GEOTECHNICAL REPORT

Taylor Way and Lincoln Avenue Industrial Sites
Taylor Way and Lincoln Avenue
Tacoma, Washington

Project No. T-7543

Terra Associates, Inc.

Prepared for:

Avenue 55, LLC
Seattle, Washington

April 10, 2017

TERRA ASSOCIATES, Inc.
Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

April 10, 2017
Project No. T-7543

Mr. Drew Zaborowski
Avenue 55, LLC
600 University Street, Suite 2305
Seattle, Washington 98101

Subject: Geotechnical Report
Taylor Way and Lincoln Avenue Industrial Sites
Taylor Way and Lincoln Avenue
Tacoma, Washington

Dear Mr. Zaborowski:

As requested, we have conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Our field exploration indicates the soil conditions at the Taylor Way site consisted of five to ten feet of loose to medium dense, fill material overlying alluvial silts and sands. The fill material consists of silty sand with gravel, sand, and silt mixed with organics and construction rubble. The upper alluvium is composed predominantly of loose to medium dense silt, sandy silt, and silty sand. CPT data indicates highly variable interbedded alluvial soils composed of silts, clays, and silty sand layers are present to a depth of 35 to 42 feet followed by medium dense to dense silty sand and sand to the termination depths of the CPTs, 60 feet. In general, where fine grained sediments (silt and clay soils) are indicated, correlated N_{60} values, indicate consistencies in the soft to stiff range. Where cohesionless (sand) sediments are indicated, correlated N_{60} values indicate relative densities in the medium dense to dense range.

In general, the soil conditions observed in the test borings at the Lincoln Avenue site consisted of four and one-half to seven feet of medium dense to dense, inorganic fill material overlying alluvial silts and sands with some organic fragments. The upper alluvium is composed predominantly of loose to medium dense silt, sandy silt, and silty sand. CPT data again indicates highly variable interbedded alluvial soils composed of silts, clays, and silty sand layers are present to a depth of 18 to 40 feet followed by medium dense to dense silty sand and sand to the termination depths of the CPTs, 60 feet.

Soil conditions would not be suitable for support of the proposed buildings and infrastructure in their current condition. In order to gain suitable support, ground conditions will need to be improved by implementing a surcharge program and excavating and replacing soils immediately below footings with granular structural fill. In addition, the existing fill material on the Taylor Way site will need to be overexcavated and replaced or compacted in place. Also, if the owner is not willing to accept the risk for building damage due to the potential for liquefaction induced settlements during an earthquake or it is determined that the estimated liquefaction settlements would preclude design of the structure of the building shells on the project to meet all governing life safety codes, including the life safety provisions of the 2015 International Building Code, the building foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements or the building site grades should be raised.

Detailed geotechnical engineering recommendations regarding these issues along with other geotechnical design and construction considerations are summarized in the attached report.

We trust this information is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

Carolyn S. Decker, P.E.
Project Engineer

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4-9-17

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President

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1.0 PROJECT DESCRIPTION

The project will consist of redeveloping the approximately 19.6-acre site with three industrial buildings with associated access, parking, and utility improvements. Based on the conceptual site plans prepared by Craft Architects dated September 9, 2016 and October 13, 2016, the project will be completed in two phases. Phase I will consist of two buildings on the Taylor Way site and Phase II will consist of one building on the Lincoln Avenue Site. The buildings range in size from 51,800 square feet to 214,800 square feet. The buildings will have dock high loading on one side with paved parking and access around the remainder of the building. Grading plans were not available at the time of this report. Based on the existing topography, we expect grading will be minimal with cuts and fills from one to three feet.

We expect the buildings will be constructed using precast concrete wall panels with interior columns supporting the roof structure and possible mezzanine level. Structural loading is expected to consist of perimeter wall loads ranging from 4 to 6 kips per foot with interior columns carrying 100 to 150 kips. Uniform distribution of product loading on the slab-on-grade floors is not expected to exceed 350 pounds per square foot (psf).

The recommendations in the following sections of this report are based on our understanding of the design features outlined above. We should review design drawings as they become available to verify that our recommendations have been properly interpreted and to supplement them, if required.

2.0 SCOPE OF WORK

Our work was completed in accordance with our proposal dated October 26, 2016. On November 28, 2016, we observed the soil and groundwater conditions at 10 test pits excavated on the Taylor Way site to depths of 5 to 10 feet below current site grades. On December 7 and December 8, 2016, we observed the soil and groundwater conditions in 6 soil test borings drilled on the Lincoln Avenue site to a depth of approximately 26 feet below current site grades. On November 10 and November 11, 2016, In-Situ Engineering, under subcontract with Terra Associates, Inc., performed 9 cone penetration tests (CPTs) to depths of 60 feet below existing surface grades. Five were completed on the Taylor Way site and four were completed on the Lincoln Avenue site. Using this data and laboratory test data, we preformed analyses to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions
- Seismic Site Class per the current International Building Code (IBC)
- Geologic Hazards per City of Tacoma Municipal Code
- Site preparation and grading
- Surcharge/preload
- Excavation
- Foundations

- Slab-on-grade floors
- Lateral earth pressure on below-grade walls
- Stormwater facilities
- Drainage
- Utilities
- Pavement

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment are beyond Terra Associates' purview. A building envelope specialist or contractor should be consulted to address these issues, as needed.

3.0 SITE CONDITIONS

3.1 Surface

The project site consists of two tax parcels located south and west of the intersection of Taylor Way and Lincoln Avenue in Tacoma, Washington. Phase I is located off Taylor Way and consists of an approximately 10.5-acre irregular shaped parcel. Phase II is located at 3401 Lincoln Avenue and consists of an approximately 9.1-acre irregular shaped parcel. The approximate location of the sites are shown on Figure 1.

The Taylor Way site is currently developed with a stormwater pond in the southern portion of the site. The remainder of the site is undeveloped and covered with grass and brush. Site topography is generally flat with no obvious sloping.

The Lincoln Avenue site is currently developed with a Quonset style warehouse and associated access and parking. The access and parking areas are gravel surfaced. Site topography is generally flat with no obvious sloping.

3.2 Soils

In general, the soil conditions observed in the test pits at the Taylor Way site consisted of five to ten feet of loose to medium dense, fill material overlying alluvial silts and sands. The fill material consists of silty sand with gravel, sand, and silt mixed with large amounts of organics and construction rubble. The upper alluvium is composed predominantly of loose to medium dense silt, sandy silt, and silty sand. CPT data indicates highly variable interbedded alluvial soils composed of silts, clays, and silty sand layers are present to a depth of 35 to 42 feet followed by medium dense to dense silty sand and sand to the termination depths of the CPTs, 60 feet. In general, where fine grained sediments (silt and clay soils) are indicated, correlated N_{60} values, indicate consistencies in the soft to stiff range. Where cohesionless (sand) sediments are indicated, correlated N_{60} values indicate relative densities in the medium dense to dense range.

In general, the soil conditions observed in the test borings at the Lincoln Avenue site consisted of four and one-half to seven feet of medium dense to dense, inorganic fill material overlying alluvial silts and sands with some organic fragments. The upper alluvium is composed predominantly of loose to medium dense silt, sandy silt, and silty sand. CPT data again indicates highly variable interbedded alluvial soils composed of silts, clays, and silty sand layers are present to a depth of 18 to 40 feet followed by medium dense to dense silty sand and sand to the termination depths of the CPTs, 60 feet.

The *Geological Map of Washington – Northwest Quadrant,* by J.D. Dragovich, et al. (2002) maps the site as Modified Land (Qml). This mapped description is consistent with the soils observed in the upper portions of the test pits, test borings, and CPTs.

The preceding discussion is intended to be a brief review of the soil conditions observed at the site. More detailed descriptions are presented on the Test Pit Logs, Test Boring Logs, and CPT Logs attached in Appendix A.

3.3 Groundwater

We observed minor to moderate groundwater seepage in all ten of the test pits excavated on the Taylor Way site between two and four feet below current site grades. We observed groundwater in all six of the test borings completed on the Lincoln Avenue site at approximately seven feet below current site grades.

We also performed pore water dissipation testing at CPT-1, CPT-4, and CPT-9 at 24, 30, and 42 feet below current site grades, respectively. A pressure transducer mounted behind the tip of the cone measures the pore water pressure as the cone is advanced. Dissipation testing consists of terminating cone advancement and allowing the pore water pressure to stabilize. Once stabilized, the pressure reading represents the head of water above the cone tip. The results of the dissipation testing are included with the CPT Log attached in Appendix A. Dissipation testing indicated the static groundwater table was at the ground surface.

Fluctuations in the static groundwater level will occur seasonally. Typically, groundwater will reach maximum levels during the wet winter months. Based on the time of year of our site exploration, the groundwater levels observed at the site likely represent the seasonal high groundwater levels.

4.0 GEOLOGIC HAZARDS

4.1 Seismic Considerations

Section 6.4.7.B.3 of the City of Tacoma Municipal Code (TMC) defines a seismic hazard as "areas subject to severe risk of damage as a result of seismic-induced settlement, shaking, lateral spreading, surface faulting, slope failure, or soil liquefaction. These conditions occur in areas underlain by soils of low cohesion or density usually in association with a shallow groundwater table. Seismic hazard areas shall be as defined by the Washington Department of Ecology Coastal Zone Atlas (Seismic Hazard Map prepared Tacoma Municipal Code City Clerk's Office 13-409 (Revised 9/2016) by GeoEngineers) as: Class U (Unstable), Class Uos (Unstable old slides), Class Urs (Unstable recent slides), Class I (Intermediate), and Class M (Modified) as shown in the Seismic Hazard Map."

The northwest corner of the Taylor Way site is mapped as a Category M (Modified) on the Washington Department of Ecology Coastal Zone Atlas. Therefore, the northwest corner of the Taylor Way site would be classified as a seismic hazard area.

Based on the soil conditions encountered and the local geology, per Section 16 of the 2015 International Building Code (IBC) for seismic conditions, site class "E" should be used in design of the structure. Based on this site class, in accordance with the 2015 IBC, the following parameters should be used in computing seismic forces:

Seismic Design Parameters (IBC 2015)

Spectral response acceleration (Short Period), S_{MS}	1.163
Spectral response acceleration (1 – Second Period), S_{M1}	1.201
Five percent damped .2 second period, S_{DS}	0.775
Five percent damped 1.0 second period, S_{D1}	0.801

These values were determined using the latitude/longitude coordinates 47.270978/-122.388479 and the United States Geological Survey (USGS) Ground Motion Parameter Calculator accessed on December 22, 2016 at the web site http://earthquake.usgs.gov/designmaps/us/application.php.

Soil Liquefaction

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in pore water pressure induced by vibrations from a seismic event. Liquefaction mainly affects geologically recent deposits of fine-grained sands that are below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil's strength.

As described earlier, the soils indicated at the site by the CPT data consist of highly variable interbedded layers of fine grained sediments (silts and clays) and cohesionless layers composed of silty sand, sandy silt, and relatively clean sand. The consistency of the fine grained sediments indicate that they would exhibit sufficient undrained strength to offset shear stresses imposed during an earthquake and would resist the liquefaction phenomenon. The indicated relative density of the coarser alluvial sediments also indicates that these layers have likely liquefied during past seismic events, thus increasing their relative density and making them more resistant to liquefaction during future events.

We completed a liquefaction analysis using the computer program LiquifyPro following procedures outlined by Seed and Idriss. The analysis was completed using a ground acceleration of .31g, which was determined in accordance with the National Earthquake Hazards Reduction Program (NEHRP) recommendations outlined in Federal Emergency Management Agency (FEMA) Publication P-750. This value is equivalent to $S_{DS}/2.5$.

The impact to the site should liquefaction occur will be in the form of surface subsidence or settlement. Estimated total potential settlement from our analysis of the CPT data for the Taylor Way site is in the range of one and one-half to four inches. Estimated total potential settlement from our analysis of the CPT data for the Lincoln Avenue site is in the range of four and one-half to six inches. Approximately one-half of these total settlements would likely be differential in nature. The settlements are border line regarding structural impairment and should be reviewed by the project structural engineer. If the structural engineer indicates the settlement could structurally impair the buildings, foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements. Alternatively, the building site grades could be raised by a minimum of four feet, which would reduce the total potential settlement from four and one-half to six inches to three to four inches and differential settlement to about two inches. In our opinion, this amount of settlement would not structurally impair the building but would result in damage of a cosmetic nature.

If the owner is not willing to accept the risk of building damage requiring repair should liquefaction induced settlements occur, or if the structural engineer cannot design the structure of the building shells on the project to meet all governing life safety codes, including the life safety provisions of the 2015 International Building Code, foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements. Results of the liquefaction analysis are attached in Appendix B.

4.2 Erosion Hazard Areas

Section 6.4.7.B.1 of the TMC defines an erosion hazard area as "areas where the combination of slope and soil type makes the area susceptible to erosion by water flow, either by precipitation or by water runoff. Concentrated stormwater runoff is a major cause of erosion and soil loss. Erosion hazard critical areas include the following:

> a. Areas with high probability of rapid stream incision, stream bank erosion or coastal erosion, or channel migration.
>
> b. Areas defined by the Washington Department of Ecology Coastal Zone Atlas as one of the following soil areas: Class U (Unstable) includes severe erosion hazards and rapid surface runoff areas, Class Uos (Unstable old slides) includes areas having severe limitations due to slope, Class Urs (Unstable recent slides), and Class I (Intermediate).
>
> c. Any area characterized by slopes greater than 15 percent; and the following types of geologic units as defined by draft geologic USGS maps: m (modified land), Af (artificial fill), Qal (alluvium), Qw (wetland deposits), Qb (beach deposits), Qtf (tide-flat deposits), Qls (landslide deposits), Qmw (mass-wastage deposits), Qf (fan deposits), Qvr and Qvs series of geologic material types (Vashon recessional outwash and Steilacoom Gravel), and Qvi (Ice-contact deposits).
>
> d. Slopes steeper than 25 percent and a vertical relief of 10 or more feet."

The site is relatively flat with no slopes greater than 15 percent and does not contain any of the above conditions. Therefore, the site is not considered an erosion hazard area by the City of Tacoma. Regardless, erosion protection measures as required by the City of Tacoma will need to be in place prior to starting grading activities on the site. This would include perimeter silt fencing to contain erosion on-site and cover measures to prevent or reduce soil erosion during and following construction.

4.3 Landslide Hazard Areas

Section 6.4.7.B.2 of the TMC defines an erosion hazard area as “areas potentially subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include areas susceptible because of any combination of bedrock, soil, slope, slope aspect, structure, hydrology, or other factors. Landslide hazard areas are identified as any area with all three of the following characteristics:

a. Slopes steeper than 25 percent and a vertical relief of 10 or more feet.

b. Hillsides intersecting geologic contacts that contain impermeable soils (typically silt and clay) frequently interbedded with permeable granular soils (predominantly sand and gravel), or impermeable soils overlain with permeable soils.

c. Springs or groundwater seepage.

d. Any area which has exhibited movement during the Holocene epoch (from 10,000 years ago to present) or that are underlain or covered by mass wastage debris of that epoch.

e. Any area potentially unstable due to rapid stream incision stream bank erosion or undercutting by wave action.

f. Any area located on an alluvial fan presently subject to, or potentially subject to, inundation by debris flows or deposition of stream-transported sediments.

g. Any area where the slope is greater than the angle of repose of the soil.

h. Any shoreline designated or mapped as Class U, Uos, Urs, or I by the Washington Department of Ecology Coastal Zone Atlas.”

None of the above conditions are present at the site. Therefore, the site is not a landslide hazard as defined by the TMC.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

In our opinion, there are no geotechnical considerations that would preclude development of the site, as planned. The primary geotechnical concern on both sites are the soft, fine grained native soil layers that will consolidate under static dead loads imposed by the structures and by product loading on structural floor slabs. Improving ground conditions by surcharging the building pads to pre-consolidate the compressible soils and overexcavating and replacing these soils with compacted structural fill below the building footings is recommended.

The second concern on the Taylor Way site is the presence of the rubble fill material in the upper five to ten feet of the soil profile. These existing fills will not be suitable for immediate support of buildings or infrastructure and will require improvement either by excavation and replacement with suitable structural fill or in-situ compaction.

If potential liquefaction related settlements are determined to structurally impair the building, in our opinion, mitigating potential settlement-related impacts would best be accomplished by supporting the structure on spread footings bearing on ground conditions improved by installation of stone columns. Alternatively, the building site grades could be raised by four feet and the potential liquefaction related settlement would be reduced.

The soils observed at the site contain a significant amount of fines and will be difficult to compact as structural fill when too wet. The ability to use native soil and existing fill soils from site excavations as structural fill will depend on its moisture content and the prevailing weather conditions at the time of construction. If grading activities will take place during winter, the owner should be prepared to import clean granular material for use as structural fill and backfill. Alternatively, stabilizing the moisture in the native and existing fill soils with cement or lime can be considered.

Detailed recommendations regarding these issues and other geotechnical design considerations are provided in the following sections. These recommendations should be incorporated into the final design drawings and construction specifications.

5.2 Site Preparation and Grading

To prepare the Taylor Way site for construction, existing surface vegetation and other deleterious materials should be stripped and removed. Based on conditions observed at the test pits, we would estimate that surface stripping will be minimal to remove site vegetation and associated near-surface organic debris. Organic topsoil will not be suitable for use as structural fill, but may be used for limited depths in nonstructural areas.

Based on the current site conditions, site preparation on the Lincoln Avenue site will mainly involve removal of the existing structures. Demolition of existing structures should include removal of existing foundations and abandonment of underground septic systems and other buried utilities.

As noted above, the existing fill material on the Taylor Way site would not be suitable for support of building elements in its current condition. In order to prepare the site for building support, we recommend removing the existing fill material and replacing it with new structural fill as outlined below. The actual depth and lateral extent of the excavation will need to be determined in the field at the time of grading. We can use the existing test pit information to prepare a conceptual excavation map, if requested. The maximum excavation depth is expected to be approximately ten feet. The excavated material will not be suitable for reuse as structural fill. We recommend importing a material that meets the requirements outlined below.

Once clearing and demolition operations are complete fill operations can be initiated to establish desired building grades. Prior to placing fill, all exposed bearing surfaces should be observed by a representative of Terra Associates to verify soil conditions are as expected and suitable for support of new fill or building elements. Our representative may request a proofroll using heavy rubber-tired equipment to determine if any isolated soft and yielding areas are present. If excessively yielding areas are observed, and they cannot be stabilized in place by compaction, the affected soils should be excavated and removed to firm bearing and grade restored with new structural fill. If the depth of excavation to remove unstable soils is excessive, the use of geotextile fabrics, such as Mirafi 500X, or an equivalent fabric, can be used in conjunction with clean granular structural fill. Our experience has shown that, in general, a minimum of 18 inches of a clean, granular structural fill placed and compacted over the geotextile fabric should establish a stable bearing surface.

We recommend supporting conventional spread footing foundations on a minimum of two feet of granular structural fill that replaces the native alluvial soils. The granular structural fill should meet requirements for wet weather structural fill as discussed in the following paragraphs. The structural fill should extend a minimum of one-foot laterally from the edges of the continuous wall or isolated column footing. Depending on final building elevations, structural fill placed to establish the design floor grade could meet this requirement for support of interior column footings. Overexcavation of loose and soft native alluvial soils and replacement with granular structural fill will likely be required below perimeter strip footings adjacent the loading dock areas.

A representative of Terra Associates should observe all bearing surfaces to verify that soil conditions are as expected and are suitable for support of building foundations, floor slabs, and site pavements.

Our study indicates that the native soils contain a sufficient percentage of fines (silt and clay size particles) that will make them difficult to compact as structural fill if they are too wet or too dry. Accordingly, the ability to use these native soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions when site grading activities take place. Native soils that are too wet to properly compact could be dried by aeration during dry weather conditions or mixed with an additive such as cement or lime to stabilize the soil and facilitate compaction. If an additive is used, additional Best Management Practices (BMPs) for its use will need to be incorporated into the Temporary Erosion and Sedimentation Control plan (TESC) for the project.

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

* Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc. should observe and test all materials imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-698 (Standard Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction can be reduced to 90 percent.

Deep Dynamic Compaction (DDC)

As an alternative to excavation and replacement of the existing fill soils, we recommend improving the fill condition using DDC. This process imparts significant energy into the ground that will densify the fill and establish suitable support for buildings and infrastructure. The process consists of repeatedly dropping a heavy weight onto the ground surface from a pre-determined height using a large crane. The impact or drop locations are set up in a grid pattern with center to center spacing of about ten feet. The weight is dropped on the same location several times before moving to the next impact site. The operation results in considerable surface disturbance with deep craters formed at the impact sites. Once the DDC is completed the upper disturbed surface is densified using conventional earth moving equipment.

The required weight and drop height is dependent on soil type and desired improvement depth. For the rubble fill depth of 10 feet, we estimate a 5 metric ton weight dropped from a height of 20 to 25 feet will be required. A specialty contractor will need to be retained to complete the DDC. Various combinations of weight and drop heights can be used and will be dependent on the contractor's equipment. We will work closely with the contractor to establish the requirements for completing the DDC and to establish a quality control program to verify results.

5.3 Surcharge

We recommend implementing a surcharge program to limit static building and floor slab settlements to tolerable levels. For this procedure, we recommend placing a minimum of four feet of surcharge fill above the finished floor grades in the building areas and delaying building construction until settlement under this fill load has occurred. The fill should extend a minimum of two feet beyond the outside edge of the perimeter building footing.

For the Taylor Way site the surcharge program should be implemented following the overexcavation or DDC.

We estimate that total settlement under the surcharge fill will be in the range of three to seven inches. It is estimated that 90 percent of the consolidation settlement will occur in about 4 to 6 weeks following full application of the surcharge.

To evaluate the amount of settlement and the time rate of movement, the preload/surcharge program should be monitored by installing settlement markers. The settlement markers should be installed on the existing grade prior to placing any surcharge fill. Once installed, elevations of both the fill height and marker should be taken daily until the full height of the surcharge is in place. Once fully surcharged, readings should continue weekly until the anticipated settlements have occurred. Monitoring data should be forwarded to us within two days after it is obtained for review and comment. A typical settlement marking detail is shown on Figure 3.

It is critical that the grading contractor recognize the importance of the settlement marker installations. All efforts must be made to protect the markers from damage during fill placement. It is difficult, if not impossible, to evaluate the progress of the preload/surcharge program if the markers are damaged or destroyed by construction equipment. If the markers are impacted, it may be necessary to install new markers and extend the surcharging time period in order to ensure that settlements have ceased and building construction can begin.

Following the successful completion of the preload/surcharge program, with foundations designed as recommended in Section 5.5 of this report, you should expect maximum total and differential post-construction settlements of one-inch for perimeter foundations and interior columns.

5.4 Excavation

All excavations at the site associated with confined spaces, such as utility trenches, must be completed in accordance with local, state, and federal requirements. Based on regulations outlined in the Washington Industrial Safety and Health Act (WISHA), the native soils would be classified as Type C soils. Temporary excavation side slopes in Type C soils can be laid back at a minimum slope inclination of 1.5:1 (Horizontal:Vertical). If there is insufficient room to complete the excavations in this manner, using temporary shoring to support the excavations may need to be considered. A properly designed and installed shoring trench box can be used to support utility trench excavation sidewalls.

Groundwater should be anticipated within excavations extending below depths of two to seven feet from current surface grades. Based on our study, the volume of water and rate of flow into the excavation will be moderate particularly where excavations extend greater than five to ten feet below current site grades. For shallower excavations conventional sump pumping procedures and a system of collection trenches, if necessary, should be capable of maintaining a relatively dry excavation for construction purposes. If the excavations extend deeper than ten feet, particularly during the winter months, it is likely that the excavation will require dewatering by well points or isolated deep-pump wells. The utility subcontractor should be prepared to implement excavation dewatering by well point or deep-pump wells, as needed.

This information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

5.5 Foundations

In our opinion, following the successful implementation of the surcharge program as outlined in Section 5.3 of this report the buildings can be supported on conventional spread footing foundations. However, if the owner is not willing to accept the risk for building damage due to the potential for liquefaction induced settlements during an earthquake or it is determined that the estimated liquefaction settlements would preclude design of the structure of the building shells on the project to meet all governing life safety codes, including the life safety provisions of the 2015 International Building Code, the building foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements.

In addition, the existing fill soils on the Taylor Way site must be either overexcavated and replaced or compacted in place using DDC.

Spread Footings

In our opinion, following successful completion of a surcharge program and overexcavation or DDC on the existing fill soils on the Taylor Way site, the buildings may be supported on conventional spread footing foundations bearing on a minimum of two feet of structural fill placed and compacted as recommended in Section 5.2 of this report. Foundations exposed to the weather should bear at a minimum depth of 1.5 feet below adjacent grades for frost protection. Interior foundations can be supported at any convenient depth below the floor slab, provided immediate support is obtained on a minimum of two feet of structural fill.

We recommend designing foundations for a net allowable bearing capacity of 2,500 psf. For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. Following successful completion of the surcharge program with the expected building loads and this bearing stress applied, in general, total and differential settlements should not exceed one-inch.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the sides of the footings can also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pcf. We do not recommend including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundation will be backfilled with structural fill, as described in Section 5.2 of this report. The values recommended include a safety factor of 1.5.

Ground Improvement

One method to reduce the potential liquefaction settlements consists of improving ground conditions by installation of stone columns. Stone columns are highly densified columns of graded aggregate that would extend through the soft and loose alluvial sediments to a predetermined depth required to reduce liquefaction settlements to a tolerable amount. Because of the methods used to construct the columns some improvement of the adjacent soils is also realized. Conventional spread footing foundations can then be designed to bear immediately above the stone column locations. This ground improvement technique is typically completed on a design/build approach with both design and construction completed by a specialty geotechnical contractor. We can assist in contacting and selecting the specialty contractor, if desired.

As discussed earlier, another method of improving ground conditions and reducing potential liquefaction settlements would be to raise site grades. This method reduces the liquefaction potential and settlement in soft ground by increasing the overburden stress during an earthquake along with an increase in soil strength due to the increase in overburden stress. If site grades are raised four feet, analysis indicates liquefaction induced settlement would be reduced to three to four inches.

5.6 Slab-on-Grade Construction

Slab-on-grade floors may be supported on subgrades prepared as recommended in Section 5.2 of this report. Immediately below the floor slabs, we recommend placing a four-inch thick capillary break layer of clean, free-draining, coarse sand or fine gravel that has less than three percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slabs.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting uniform curing of the slab, and can actually serve as a water supply for moisture transmission through the slab and affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained. We recommend floor designers and contractors refer to the current American Concrete Institute (ACI) Manual of Concrete Practice for further information regarding vapor barrier installation below slab-on-grade floors.

With floor subgrade prepared as recommended in Section 5.2, a subgrade modulus of 100 pci can be used in design.

5.7 Lateral Earth Pressures for Wall Design

The magnitude of earth pressure development on below-grade walls will partly depend on the quality of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 5.2 of this report. To guard against hydrostatic pressure development, wall drainage must also be installed. A typical recommended wall drainage detail is shown on Figure 4.

With wall backfill placed and compacted as recommended, and drainage properly installed, we recommend designing unrestrained walls for an active earth pressure equivalent to a fluid weighing 35 pounds per cubic foot (pcf). For restrained walls, an additional uniform load of 100 psf should be added to the 35 pcf. To account for typical traffic surcharge loading, the walls can be designed for an additional imaginary height of two feet (two-foot soil surcharge). For evaluation of wall performance under seismic loading, a uniform pressure equivalent to 8H psf, where H is the height of the below-grade portion of the wall should be applied in addition to the static lateral earth pressure. These values assume a horizontal backfill condition and that no other surcharge loading, sloping embankments, or adjacent buildings will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 5.5 of this report.

5.8 Stormwater Facilities

Stormwater management plans were unavailable at the time of this report. There is an existing stormwater detention pond along the southern portion of the Taylor Way site. We would assume that this pond will be incorporated into the final plans for the site.

Detention Vault

The magnitude of earth pressures developing on the vault walls will depend in part on the quality and compaction of the wall backfill. We recommend placing and compacting wall backfill as structural fill, as recommended in the Section 5.2 of this report. Lateral earth pressures recommended in Section 5.7 can be used in designing the below-grade vault walls. If it is not possible to discharge collected water at the footing elevation, we recommend setting the invert elevation of the wall drainpipe equivalent to the outfall invert and connecting the drain to the outfall pipe for discharge. For any portion of the wall that falls below the invert elevation of the wall drain, an earth pressure equivalent to a fluid weighing 85 pcf should be used.

Detention Pond

If fill berms will be constructed, the berm locations should be stripped of topsoil, duff, and soils containing organic material prior to the placement of fill. Fill material required to construct perimeter containment berm should consist of silty soils with at least 25 percent fines that is compacted structurally, as recommended in Section 5.2 of this report.

Because of exposure to fluctuating stored water levels, soils exposed on the interior side slopes of the ponds may be subject to some risk of periodic shallow instability or sloughing. Establishing interior slopes at a 3:1 gradient will significantly reduce or eliminate this potential. Exterior berm slopes and interior slopes above the maximum water surface should be graded to a finished inclination no steeper than 2:1. Finished slope faces should be thoroughly compacted and vegetated to guard against erosion.

We should review stormwater management plans when they become available to verify suitability of soils in the planned locations and to provide supplemental discussion and recommendations, if needed.

5.9 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the site at all times. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building areas. We recommend providing a positive drainage gradient away from the building perimeters. If this gradient cannot be provided, surface water should be collected adjacent to the structures and disposed to appropriate storm facilities.

Subsurface

Considering that impervious pavements will extend up to the building perimeter along with positive drainage maintained away from the structure, installation of customary perimeter foundation drains adjacent the strip footings would not be necessary, in our opinion.

5.10 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA), or City of Tacoma specifications. As a minimum, trench backfill should be placed and compacted as structural fill, as described in Section 5.2 of this report. The native alluvial soils will likely be excavated in a wet condition and would not be suitable for use as trench backfill unless dried back to a moisture content that will facilitate proper compaction. If utility construction takes place during the wet winter months, it will likely be necessary to import suitable wet weather fill for utility trench backfilling.

Excavations into the native soils below the groundwater table will likely expose soft soils that will be unstable and would not provide suitable support for the utility pipes when backfilled. When soft unstable soils are exposed, the utility contractor should be prepared to overexcavate and remove the soils and replace them with crushed rock or bedding aggregate to establish a stable pipe foundation. Given conditions indicated by the CPTs, we would not expect overexcavation and replacement of soils for establishing stable pipe foundations would exceed three feet.

5.11 Pavements

Pavement subgrade should be prepared as described in the Section 5.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. The subgrade should be proofrolled with heavy rubber-tired construction equipment such as a load 10-yard dump truck to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. We expect traffic at the facility will consist of cars and light trucks, along with heavy traffic in the form of tractor-trailer rigs. For design considerations, we have assumed traffic in parking and in car/light truck access pavement areas can be represented by an 18-kip Equivalent Single Axle Loading (ESAL) of 50,000 over a 20-year design life. For heavy traffic pavement areas, we have assumed an ESAL of 500,000 would be representative of the expected loading. These ESALs represent traffic loading equivalent to 3 and 29, loaded (80,000 pound gross vehicle weight) tractor-trailer rigs, respectively, traversing the pavement per day over a 20-year design life.

With a stable subgrade prepared as recommended, we recommend the following pavement sections:

Light Traffic and Parking:

- Two inches of hot mix asphalt (HMA) over six inches of crushed rock base (CRB)
- Four inches of full depth HMA

Heavy Traffic:

- Three inches of HMA over eight inches of CRB
- Six inches of full depth HMA

The paving materials used should conform to the current Washington State Department of Transportation (WSDOT) specifications for ½-inch hot mix asphalt HMA and CRB surfacing.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. For optimum performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

6.0 ADDITIONAL SERVICES

Terra Associates, Inc. should review the final design drawings and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical services during construction to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

7.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the Taylor Way and Lincoln Avenue Industrial Sites project in Tacoma, Washington. This report is for the exclusive use of Avenue 55 and their authorized representatives.

The analyses and recommendations presented in this report are based on data obtained from the subsurface explorations performed on the site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.

REFERENCE: http://www.wsdot.wa.gov/data/tools/geoportal/ ACCESSED 1/3/17

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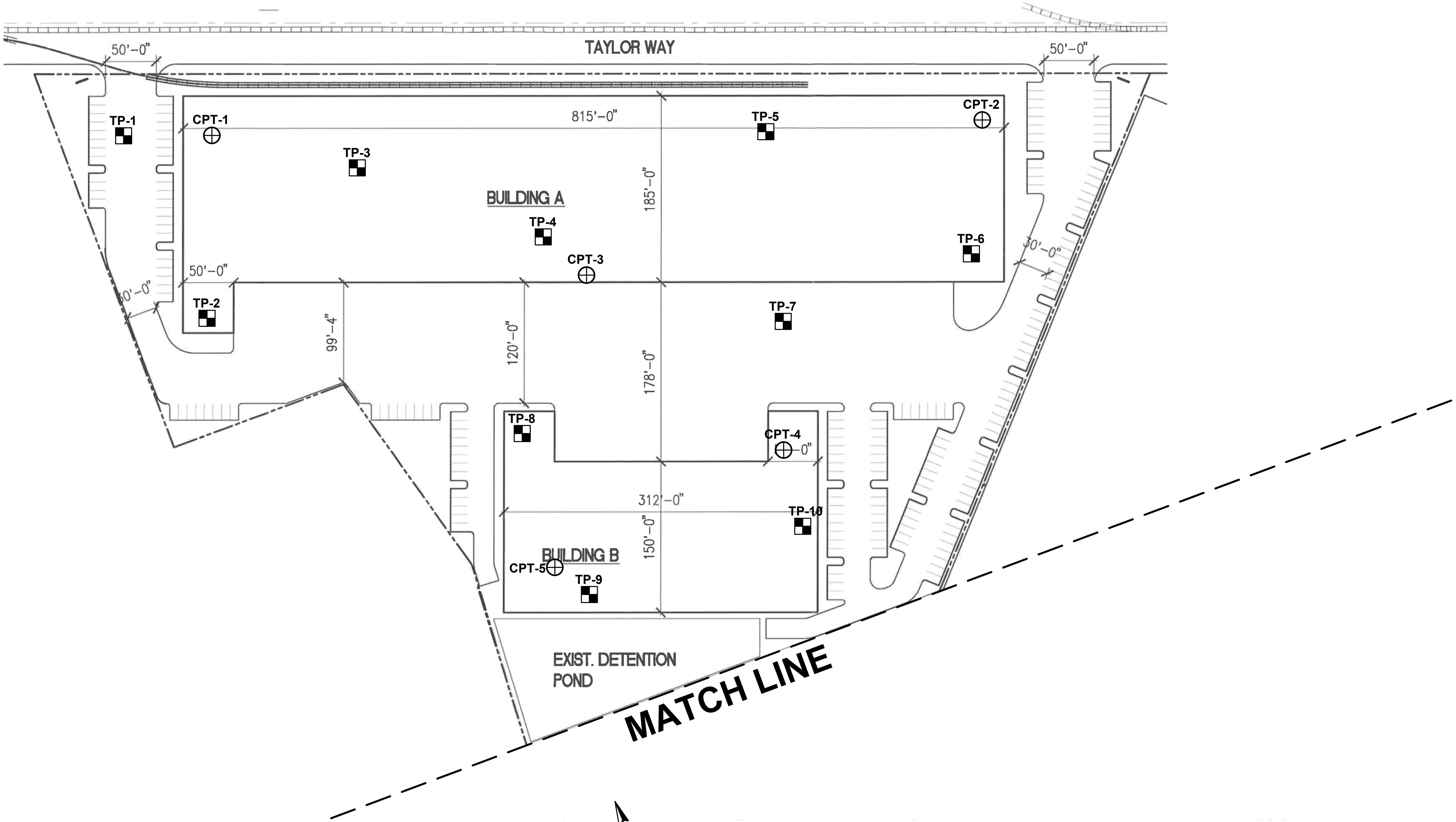
VICINITY MAP
TAYLOR WAY AND LINCOLN AVE INDUSTRIAL SITES
TACOMA, WASHINGTON

Proj.No. T-7543	Date: APR 2017	Figure 1



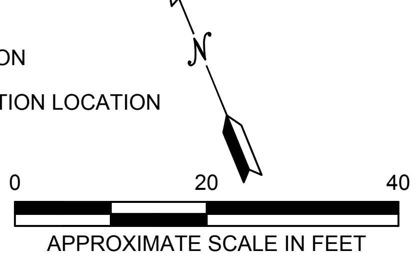
NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: SITE PLAN PROVIDED BY CRAFT ARCHITECTS.

LEGEND:

▚	APPROXIMATE BORING LOCATION
⊕	APPROXIMATE CONE PENETRATION LOCATION



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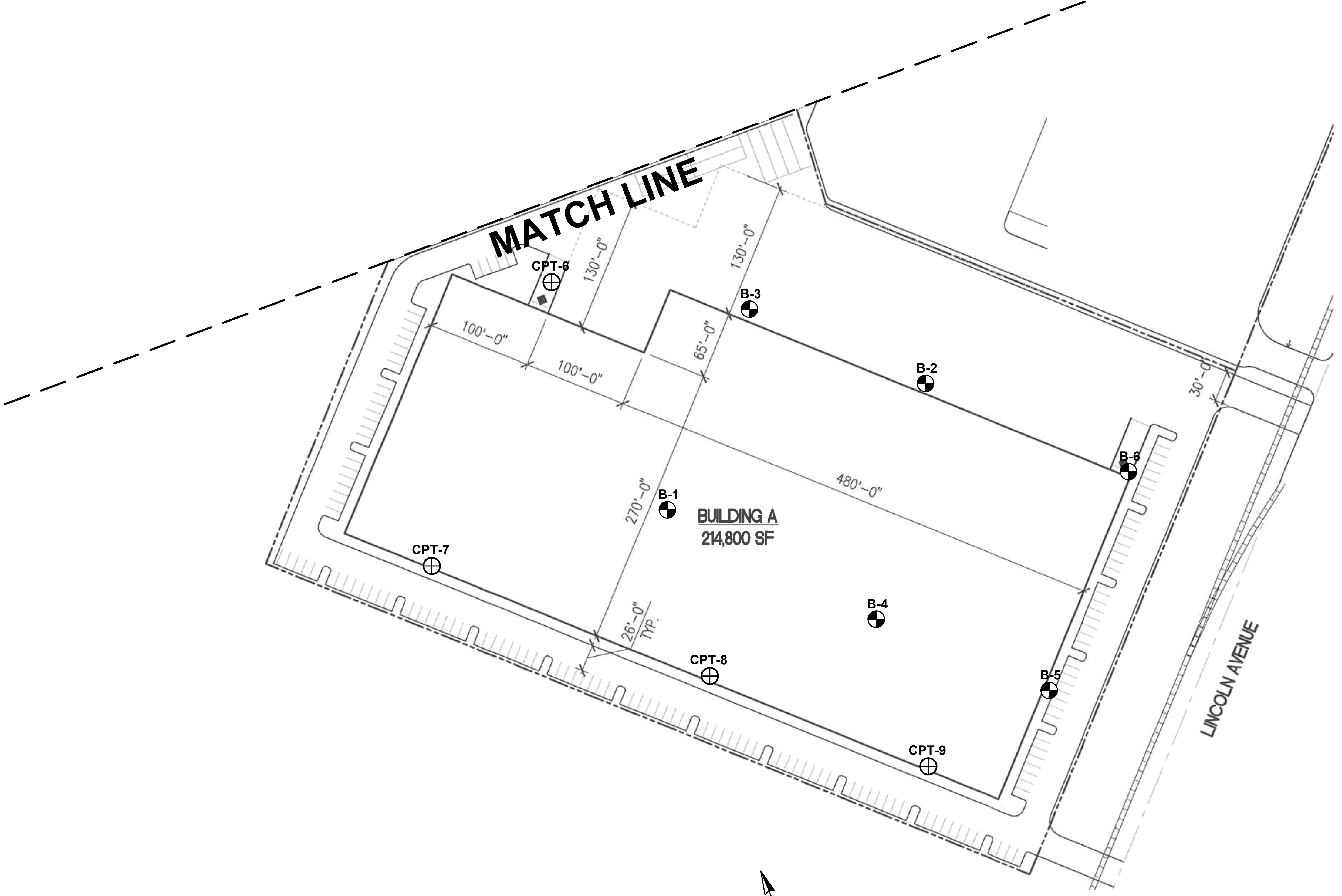
EXPLORATION LOCATION PLAN
TAYLOR WAY AND LINCOLN AVE INDUSTRIAL SITES
TACOMA, WASHINGTON

Proj.No. T-7543 | Date: APR 2017 | Figure 2A



NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: SITE PLAN PROVIDED BY CRAFT ARCHITECTS.

LEGEND:

- ◕ APPROXIMATE TEST PIT LOCATION
- ⊕ APPROXIMATE CONE PENETRATION LOCATION

0 100 200

APPROXIMATE SCALE IN FEET

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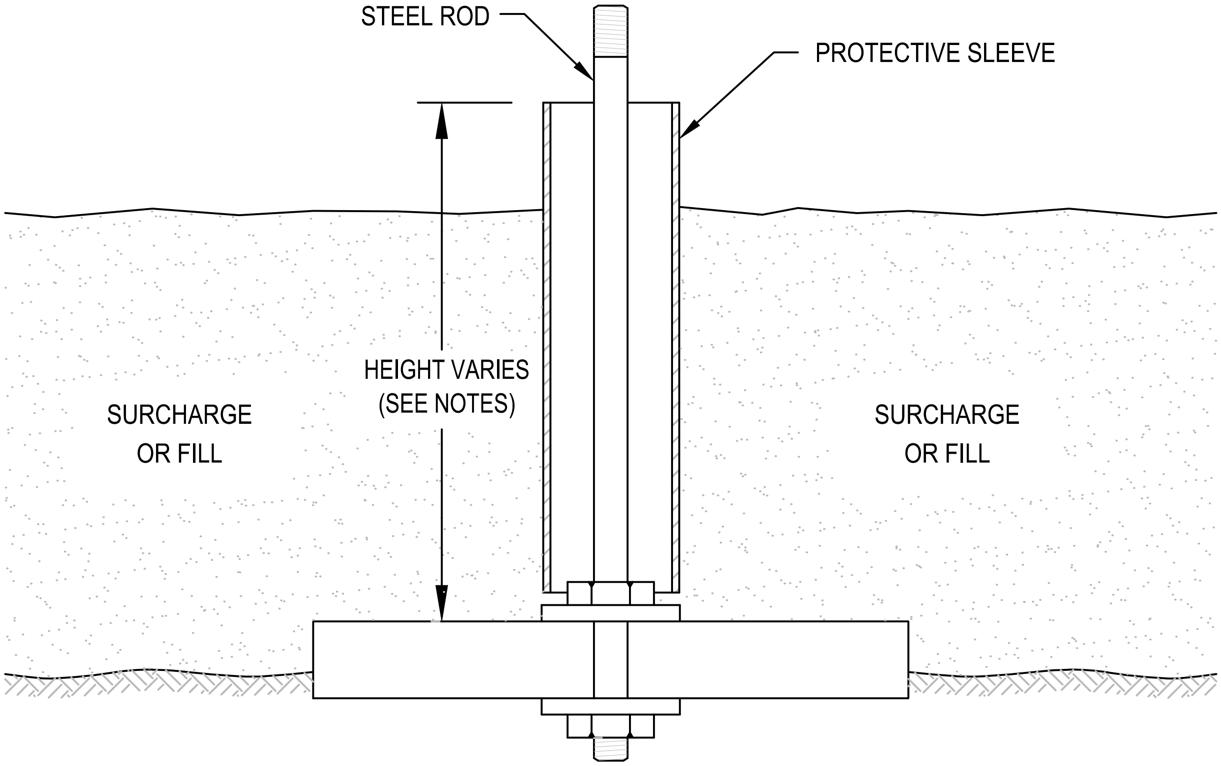
EXPLORATION LOCATION PLAN
TAYLOR WAY AND LINCOLN AVE INDUSTRIAL SITES
TACOMA, WASHINGTON

Proj.No. T-7543	Date: APR 2017	Figure 2B



NOT TO SCALE

NOTES:

1. BASE CONSISTS OF 3/4" THICK, 2'x2' PLYWOOD WITH CENTER DRILLED 5/8" DIAMETER HOLE.
2. BEDDING MATERIAL, IF REQUIRED, SHOULD CONSIST OF CLEAN COARSE SAND.
3. MARKER ROD IS 1/2" DIAMETER STEEL ROD THREADED AT BOTH ENDS.
4. MARKER ROD IS ATTACHED TO BASE BY NUT AND WASHER ON EACH SIDE OF BASE.
5. PROTECTIVE SLEEVE SURROUNDING MARKER ROD SHOULD CONSIST OF 2" DIAMETER PLASTIC TUBING. SLEEVE IS NOT ATTACHED TO ROD OR BASE.
6. ADDITIONAL SECTIONS OF STEEL ROD CAN BE CONNECTED WITH THREADED COUPLINGS.
7. ADDITIONAL SECTIONS OF PLASTIC PROTECTIVE SLEEVE CAN BE CONNECTED WITH PRESS-FIT PLASTIC COUPLINGS.
8. STEEL MARKER ROD SHOULD EXTEND AT LEAST 6" ABOVE TOP OF PLASTIC PROTECTIVE SLEEVE.
9. PLASTIC PROTECTIVE SLEEVE SHOULD EXTEND AT LEAST 1" ABOVE TOP OF FILL SURFACE.

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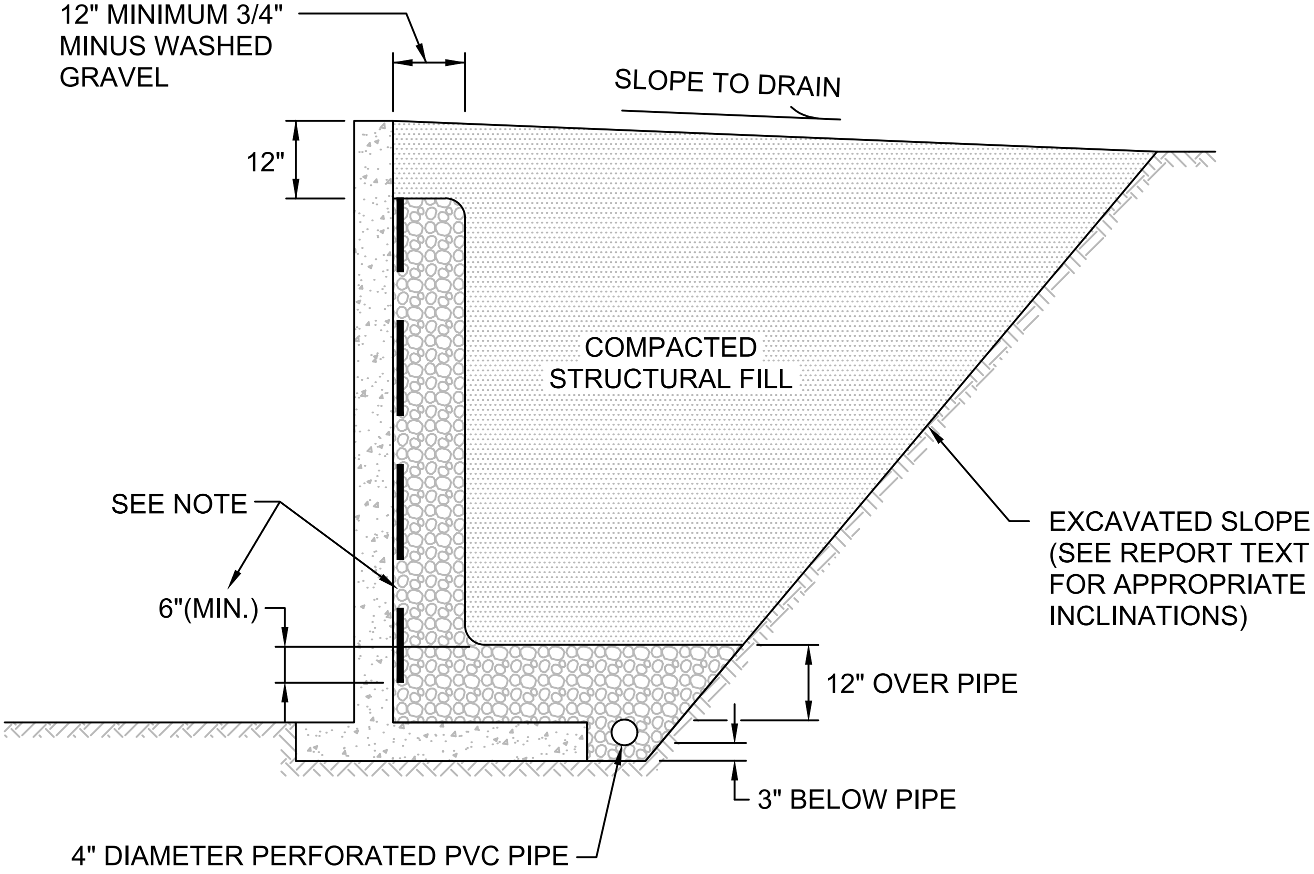
SETTLEMENT MARKER DETAIL
TAYLOR WAY AND LINCOLN AVE INDUSTRIAL SITES
TACOMA, WASHINGTON

Proj.No. T-7543	Date: APR 2017	Figure 3



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.

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TYPICAL WALL DRAINAGE DETAIL
TAYLOR WAY AND LINCOLN AVE INDUSTRIAL SITES
TACOMA, WASHINGTON

Proj.No. T-7543	Date: APR 2017	Figure 4

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

Taylor Way and Lincoln Avenue Industrial Sites
Tacoma, Washington

On November 28, 2016, we completed our site exploration by observing soil conditions at 10 test pits. On December 7 and December 8, 2016, we supplemented this data by observing soil conditions at 6 test borings drilled to a depth of 26 feet. The test pits were excavated using a track-mounted excavator to a maximum depth of ten feet below existing site grades. Test pit and boring locations were determined in the field by measurements from existing site features. The approximate location of the test pits and test borings is shown on the attached Exploration Location Plans, Figures 2a and 2b. Test Pit Logs and Test Boring Logs are attached as Figures A-2 through A-17.

An engineering geologist from our office conducted the field exploration. Our representative classified the soil conditions encountered, maintained a log of each test pit and test boring, obtained representative soil samples, and recorded water levels observed during excavation. During drilling, soil samples were obtained in general accordance with ASTM Test Designation D-1586. Using this procedure, a 2-inch (outside diameter) split barrel sampler is driven into the ground 18 inches using a 140-pound hammer free falling a height of 30 inches. The number of blows required to drive the sampler 12 inches after an initial 6-inch set is referred to as the Standard Penetration Resistance value or N value. This is an index related to the consistency of cohesive soils and relative density of cohesionless materials. N values obtained for each sampling interval are recorded on the Boring Logs, Figures A-12 through A-17. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test pits and test borings were placed in closed containers and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the individual Test Pit Logs and Test Boring Logs. Atterberg Limits Tests were performed on selected samples. The results of the Atterberg Limits tests are shown on the individual Test Boring Logs.

InSitu Engineering, under subcontract with Terra Associates, Inc. conducted nine electric CPTs at locations selected by Terra Associates, Inc., which are shown on Figures 2a and 2b. The CPTs were advanced to depths of 60 feet below the surface. The CPT is an instrumented approximately 1 ½-inch diameter cone that is pushed into the ground at a constant rate. During advancement, continuous measurements are made of the resistance to penetration of the cone and the friction of the outer surface of a sleeve. The cone is also equipped with a porous filter and a pressure transducer for measuring groundwater or pore water pressure generated. Measurements of tip and sleeve frictional resistance, pore pressure, and interpreted soil conditions are summarized in graphical form on the attached CPT Logs.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS More than 50% material larger than No. 200 sieve size	**GRAVELS** More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
			SP	Poorly-graded sands, sands with gravel, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS More than 50% material smaller than No. 200 sieve size	**SILTS AND CLAYS** Liquid Limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity. (Lean clay)
			OL	Organic silts and organic clays of low plasticity.
	SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.
			CH	Inorganic clays of high plasticity. (Fat clay)
			OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS

Density	Standard Penetration Resistance in Blows/Foot
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

COHESIVE

Consistancy	Standard Penetration Resistance in Blows/Foot
Very Soft	0-2
Soft	2-4
Medium Stiff	4-8
Stiff	8-16
Very Stiff	16-32
Hard	>32

I	2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
Ⅱ	2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
▼	WATER LEVEL (Date)
Tr	TORVANE READINGS, tsf
Pp	PENETROMETER READING, tsf
DD	DRY DENSITY, pounds per cubic foot
LL	LIQUID LIMIT, percent
PI	PLASTIC INDEX
N	STANDARD PENETRATION, blows per foot

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UNIFIED SOIL CLASSIFICATION SYSTEM
TAYLOR WAY AND LINCOLN AVE INDUSTRIAL SITES
TACOMA, WASHINGTON

Proj.No. T-7543 | Date: APR 2017 | Figure A-1

LOG OF TEST PIT NO. TP-1

FIGURE A-2

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Bare/Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 2 Feet **DEPTH TO CAVING:** 2 Feet

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0 1		FILL: Gray silty SAND with gravel, fine grained, moist to wet.	Medium Dense	
▼ 2 3 4		Dark brown silt and wood debris, mostly wood debris and rubble.	Loose	
5 6 7 8 9 10		Test pit terminated at 5 feet due to heavy caving. Groundwater seepage observed at 2 feet.		

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-2

FIGURE A-3

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Bare/Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 4 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		FILL: Tan SAND, medium grained, moist.		
1		FILL: Gray silty SAND with gravel, fine grained, moist.	Medium Dense	
2				
3		FILL: Brown silty SAND, sticks, and organic debris. Heavy seepage at 4 feet.	Soft	
▼ 4		FILL: Metal, wood, and various other types of rubble.	Loose	
5				
6				
7				
8		Test pit terminated at 8 feet. Excavator stuck on rubble. Groundwater seepage observed at 4 feet.		
9				
10				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-3

FIGURE A-4

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Asphalt **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 3 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		FILL: Sand with gravel, medium grained, moist.		
1		FILL: Gray silty SAND with gravel, fine grained, moist.		
2				
▼ 3		FILL: Bricks and rubble, saturated.		
4				
5				
6				
7		Dark brown and gray silty CLAY/clayey SILT, soft, moist. (ML)		
8				
9				
10		Test pit terminated at 10 feet. Groundwater seepage observed at 3 feet.		
11				
12				
13				
14				
15				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-4

FIGURE A-5

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Bare/Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 2 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		FILL: Gravel with silt, moist.	Medium Dense	
1		FILL: Gray silty SAND with gravel, fine grained, moist.		
▼ 2		FILL: Gray gravelly SAND with wood debris, medium grained, moist. Light seepage from 2 to 5 feet.	Loose	
5		FILL: Dark brown SILT with wood debris, moist.	Soft	
7		Gray and brown silty CLAY/clayey SILT, moist. (ML)	Soft	
10		Test pit terminated at 10 feet. Groundwater seepage observed at 2 feet.		
15				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-5

FIGURE A-6

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Bare/Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 3 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0 1 2		FILL: Tan and gray silty SAND with gravel, fine grained, saturated. Heavy seepage observed at 3 feet.	Medium Dense	
▼ 3 4 5 6		FILL: Brick and concrete rubble with cobbles, saturated.	Loose	
7		FILL: Dark brown organic SILT, moist. (ML)	Soft	
8 9		Brown silty CLAY/clayey SILT, moist. (ML)	Soft	
10 11 12 13 14 15		Test pit terminated at 10 feet. Groundwater seepage observed at 3 feet.		

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-6

FIGURE A-7

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Bare/Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 4 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		FILL: Brown SAND, medium grained, moist, minor rubble debris.		
1				
2			Medium Dense	
3				
▼ 4		Brown and gray sandy SILT and SILT, wet. (ML)		
5			Soft	
6				
7		Dark gray SAND, meidum grained, wet to saturated. (SP)		
8			Loose	
9				
10		Test pit terminated at 10 feet. Groundwater seepage observed at 4 feet.		
11				
12				
13				
14				
15				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-7

FIGURE A-8

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Bare/Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 4 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(TOPSOIL)		
1 2 3 ▼ 4 5 6		FILL: Gray SAND, fine to medium grained, moist.	Loose	
7 8 9 10		Test pit terminated at 7 feet due to excessive caving. Groundwater seepage observed at 4 feet.		

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-8

FIGURE A-9

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 7 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1		FILL: Grayish-brown silty SAND with gravel, fine to medium grained, moist, occasional cobble sized chunks of asphalt and concrete rubble.		
2				
3				
4				
5			Loose	
6				
▼ 7		Light to moderate seepage observed at 7 feet.		
8				
9				
10		Test pit terminated at 10 feet. Groundwater seepage observed at 7 feet.		
11				
12				
13				
14				
15				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-9

FIGURE A-10

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		FILL: Grayish-brown silty SAND with gravel, fine grained, moist, minor brick and concrete debris, minor organics.	Loose	
1				
2				
3				
4				
5		Cobbles in fill from 5 to 10 feet.	Loose to Medium Dense	
6				
7				
8				
9				
10		Test pit terminated at 10 feet. No groundwater seepage observed.		
11				
12				
13				
14				
15				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-10

FIGURE A-11

PROJECT NAME: Taylor Way and Lincoln Avenue Industrial Sites **PROJ. NO:** T-7543 **LOGGED BY:** NRH

LOCATION: Tacoma, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** N/A

DATE LOGGED: November 28, 2016 **DEPTH TO GROUNDWATER:** 4 Feet **DEPTH TO CAVING:** N/A

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
		FILL: Gray silty SAND with gravel, fine grained, wet, occasional rubble.		
1				
2				
3				
▼ 4			Loose	
5				
6				
		Encountered 8-inch PVC pipe bedded in gravel at 7 feet. Bedding was saturated.		
7				
8		Test pit terminated at 8 feet in fill. Groundwater seepage observed at 4 feet.		
9				
10				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

LOG OF BORING NO. B-1

Figure No. A-12

Project: Taylor Way and Lincoln Avenue Industrial Sites **Project No:** T-7543 **Date Drilled:** December 7, 2016

Client: Avenue 55, LLC **Driller:** Boretec **Logged By:** JCS

Location: Tacoma, Washington **Depth to Groundwater:** 7 feet **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0		5-inch concrete slab. FILL: Brown SAND with gravel, fine sand, fine gravel, moist. (SP)	Medium Dense	24	
5		FILL: Dark brown SAND with silt, fine grained, moist, scattered silty sand pockets, trace of shell fragments. (SP-SM)		11	
▼		Gray-brown to dark gray-brown SAND, fine grained, wet, trace of shell fragments. (SP) (Possible fill)	Very Loose	4	
10				2	
		Gray-brown slightly clayey to clayey SILT, wet, numerous fine black organic fragments. (MH) LL=52, PL=35, PI=17	Very Soft to Soft	2	
15		Dark gray, trace to slightly clayey, silty SAND to trace to slightly clayey, sandy SILT, fine grained, wet. (SM/ML)	Very Loose	2	
20		Dark gray-brown SAND, fine grained, wet. (SP)	Medium Dense	13	
		Dark gray-brown silty SAND to sandy SILT, fine grained, wet. (SM/ML)			
25		Dark gray SAND, fine grained, wet. (SP)		13	
		Boring terminated at 26.5 feet. Groundwater encountered at approximately 7 feet.			
30					

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. B-2

Figure No. A-13

Project: Taylor Way and Lincoln Avenue Industrial Sites **Project No:** T-7543 **Date Drilled:** December 7, 2016

Client: Avenue 55, LLC **Driller:** Boretec **Logged By:** JCS

Location: Tacoma, Washington **Depth to Groundwater:** 7 feet **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0		6-inch concrete slab.			
		FILL: Gray-brown SAND with silt and gravel to silty SAND with gravel, fine to medium sand, fine to coarse gravel, moist. (SP-SM)	Medium Dense	16	
5		FILL: Brown to gray-brown SAND, fine grained, moist, scattered shell fragments, trace of silty fine sand layers. (SP)		13	
▼		Dark gray-brown SAND with silt to silty SAND, fine grained, wet. (SP-SM/SM) (Possible fill)	Loose	6	
10		Gray SAND, fine to medium grained, trace of fine gravel, wet. (SP) (Possible fill)		9	
		Dark gray SAND with silt and gravel, fine sand, fine gravel, wet, trace of wood fragments. (SP-SM)	Very Loose	4	
15 20		Dark gray silty SAND to sandy SILT, fine grained, wet, scattered wood fragments and organic fibers, trace of silty clay to clayey silt pockets and layers. (SM/ML)		2 2	
25		Dark gray-brown SAND, fine grained, wet. (SP)	Medium Dense	18	
30		Boring terminated at 26.5 feet. Groundwater encountered at approximately 7 feet.			

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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Environmental Earth Sciences

LOG OF BORING NO. B-3

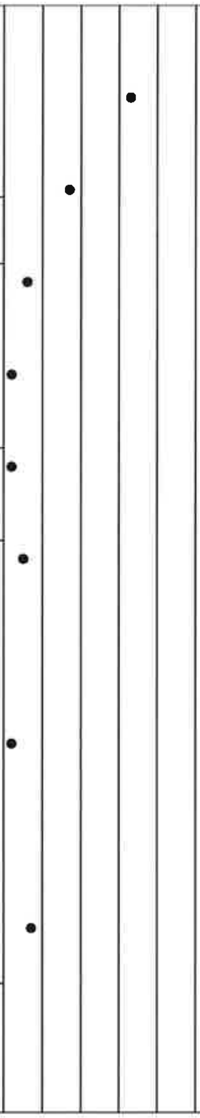
Figure No. A-14

Project: Taylor Way and Lincoln Avenue Industrial Sites **Project No:** T-7543 **Date Drilled:** December 7, 2016

Client: Avenue 55, LLC **Driller:** Boretec **Logged By:** JCS

Location: Tacoma, Washington **Depth to Groundwater:** 7 feet **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0		4-inch concrete slab. FILL: Brown SAND with silt and gravel, fine to medium sand, fine to coarse gravel, moist. (SP-SM)	Dense	33	
5		FILL: Gray-brown SAND, fine grained, moist. (SP)	Medium Dense	17	
▼		Gray SAND to SAND with silt, fine to coarse grained, trace of fine gravel, wet, trace of shell fragments. (SP/SP-SM) (Possible fill)	Loose to Very Loose	6 2	
10		Gray-brown slightly clayey SILT, wet, numerous fine black organic fragments, scattered wood fragments. (ML)	Very Soft to Soft	2	
15		Dark gray silty SAND to sandy SILT, fine grained, wet, trace of organic fibers. (SM/ML)	Very Loose to Loose	5 2	
20		Dark gray-brown SAND with silt, fine grained, wet, trace of organic fibers. (SP-SM)		7	
25		Boring terminated at 26.5 feet. Groundwater encountered below about 7 feet.			
30					



NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. B-4

Figure No. A-15

Project: Taylor Way and Lincoln Avenue Industrial Sites **Project No:** T-7543 **Date Drilled:** December 8, 2016

Client: Avenue 55, LLC **Driller:** Boretec **Logged By:** JCS

Location: Tacoma, Washington **Depth to Groundwater:** 7 feet **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0		5-inch concrete slab. FILL: Brown SAND with gravel, fine to medium sand, fine to coarse gravel, moist. (SP)	Medium Dense	15	
5		Gray-brown SAND to SAND with silt, fine grained, moist. (SP/SP-SM)		11	
▼		Gray SAND, fine grained, wet. (SP)	Very Loose	4	
10		Gray-brown sandy SILT, fine grained, trace of clay, wet, trace of organic fibers. (ML)		1	
		Light brown slightly clayey to clayey SILT, wet, numerous fine black organic fragments, scattered wood fragments and organic fibers. (ML/MH)	Very Soft to Soft	2	
15		Interbedded gray SILT to sandy SILT and SAND, fine grained, wet, scattered organic fibers and wood fragments. (ML/SP)	Loose to Medium Dense	4	
		Dark gray SAND, fine grained, wet. (SP)			
20				12	
25				5	
		Boring terminated at 26.5 feet. Groundwater encountered at approximately 7 feet.			
30					

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. B-5

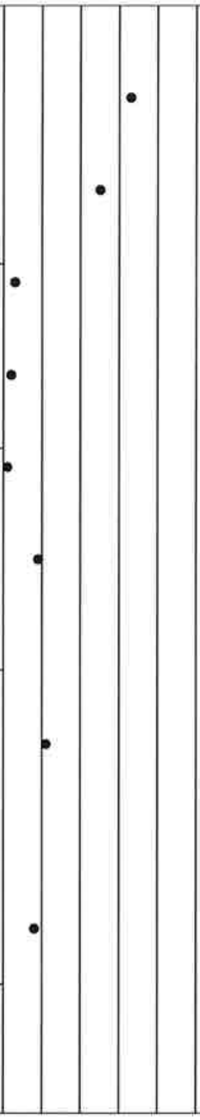
Figure No. A-16

Project: Taylor Way and Lincoln Avenue Industrial Sites **Project No:** T-7543 **Date Drilled:** December 8, 2016

Client: Avenue 55, LLC **Driller:** Boretec **Logged By:** JCS

Location: Tacoma, Washington **Depth to Groundwater:** 7 feet **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0 5		5-inch concrete slab. FILL: Brown SAND to SAND with silt, fine grained, trace of fine gravel, moist. (SP/SP-SM)	Medium Dense to Dense	33 25	
▼		Gray-brown SAND, fine grained, wet. (SP) (Possible fill)	Very Loose	3	
10		Interbedded dark gray SILT and SAND, fine grained, wet, trace of organic fibers. (ML/SP)		2	
15		Dark gray-brown SILT to sandy SILT, fine grained, wet, numerous black organic seams and pockets. (ML)	Very Loose to Loose	1 9	
20 25		Dark gray SAND, fine to medium grained, wet. (SP)	Loose to Medium Dense	11 8	
30		Boring terminated at 26.5 feet. Groundwater encountered below about 7 feet.			



NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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Environmental Earth Sciences

LOG OF BORING NO. B-6

Figure No. A-17

Project: Taylor Way and Lincoln Avenue Industrial Sites **Project No:** T-7543 **Date Drilled:** December 8, 2016

Client: Avenue 55, LLC **Driller:** Boretec **Logged By:** JCS

Location: Tacoma, Washington **Depth to Groundwater:** 7 feet **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0		5-inch concrete slab. FILL: Brown SAND with gravel, fine sand, fine to coarse gravel, moist. (SP)	Dense	39	
5		FILL: Gray-brown SAND, fine grained, moist, trace of shell fragments. (SP)	Medium Dense	12	
▼ 10		Interbedded dark gray-brown SAND and SILT with sand, fine grained, wet, scattered slightly clayey silt with sand layers, trace of shell fragments. (SP/ML) (Possible fill)	Very Loose	3 3	
15		Gray-brown, trace to slightly clayey SILT to sandy SILT, fine grained, wet, numerous fine black organic fragments and partings, trace of wood fragments. (ML) LL=40 PL=30 PI=10	Very Soft to Medium Stiff	2 5	
20 25		Dark gray-brown SAND to SAND with silt, fine grained, wet. (SP/SP-SM)	Loose	9 7	
30		Boring terminated at 26.5 feet. Groundwater encountered at approximately 7 feet.			

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

Terra Associates, Inc.
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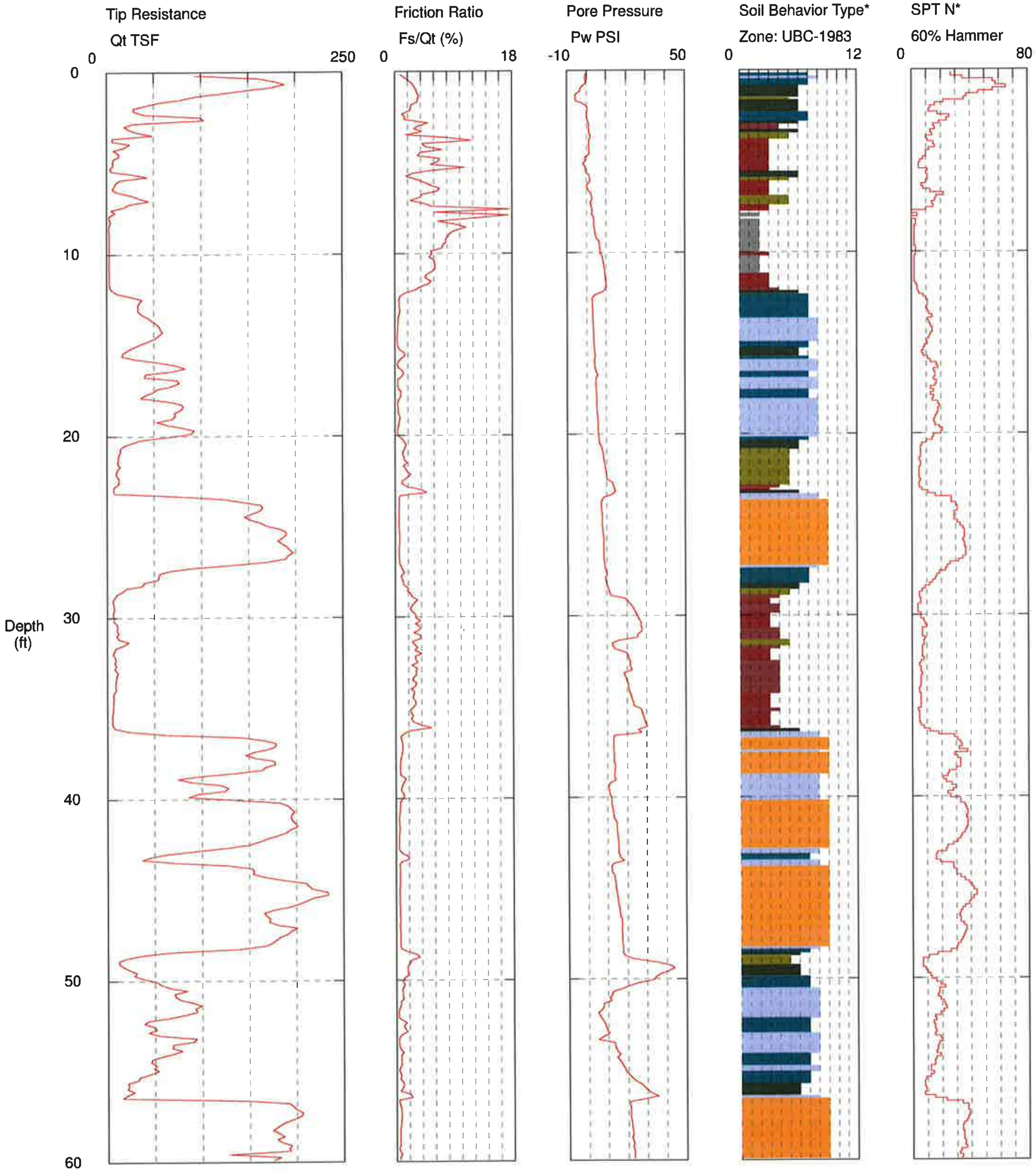
Terra Associates

Operator: Romanelli
Sounding: CPT-01
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/10/2016 5:10:25 PM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 60.04 feet

Depth Increment = 0.164 feet

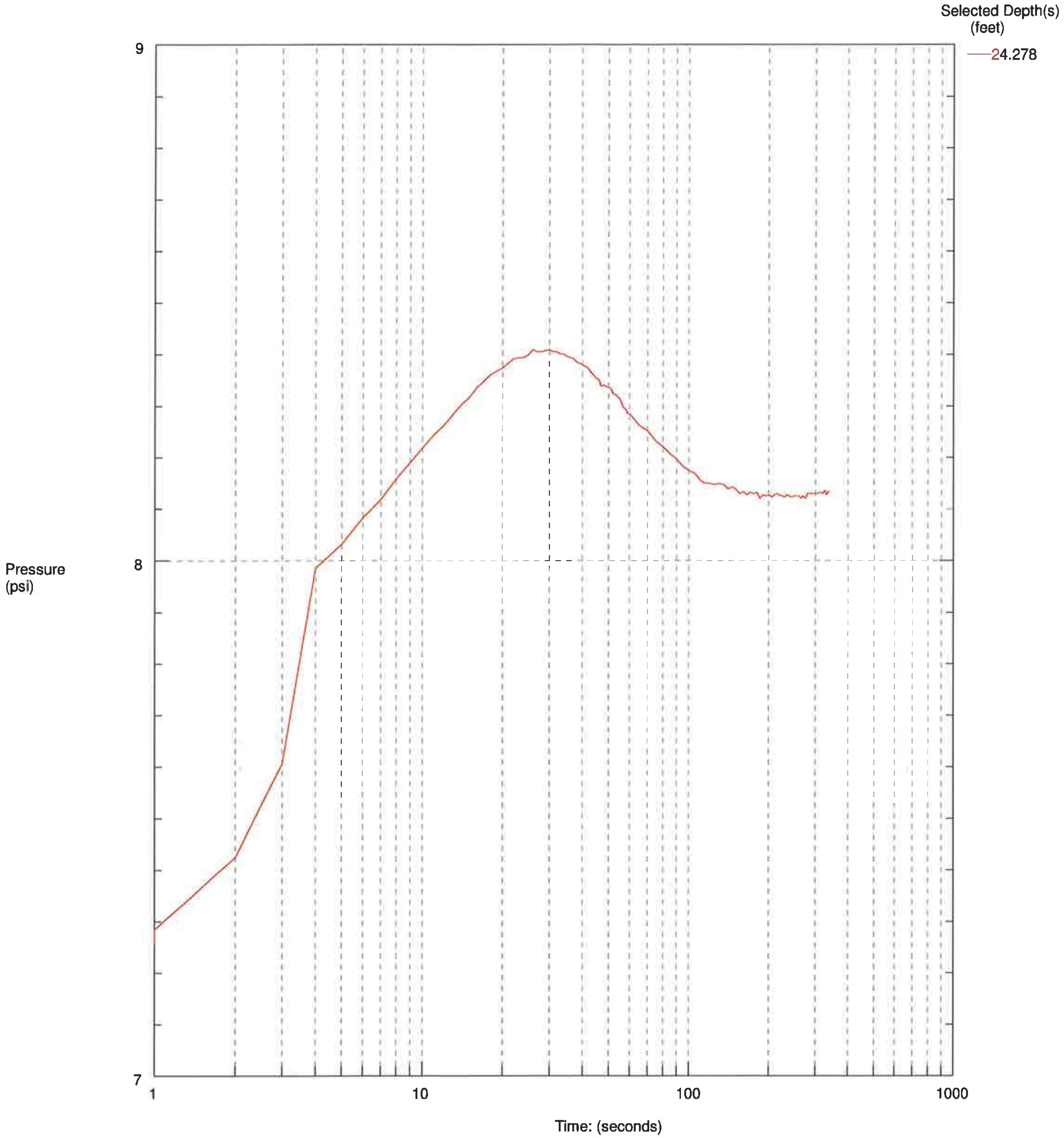
- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey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

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

Terra Associates

Operator Romanelli
Sounding: CPT-01
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/10/2016 5:10:25 PM
Location: Tacoma
Job Number: T-7543

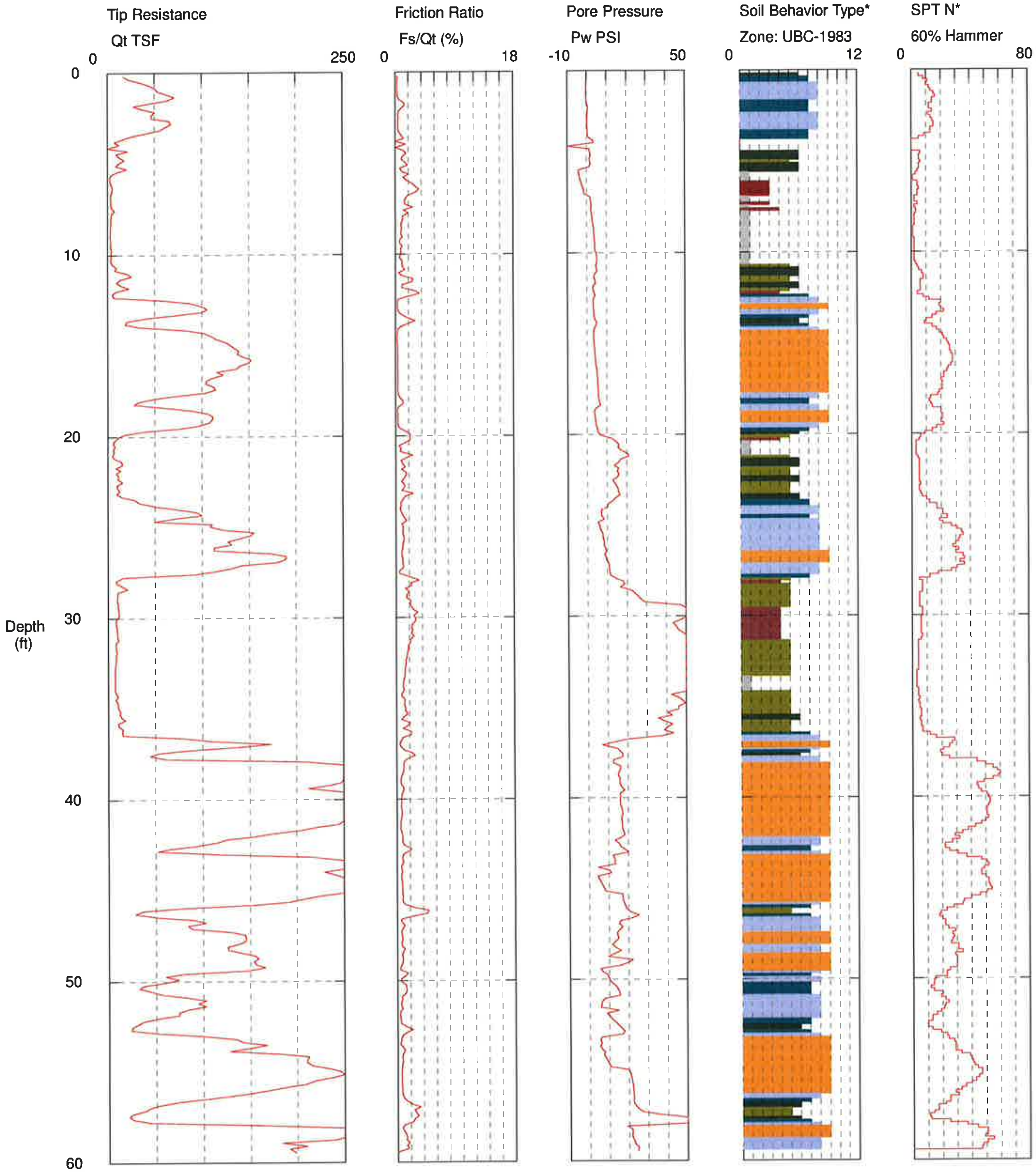


Maximum Pressure = 8.41 psi

Terra Associates

Operator: Romanelli
Sounding: CPT-02
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/10/2016 2:58:47 PM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 59.42 feet

Depth Increment = 0.164 feet

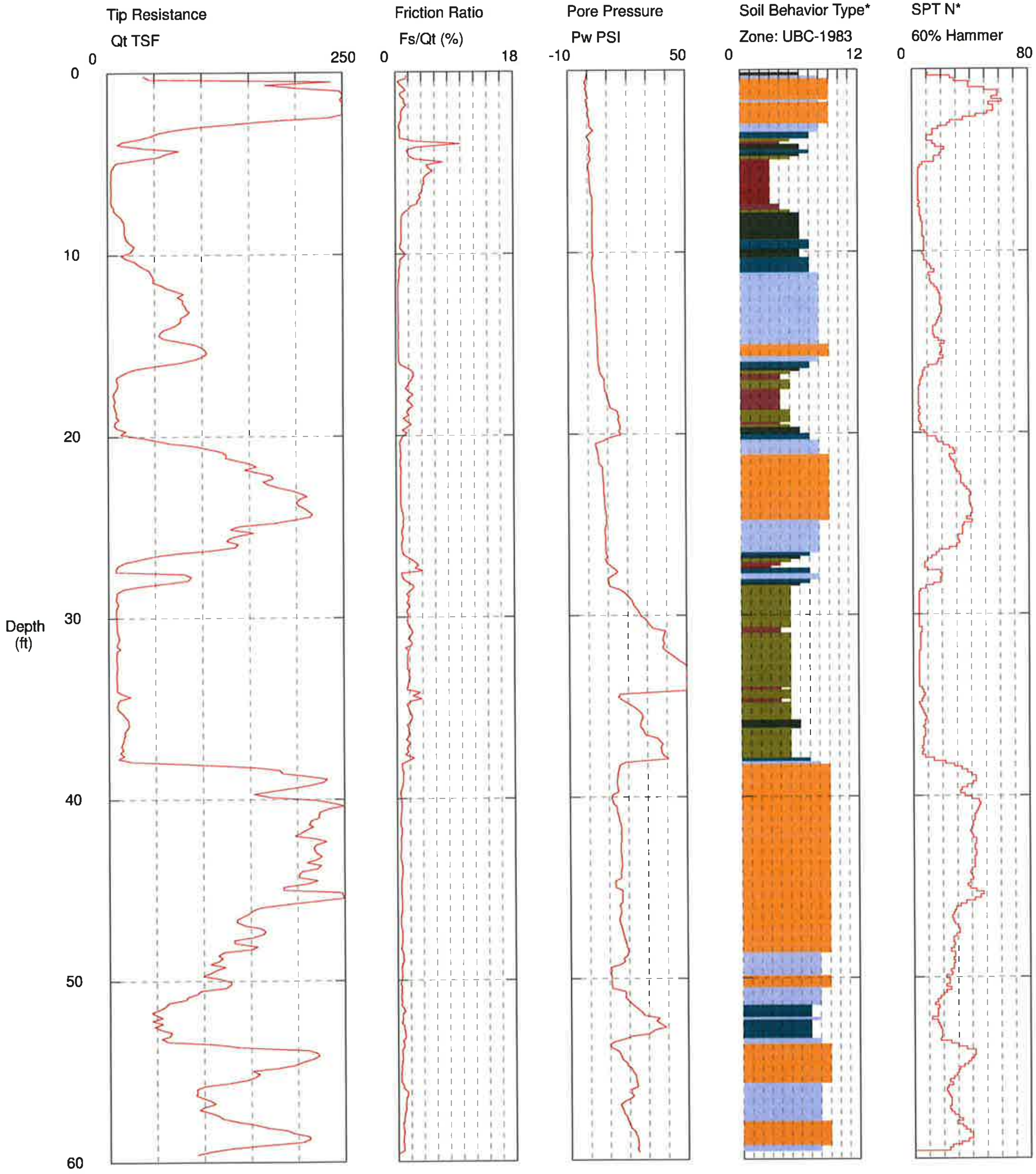
- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey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

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

Terra Associates

Operator: Romanelli
Sounding: CPT-03
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/10/2016 4:07:01 PM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 59.55 feet

Depth Increment = 0.164 feet

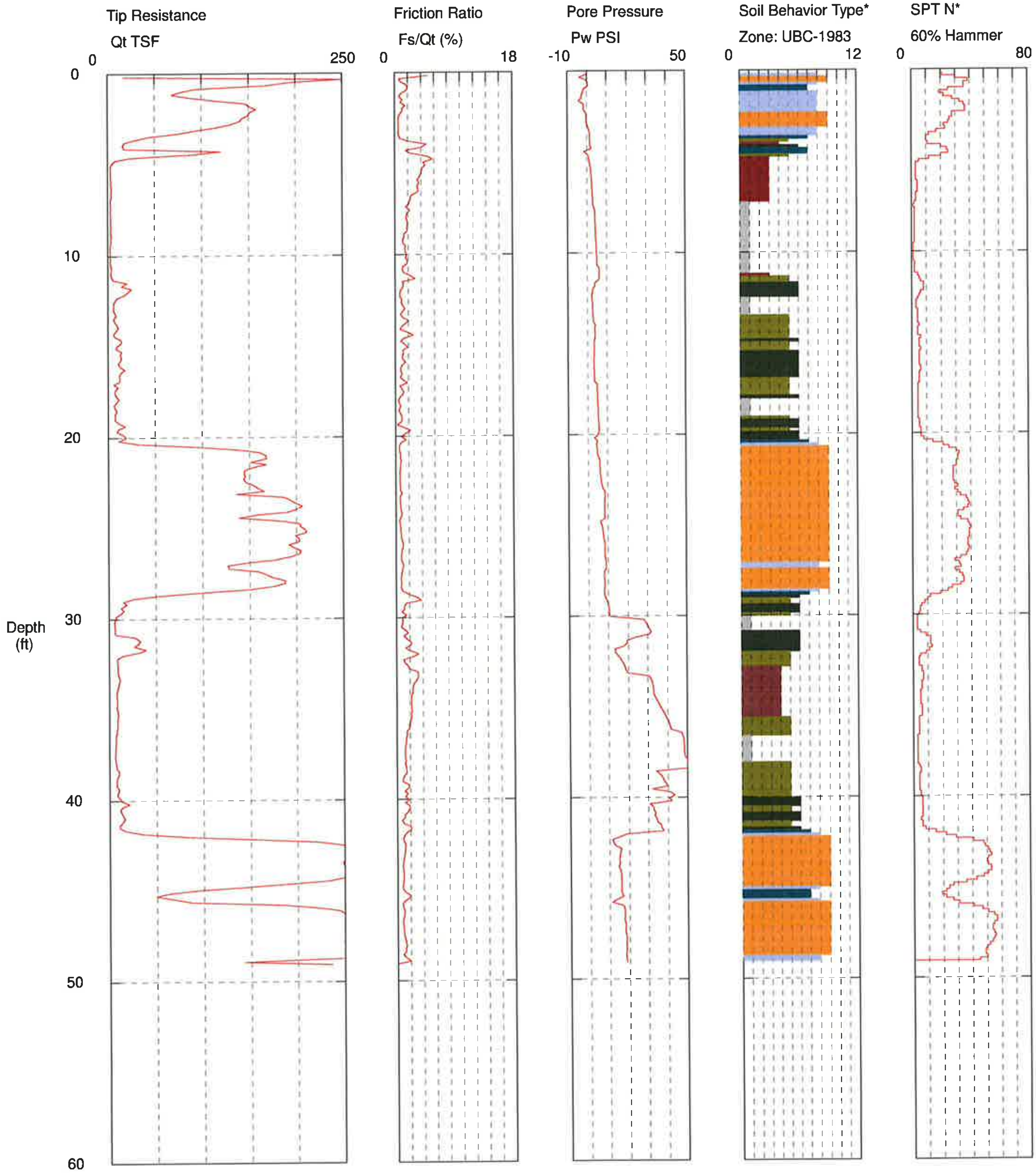
- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey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

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

Terra Associates

Operator: Romanelli
Sounding: CPT-04b
Cone Used: DDG1369
GPS Data: NO GPS

CPT Date/Time: 11/10/2016 7:08:58 PM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 49.05 feet

Depth Increment = 0.164 feet

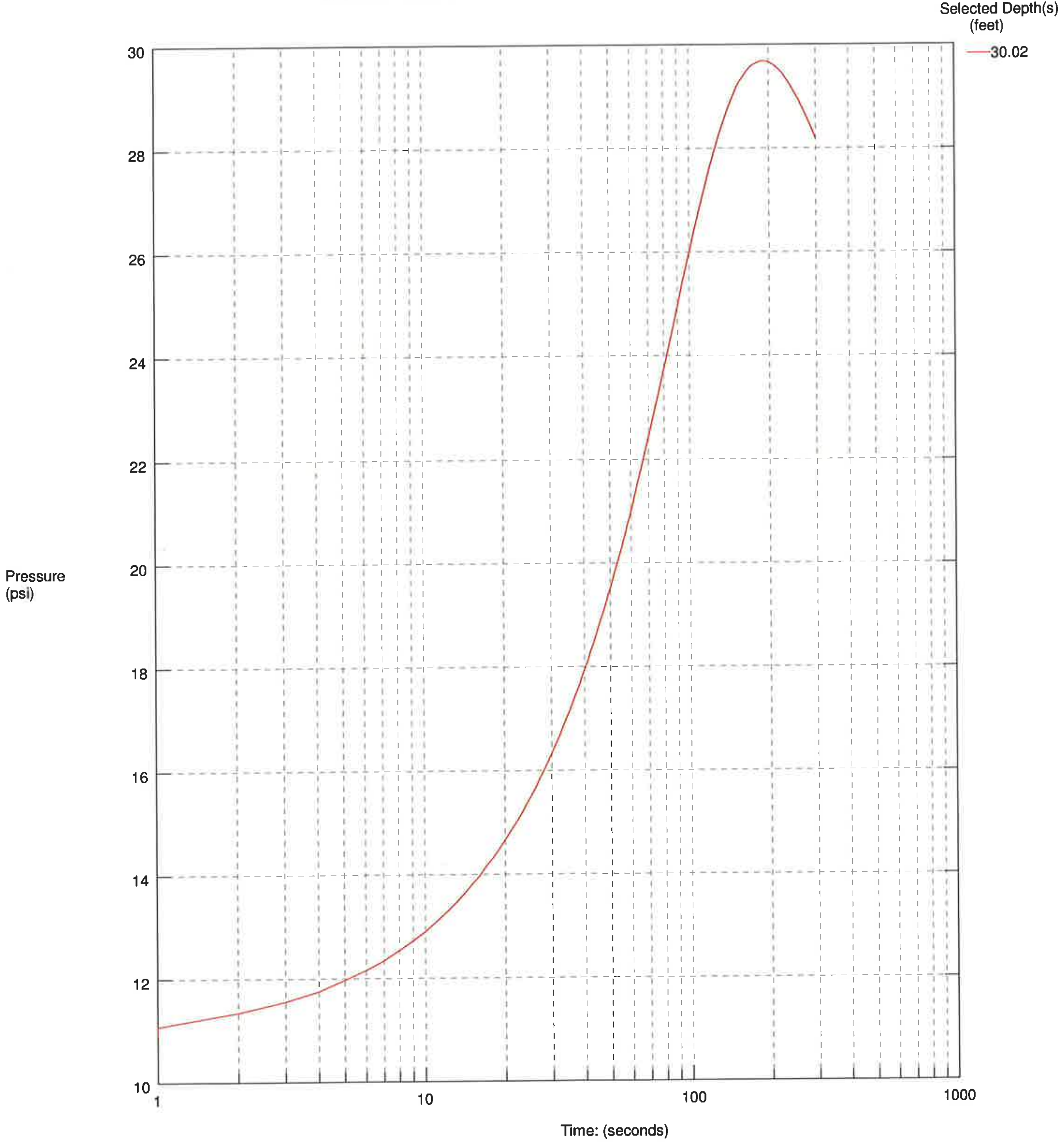
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

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

Terra Associates

Operator Romanelli
Sounding: CPT-04b
Cone Used: DDG1369
GPS Data: NO GPS

CPT Date/Time: 11/10/2016 7:08:58 PM
Location: Tacoma
Job Number: T-7543

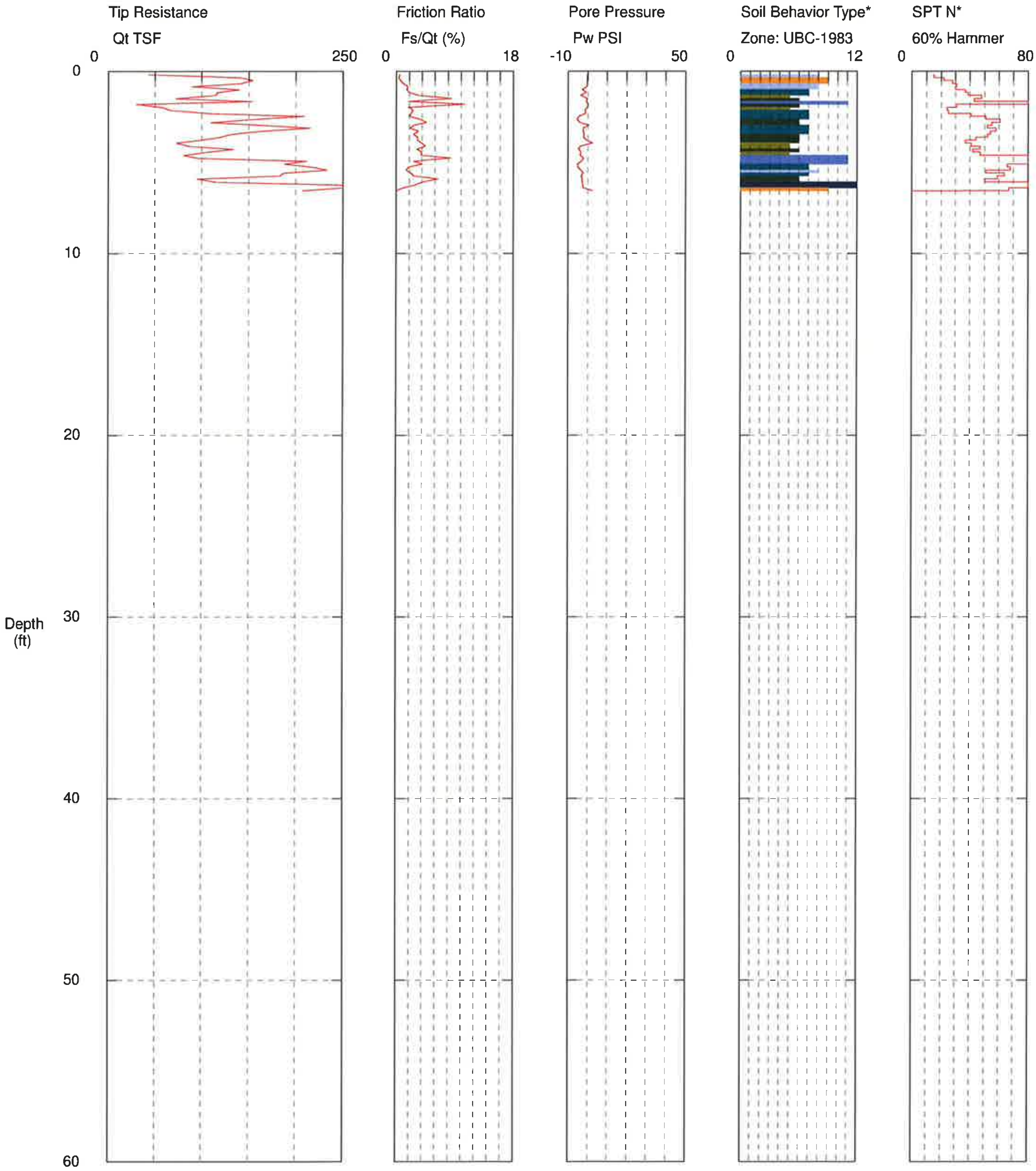


Maximum Pressure = 29.682 psi

Terra Associates

Operator: Romanelli
Sounding: CPT-05
Cone Used: DDG1369
GPS Data: NO GPS

CPT Date/Time: 11/10/2016 2:13:23 PM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 6.56 feet

Depth Increment = 0.164 feet

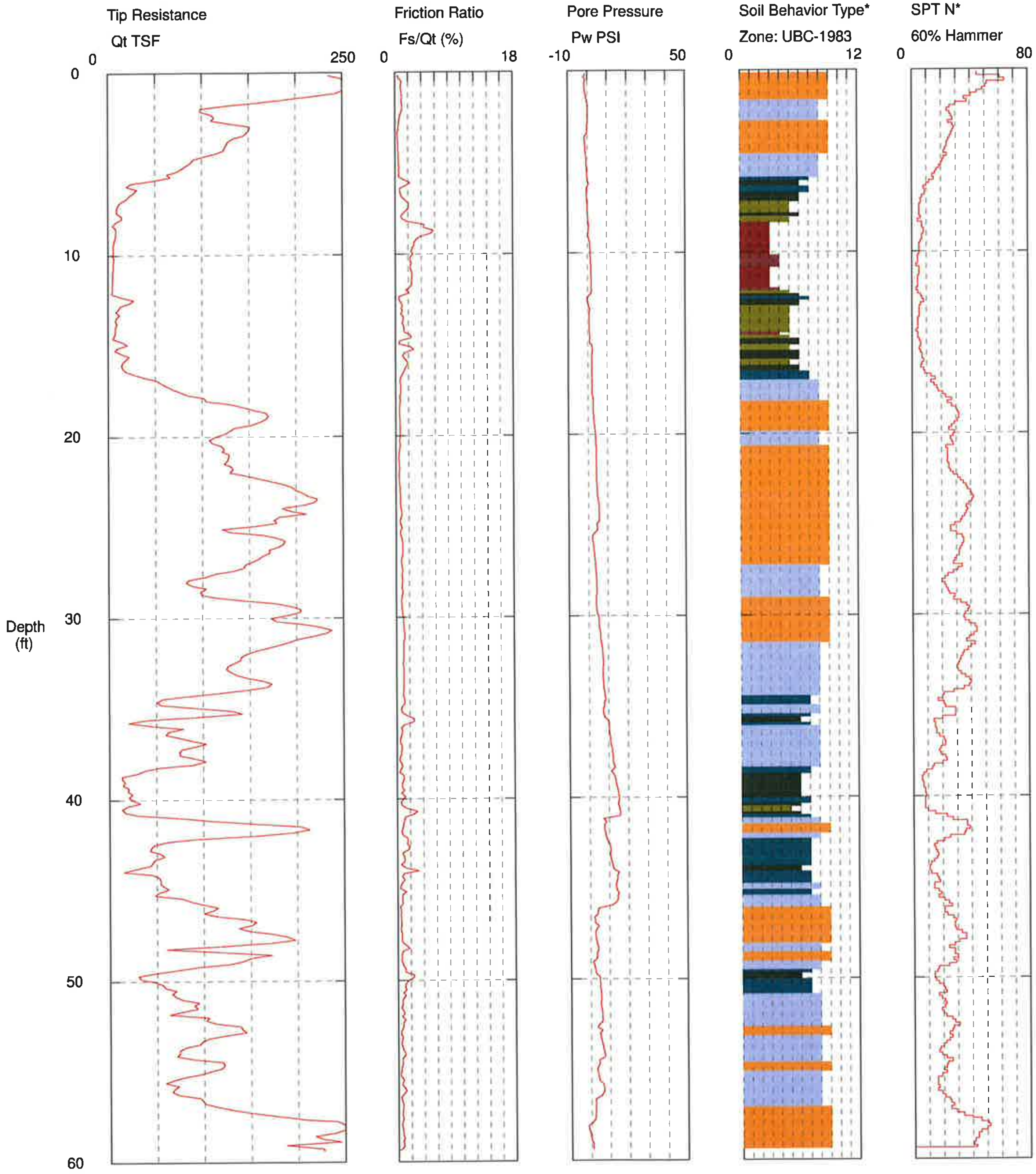
- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey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

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

Terra Associates

Operator: Romanelli
Sounding: CPT-06a
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/11/2016 8:42:28 AM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 59.38 feet

Depth Increment = 0.164 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

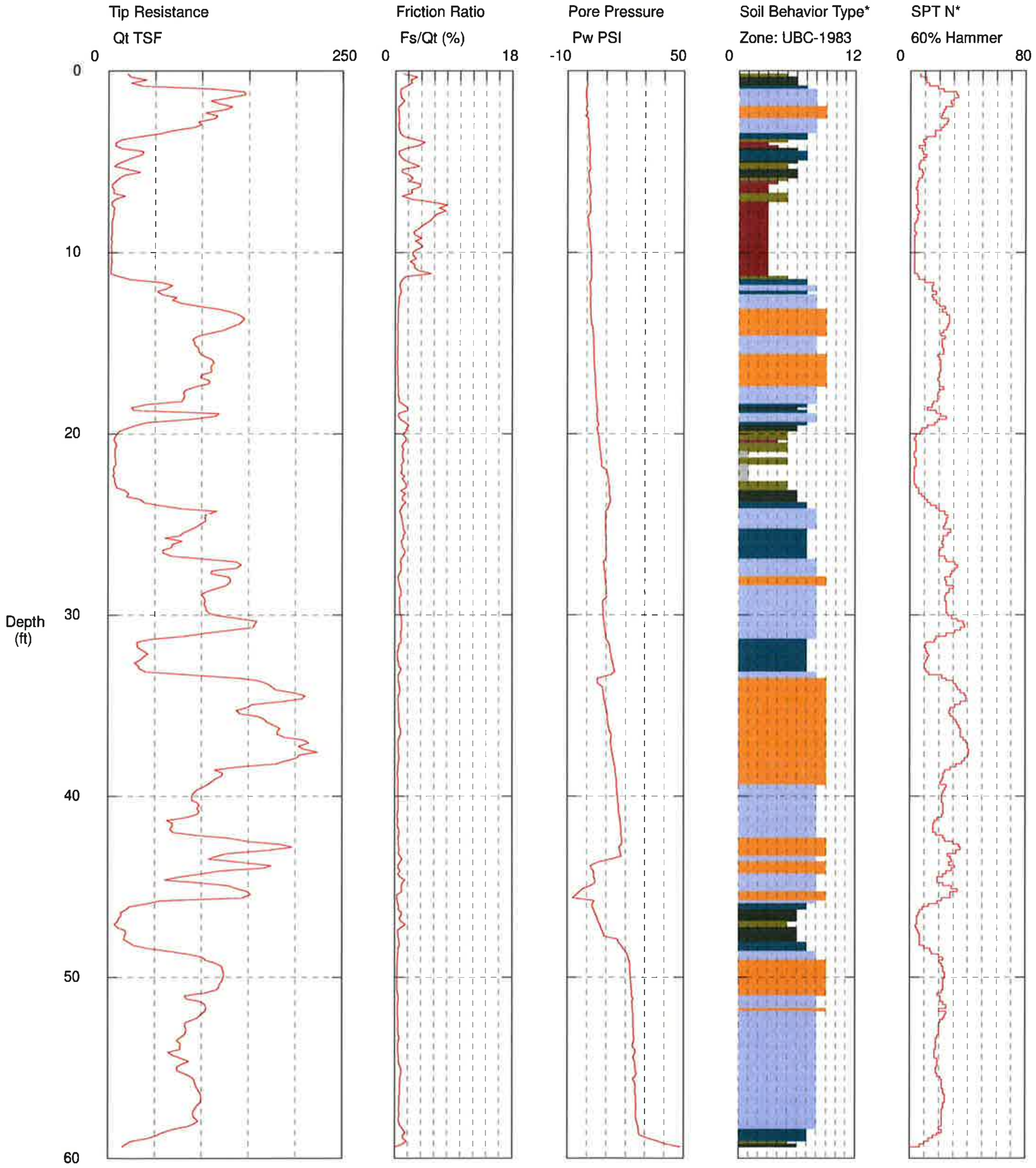
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

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

Terra Associates

Operator: Romanelli
Sounding: CPT-07
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/11/2016 9:41:54 AM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 59.38 feet

Depth Increment = 0.164 feet

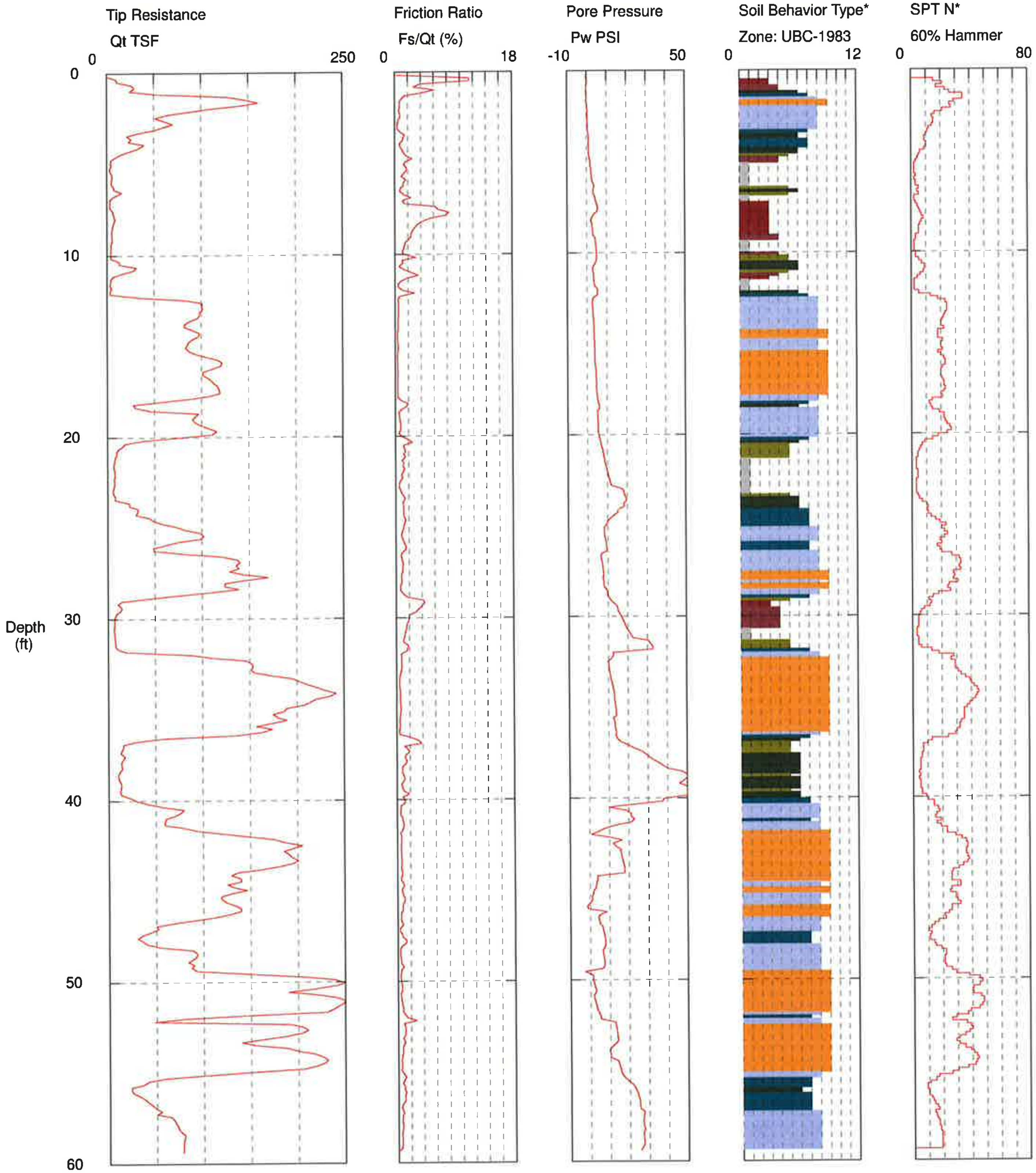
▨ 1 sensitive fine grained	▨ 4 silty clay to clay	▨ 7 silty sand to sandy silt	🟥 10 gravelly sand to sand
▨ 2 organic material	▨ 5 clayey silt to silty clay	▨ 8 sand to silty sand	🟦 11 very stiff fine grained (*)
▨ 3 clay	■ 6 sandy silt to clayey silt	🟧 9 sand	■ 12 sand to clayey sand (*)

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

Terra Associates

Operator: Romanelli
Sounding: CPT-08a
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/11/2016 10:49:49 AM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 59.38 feet

Depth Increment = 0.164 feet

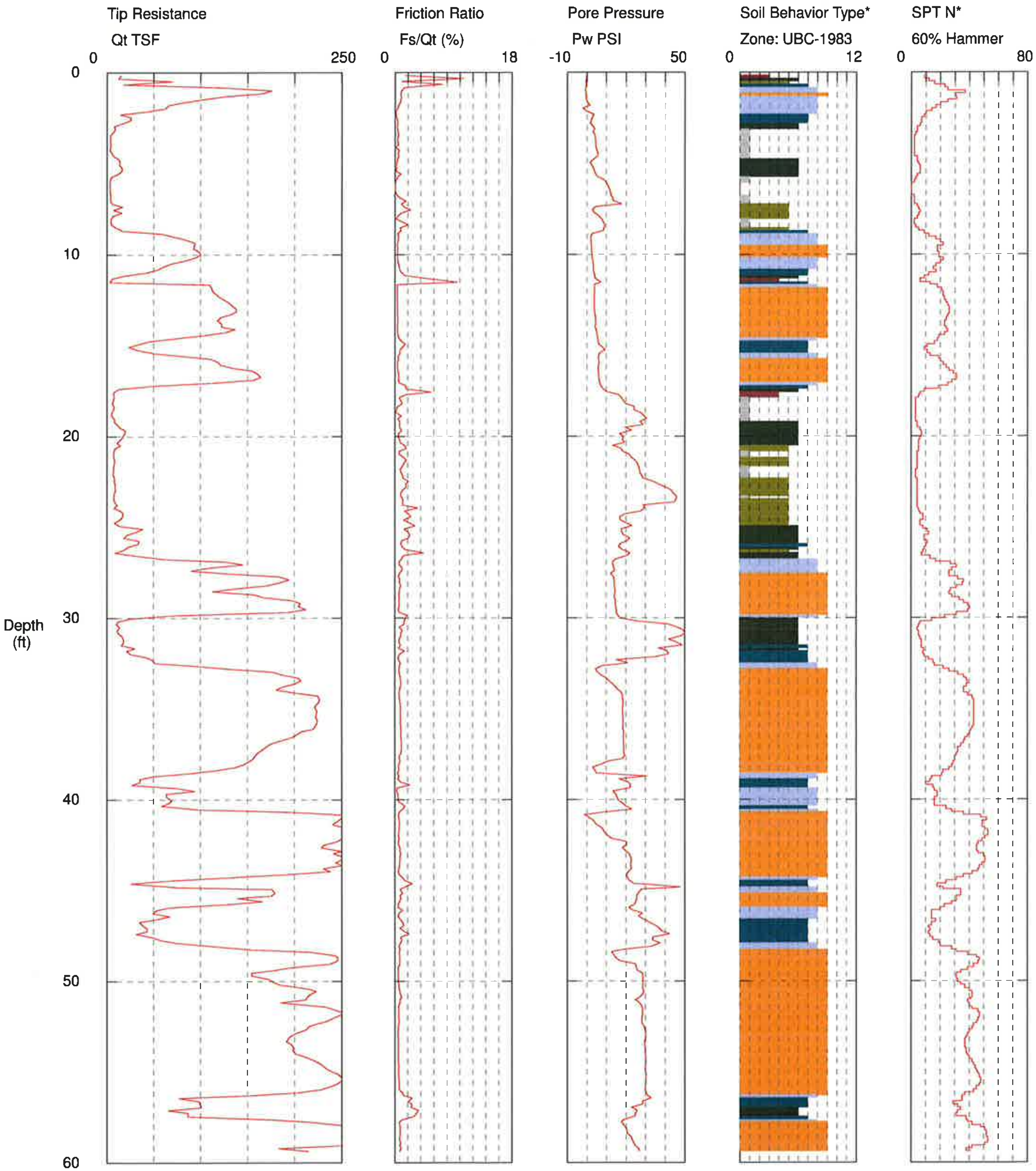
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

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

Terra Associates

Operator: Romanelli
Sounding: CPT-09a
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/11/2016 11:49:41 AM
Location: Tacoma
Job Number: T-7543



Maximum Depth = 59.38 feet

Depth Increment = 0.164 feet

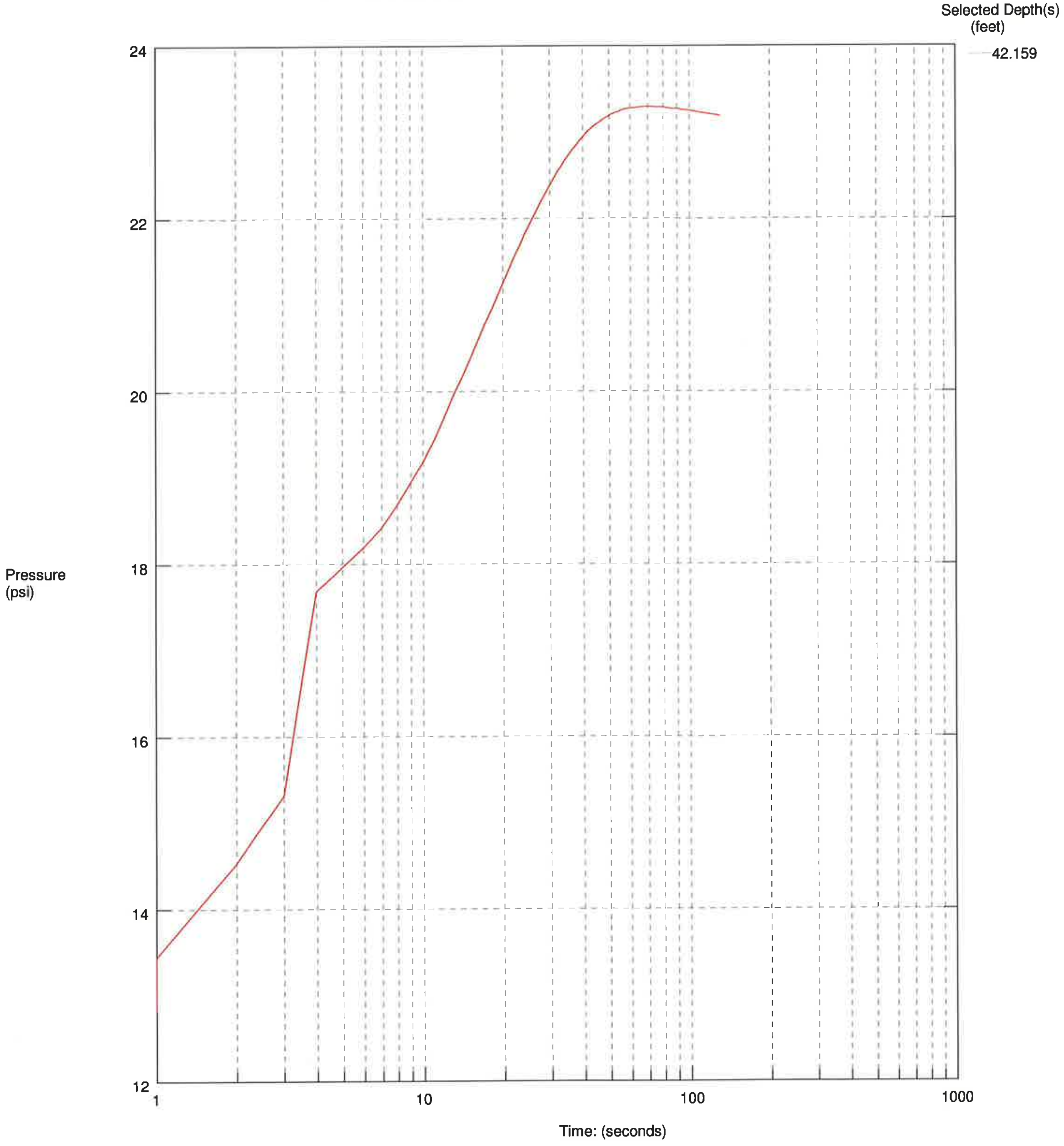
- ▨ 1 sensitive fine grained
- ▨ 2 organic material
- ▨ 3 clay
- ▨ 4 silty clay to clay
- ▨ 5 clayey silt to silty clay
- ▨ 6 sandy silt to clayey silt
- ▨ 7 silty sand to sandy silt
- ▨ 8 sand to silty sand
- ▨ 9 sand
- ▨ 10 gravelly sand to sand
- ▨ 11 very stiff fine grained (*)
- ▨ 12 sand to clayey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

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

Terra Associates

Operator Romanelli
Sounding: CPT-09a
Cone Used: DDG1263
GPS Data: NO GPS

CPT Date/Time: 11/11/2016 11:49:41 AM
Location: Tacoma
Job Number: T-7543



Maximum Pressure = 23.298 psi

APPENDIX B

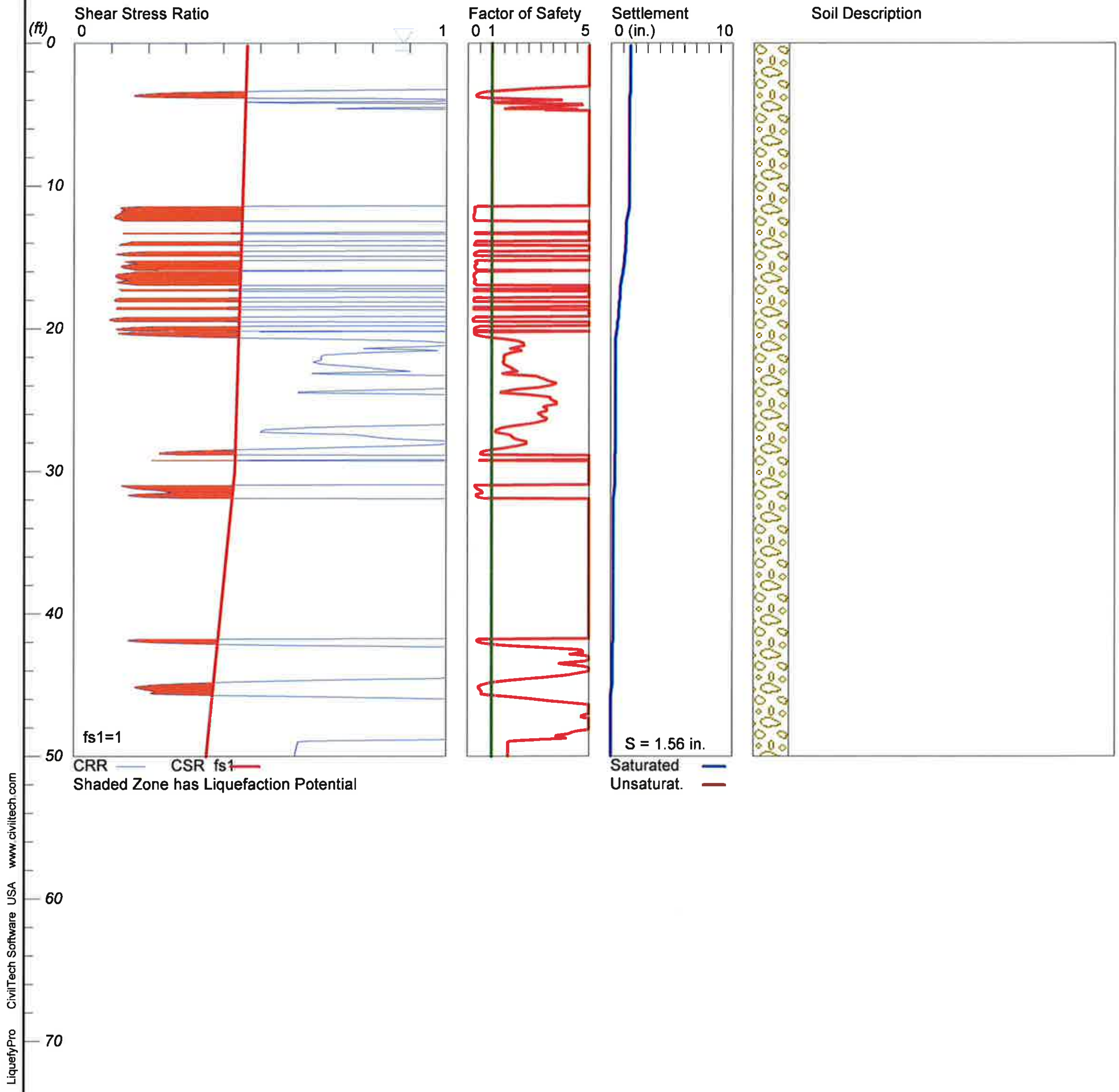
LIQUEFY PRO OUTPUT

LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-4   Water Depth=0 ft

Magnitude=7
Acceleration=.31g

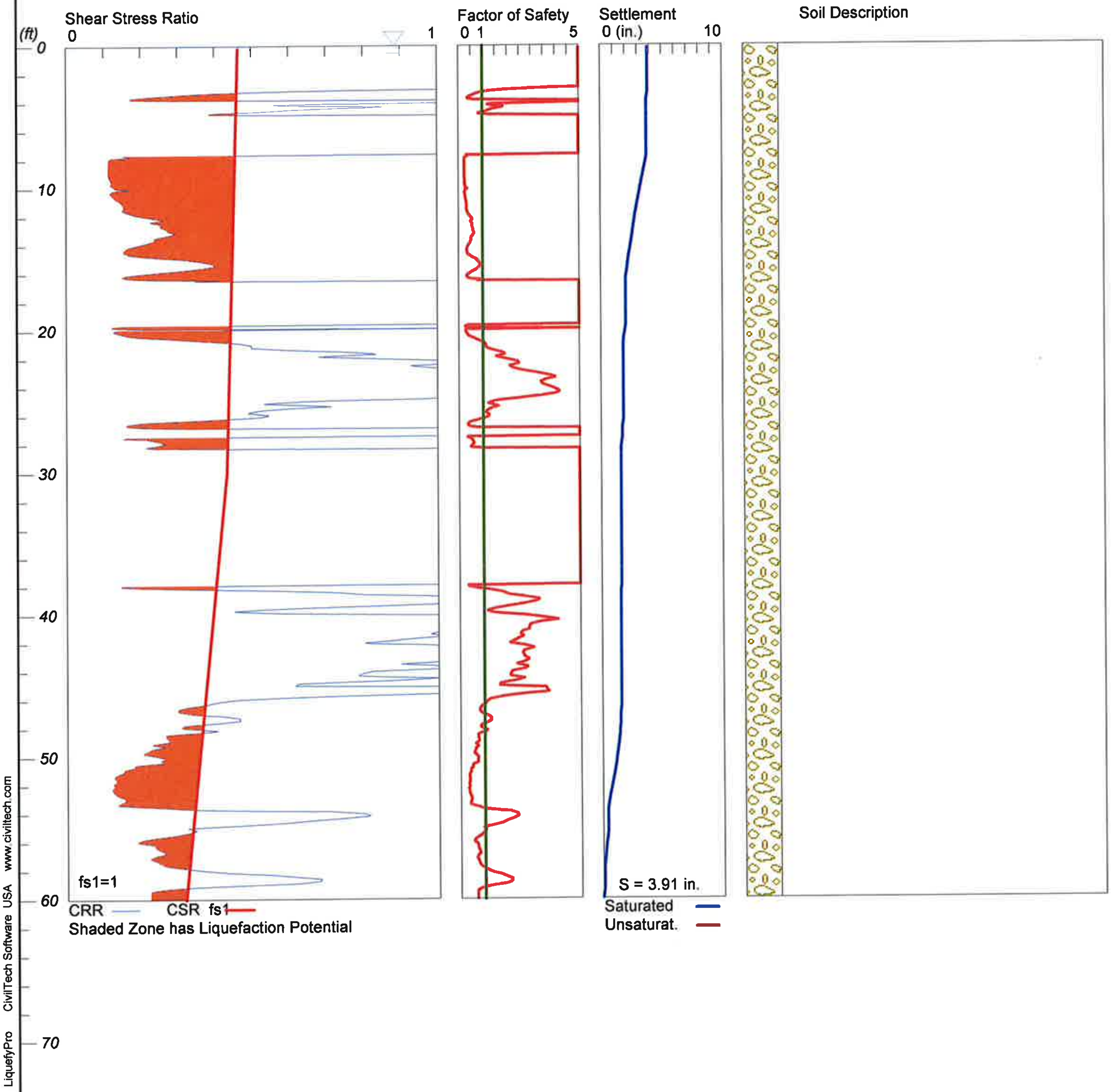


LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-3 ***Water Depth=0 ft***

Magnitude=7
Acceleration=.31g

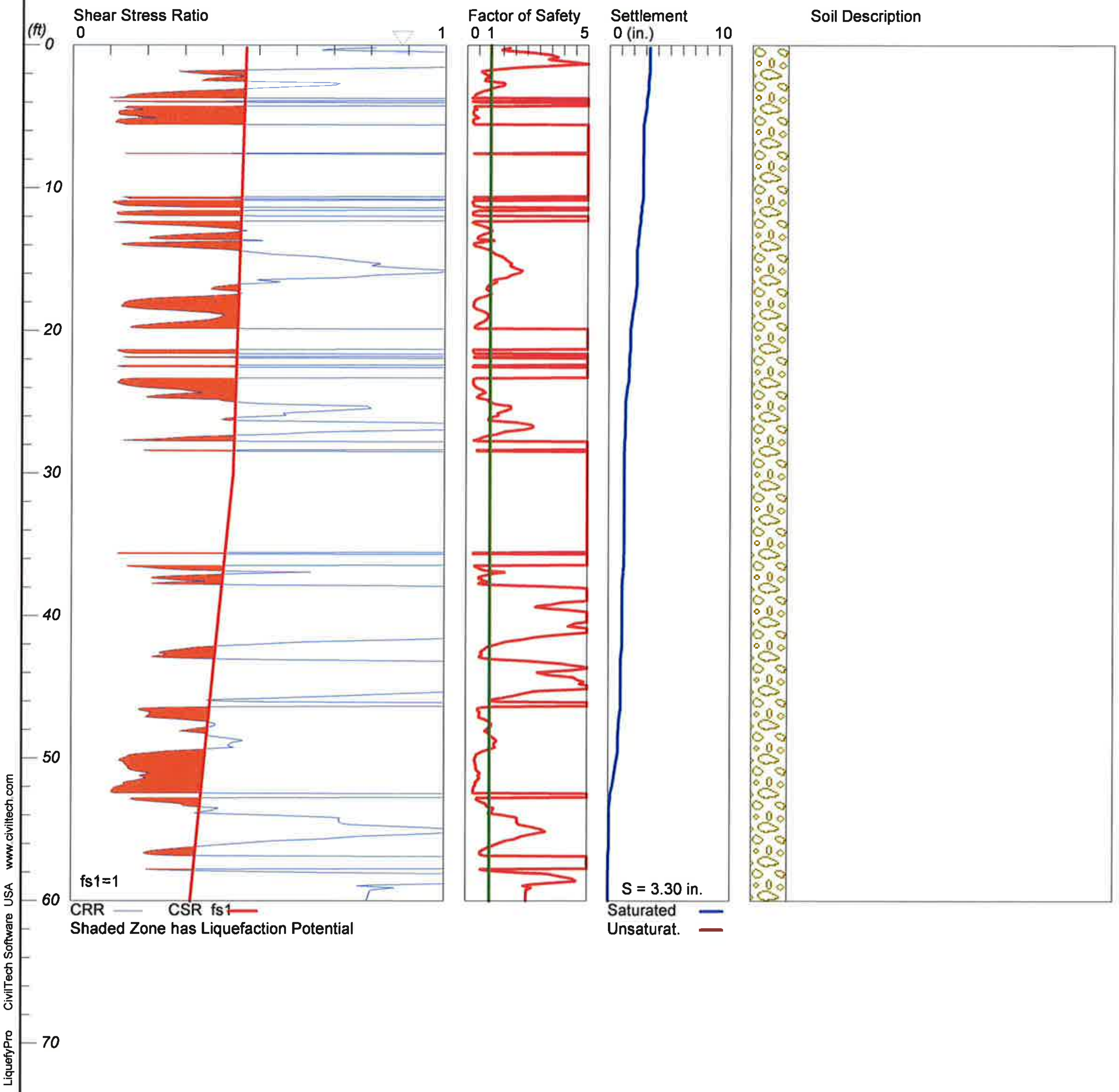


LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-2 Water Depth=0 ft

Magnitude=7
Acceleration=.31g

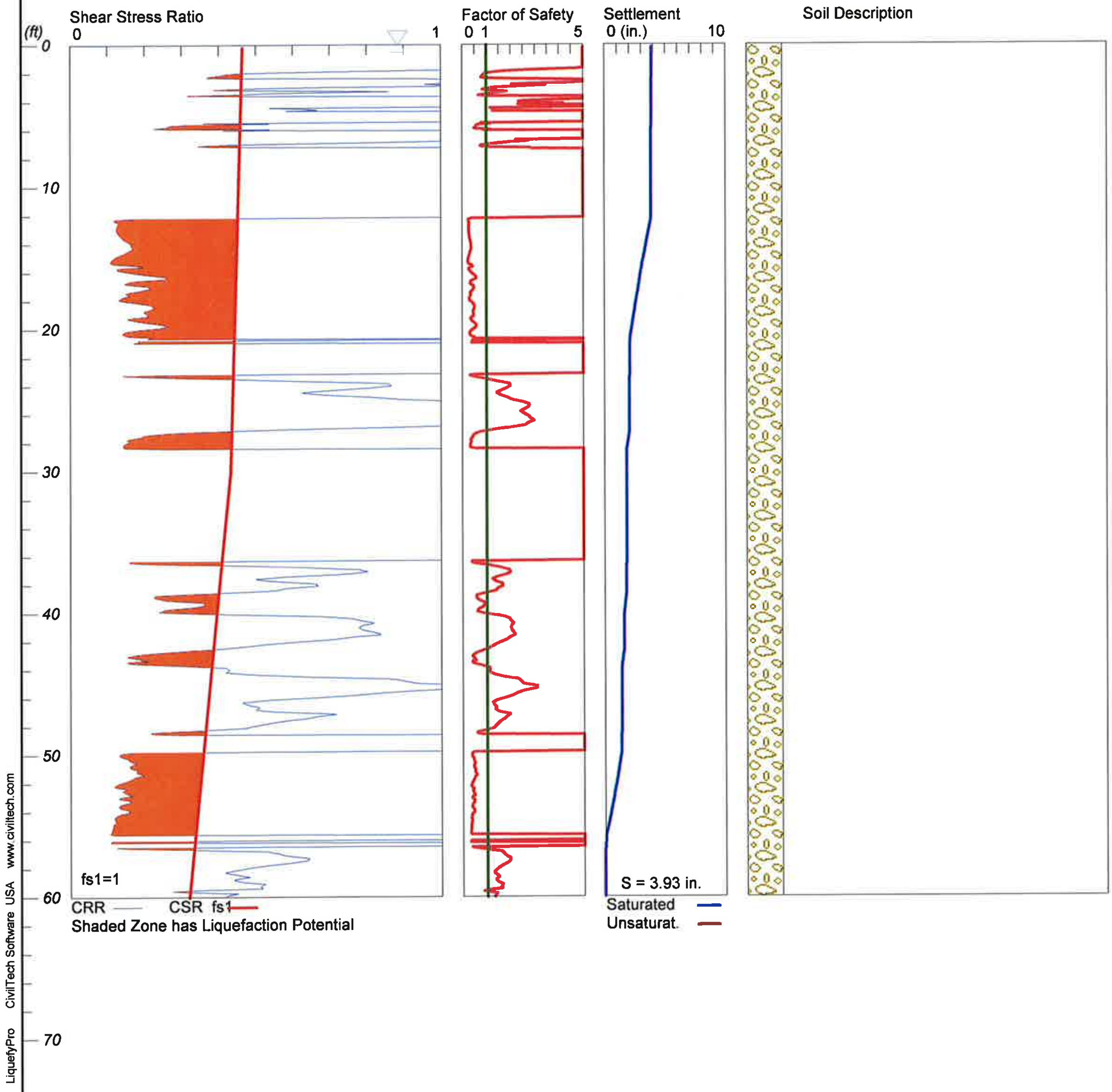


LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-1 ***Water Depth=0 ft***

Magnitude=7
Acceleration=.31g

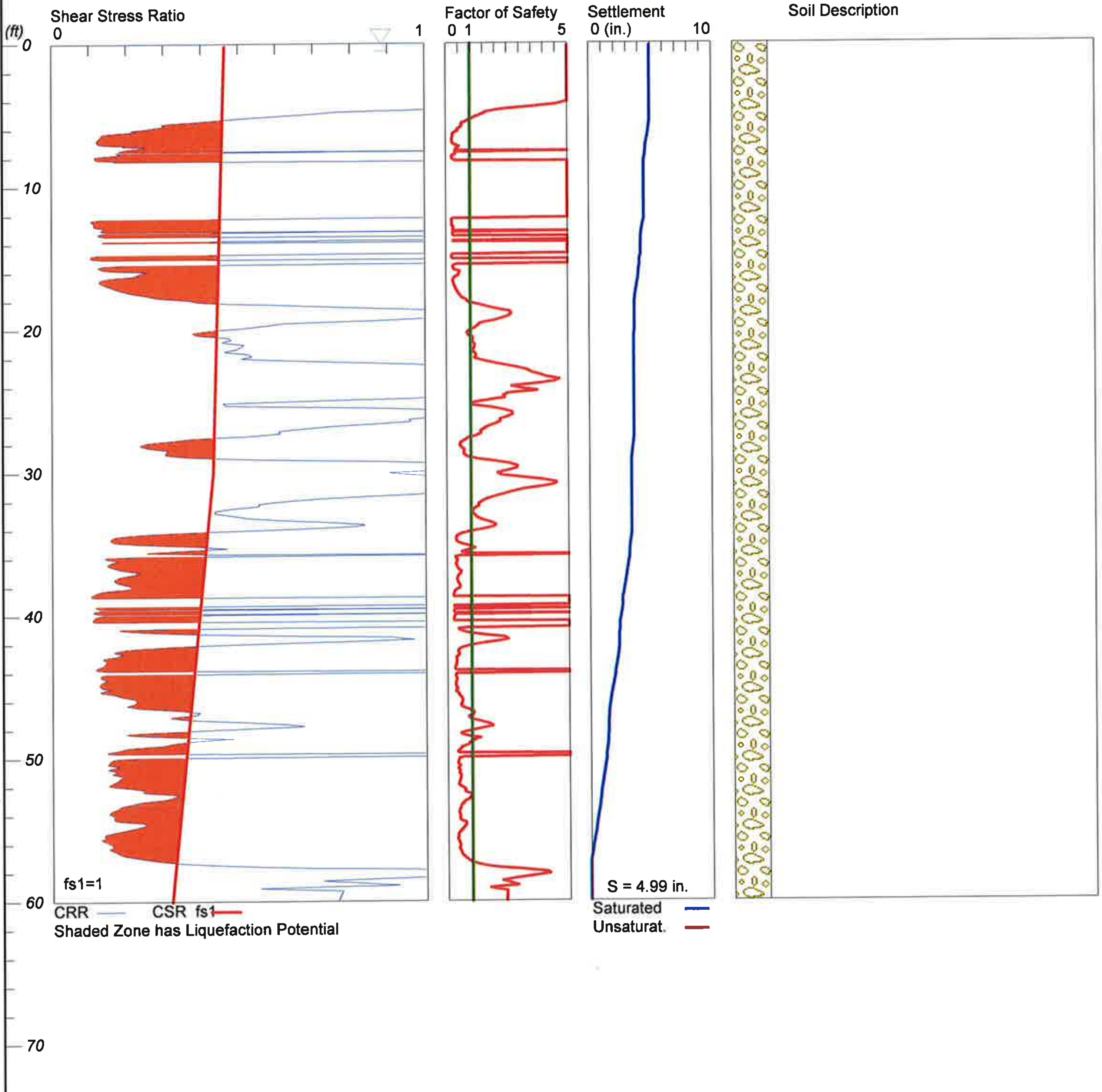


LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-6 ***Water Depth=0 ft***

Magnitude=7
Acceleration=.31g



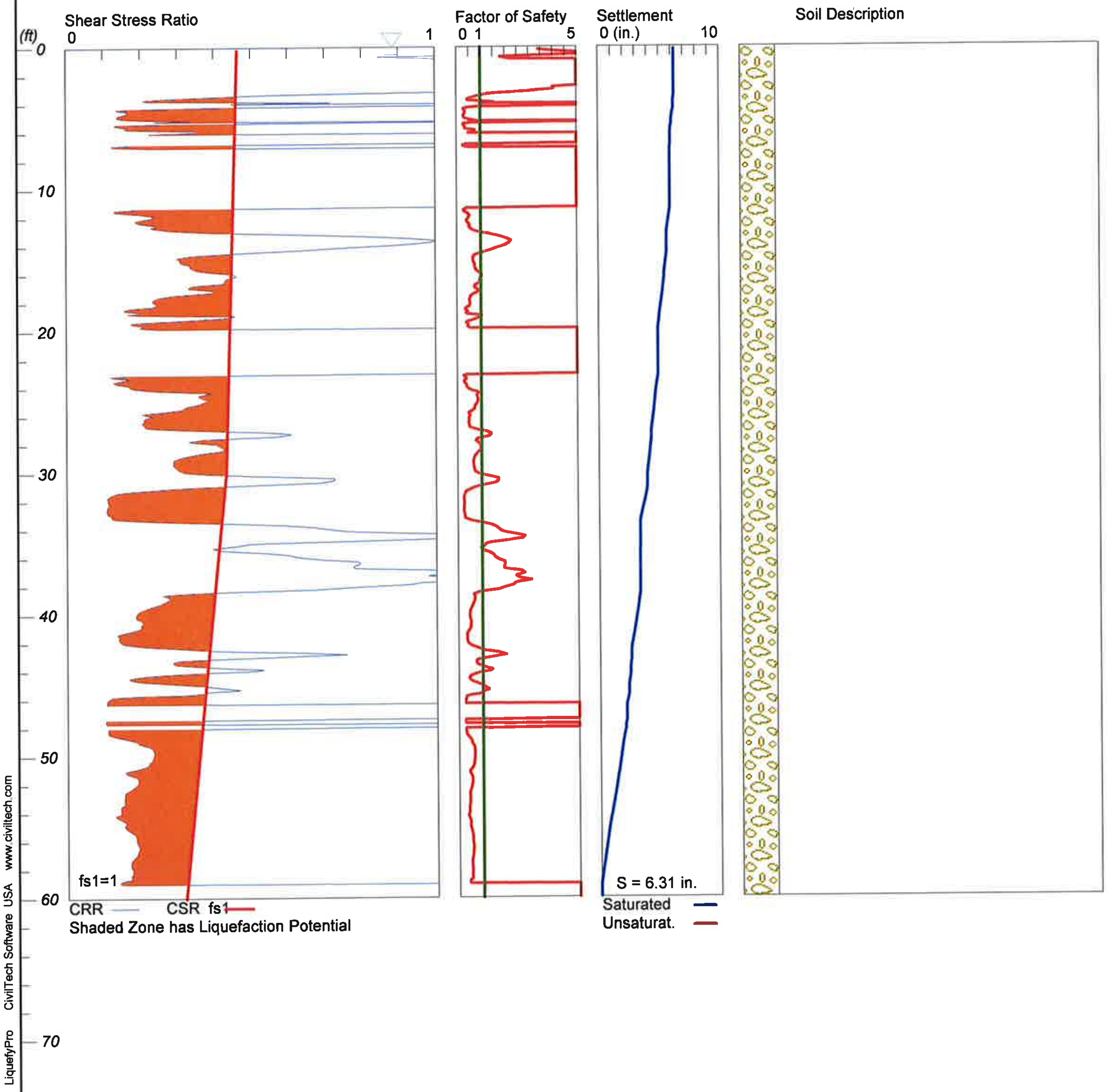
LiquefyPro CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-7 Water Depth=0 ft

Magnitude=7
Acceleration=.31g

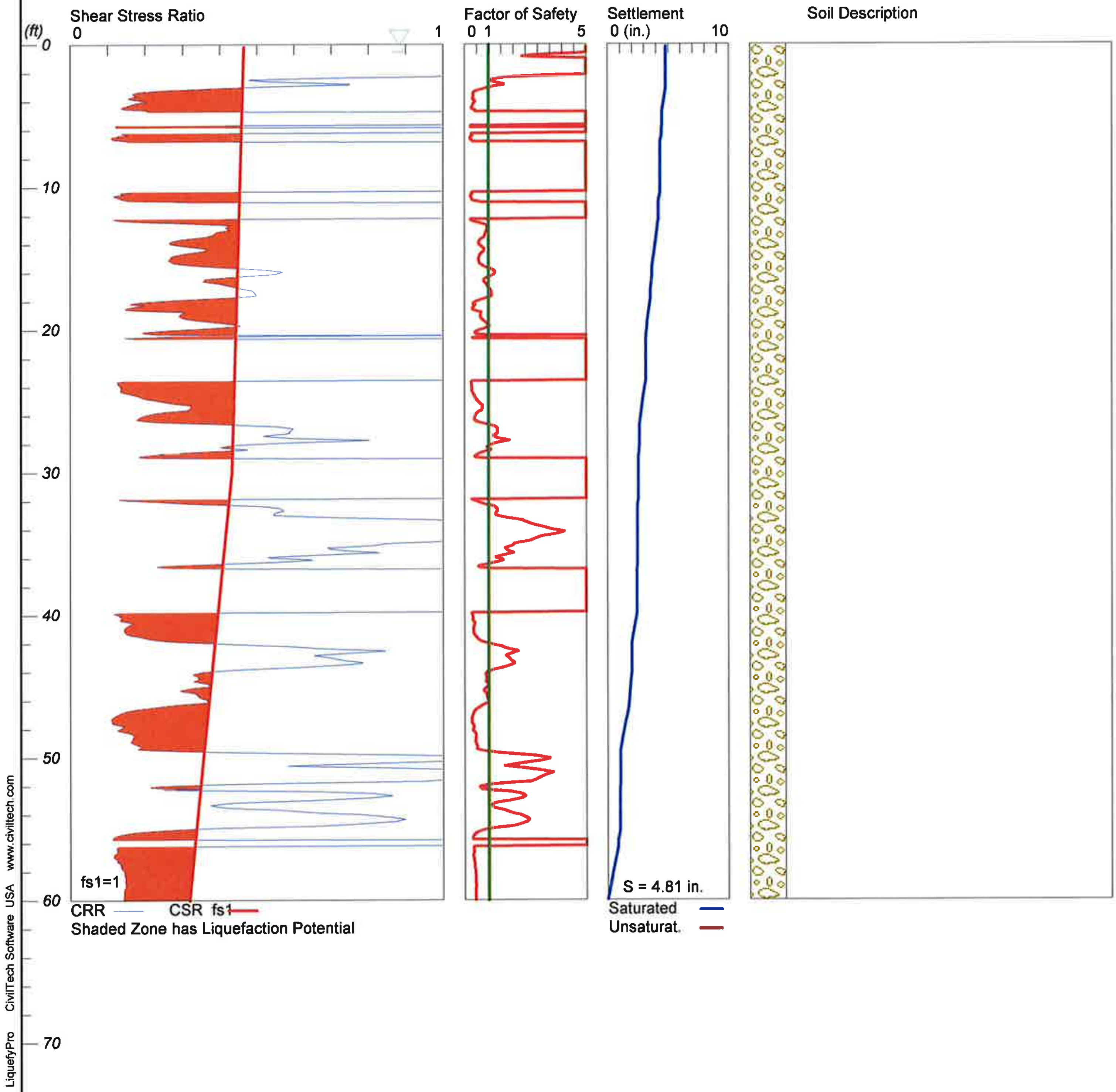


LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-8 ***Water Depth=0 ft***

Magnitude=7
Acceleration=.31g

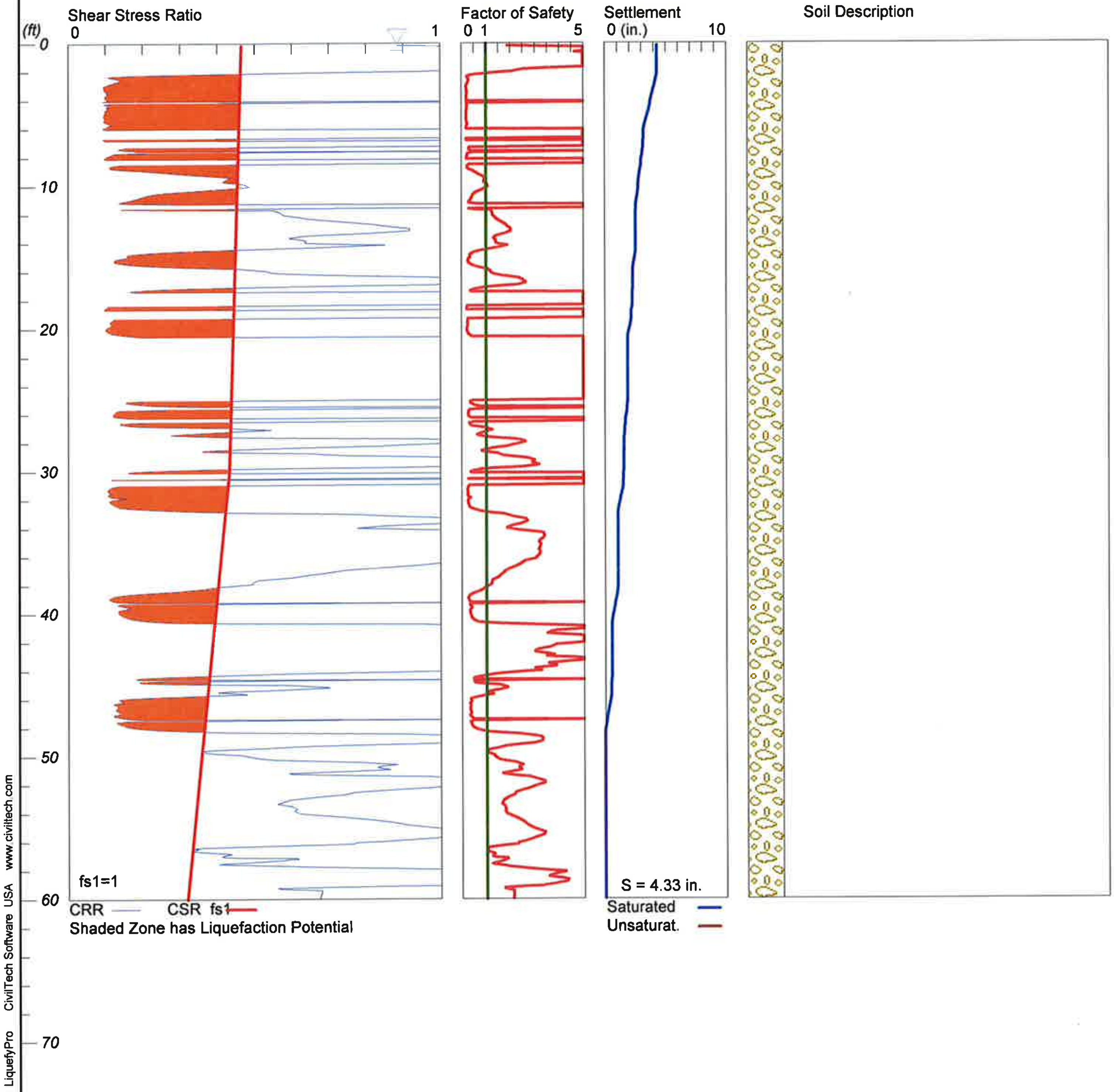


LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-9 ***Water Depth=0 ft***

Magnitude=7
Acceleration=.31g



LIQUEFACTION ANALYSIS

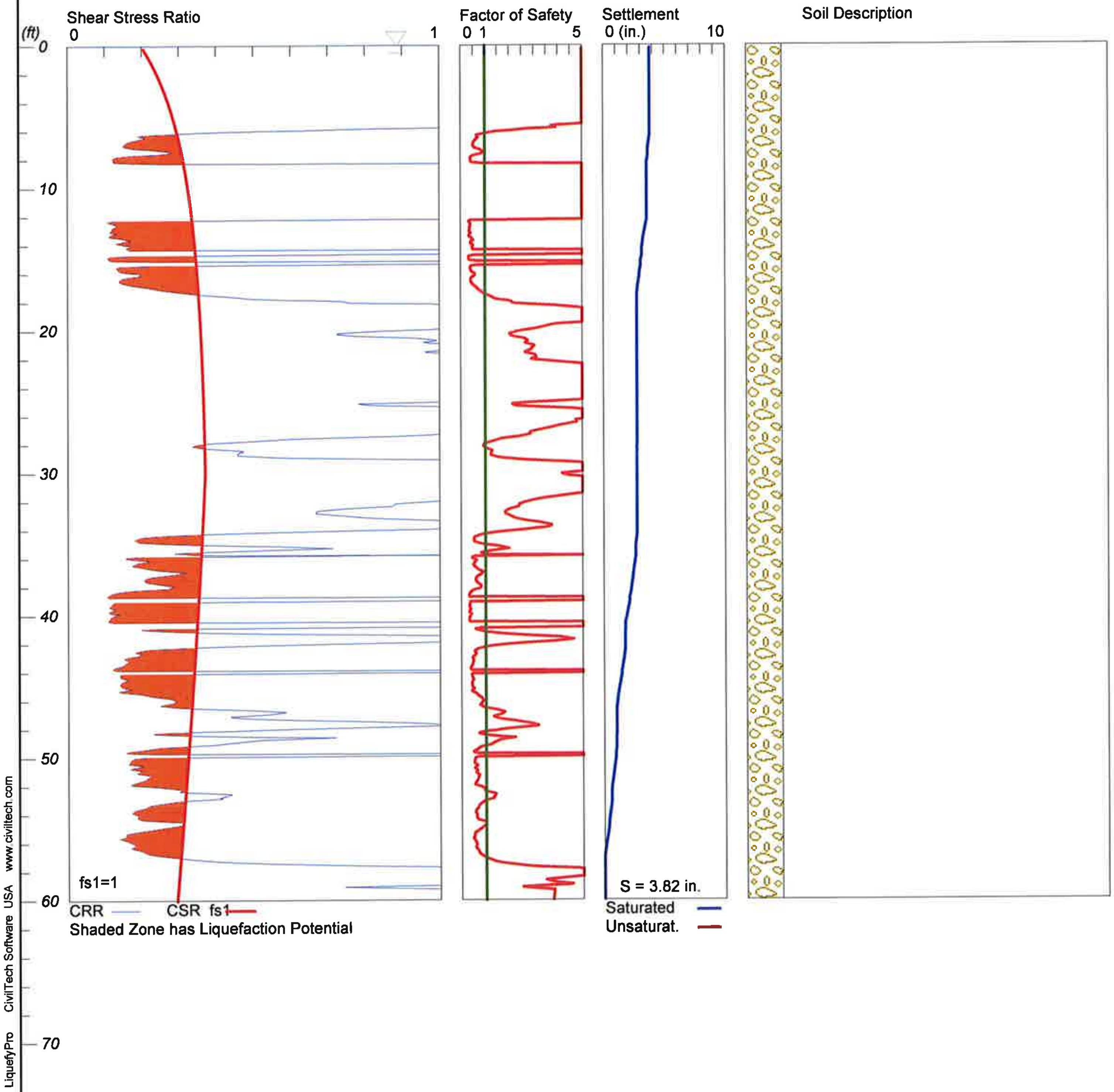
Taylor Way and Lincoln Ave

Hole No.=CPT-6 Water Depth=0 ft

Ground Improvement of Fill=4 ft

Magnitude=7

Acceleration=.31g



LIQUEFACTION ANALYSIS

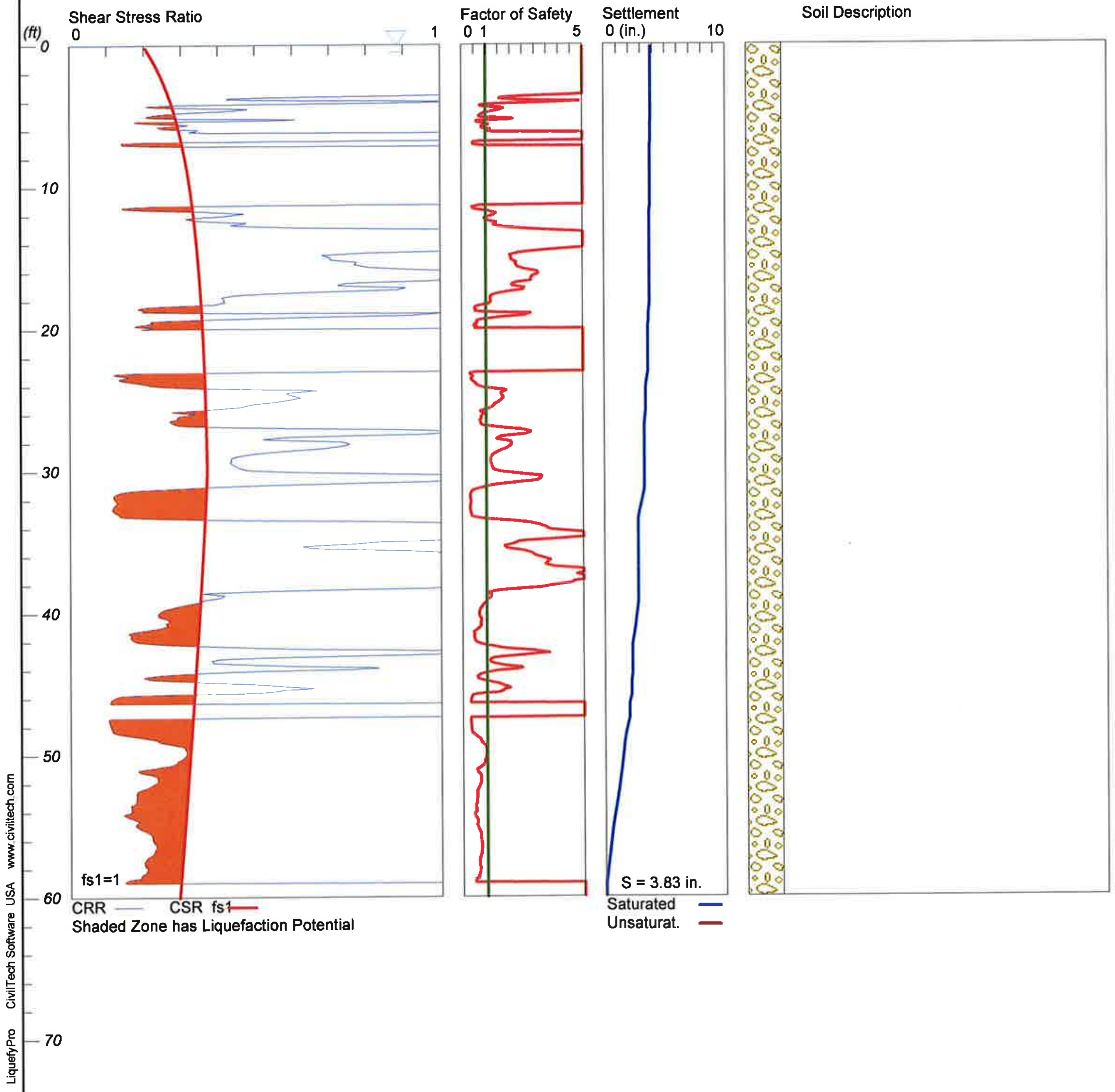
Taylor Way and Lincoln Ave

Hole No.=CPT-7 Water Depth=0 ft

Ground Improvement of Fill=4 ft

Magnitude=7

Acceleration=.31g



LIQUEFACTION ANALYSIS

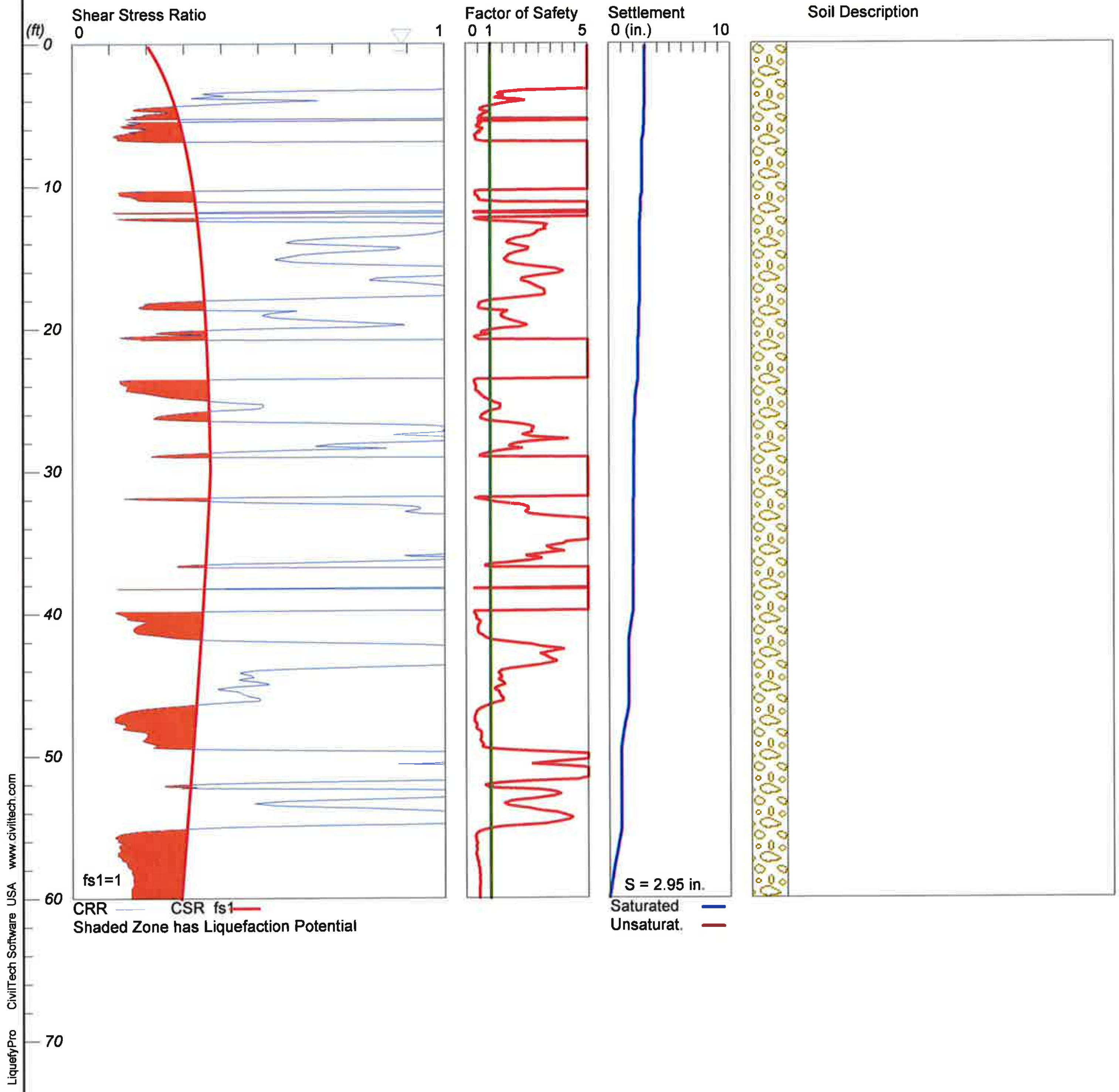
Taylor Way and Lincoln Ave

Hole No.=CPT-8   Water Depth=0 ft

Ground Improvement of Fill=4 ft

Magnitude=7

Acceleration=.31g



LIQUEFACTION ANALYSIS

Taylor Way and Lincoln Ave

Hole No.=CPT-9 Water Depth=0 ft
Ground Improvement of Fill=4 ft

Magnitude=7
Acceleration=.31g