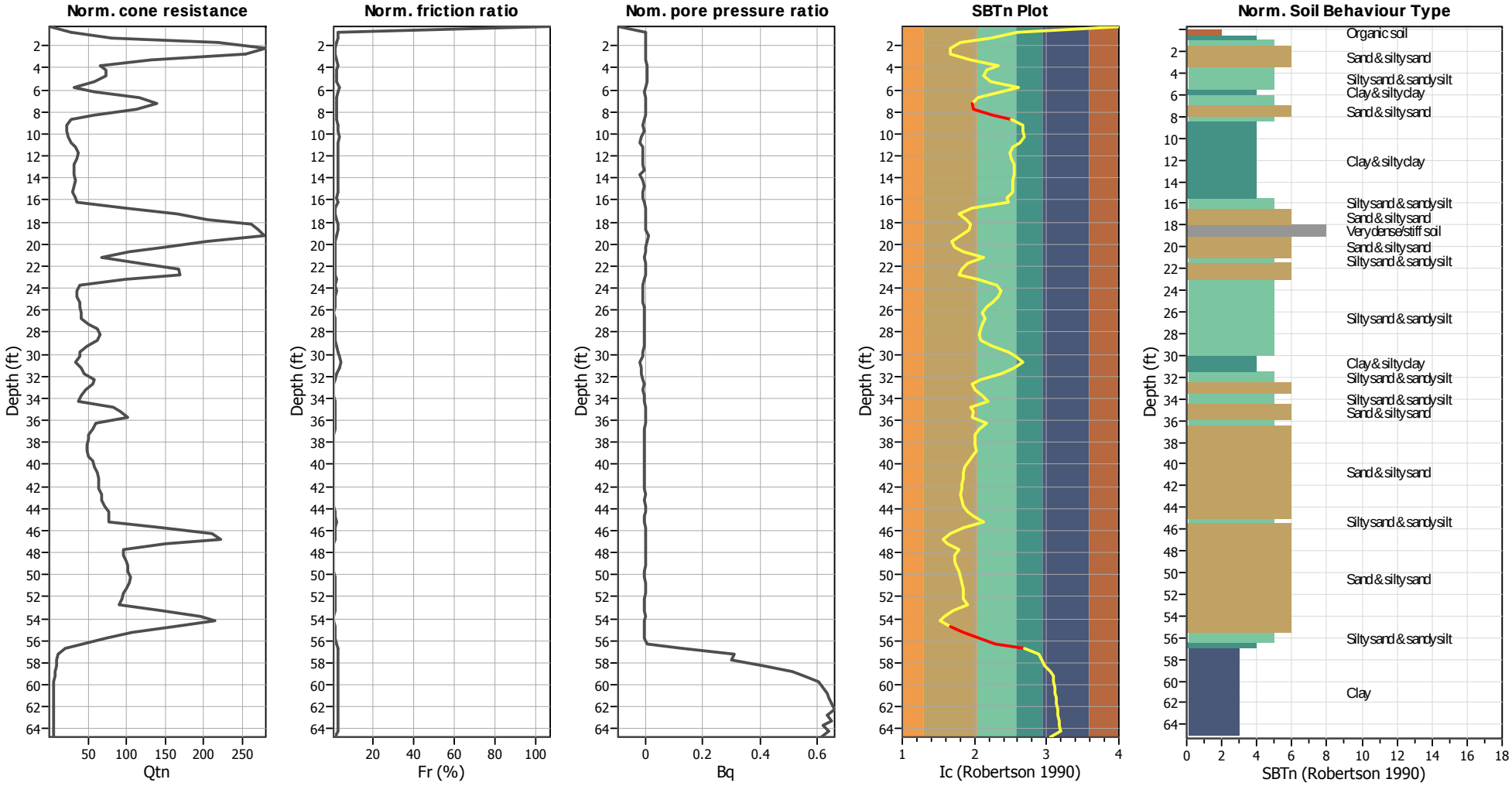






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



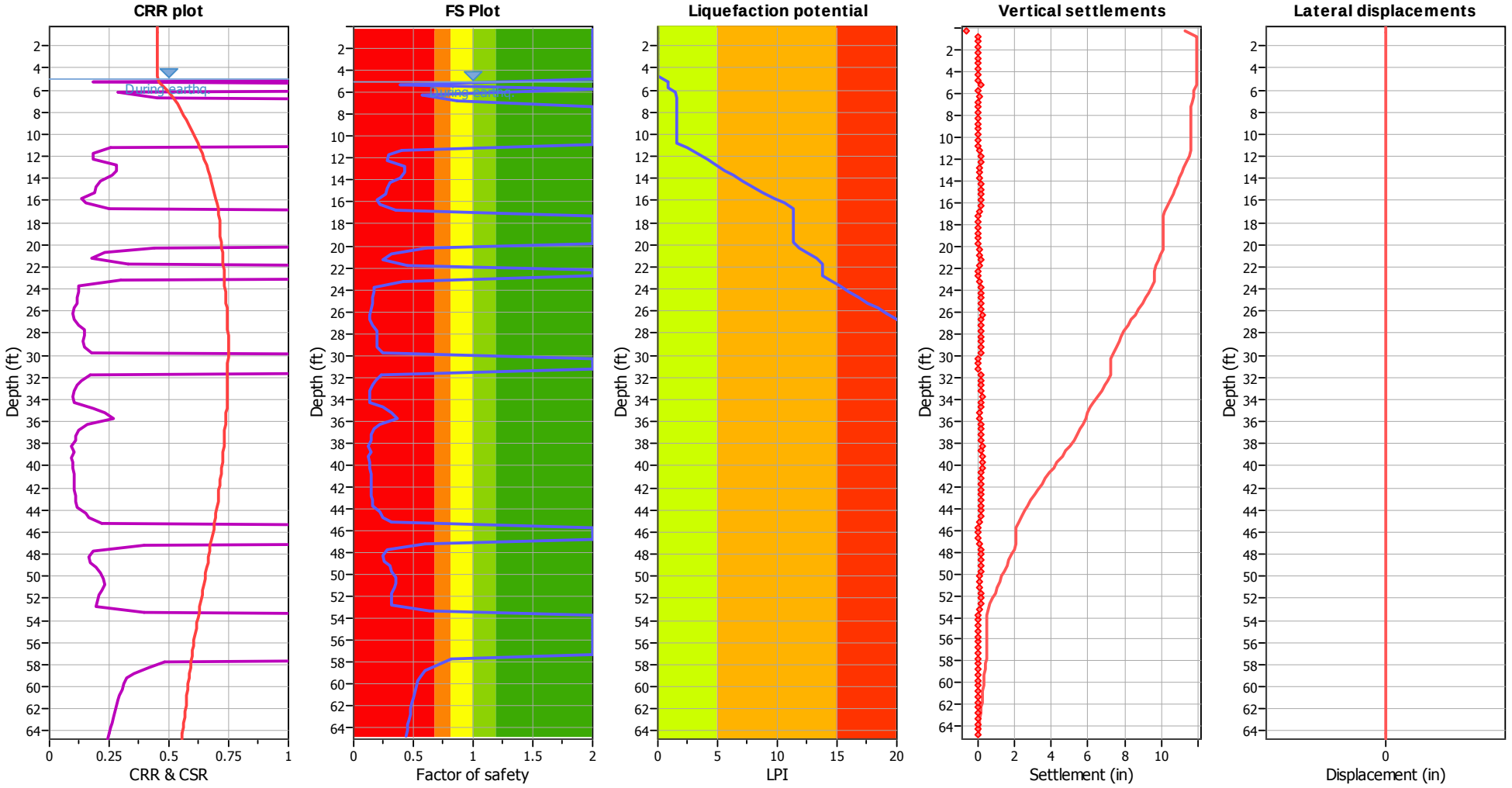
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

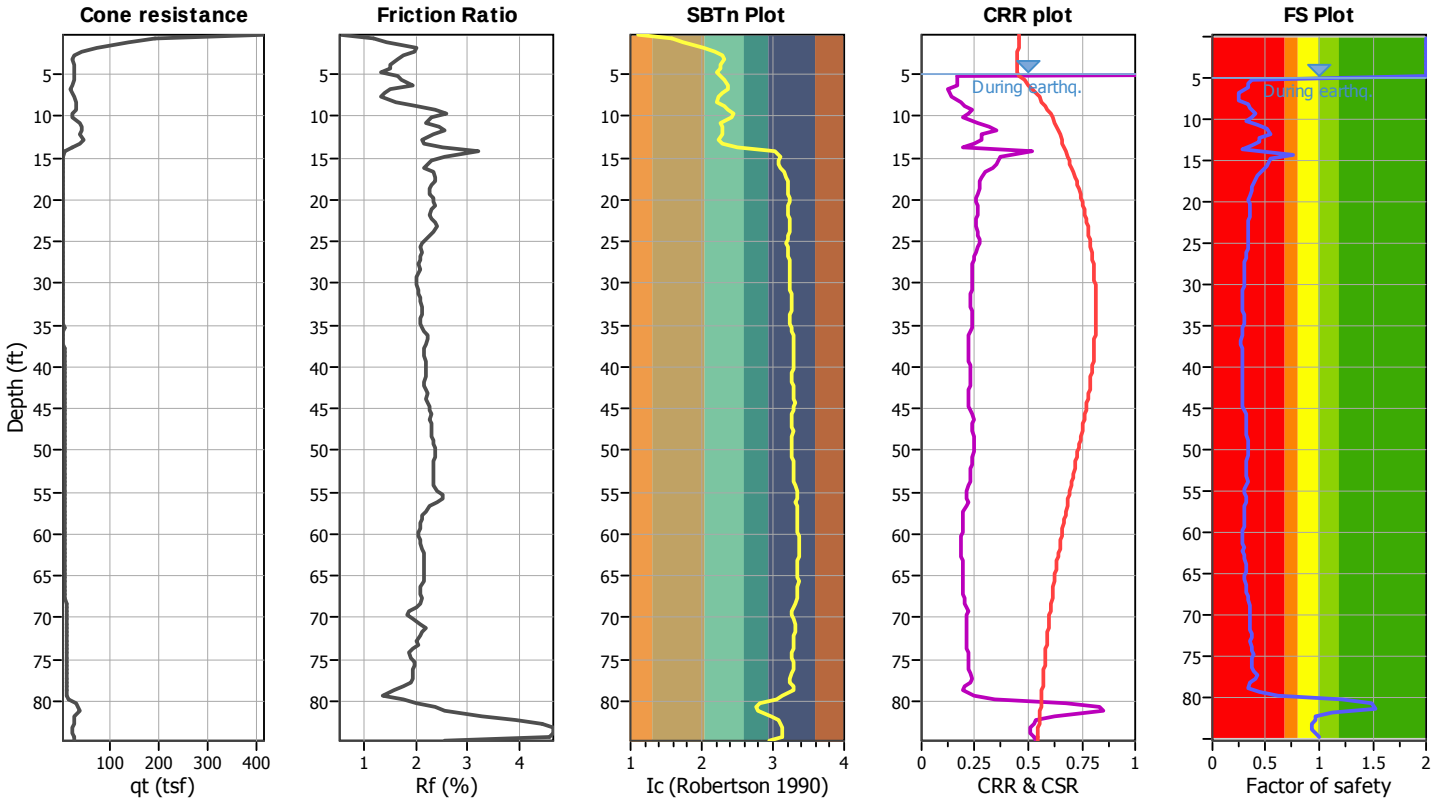
LIQUEFACTION ANALYSIS REPORT

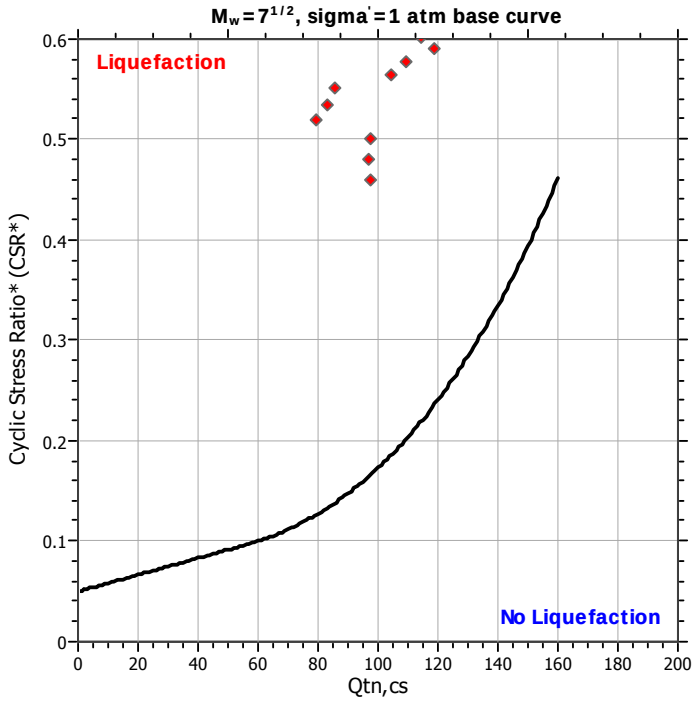
Project title : Candlestick Point **Location : San Francisco, CA**

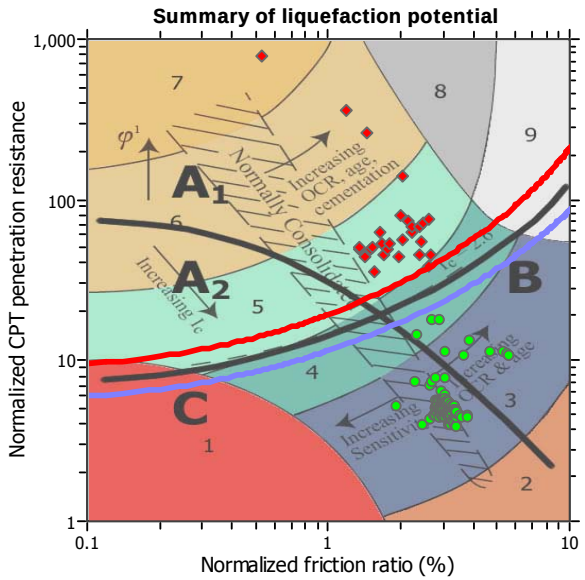
CPT file : CPT-03

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

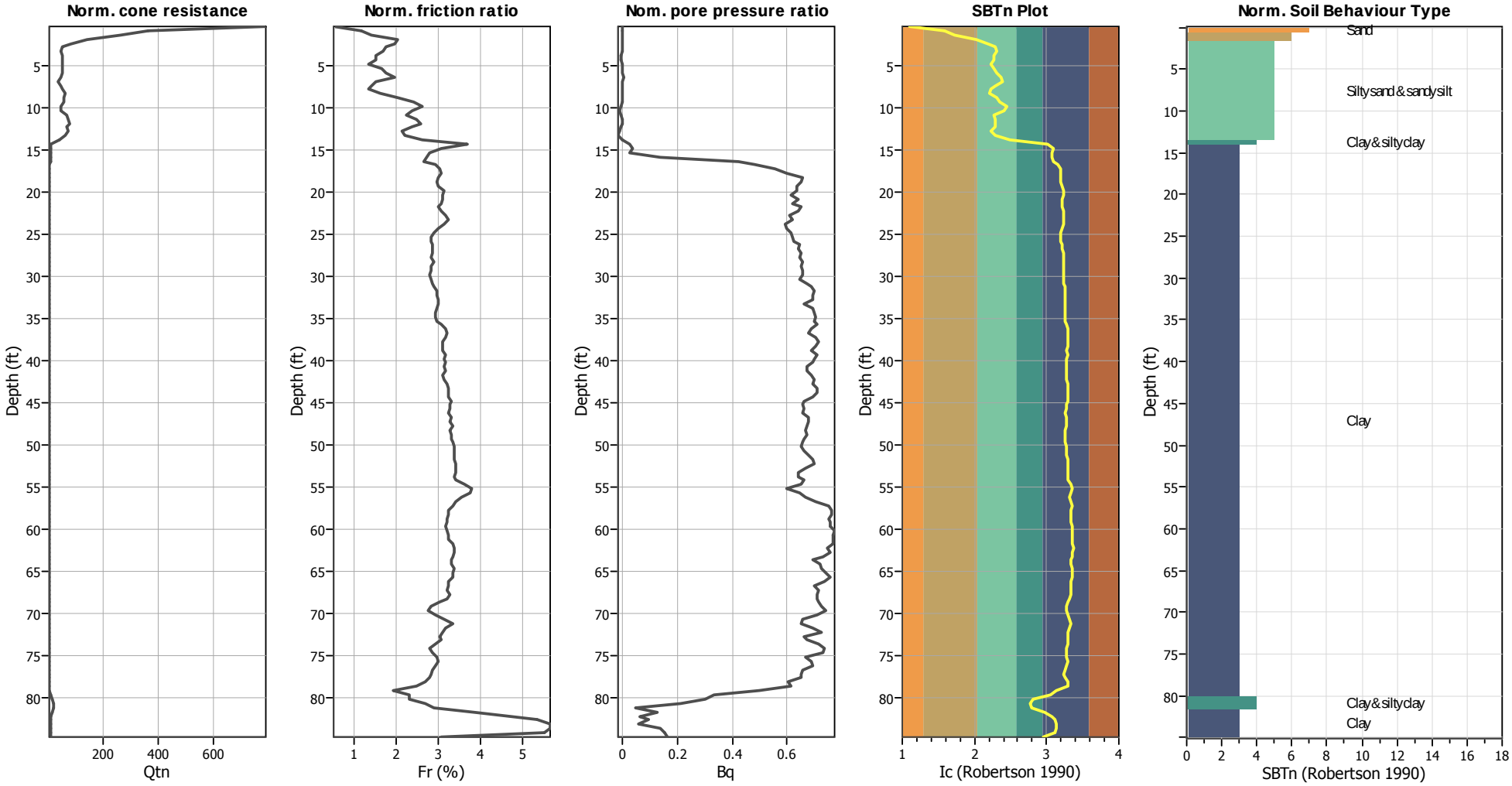






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



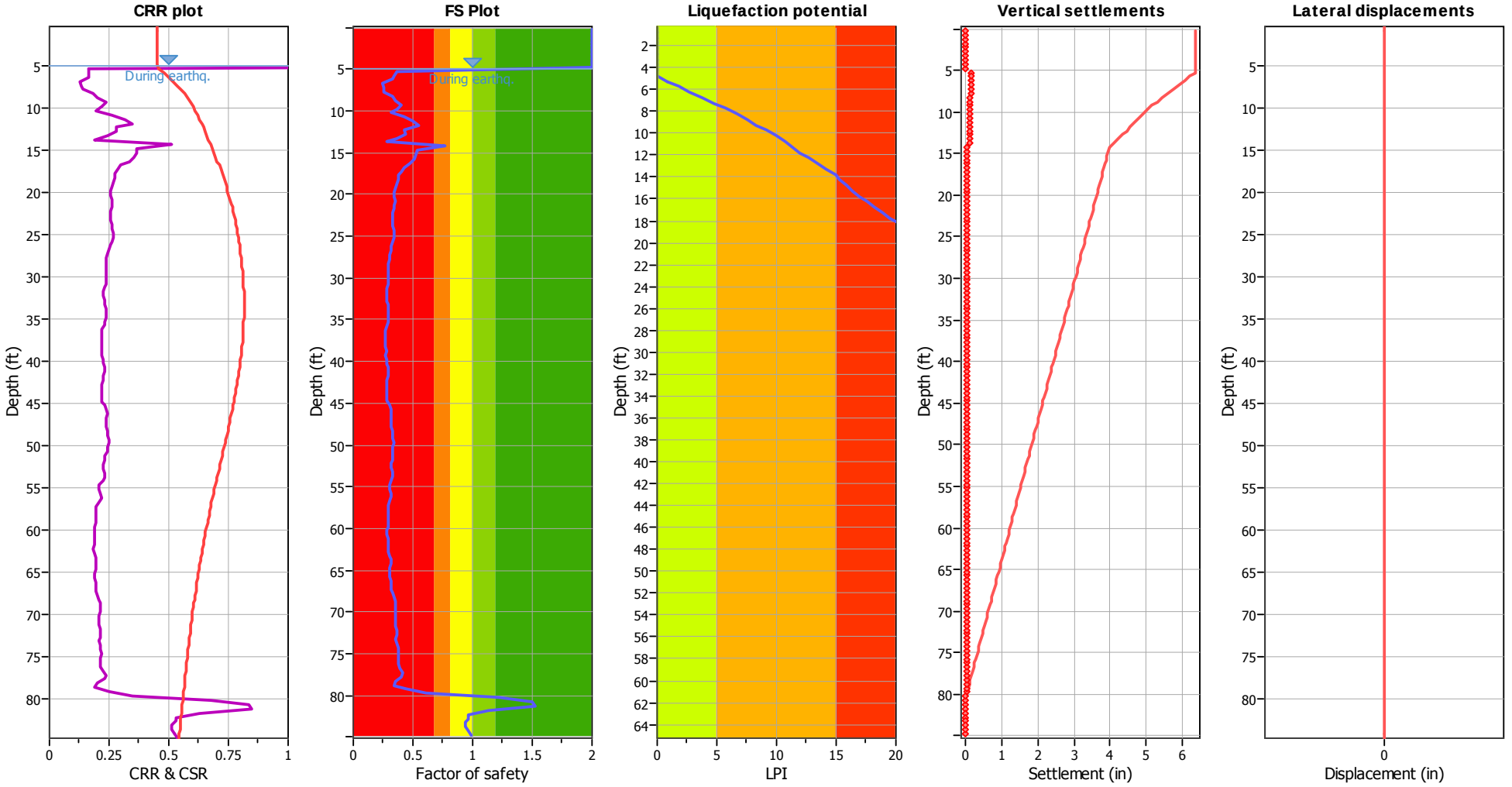
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

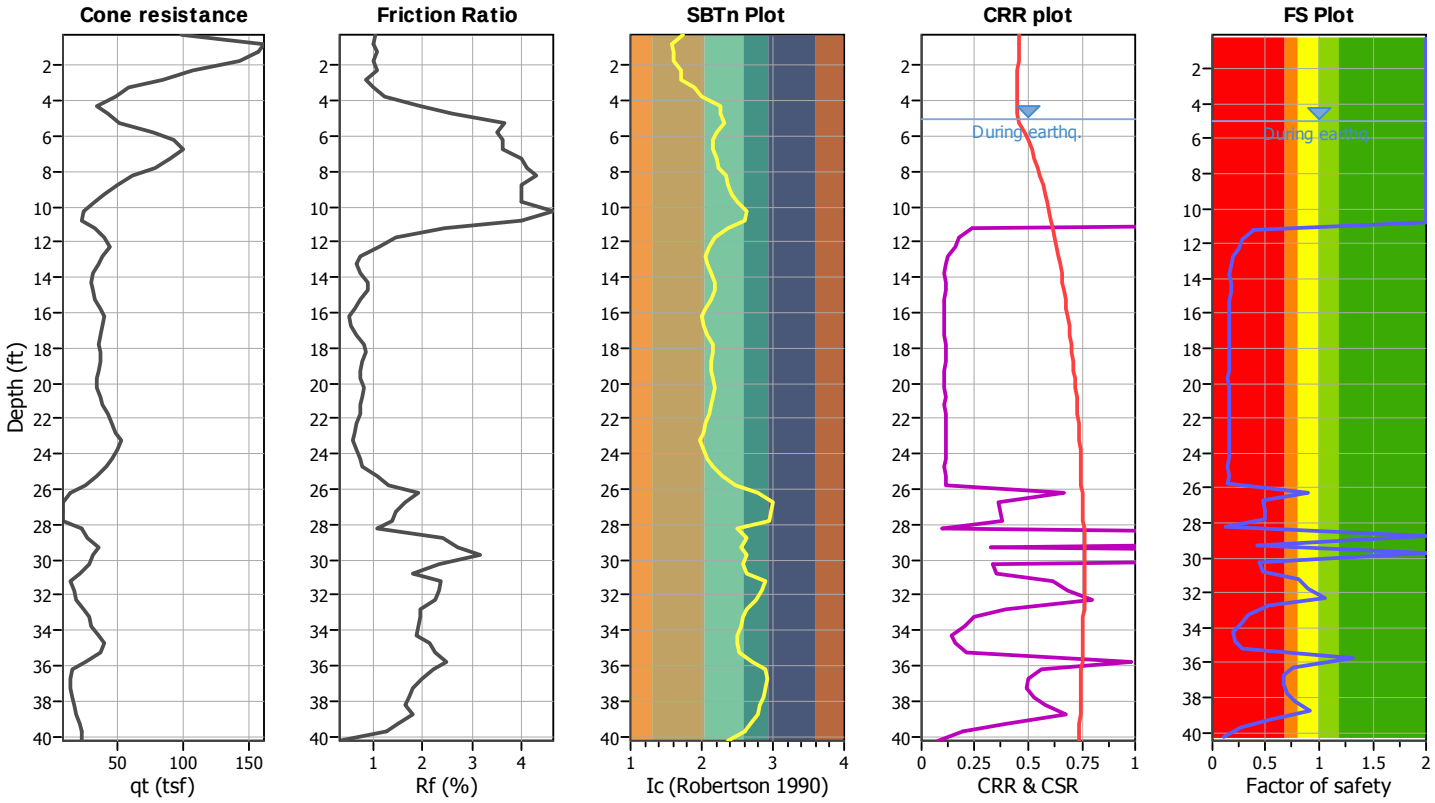
LIQUEFACTION ANALYSIS REPORT

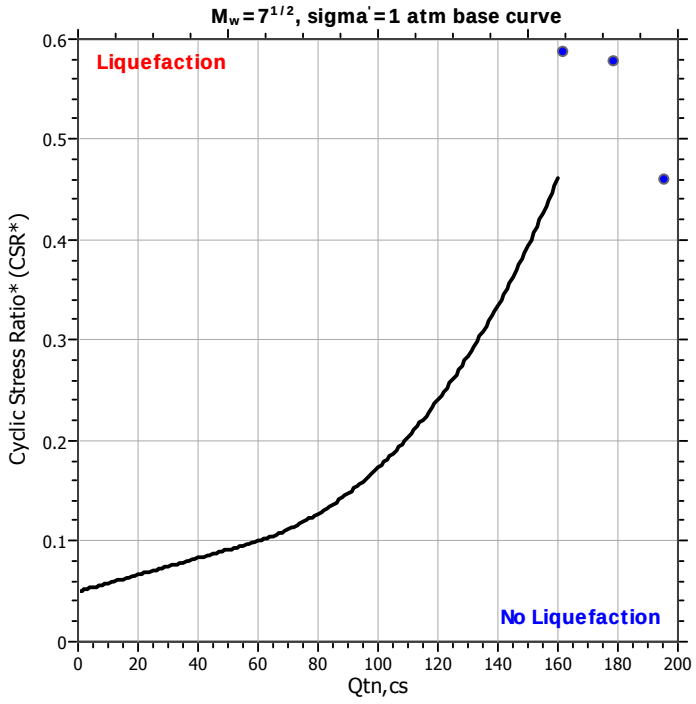
Project title : Candlestick Point **Location : San Francisco, CA**

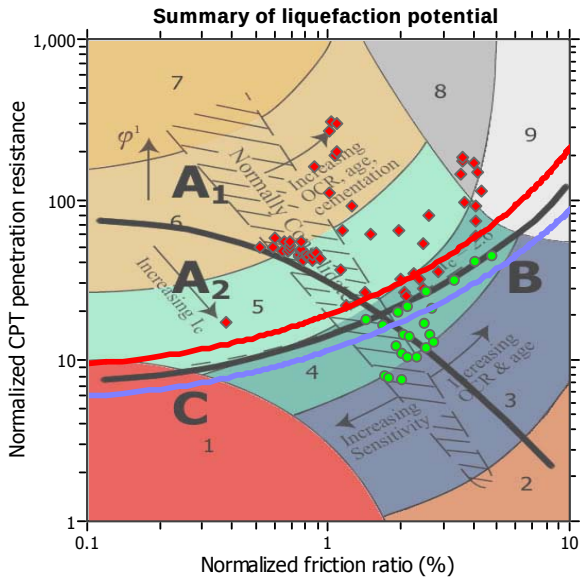
CPT file : CPT-04

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

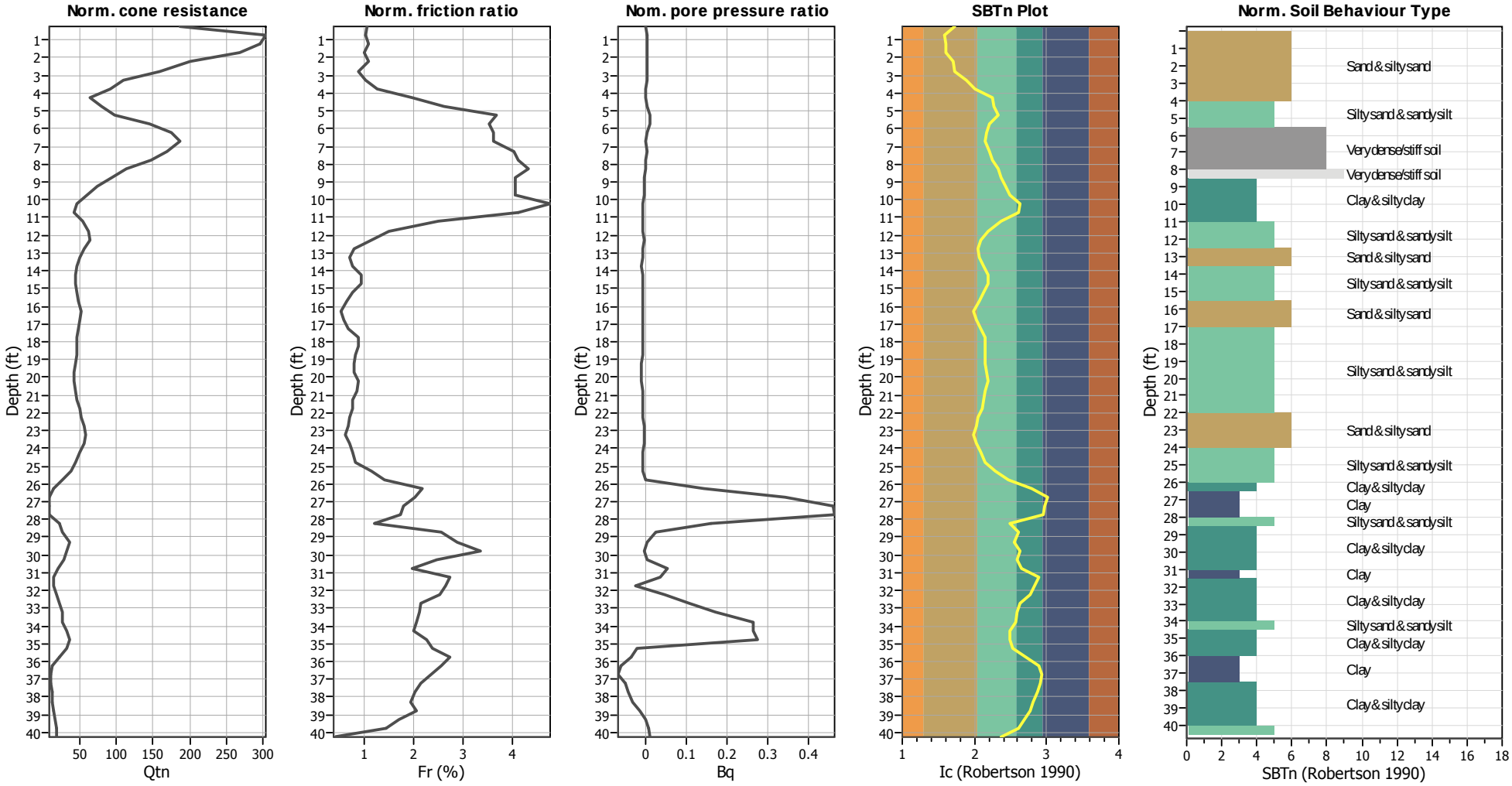






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



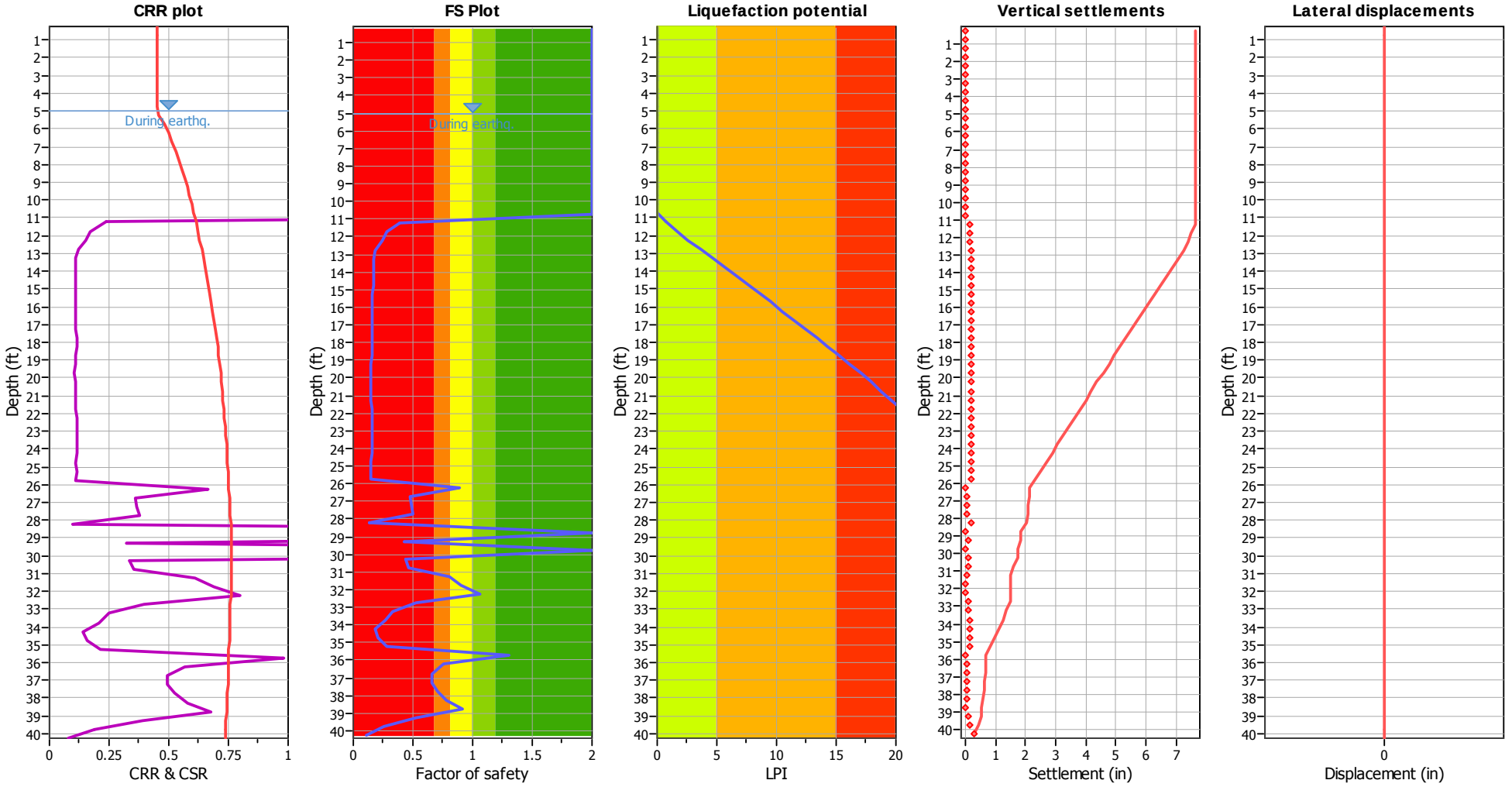
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

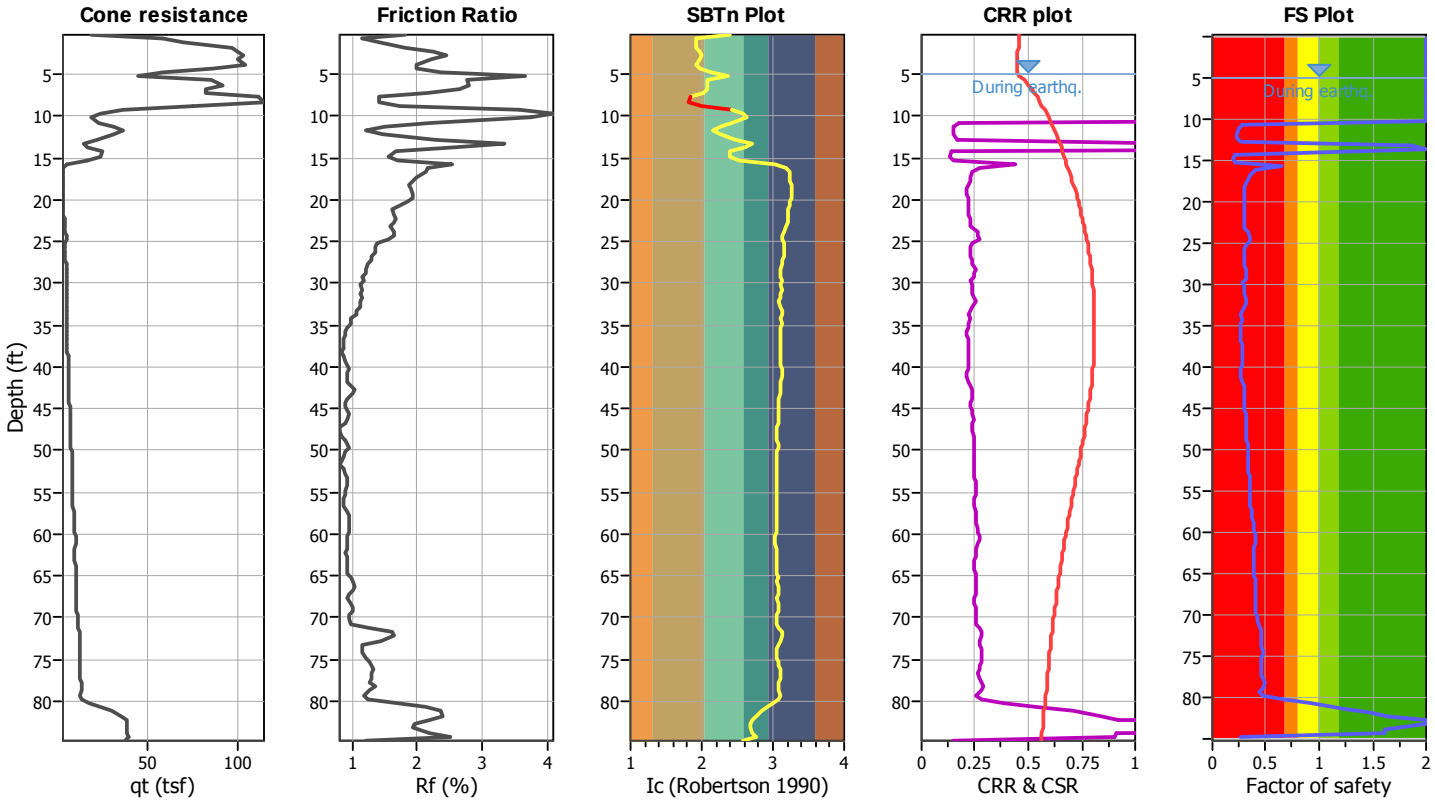
LIQUEFACTION ANALYSIS REPORT

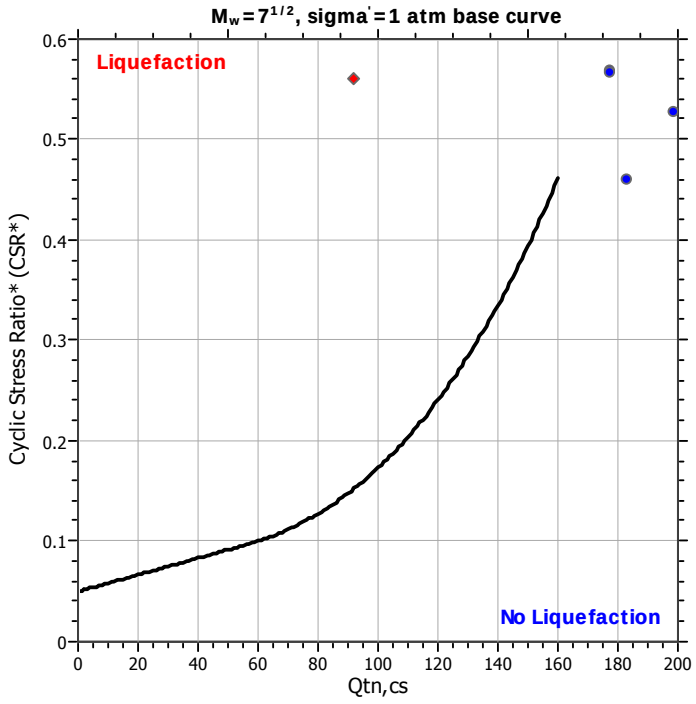
Project title : Candlestick Point **Location : San Francisco, CA**

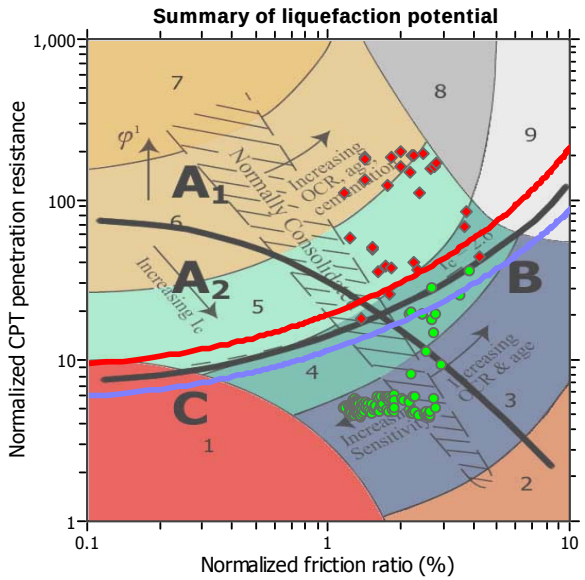
CPT file : CPT-05

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

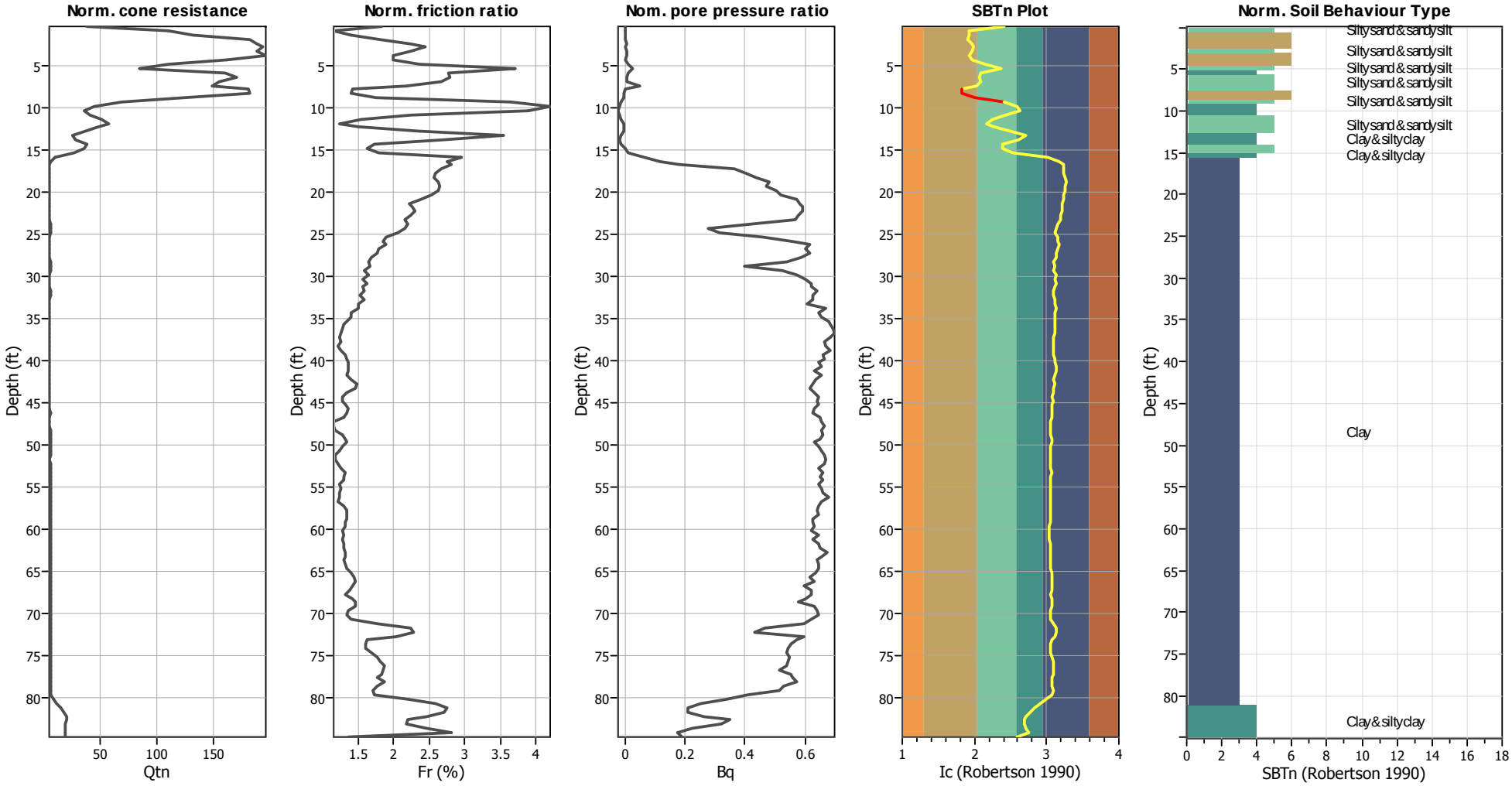






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



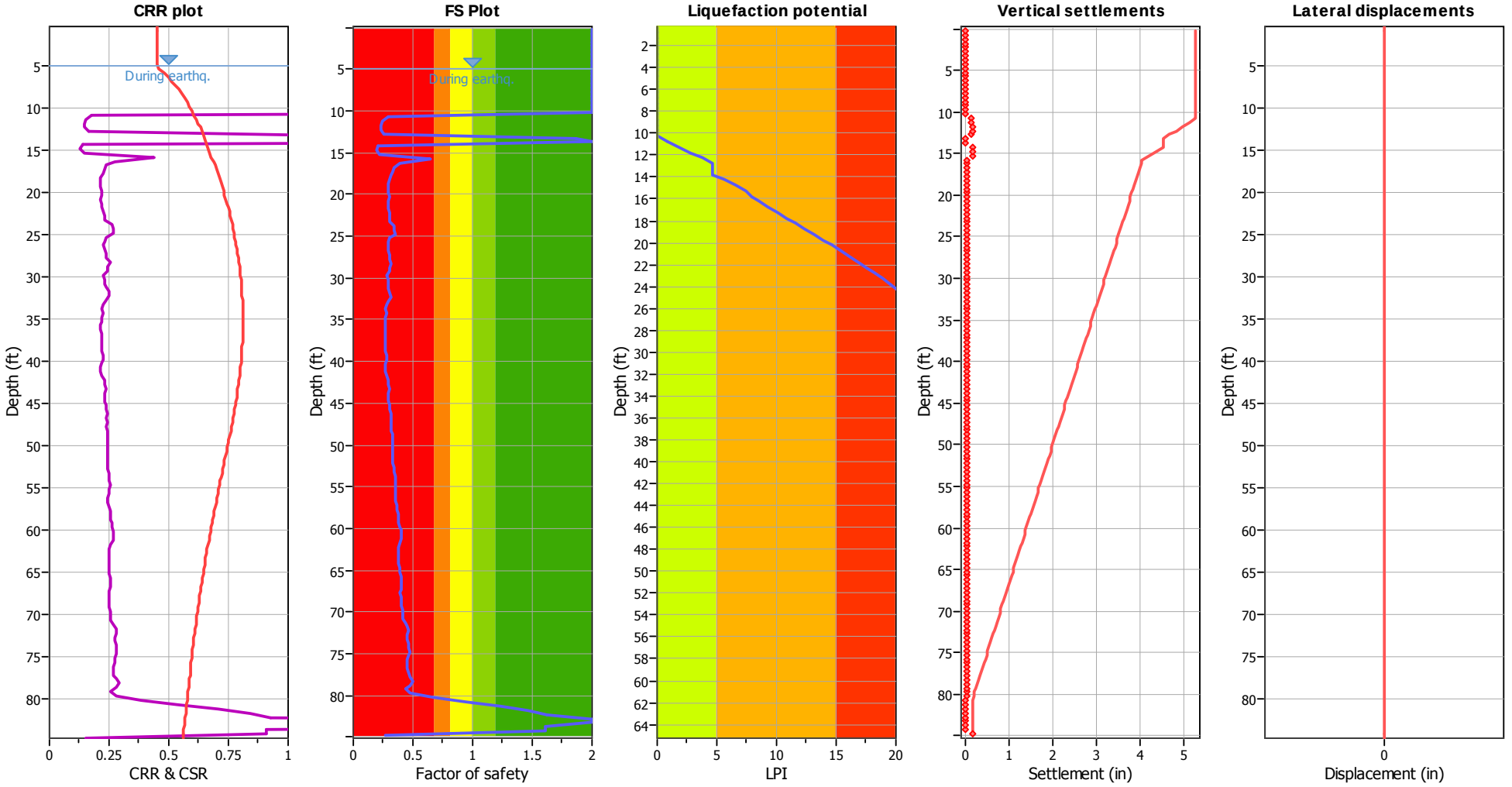
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

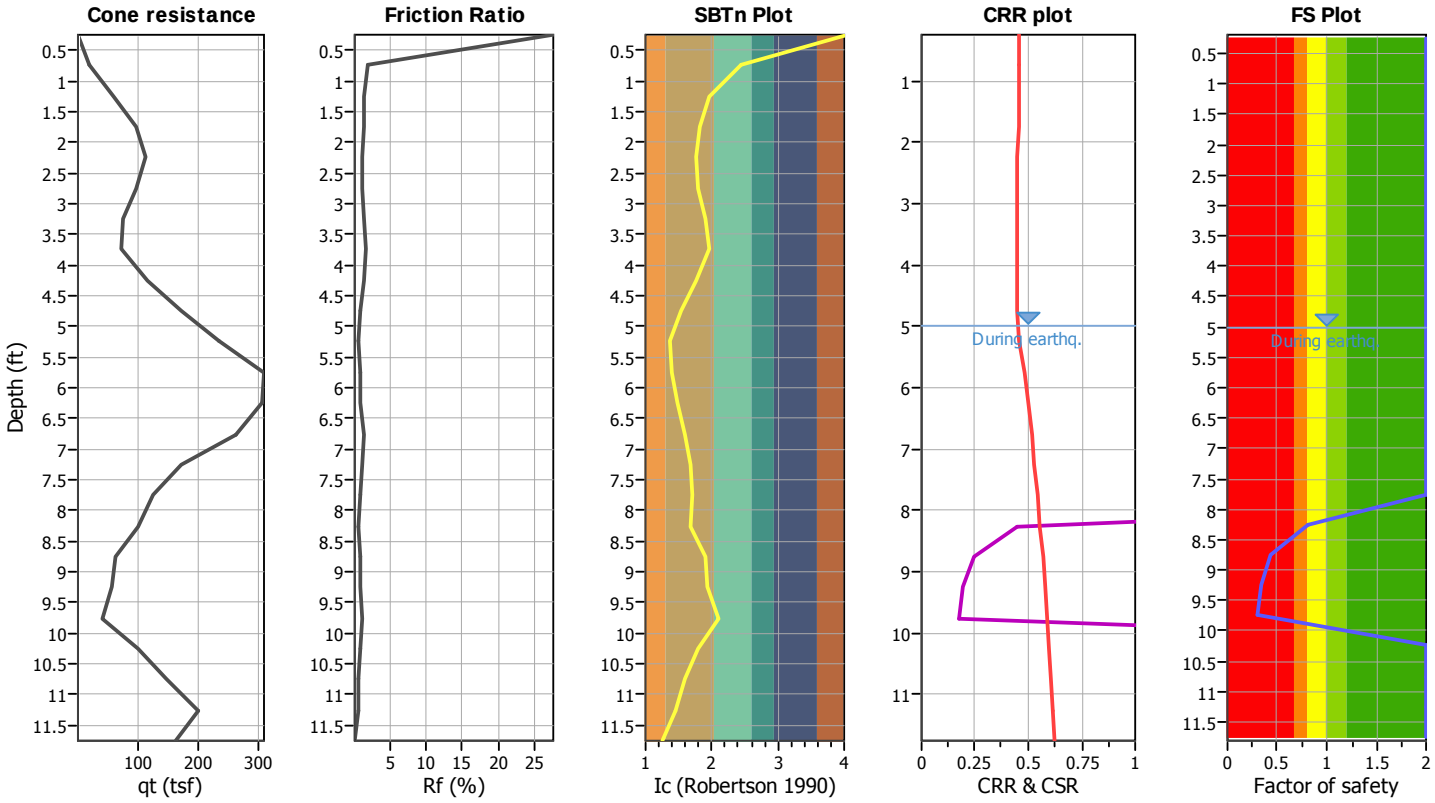
LIQUEFACTION ANALYSIS REPORT

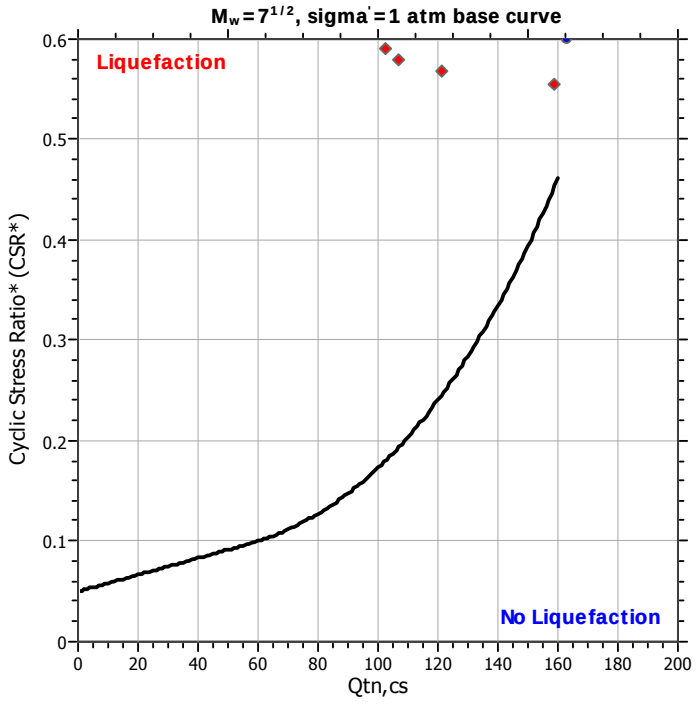
Project title : Candlestick Point **Location : San Francisco, CA**

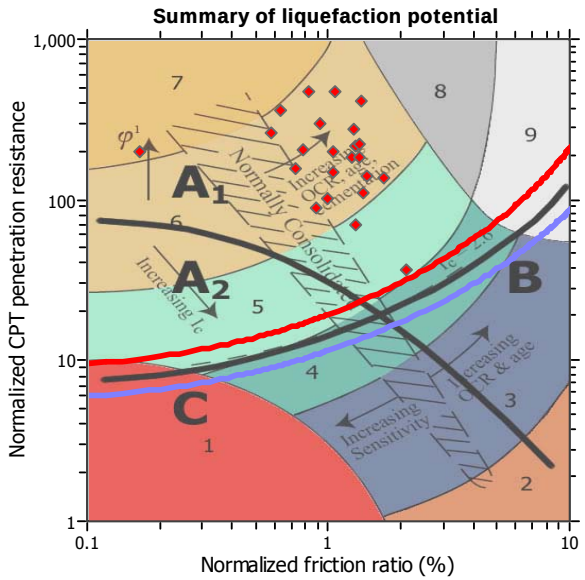
CPT file : CPT-06

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

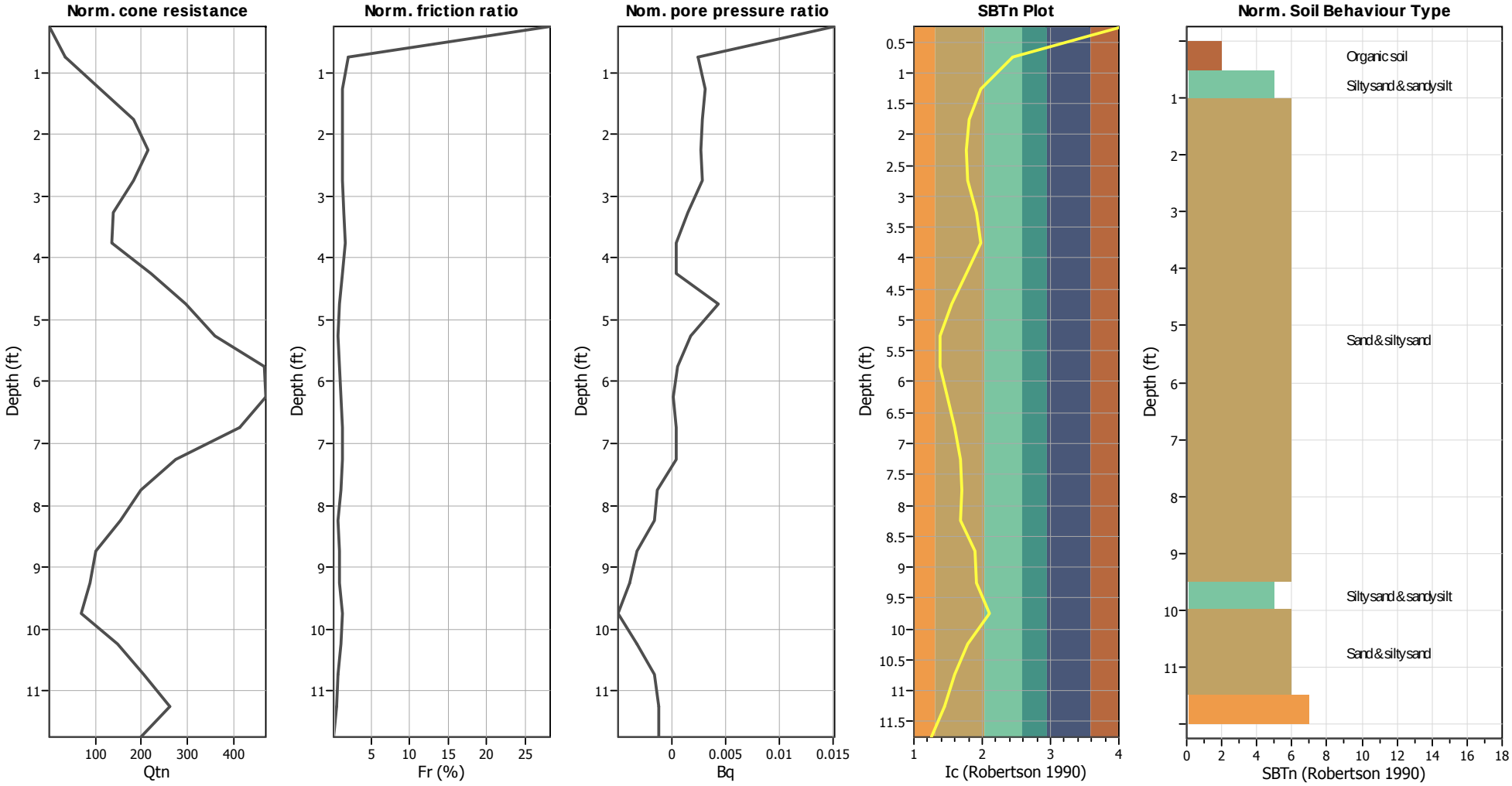






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



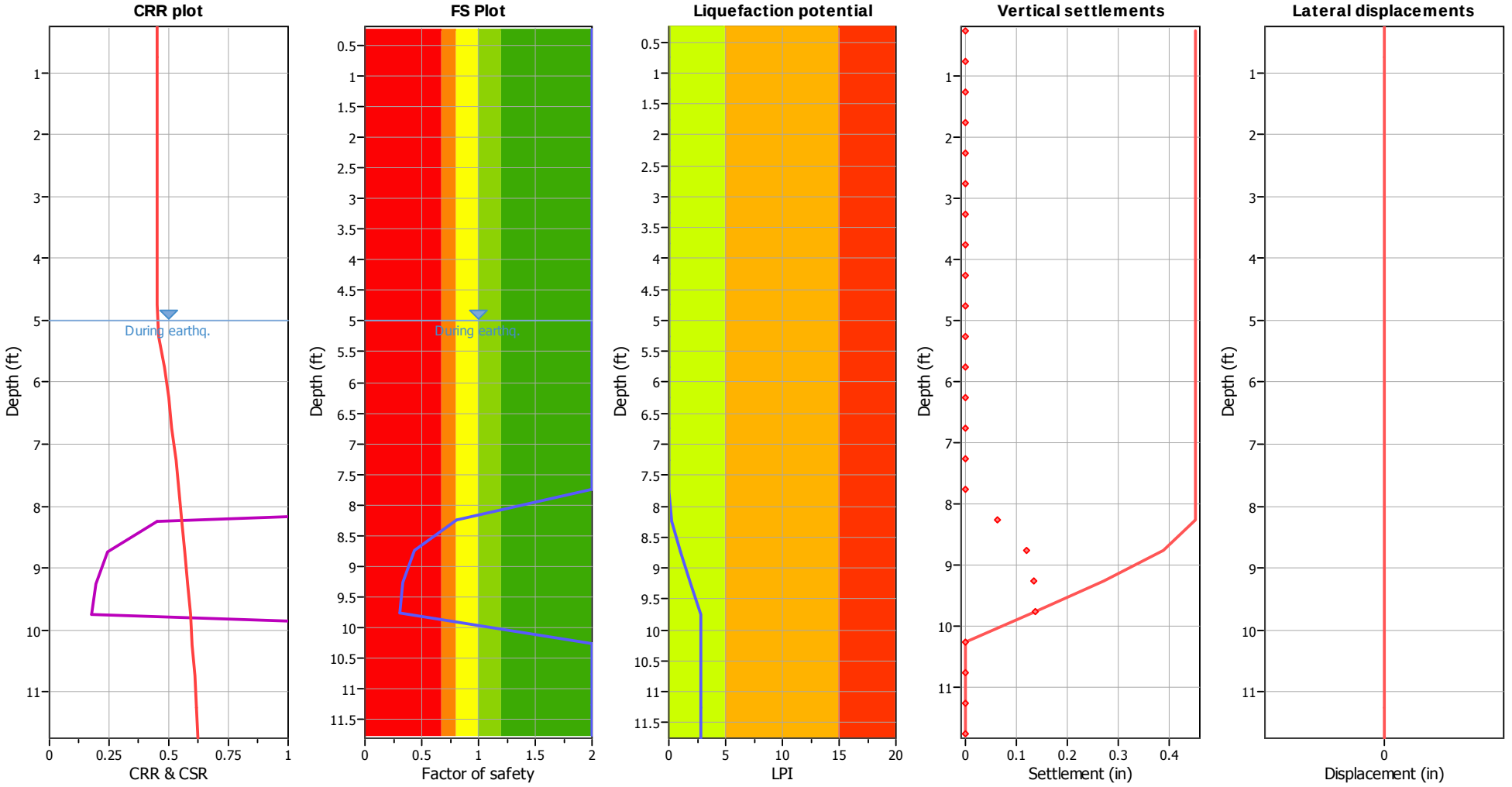
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

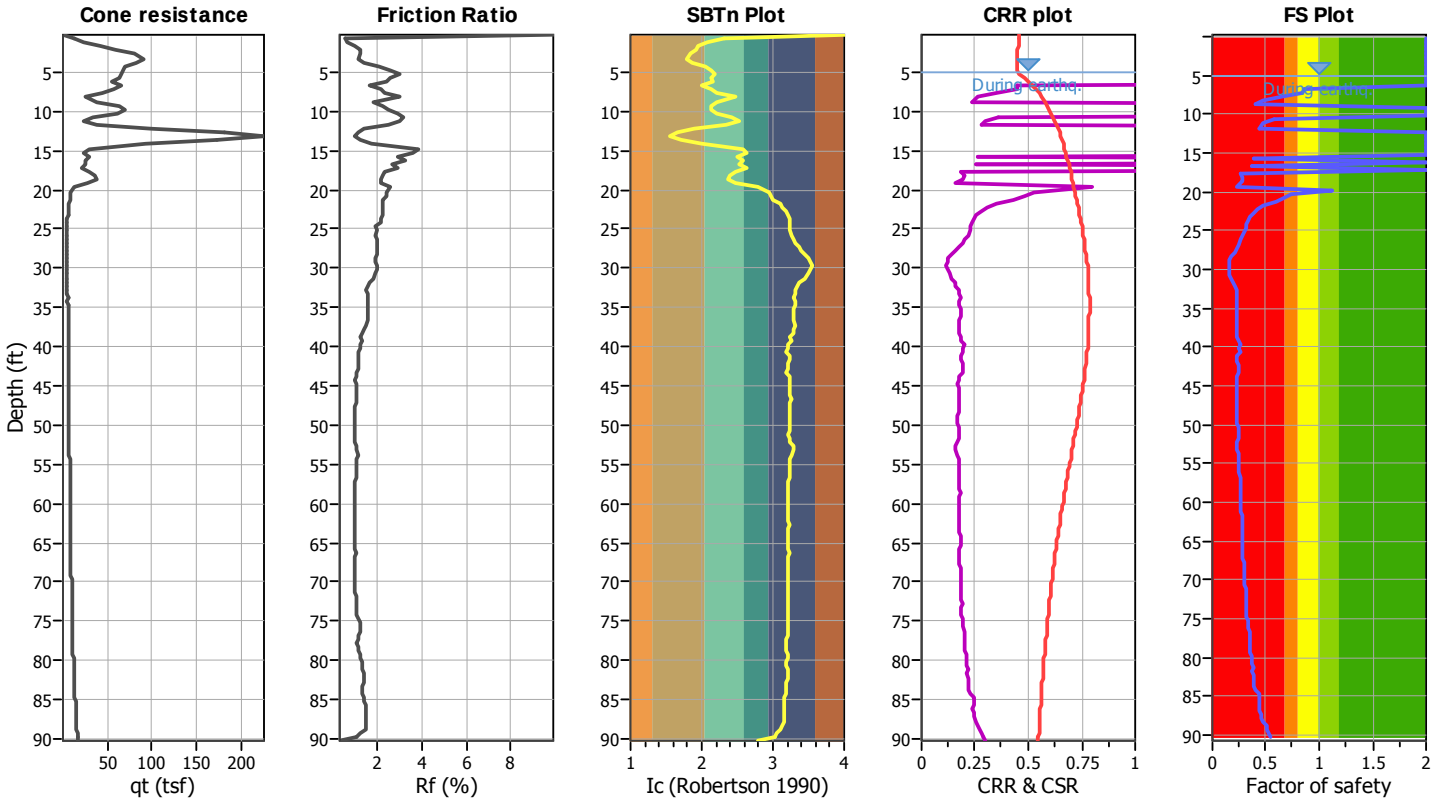
LIQUEFACTION ANALYSIS REPORT

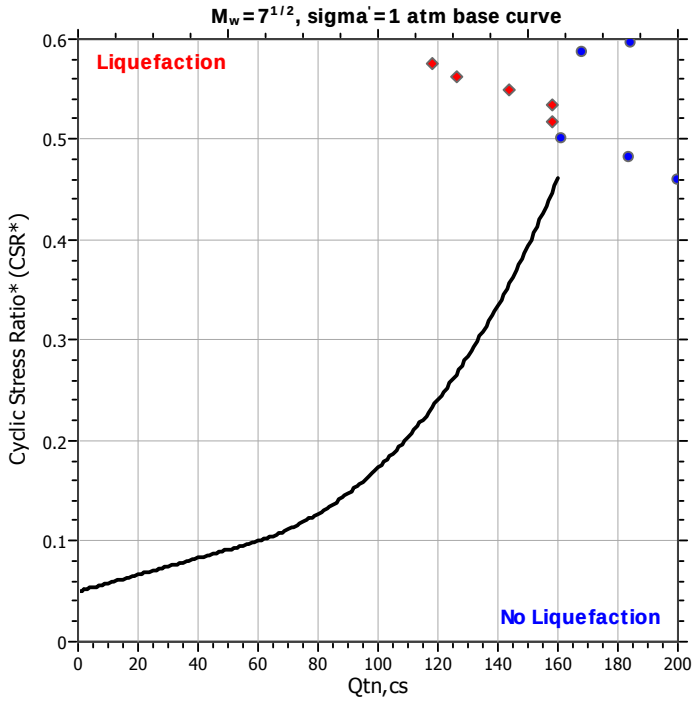
Project title : Candlestick Point **Location : San Francisco, CA**

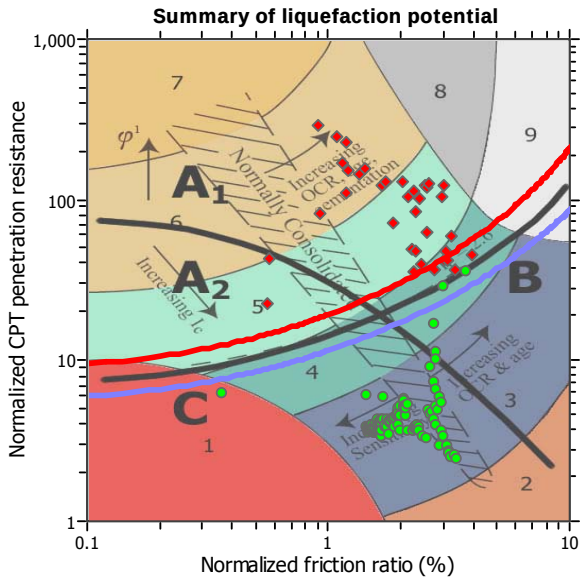
CPT file : CPT-07

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

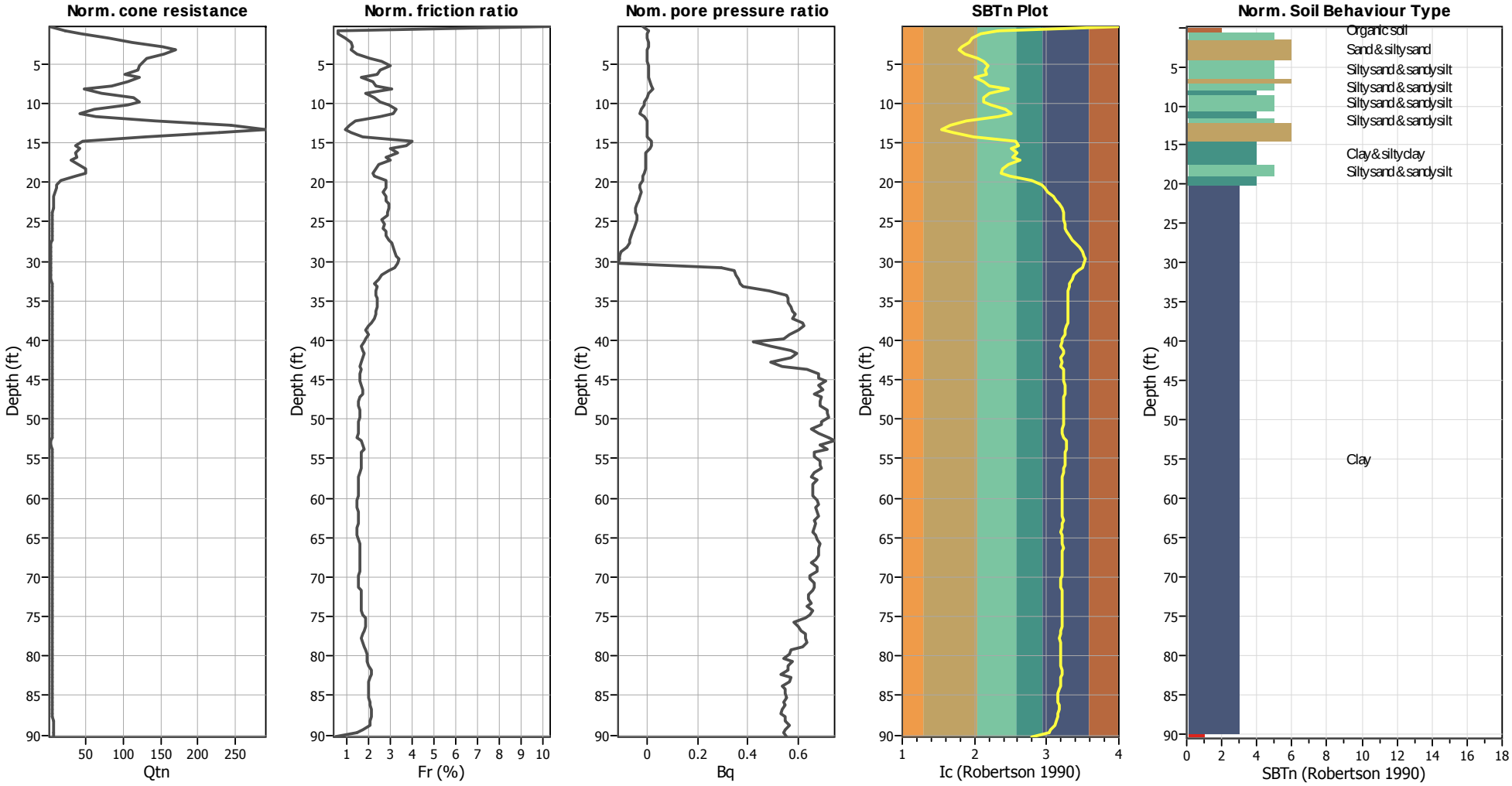






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



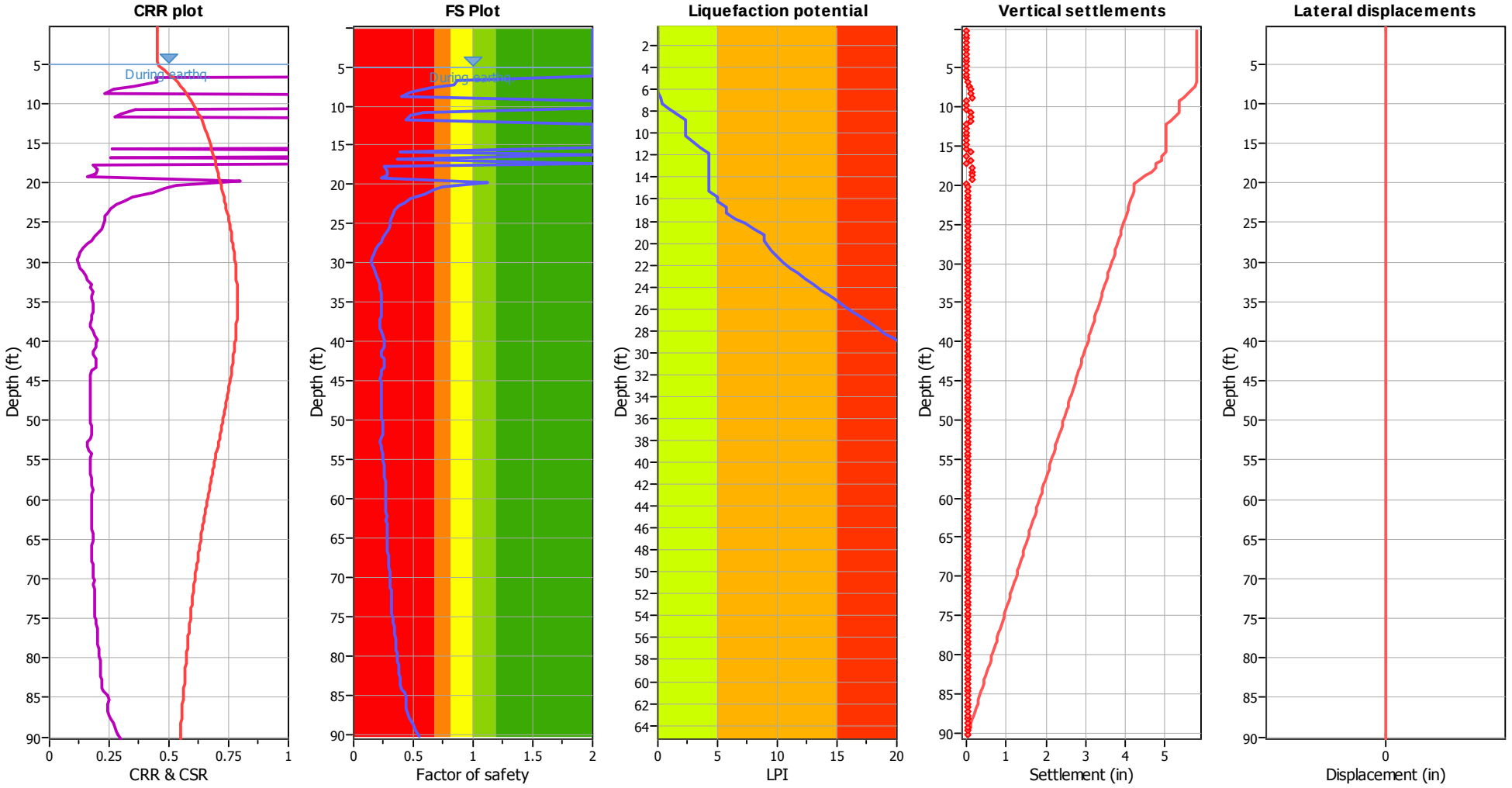
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

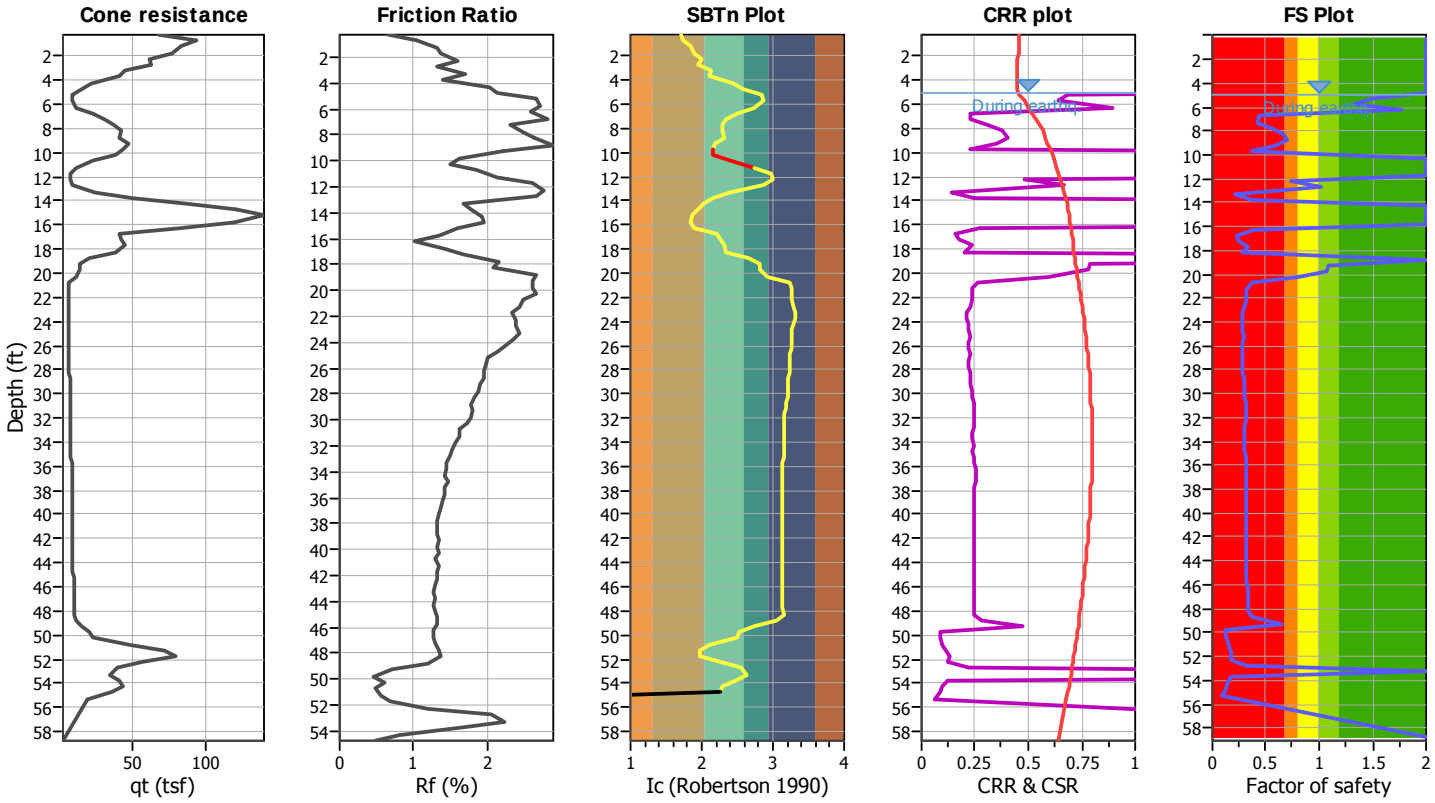
LIQUEFACTION ANALYSIS REPORT

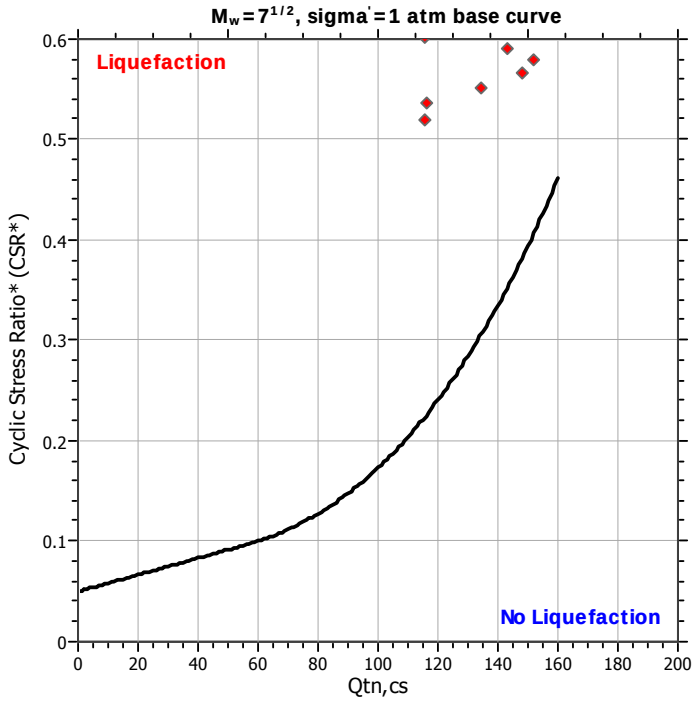
Project title : Candlestick Point **Location : San Francisco, CA**

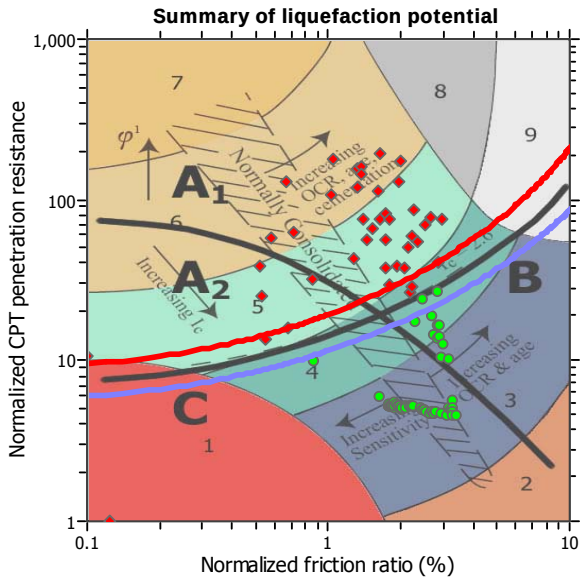
CPT file : CPT-08

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

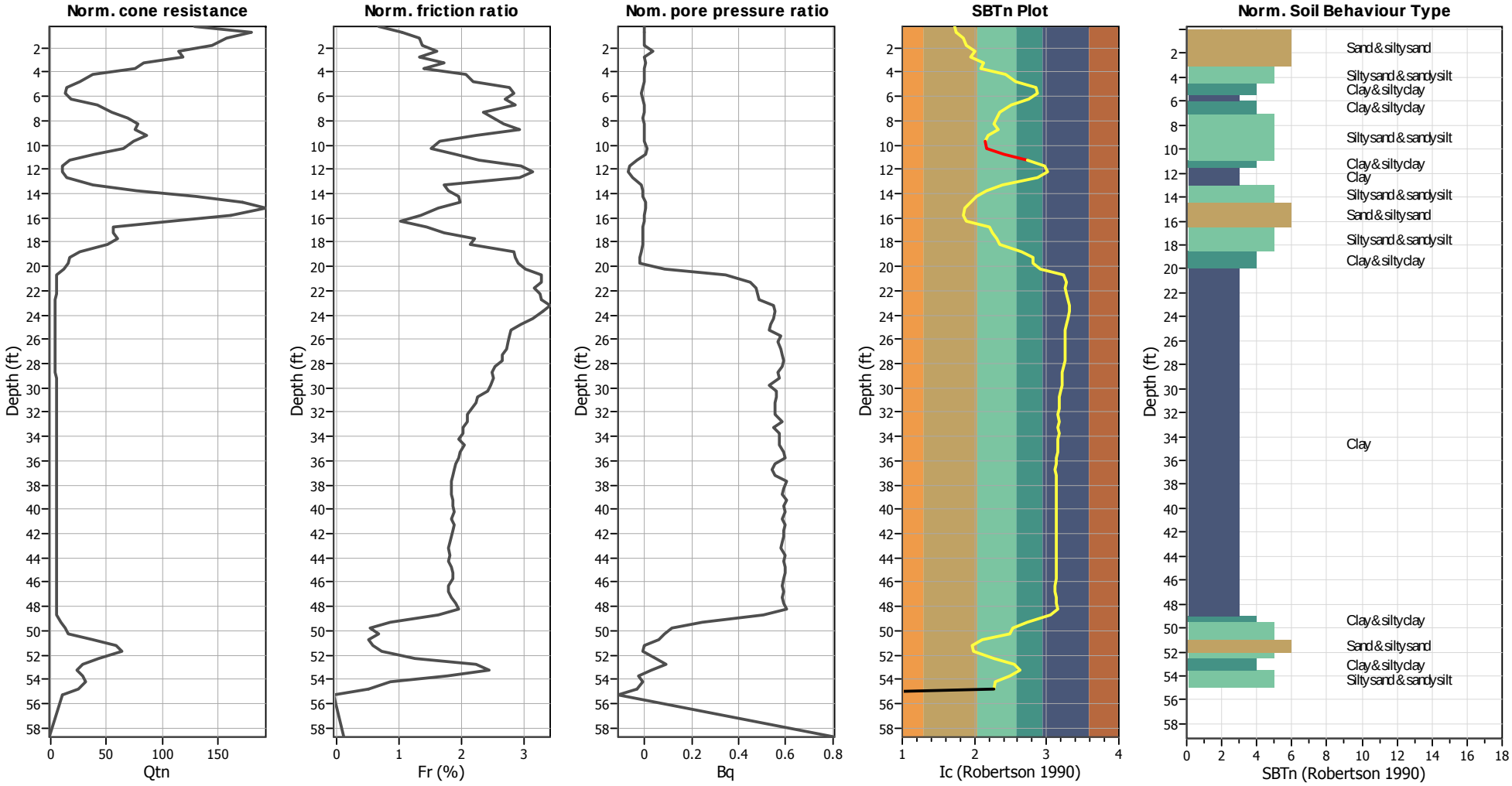






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



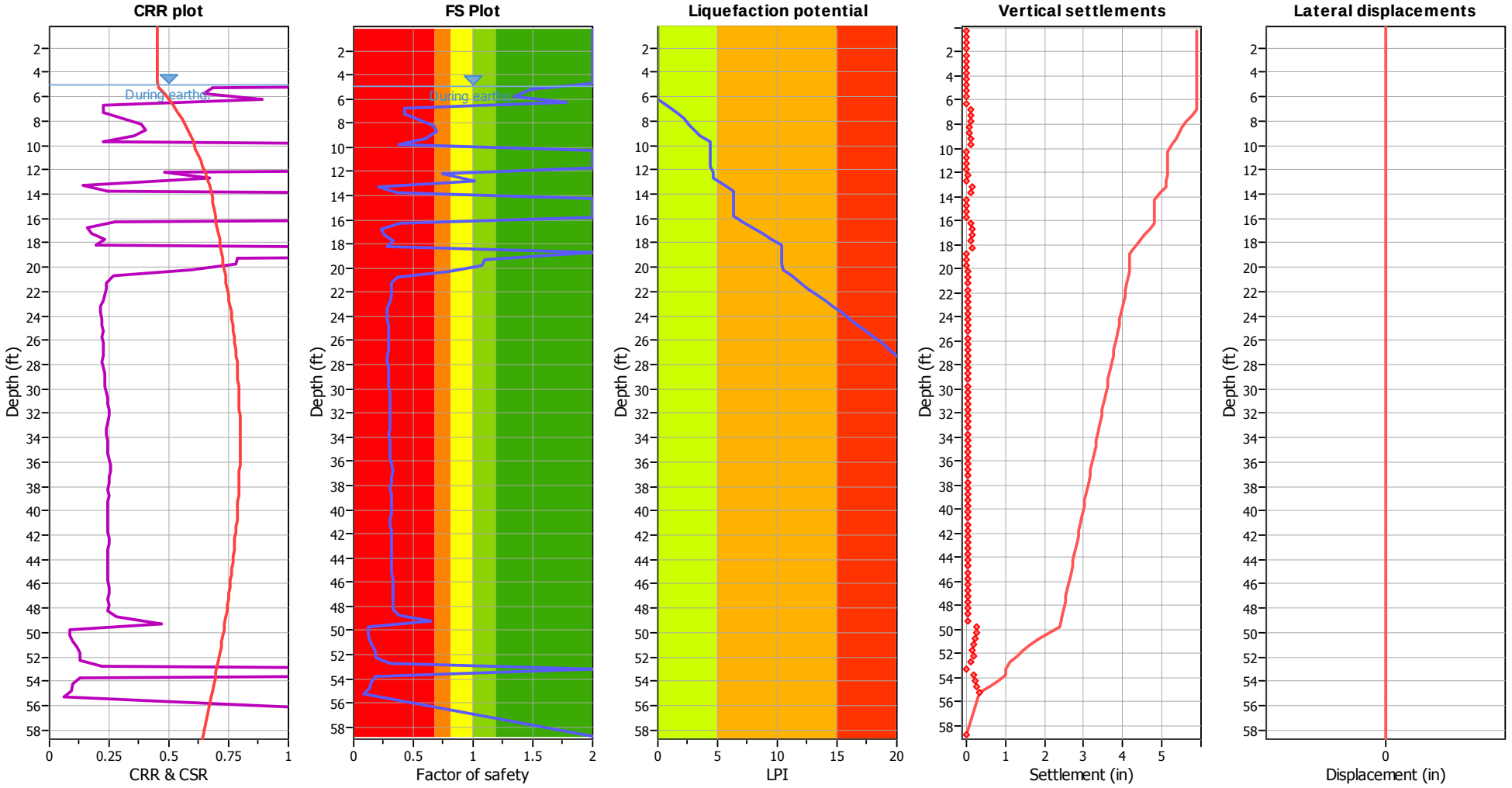
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

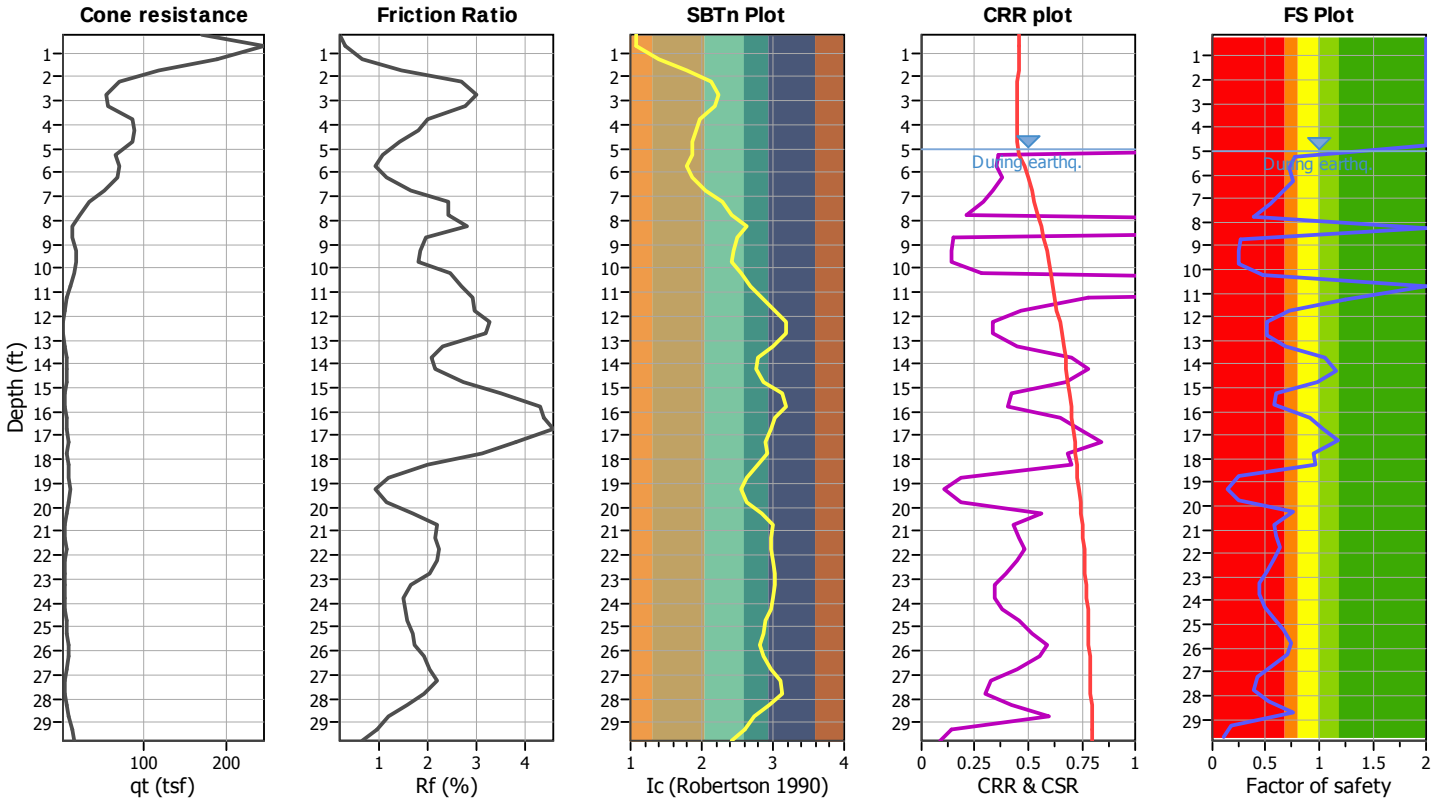
LIQUEFACTION ANALYSIS REPORT

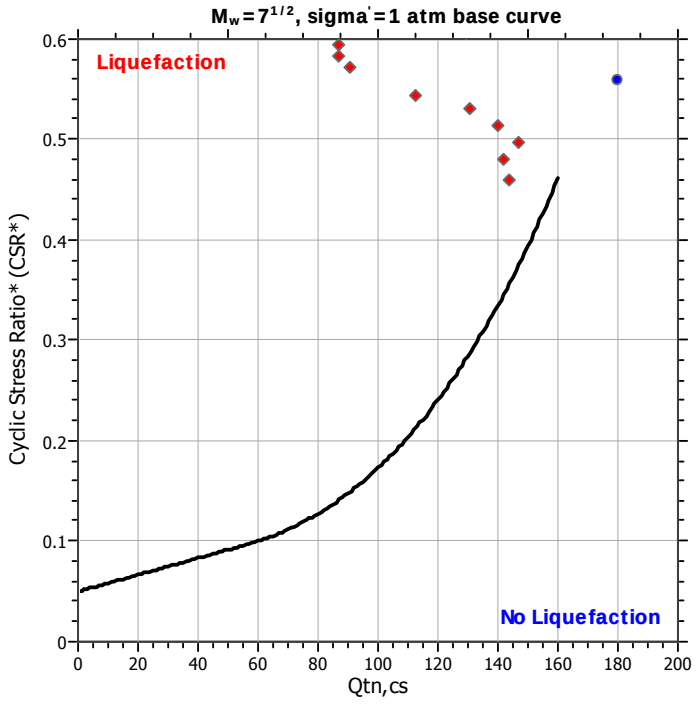
Project title : Candlestick Point **Location : San Francisco, CA**

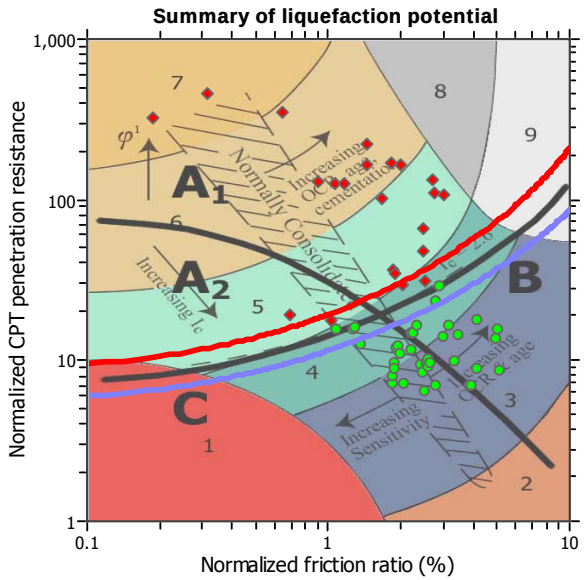
CPT file : CPT-09

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

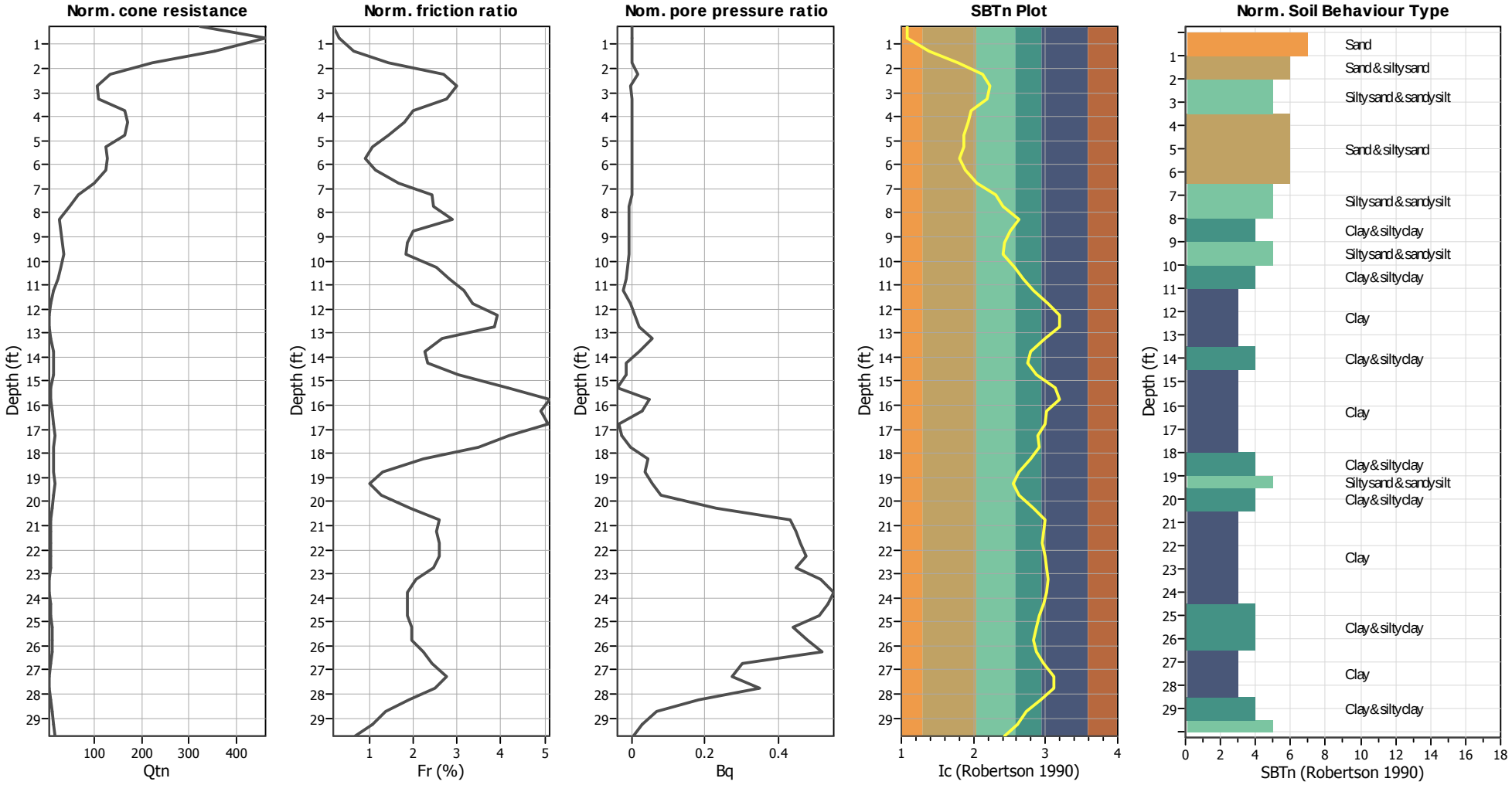






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



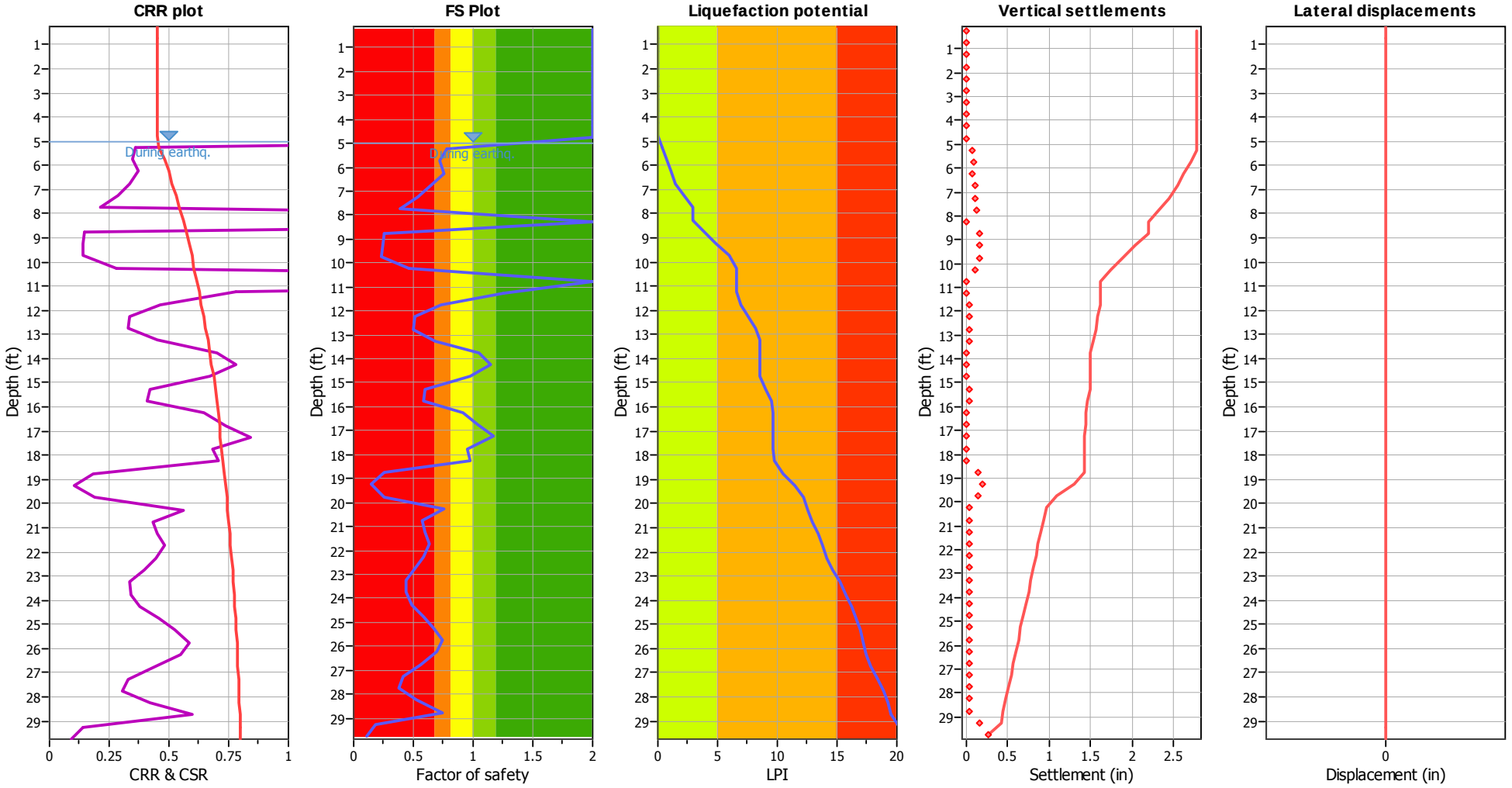
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

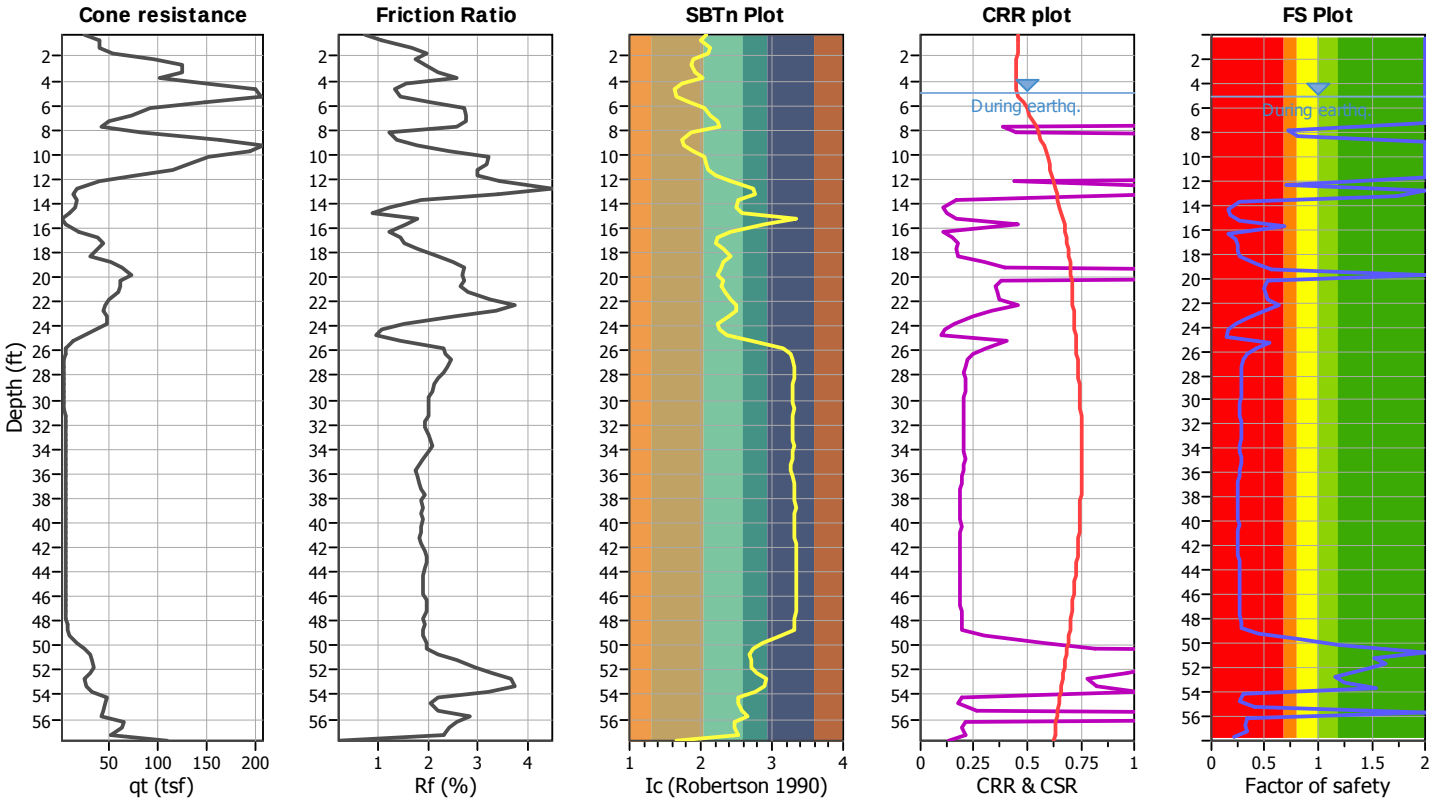
LIQUEFACTION ANALYSIS REPORT

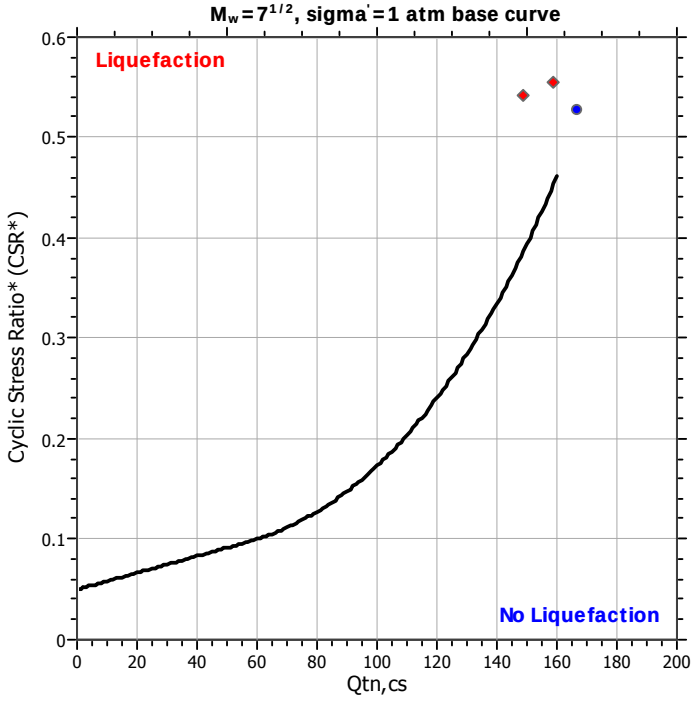
Project title : Candlestick Point **Location : San Francisco, CA**

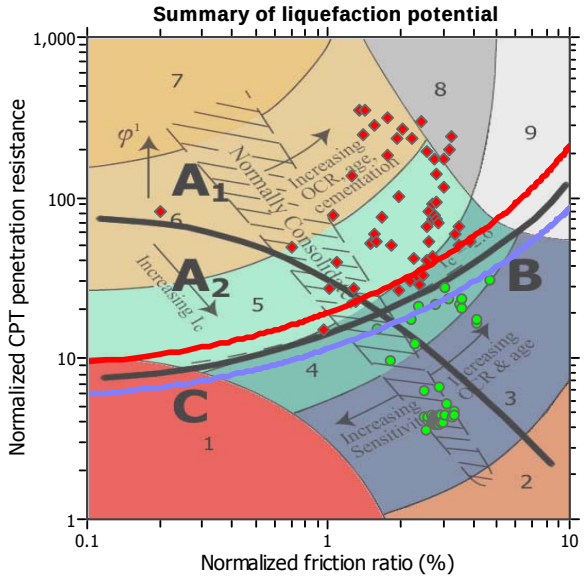
CPT file : CPT-10

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

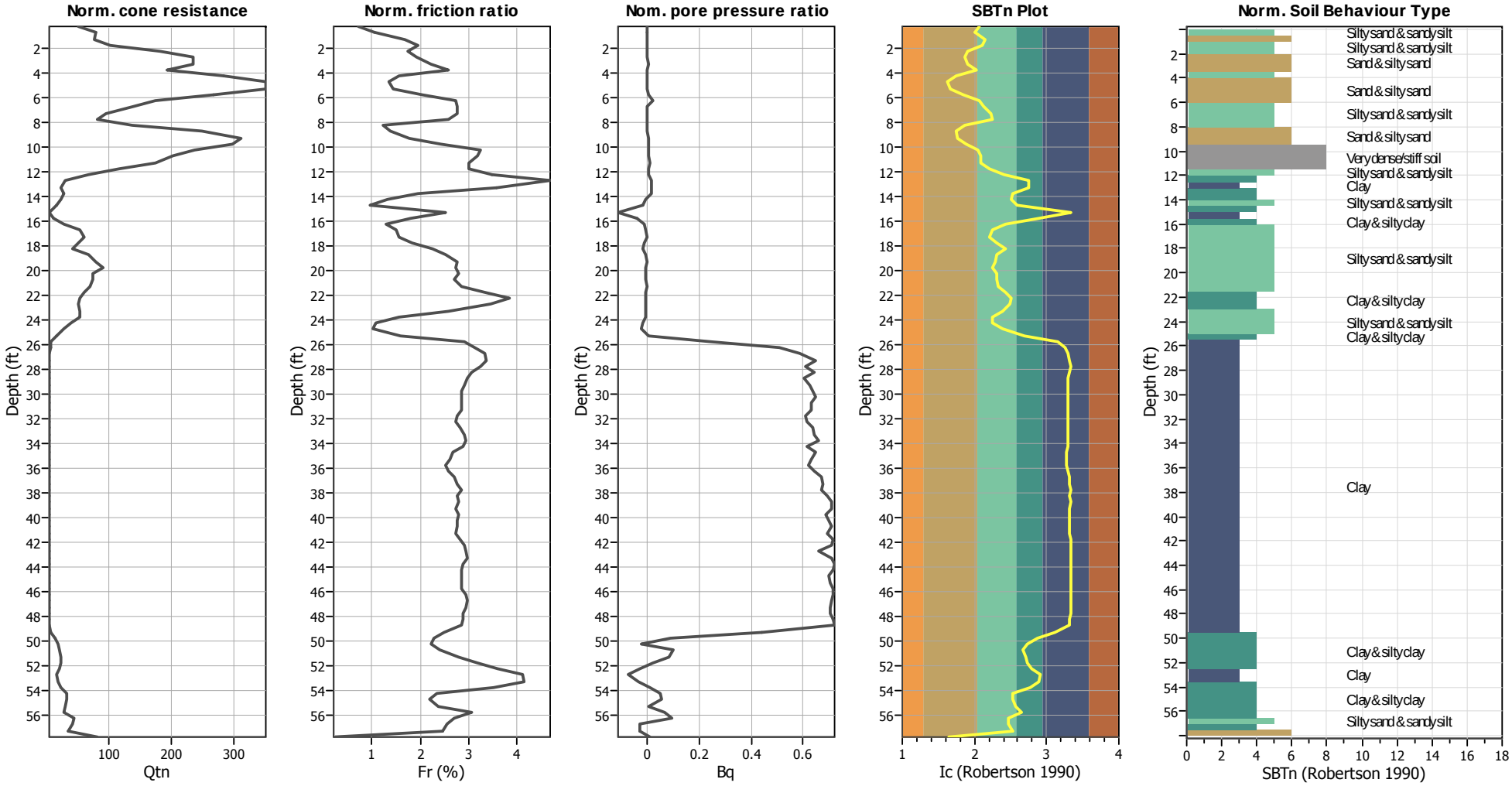






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



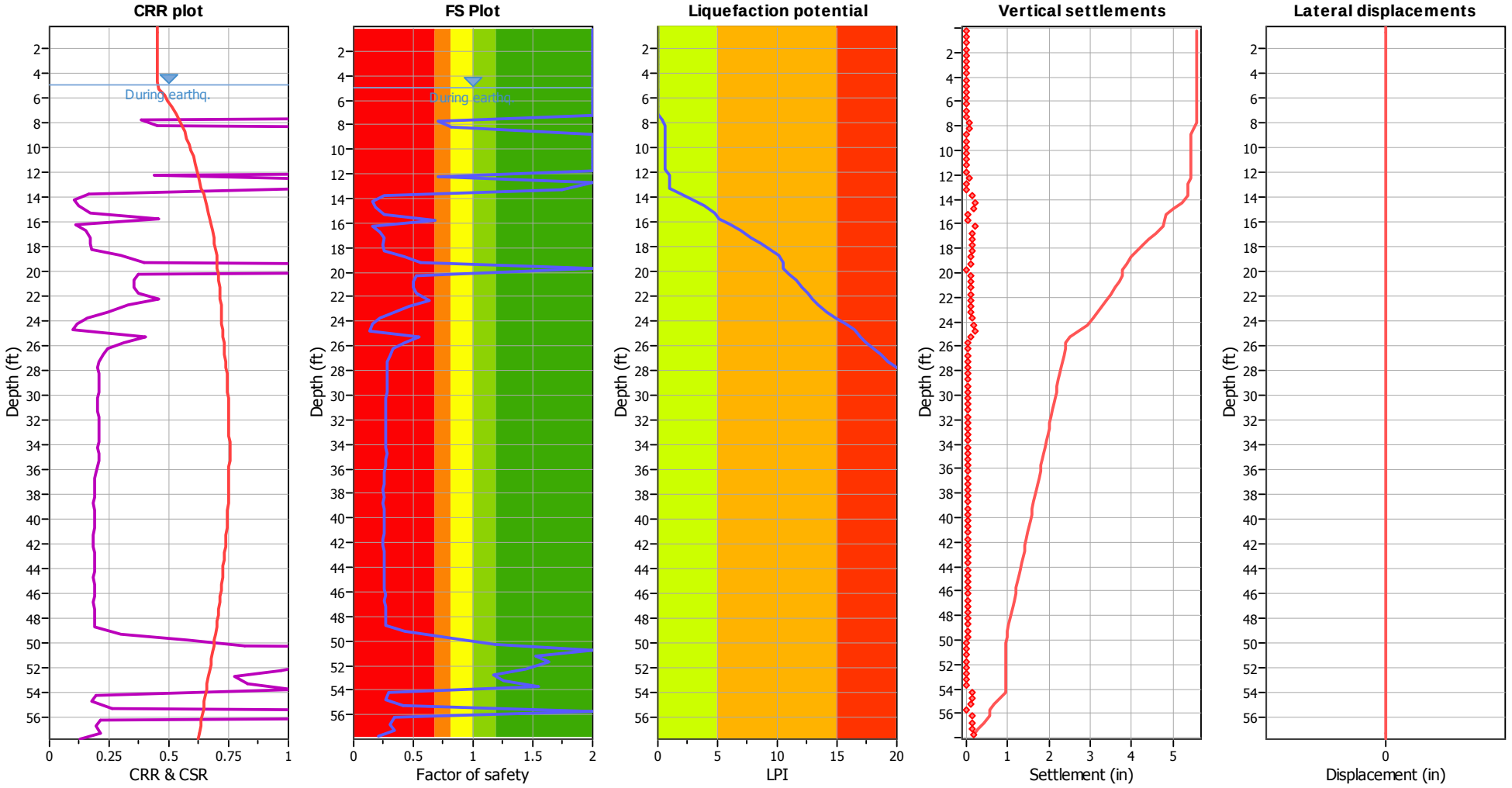
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

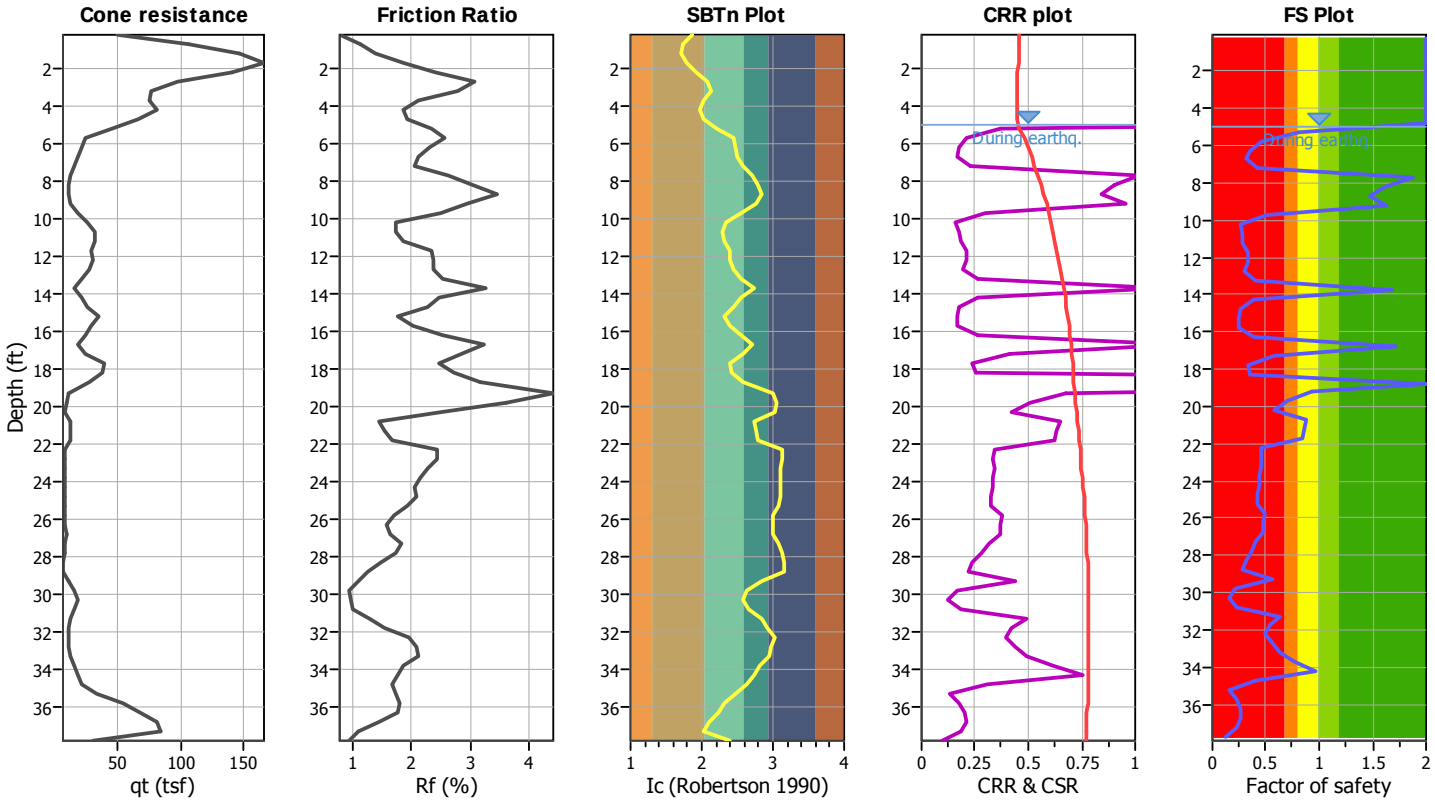
LIQUEFACTION ANALYSIS REPORT

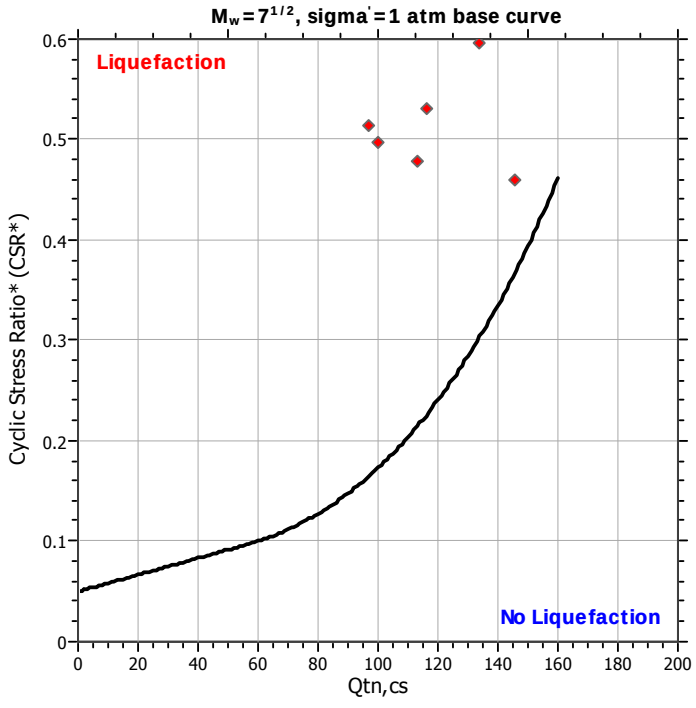
Project title : Candlestick Point **Location : San Francisco, CA**

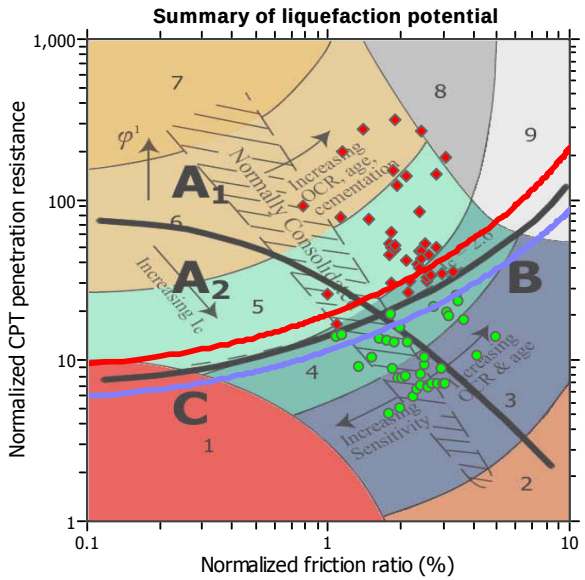
CPT file : CPT-11

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

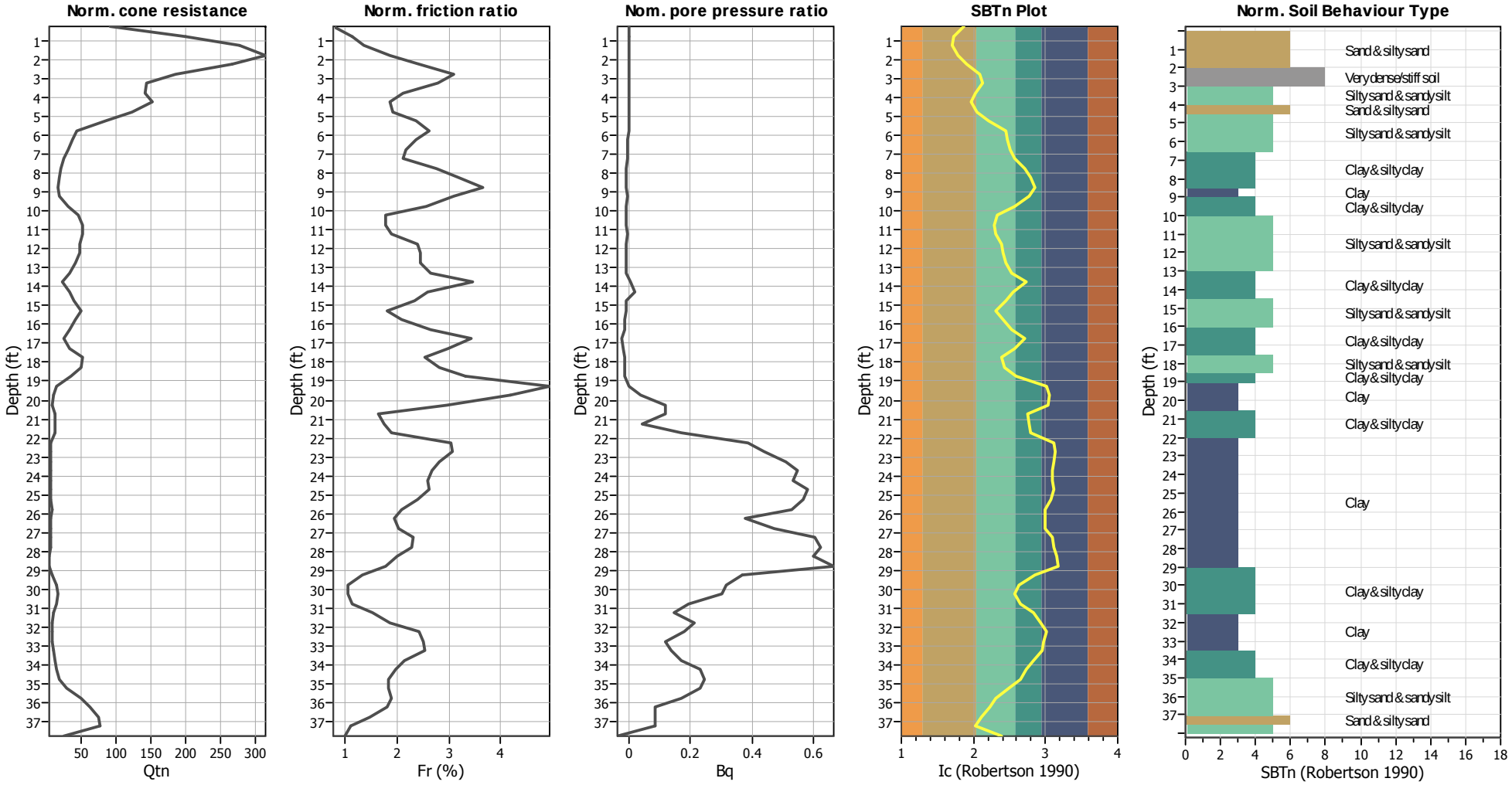






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



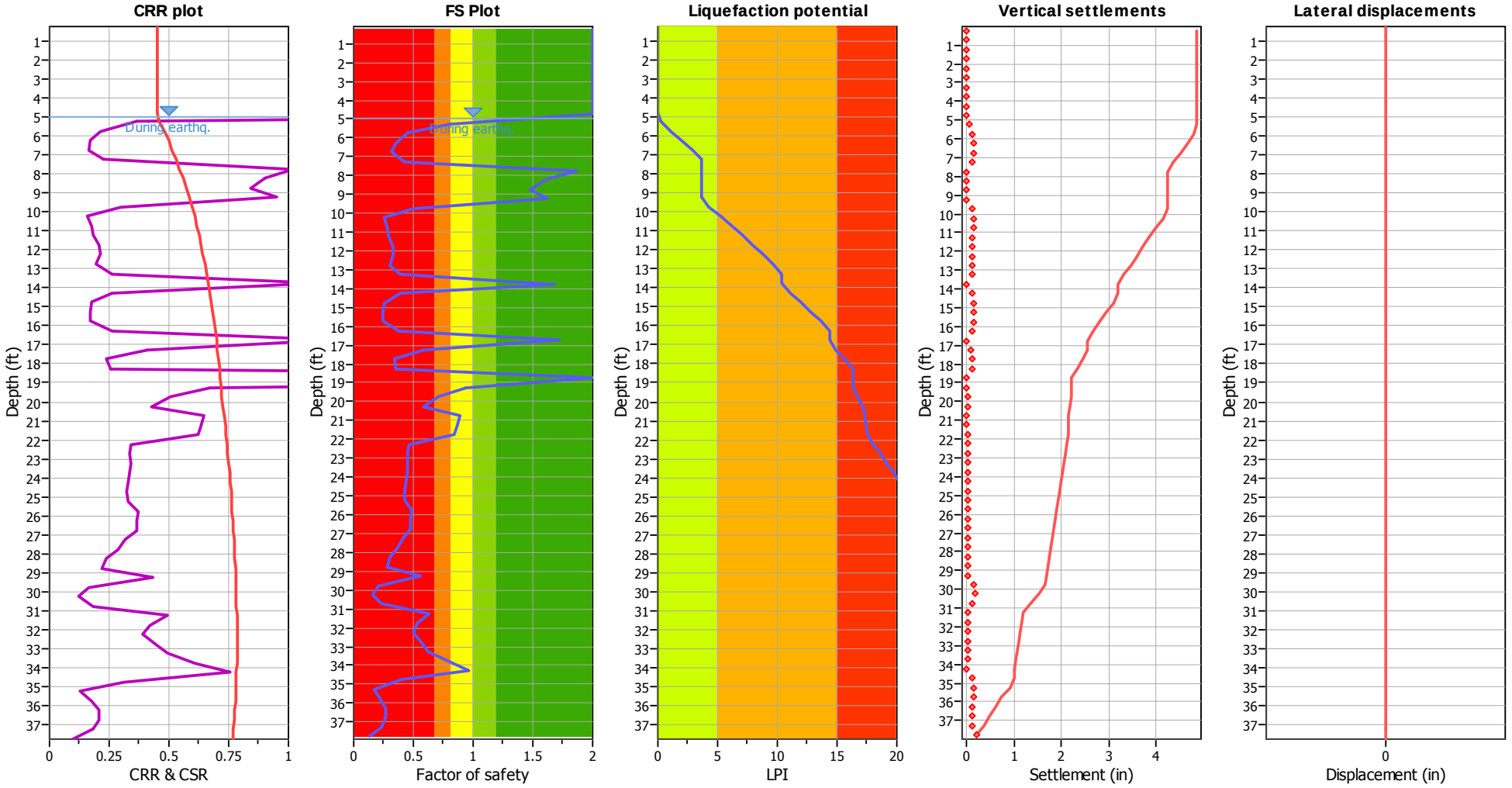
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

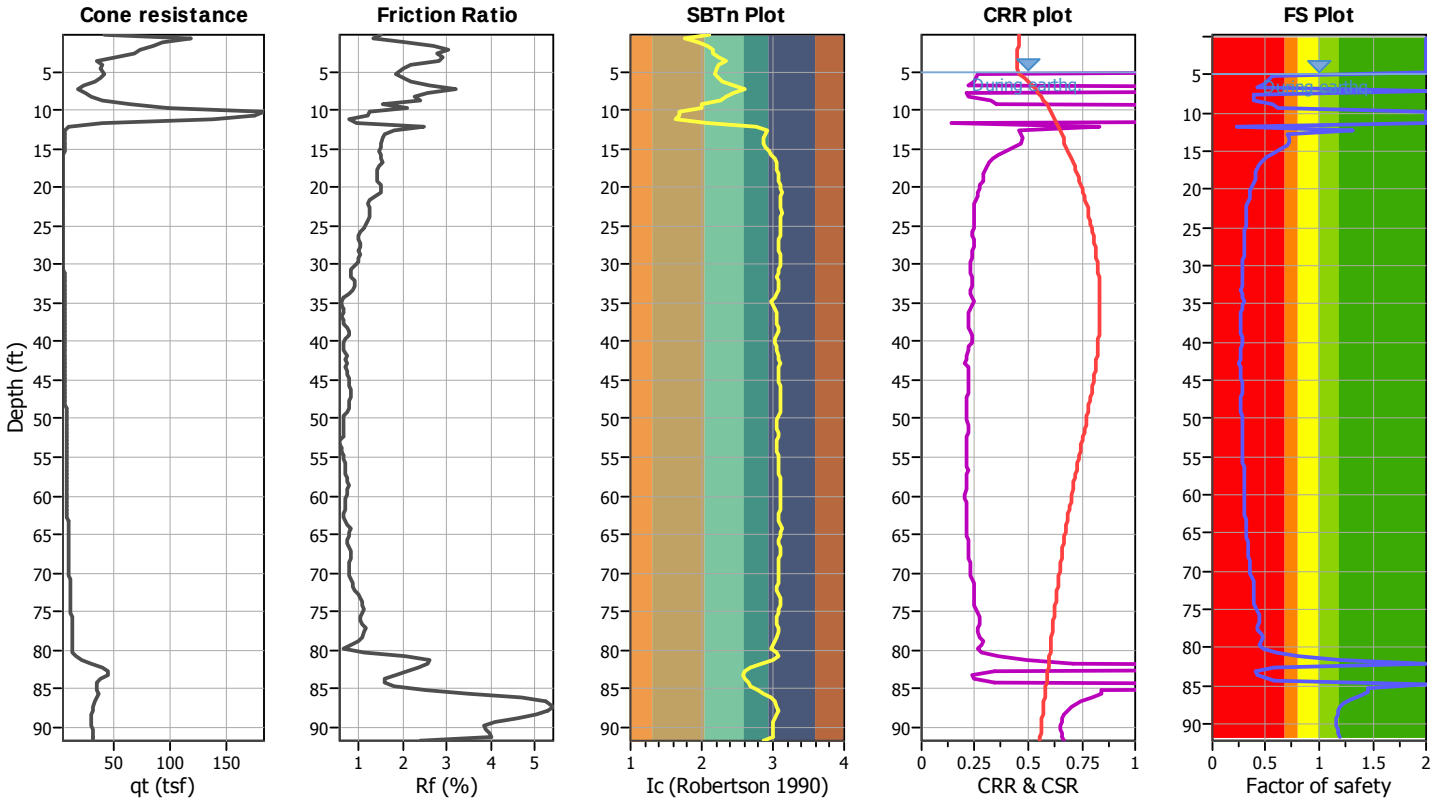
LIQUEFACTION ANALYSIS REPORT

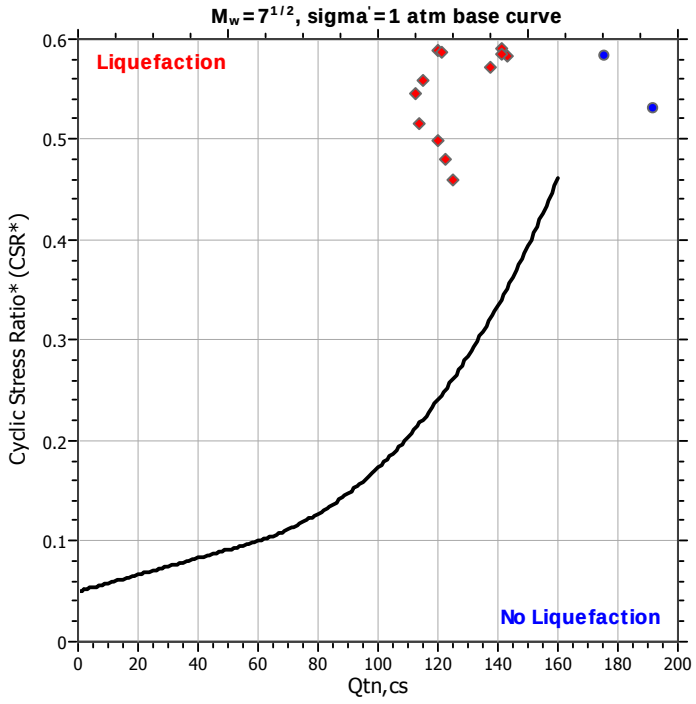
Project title : Candlestick Point **Location : San Francisco, CA**

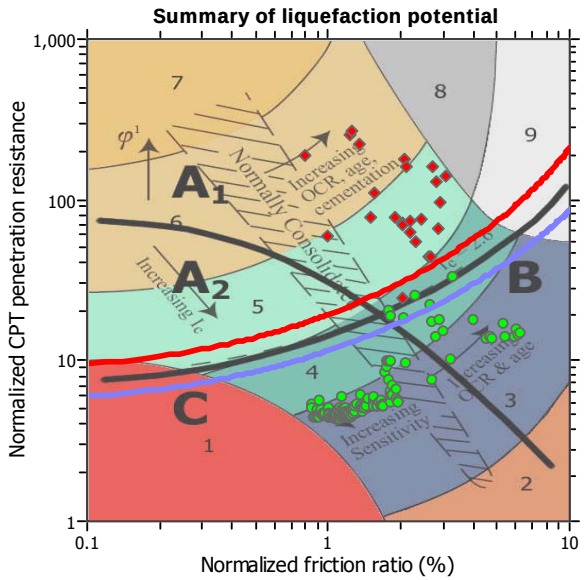
CPT file : CPT-12

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

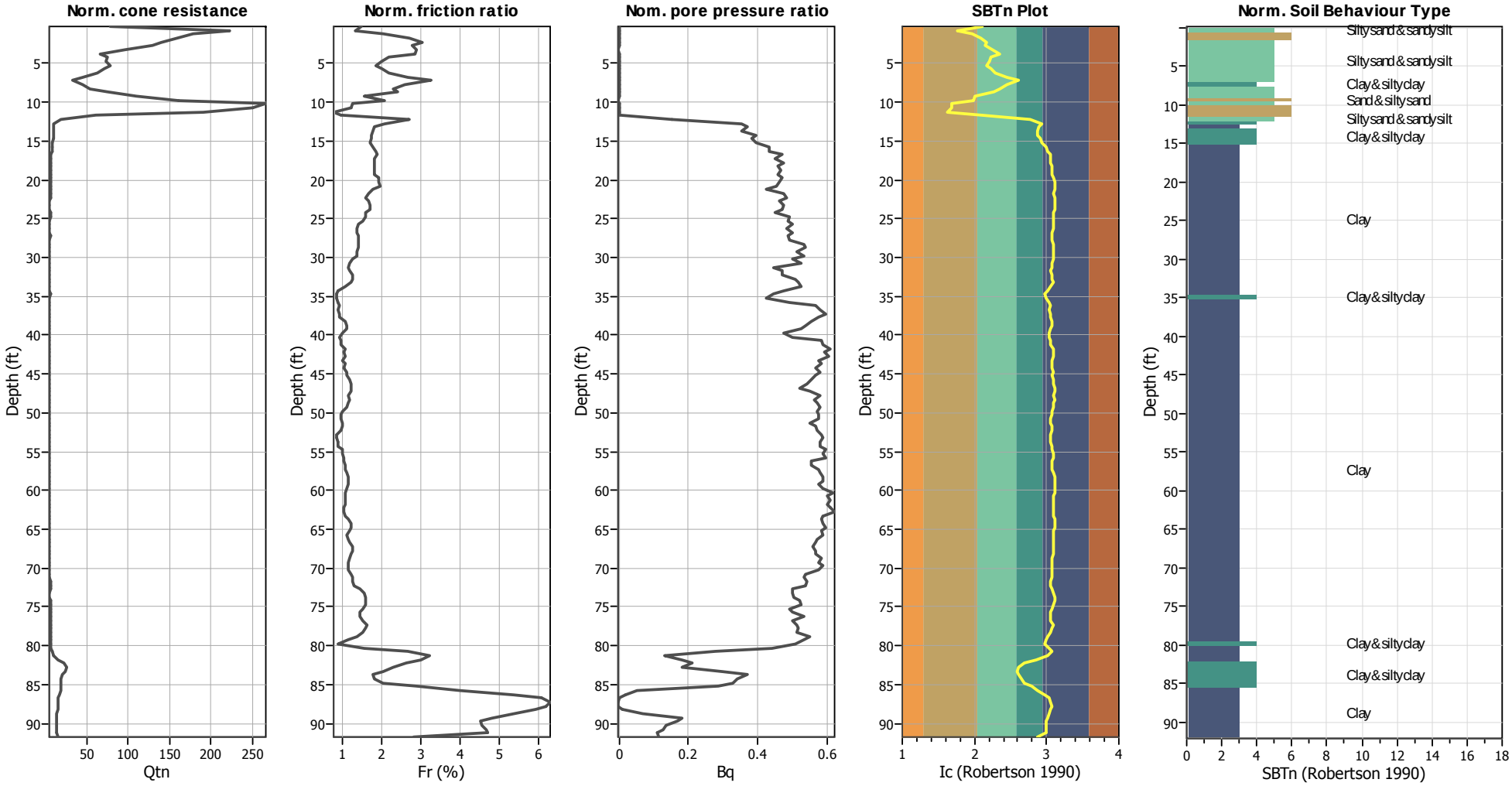






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



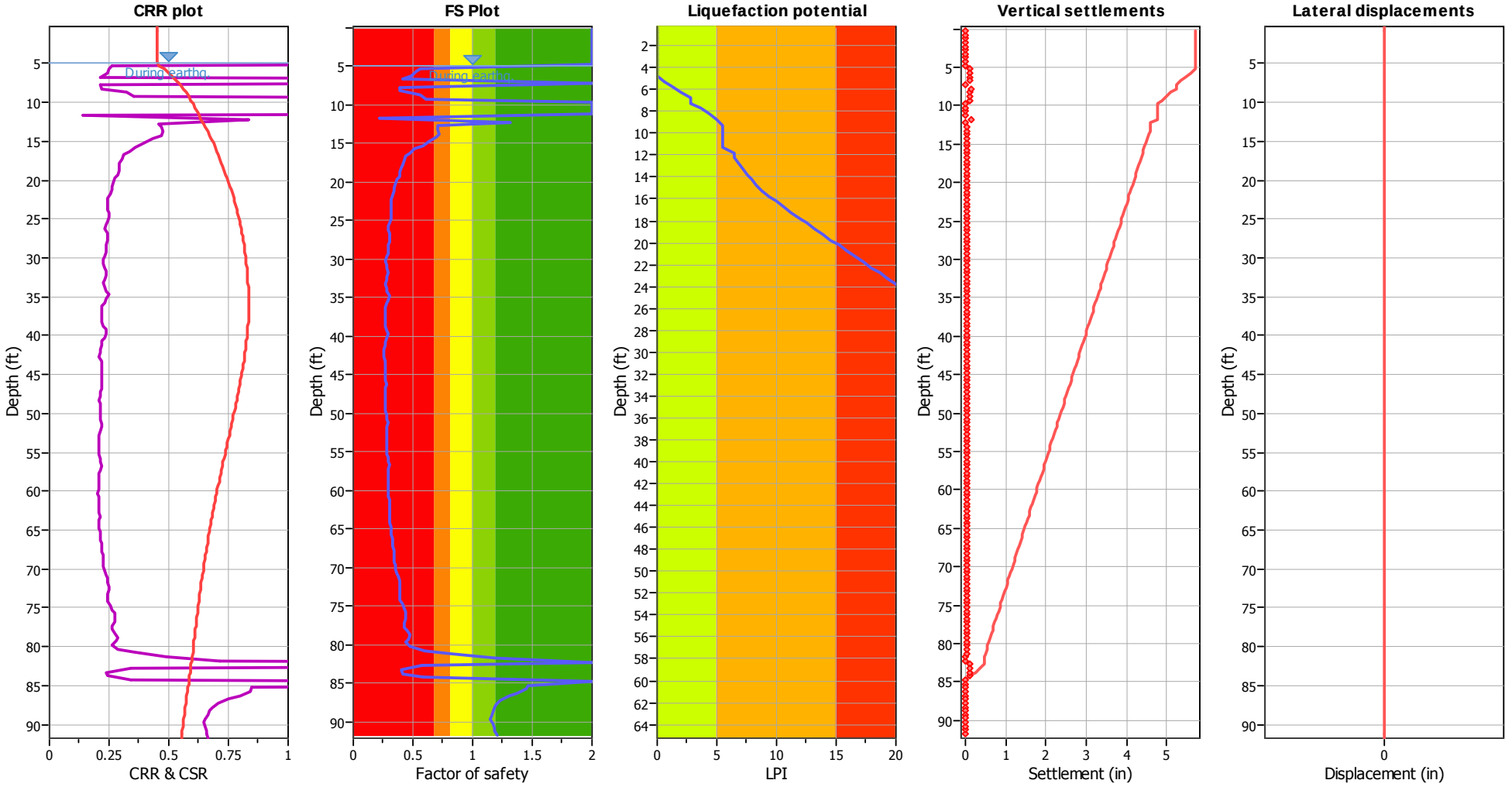
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

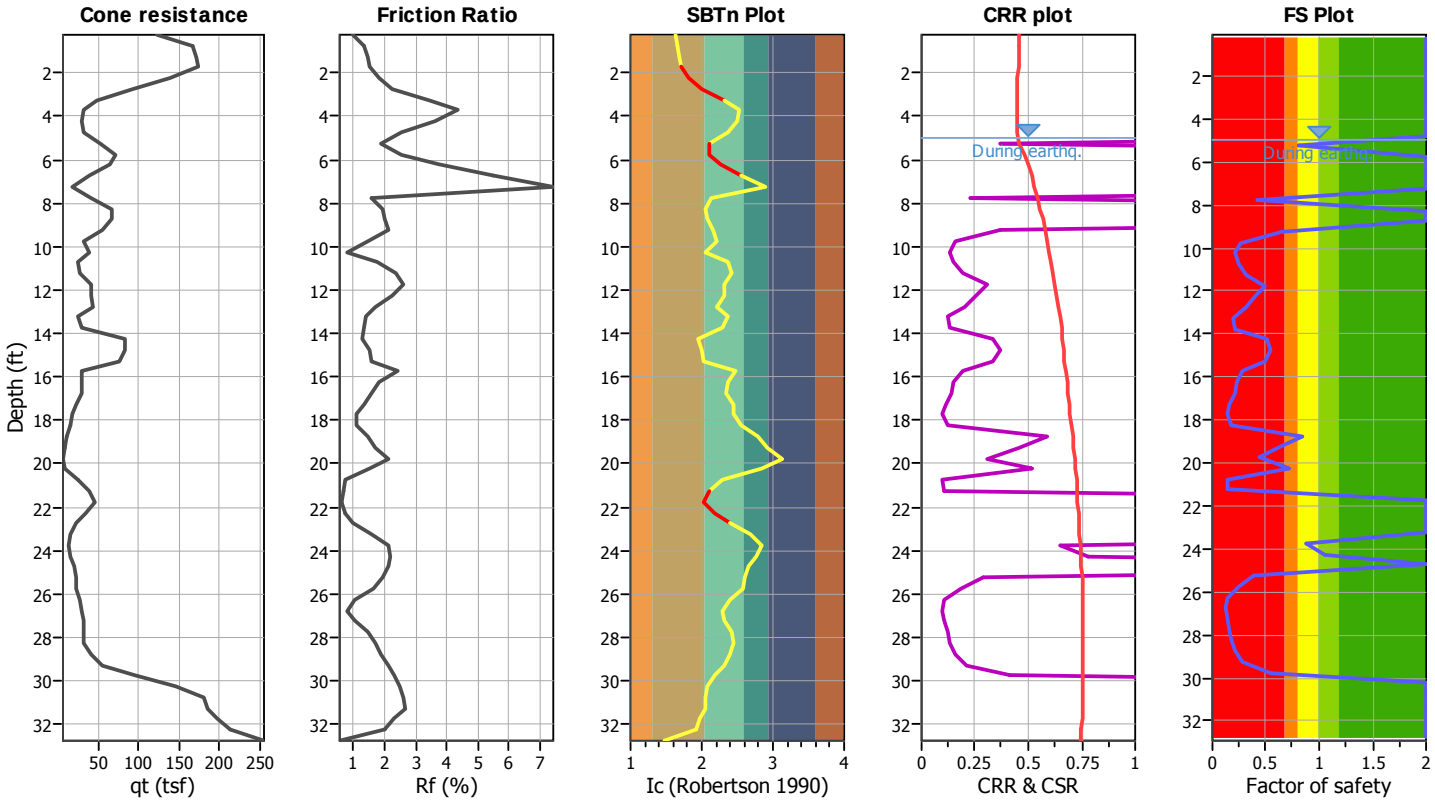
LIQUEFACTION ANALYSIS REPORT

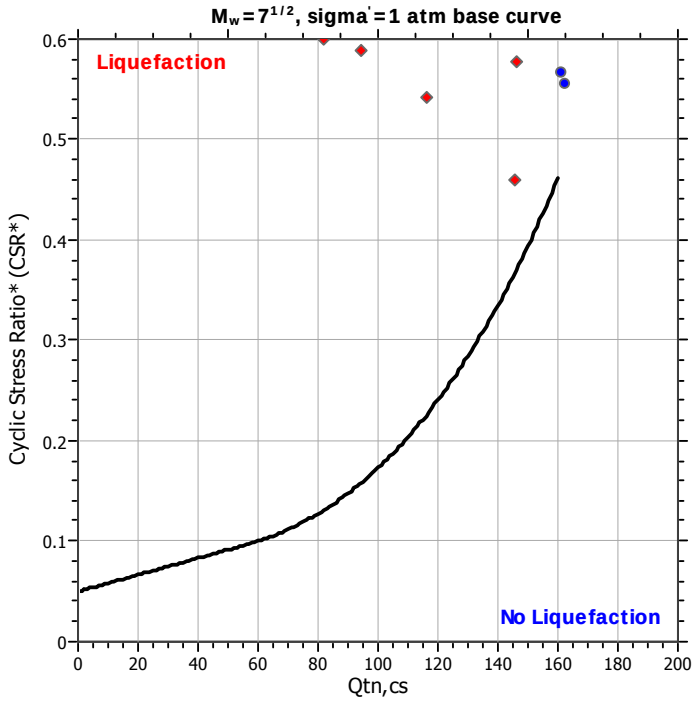
Project title : Candlestick Point **Location : San Francisco, CA**

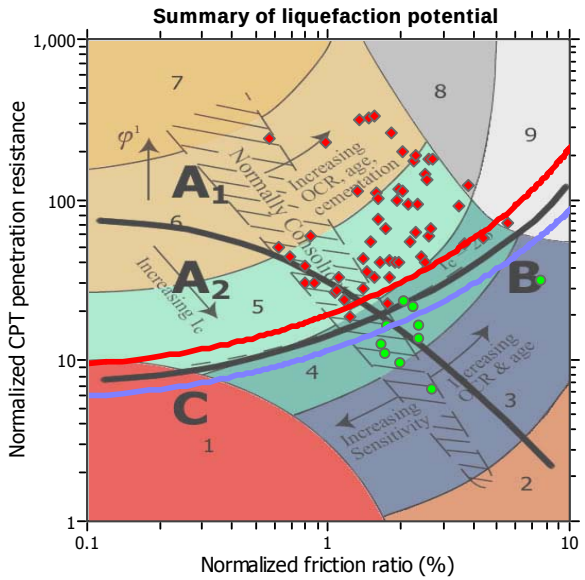
CPT file : CPT-13

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

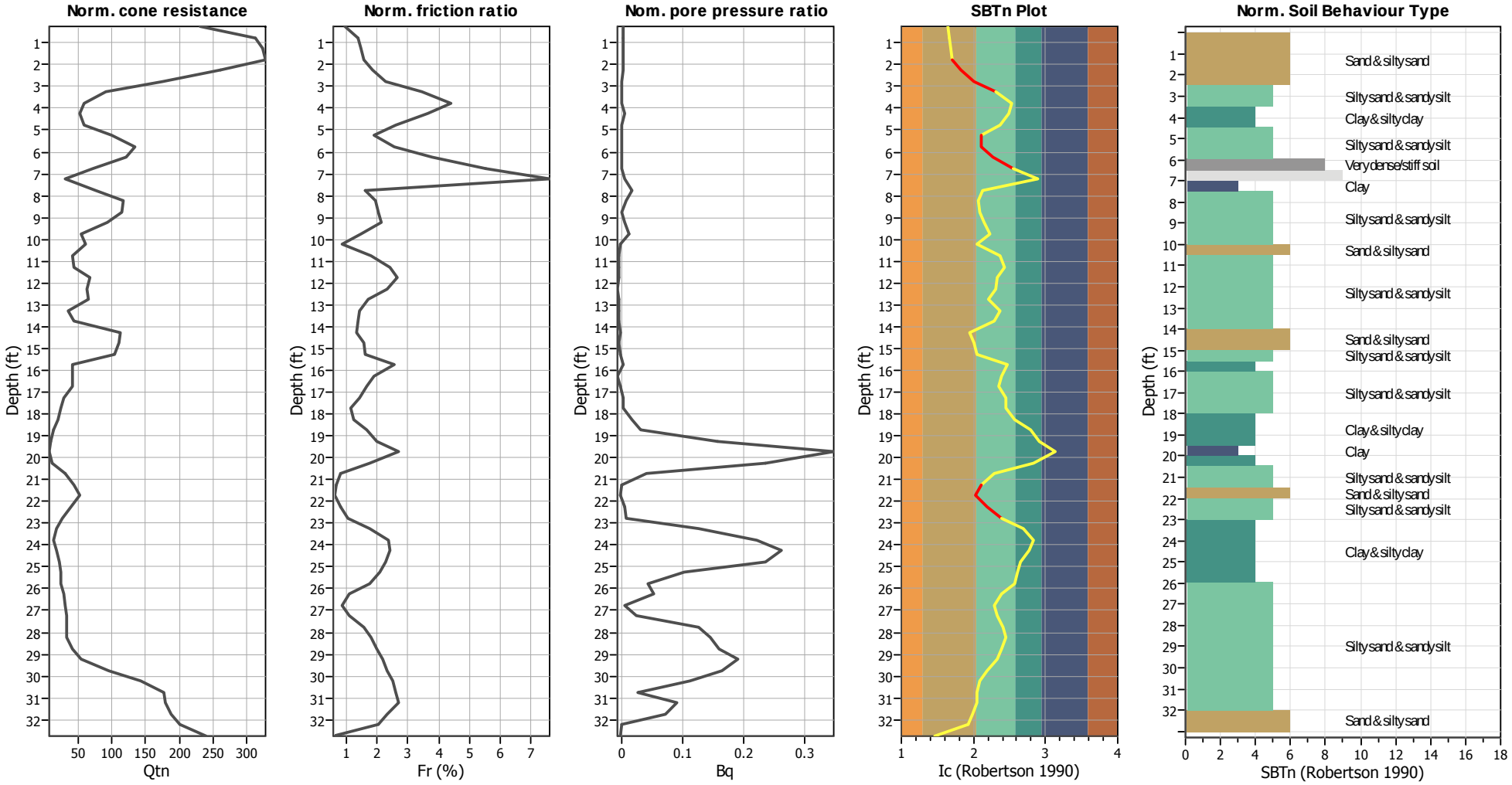






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



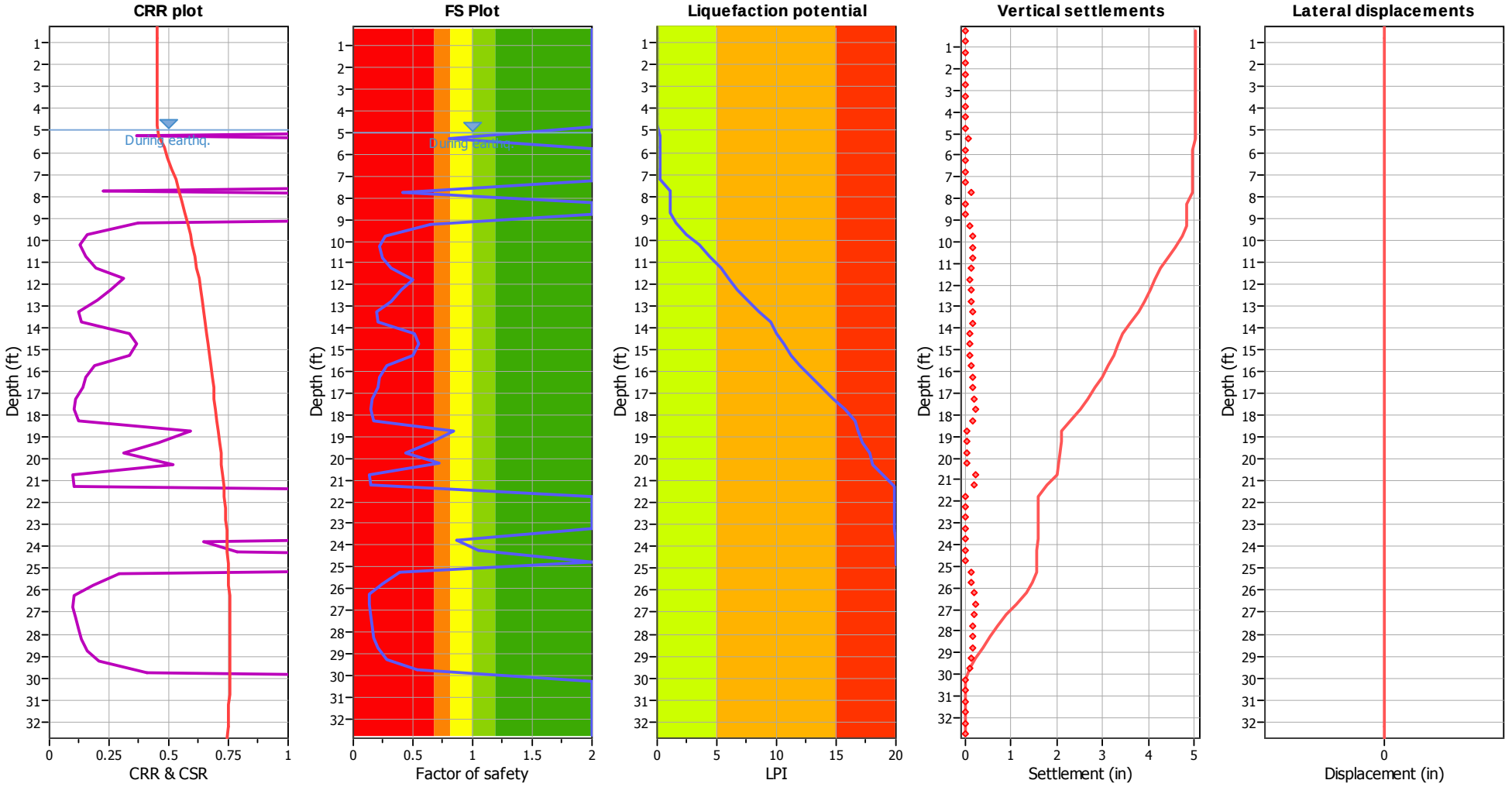
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
332 Pine St #300 San Francisco, CA 94104

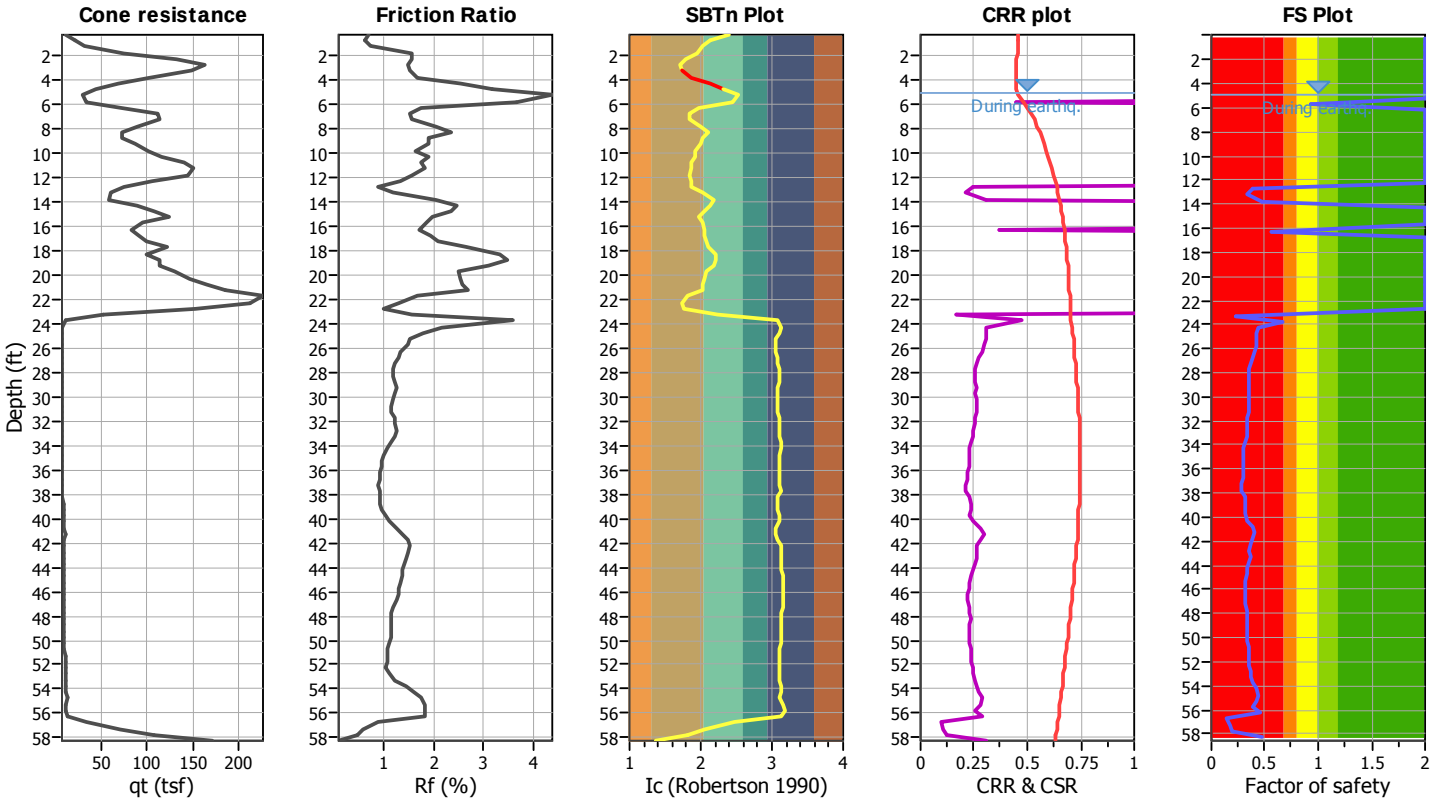
LIQUEFACTION ANALYSIS REPORT

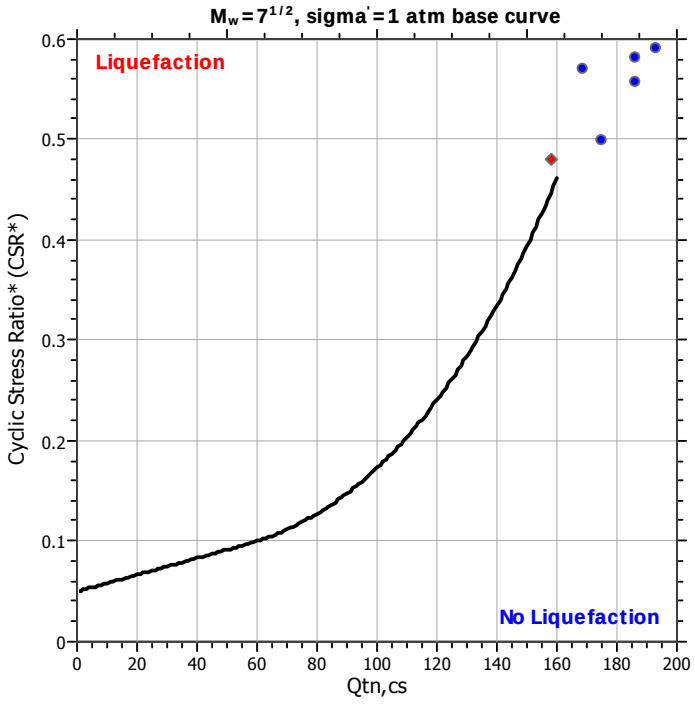
Project title : Candlestick Point **Location : San Francisco, CA**

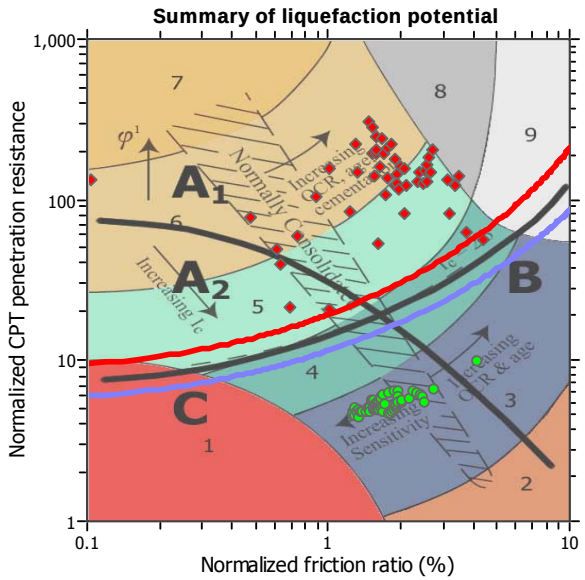
CPT file : Y-4

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes		
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	No		

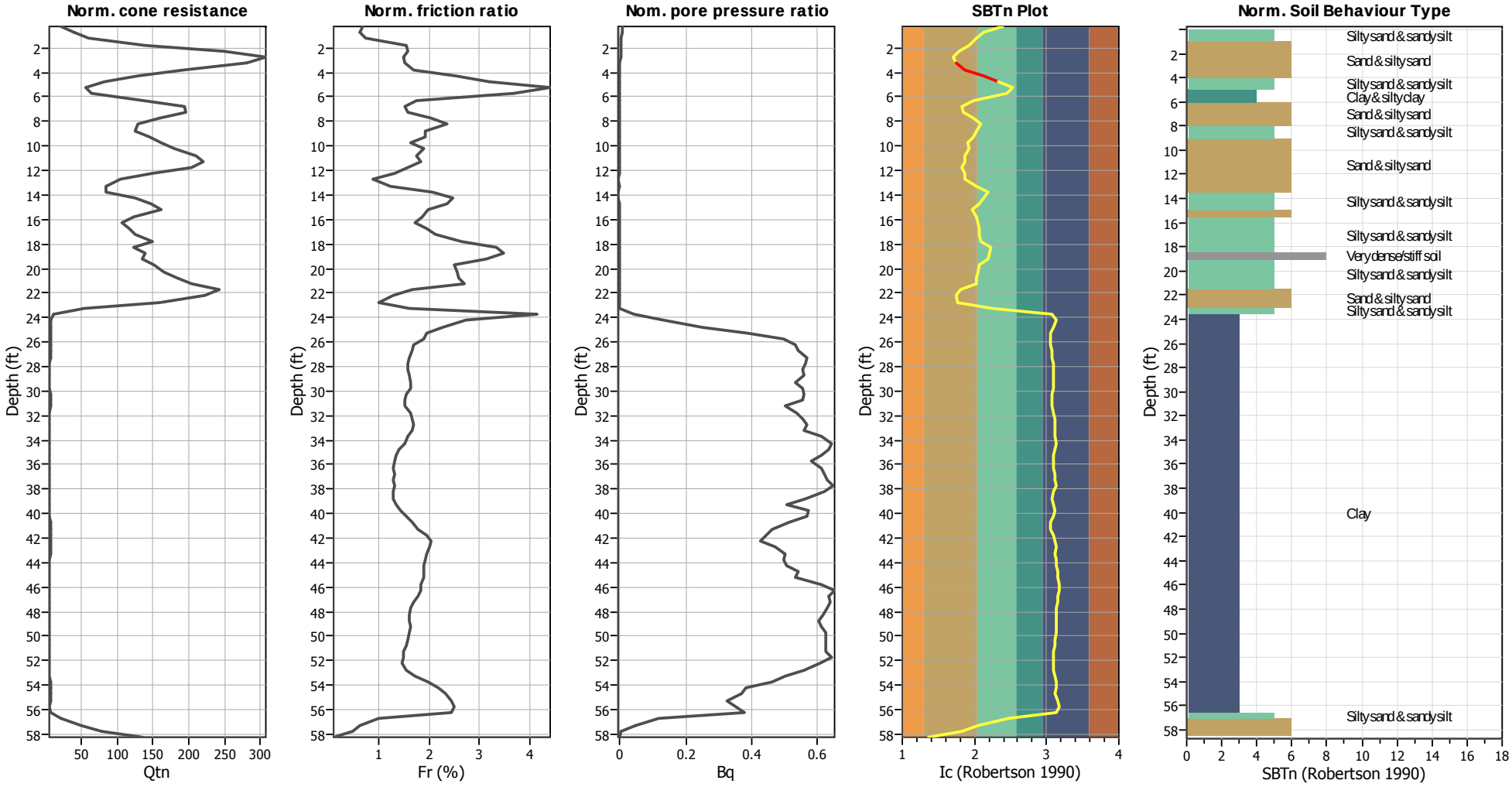






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots (normalized)



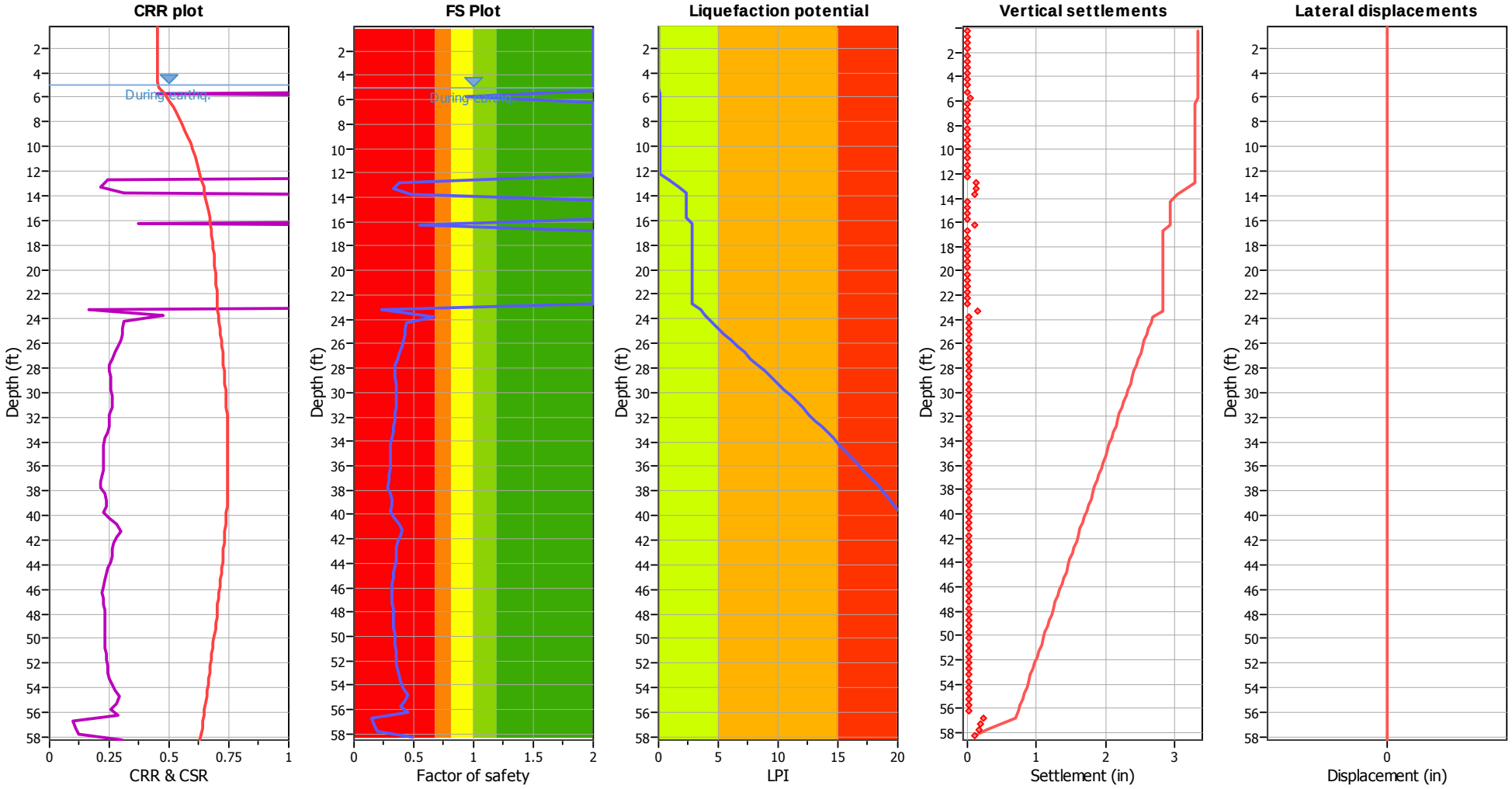
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liquefaction are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Candlestick Point Borings

Liquefaction Evaluation - Youd 2001, Seed 2003, I&B 2008 Methods -

Note, if sloping ground and non-zero statis shear stress exist, user may chose to change value of kalpha

Input

Yellow cells are calculated

Green cells require user input - reference respective papers for details
Corrdction factors on "Driving Force" and "Resisting Force" sheets require user input

Water Table depth at time of Exploration	Water Table depth at time of Liquefaction	amax/g	Mw	$V_{s*40'}$
5	5	0.61	7.9	400

* V_{S40} = Avg shear wave velocity in upper 40 feet expressed in ft/s

					At time of Exploration		At time of Liquefaction	
Boring Designation	Depth [ft]	Soil Type	N_m [Blows/ft]	FC	Total Stress [psf]	Effective Stress [psf]	Total Stress [psf]	Effective Stress [psf]
CP-B2	15	GC	3	20	1875	1251	1875	1251
CP-B2	35	GC	20	17	4200	2328	4200	2328
CP-B3	111	SM	18	20	12210	5595.6	12210	5595.6
CP-B4	123	SW	18	10	14760	7396.8	14760	7396.8
CP-B5	11	SM	7	19	1210	835.6	1210	835.6
CP-B5	18	SM	9	8	1980	1168.8	1980	1168.8
CP-B7	9	GM	20	23	1080	830.4	1080	830.4
CP-B7	38	SM	8	19	4560	2500.8	4560	2500.8
CP-Y1	11	GM	7	12	1320	945.6	1320	945.6
CP-Y1	20	SW	5	8	2600	1664	2600	1664
						0		0
						0		0
						0		0
						0		0

N_m = Measured SPT Blow Count

YOUD 2001 Methodology Results

Boring Designation	Depth	CRR	CSR	FS
CP-B2	15	0.08	0.58	0.14
CP-B2	35	0.26	0.63	0.41
CP-B3	111	0.16	0.41	0.38
CP-B4	123	0.11	0.37	0.31
CP-B5	11	0.13	0.56	0.24
CP-B5	18	0.12	0.65	0.19
CP-B7	9	TDL	0.51	TDL
CP-B7	38	0.12	0.62	0.19
CP-Y1	11	0.11	0.54	0.20
CP-Y1	20	0.07	0.59	0.12
0	0	#DIV/0!	#DIV/0!	#DIV/0!
0	0	#DIV/0!	#DIV/0!	#DIV/0!
0	0	#DIV/0!	#DIV/0!	#DIV/0!

TDL = Too Dense to Liquefy based on blowcount criteria

Candlestick Point Borings

SEED 2003 Methodology Results

			CSR			Calculated FS		
Boring Designation	Depth	CRR	mean rd	rd + sigma	rd - sigma	mean rd	rd + sigma	rd - sigma
CP-B2	15	0.05	0.40	0.43	0.36	0.12	0.11	0.14
CP-B2	35	0.16	0.38	0.49	0.26	0.43	0.33	0.62
CP-B3	111	0.07	0.43	0.64	0.22	0.15	0.10	0.30
CP-B4	123	0.05	0.42	0.64	0.20	0.12	0.08	0.24
CP-B5	11	0.09	0.37	0.40	0.35	0.24	0.23	0.26
CP-B5	18	0.09	0.41	0.46	0.36	0.22	0.20	0.25
CP-B7	9	0.43	0.38	0.41	0.36	1.13	1.07	1.19
CP-B7	38	0.06	0.38	0.51	0.25	0.15	0.11	0.23
CP-Y1	11	0.08	0.37	0.40	0.35	0.21	0.20	0.23
CP-Y1	20	0.05	0.40	0.46	0.35	0.12	0.11	0.14
0	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

THC = CRR capped at 4, in high seismicity cases, verify

Idriss & Boulanger 2008 Methodology Results

Boring Designation	Depth	CRR	CSR	FS
CP-B2	15	0.11	0.62	0.17
CP-B2	35	0.29	0.74	0.39
CP-B3	111	0.17	0.72	0.24
CP-B4	123	0.13	0.66	0.20
CP-B5	11	0.15	0.58	0.27
CP-B5	18	0.14	0.68	0.20
CP-B7	9	0.56	0.52	1.09
CP-B7	38	0.13	0.74	0.18
CP-Y1	11	0.13	0.56	0.23
CP-Y1	20	0.09	0.65	0.14
0	0	#DIV/0!	#DIV/0!	#DIV/0!
0	0	#DIV/0!	#DIV/0!	#DIV/0!
0	0	#DIV/0!	#DIV/0!	#DIV/0!

THC = CRR capped at 4, in high seismicity cases, verify

APPENDIX F

Bulk Asbestos Material Analysis (Forensic Analytical Laboratories)

APPENDIX F

Bulk Asbestos Material Analysis

(Air Resources Board Method 435, June 6, 1991)

McCampbell Analytical, Inc.
Account Payable
1534 Wilow Pass Rd

Pittsburg, CA 94565

Client ID: A31409
Report Number: N005596
Date Received: 08/20/13
Date Analyzed: 08/27/13
Date Printed: 08/27/13

Job ID/Site: 2012-017 - Hunters Point Shipyard/Candlest

FALI Job ID: A31409
Total Samples Submitted: 13
Total Samples Analyzed: 13

PLM Report Number: N/A

Sample Preparation and Analysis:

Samples were analyzed by the Air Resources Board's Method 435, Determination of Asbestos Content of Serpentine Aggregate. Samples were ground to 200 particle size in the laboratory. Approximately 1 pint was retained for analysis. Samples were prepared for observation according to the guidelines of Exception I and Exception II as defined by the 435 Method. Samples which contained less than 10% asbestos were prepared for observation according to the point count technique as defined by the 435 Method. This analysis was performed with a standard cross-hair reticle.

Sample ID	Lab Number	Layer Description
2-HP-B35-COMP.3.5-7.5	11416232	**Grey Soil**

Point Count Results:

Number of asbestos points counted:	37
Number of non-empty points:	400
Matrix percentage of entire	100
Percent asbestos in matrix:	9.3
Visual estimation percentage:	5.0
Asbestos type(s) detected:	Chrysotile

Comment:

2-CP-B4-COMP.5-15 11416233 **Dark Grey Soil**

Visual Estimation Results:

Matrix percentage of entire	100
Visual estimation percentage:	None Detected
Asbestos type(s) detected:	None Detected

Comment: This result meets the requirements of Exception I as defined by the 435 Method.

2-CP-B5-COMP.5-10 11416234 **Dark Grey Soil**

Visual Estimation Results:

Matrix percentage of entire	100
Visual estimation percentage:	None Detected
Asbestos type(s) detected:	None Detected

Comment: This result meets the requirements of Exception I as defined by the 435 Method.

3777 Depot Road, Suite 409, Hayward, CA 94545 / Telephone: (510) 887-8828 (800) 827-FASI / Fax: (510) 887-421

Bulk Asbestos Material Analysis

(Air Resources Board Method 435, June 6, 1991)

McCampbell Analytical, Inc.
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1534 Wilow Pass Rd

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PLM Report Number: N/A

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Total Samples Analyzed:	13

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Sample ID	Lab Number	Layer Description
2-CP-B8-COMP.2.5-5.5	11416235	**Brown Soil**

Visual Estimation Results:

Matrix percentage of entire	100
Visual estimation percentage:	None Detected
Asbestos type(s) detected:	None Detected

Comment: This result meets the requirements of Exception I as defined by the 435 Method.

Sample ID	Lab Number	Layer Description
2-CP-B8-COMP.7.5-10	11416236	**Brown Soil**

Visual Estimation Results:

Matrix percentage of entire	100
Visual estimation percentage:	None Detected
Asbestos type(s) detected:	None Detected

Comment: This result meets the requirements of Exception I as defined by the 435 Method.

Tad Thrower, Laboratory Supervisor, Hayward Laboratory

Note: Limit of Quantification (LOQ) = 0.25%. Trace denotes the presence of asbestos below the LOQ. ND = None Detected.

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