GEOTECHNICAL REPORT

240 – 15th Street SE Industrial
240 – 15th Street SE
Puyallup, Washington

Project No. T-8661

Terra Associates, Inc.

Prepared for:

Cref3 Puyallup Owner, LLC
Los Angeles, California

January 12, 2022

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

January 12, 2022
Project No. T-8661

Mr. Michael Cohn
Cref3 Puyallup Owner, LLC
11611 San Vicente Boulevard, 10th Floor
Los Angeles, California 90049

Subject: Geotechnical Report
240 – 15th Street SE Industrial
240 – 15th Street SE
Puyallup, Washington

Dear Mr. Cohn:

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.

The native soils observed in the test borings are alluvial deposits generally consisting of loose to medium dense, wet, fine sand, silty fine sand, and silt with varying proportions of fine sand. The CPT data shows similar interbedded alluvial soils extending to a depth of about 80 feet. Groundwater levels at the site range between depths of about 2.5 and 5 feet. In our opinion, the soil and groundwater conditions observed at the site would not preclude the proposed development provided the recommendations contained herein are incorporated into design and construction.

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

Sincerely yours,
TERRA ASSOCIATES, INC.

John C. Sadler

John C. Sadler, L.E.G., L.H.G.
Senior Engineering Geologist

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Carolyn S. Decker

1-12-2022

Carolyn S. Decker, P.E.
President

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Geotechnical Report
240 – 15th Street SE Industrial
240 – 15th Street Southeast
Puyallup, Washington

1.0 PROJECT DESCRIPTION

The proposed project is an industrial development consisting of a warehouse-style building and associated paved access, parking, and utility improvements. A conceptual site plan by Mackenzie, dated September 27, 2021, shows a 131,250 square-foot building in the central portion of the site. Truck and trailer parking is shown on the northern and western sides of the building, respectively. Passenger vehicle parking is shown on the eastern side of the building. Building plans are currently not available; however, we expect the building will be constructed using precast concrete tilt-up perimeter wall panels with interior columns spaced at 30 to 50 feet. Building floors will be constructed at grade with dock high access on the northern side of the building. Structural loading is expected to be light to moderate, with isolated columns carrying loads of 50 to 100 kips, and bearing walls carrying 4 to 8 kips per foot.

The recommendations in 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 scope of work for this project included subsurface exploration, laboratory testing, office review, engineering analysis, and preparation of this report. Our subsurface exploration included ten test borings drilled to maximum depths of 6.5 feet and 31.5 feet with a limited access, track-mounted drill rig using hollow-stem auger drilling methods, one approximately 60-foot deep cone penetration test (CPTs), and one approximately 84-foot deep CPT.

Using the results of our subsurface explorations and laboratory testing, analyses were undertaken to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic hazards per the City of Puyallup Municipal Code
- Seismic Site Class
- Site preparation and grading including recommendations for building preload or surcharge to mitigate floor and foundation settlement.

- Excavations
- Foundations
- Slab-on-grade floors.
- Lateral earth pressures for wall design.
- Subsurface drainage.
- Infiltration feasibility.
- Utilities
- Pavement

3.0 SITE CONDITIONS

3.1 Surface

The site is an approximately 8.74-acre assemblage of three parcels located northwest of and adjacent to the intersection of 15th Street SE and E Pioneer Avenue in Puyallup, Washington. The site location is shown on Figure 1.

Existing site improvements include a small office building in the northeastern portion of the site, a vacant industrial building in the southeast corner of the site, and the remains of a large cold-storage warehouse in the central portion of the site that was recently destroyed by fire. Areas around the buildings are typically surfaced with asphalt or concrete pavement or crushed gravel. An open area of the site located west of the cold storage building is an undeveloped grass field. Site topography is relatively flat.

3.2 Soils

The native soils observed in the test borings are alluvial deposits generally consisting of loose to medium dense, wet, fine sand, silty fine sand, and silt with varying proportions of fine sand and traces of fine organic particles. Fine-grained sand deposits encountered between depths of 20 and 21.5 feet in Borings B-1, B-2, B-6, and B-10 contained numerous fine pumice grains.

The upper approximately 3 to 4 feet of soil encountered in Borings B-7 through B-10 consists of loose to medium dense, silty fine sand that is interpreted to be fill. The fill materials observed in Borings B-7 and B-10 contain numerous wood shavings or fragments.

The CPT data shows interbedded alluvial soils extending the full 60-foot depth of CPT-2 and to a depth of about 80 feet in CPT-1. Soil behavior types determined from the CPT data generally consist of about 30 feet of sand to silty sand and silty sand to sandy silt with scattered clayey silt to silty clay interbeds underlain primarily by interbedded sandy silt to silty clay. A soil behavior type consistent with gravelly sand to sand was encountered below a depth of about 80 feet in CPT-1. In general, where cohesive silt and clay soils are indicated, correlated N_{60} values, indicate consistencies in the medium stiff to stiff range above a depth of about 72 feet and stiff to very stiff below that depth. Where cohesionless sand, silty sand, and silt soils are indicated, correlated N_{60} values indicate relative densities typically in the loose to medium dense range. The soil conditions determined from the CPTs are generally consistent with those observed in the test borings.

The *Geologic map of the Tacoma 1:100,000-scale quadrangle, Washington,* by J.E. Schuster (2015), shows surficial geology at the site mapped as Holocene alluvium (Qa). The soils observed in our subsurface explorations are consistent with this geologic map unit.

Detailed descriptions of the conditions observed in our subsurface explorations are given on the Boring Logs in Appendix A. The CPT data plots are also attached in Appendix A. The approximate test boring and CPT locations are shown on Figure 2.

3.3 Groundwater

Groundwater was encountered in all of the test borings with groundwater levels typically encountered below a depth of about 5 feet. Pore pressure dissipation testing performed in CPT-2 determined a hydrostatic level approximately 5 feet below ground surface as well. Borings B-3 through B-5 and Boring B-7 all encountered wet soils below depths of about 2.5 to 3 feet.

The depths to groundwater at the site will fluctuate on a seasonal basis with maximum levels occurring during the wet winter and spring months. Considering that our field work occurred during late November, we expect that the observed groundwater levels are approaching seasonal high levels.

3.4 Seismic Site Class

Soil conditions at the site, as discussed in the following section, will be subject to the soil liquefaction phenomenon. Because of this condition, per the current International Building Code (IBC), subsurface conditions would be assigned site class “F” which would require performing a site-specific seismic analysis to determine seismic forces for structural design. However, the IBC allows for using code derived seismic values for the soil conditions indicated if the building’s fundamental period is equal to or less than 0.5 seconds. We expect that the proposed industrial building will fall into this category. In this case, based on soil conditions encountered and our knowledge of the area geology, site class “D” can be used to determine seismic design forces.

3.5 Geologic Hazards

Chapter 21.06.1210(1) of the Puyallup Municipal Code (PMC) defines geologic hazard areas as "…areas susceptible to erosion, landsliding, earthquake, volcanic activity or other potentially hazardous geological processes." Site conditions do not meet the PMC criteria defining landslide hazard areas or erosion hazard areas. In our opinion, site conditions are susceptible to potential seismic and volcanic hazards as discussed below.

3.5.1 Seismic Hazards

Chapter 21.06.1210(3)(c) of the PMC defines seismic hazard areas as "…areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement or subsidence, soil liquefaction, or tsunamis. Settlement and soil liquefaction conditions occur in areas underlain by cohesionless, loose, or soft-saturated soils of low density, typically in association with a shallow ground water table."

The site conditions are not susceptible to seismically-induced slope failure and the site is not located within an area that is susceptible to tsunamis inundation. In our opinion, potential hazards associated with ground shaking would be adequately mitigated by designing with seismic forces determined by local building codes or site specific seismic analysis, if needed.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of fine-grained sands underlying 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.

We completed a liquefaction analysis using the computer program LiquefyPro published by CivilTech Corporation. The analysis was completed using a site modified peak ground acceleration (PGA_M) of 0.60g representing the peak horizontal acceleration for the maximum considered earthquake (MCE) having a 2 percent probability of exceedance in 50 years. The value was obtained for Latitude 47.18978287°N and Longitude -122.27573704°W using the Structural Engineers Association of California (SEAOC) U.S. Seismic Design Maps website (https://seismicmaps.org/) accessed on December 27, 2021. The results of the liquefaction analysis are attached in Appendix B.

The results of our analysis indicate the site is a seismic hazard area with respect to soil liquefaction. Soil liquefaction could occur during the design earthquake event resulting in total settlements ranging between about 4.5 and 7 inches with about one-half of this settlement likely being differential in nature. In our opinion, this amount of settlement has the potential to structurally impair the building. The structural engineer should review the estimated settlement to determine if additional mitigation measures are necessary. Additionally, cosmetic damage to the structure in the form of misaligned doors and windows, cracking, and floor settlement could occur. Some utility connections may also be impacted. If the owner is not willing to accept the risk of building damage requiring repair should liquefaction-induced settlements occur, foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements below the building foundations.

3.5.2 Volcanic Hazards

Chapter 21.06.1210(3)(d) of the PMC defines volcanic hazard areas as "…areas subject to pyroclastic flows, lava flows, debris avalanche, inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity. Volcanic hazard areas shall be classified as Case I or Case II lahars per the definitions in PMC 21.06.210." The site is located in a potential Case II lahar inundation zone. Therefore, per the PMC, the site is considered a volcanic hazard area.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

In our opinion, there are no geotechnical considerations that would preclude development of the site, as planned. The fine-grained native soils observed at the site will consolidate under static dead loads imposed by the structure and by product loading on structure floor slabs. To mitigate the potential for post-construction settlement due to this consolidation, we recommend preloading the building location. Preloading will involve placing the structural fill required to achieve the finish floor elevation and allowing settlements to occur under this load before building construction is initiated. We expect that these settlements would occur in about two to four weeks following full application of the building fill.

The preloading program will adequately mitigate post-construction settlement under static loading but will not eliminate the risk of damage resulting from seismically-induced soil liquefaction. If the owner is not willing to accept the risk of building damage requiring repair should liquefaction-induced settlements occur, foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements below the building foundations. The use of stone columns to improve the foundation subgrade would preclude the need for preloading.

After completing the preload, building construction can begin. The buildings can be supported on conventional spread footings bearing on a minimum of two feet of compacted structural fill. Overexcavation of native soils and replacement with structural fill will likely be required where deeper footing depths are required, such as below the perimeter foundations adjacent to the loading dock areas or where perimeter footings are deepened for seismic resistance. In our opinion, mitigation of the weak subgrade soils in paved areas will require cement amending or excavation and replacement with imported gravel base material.

The native soils encountered at the site contain a sufficient percentage of fines that will make it difficult to compact as structural fill when too wet. The ability to use soils from site excavations as structural fill will depend on the soil moisture content and the prevailing weather conditions at the time of construction. The contractor should be prepared to dry the native soils by aeration during the normally dry summer season to facilitate compaction as structural fill. Alternatively, stabilizing the moisture in the native soil with cement or lime can be considered. If grading activities will take place during the winter season, the contractor should be prepared to import clean granular material for use as structural fill and backfill.

The following sections provide detailed recommendations regarding the above issues and other geotechnical design considerations. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

In general, it will not be necessary to strip the organic surface layer where structural fill thicknesses above existing grade are a minimum of 3 feet and 2 feet in building and pavement areas, respectively. However, existing surface vegetation, such as that in the western portion of the site, should be mowed close to the ground with the cut debris removed from the site. Clearing of trees should include removal of the entire tree root ball. Where structural fill thicknesses are less than the recommended minimums, both the organic surface soil and vegetation should be stripped from below building and pavement areas. In this case surface stripping depths of four to six inches should be expected. Topsoil will not be suitable for use as structural fill, but can be used in landscaped areas.

We recommend removing existing building foundations and slabs and abandoning underground septic systems and other buried utilities from the planned development area. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil.

Prior to placing fill or constructing footings, all exposed bearing surfaces should be observed by a representative of Terra Associates, Inc. to verify that soil conditions are as expected and suitable for support of new fill or building elements. Our representative may request proofrolling the exposed subgrade for pavement and floor slab support with a loaded 10 yard dump truck. If unstable soils are observed and 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.

All building footings should obtain support on a minimum of two feet of granular structural fill. The fill should extend laterally from the edge of footing a minimum distance of one-foot. Based on planned grades, for normal perimeter footings bearing at the frost depth and interior footings immediately below the slab-on-grade floor, we expect that this requirement will be met over most of the building area with the fill depth required to achieve the design floor elevations. Deeper footings such as the perimeter footings adjacent the loading docks and for shear walls may require some overexcavation and grade restoration with structural fill.

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.

If grading activities are planned during the wet winter months, and the on-site soils become too wet to achieve adequate compaction, the owner or contractor should be prepared to treat soils with lime, cement, or import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

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 examine and test all materials to be imported to the site for use as structural fill. If building subgrades constructed using native soils will be exposed during wet weather, it would be advisable to place 12 inches of this granular structural fill on the building pad to prevent deterioration of the floor subgrade.

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 same ASTM standard. In nonstructural areas the degree of compaction can be reduced to 90 percent.

4.3 Preload

We recommend preloading the building areas to limit building and floor slab settlements to tolerable levels. For this procedure, we recommend placing structural fill in the building areas to the design floor elevation, and delaying building construction until settlement under this fill load has occurred. The preload fill should extend a minimum of five feet beyond the building perimeter. A minimum of three feet of fill should be placed. If this fill depth exceeds that required to achieve design floor grade, the surplus depth would be treated as a surcharge and removed following completion of settlement as indicated by survey readings at settlement markers as discussed below.

Total settlement under the building fill is estimated in the range of one to three inches. These settlements are expected to occur in about three to four weeks following full application of the building fill.

To verify the amount of settlement and the time rate of movement, the preload program should be monitored by installing settlement markers. The settlement markers should be installed on the existing grade prior to placing any building or preload fills. Once installed, elevations of both the fill height and marker should be taken daily until the full height of the preload is in place. Once fully preloaded, readings should continue weekly until the anticipated settlements have occurred. A typical settlement marker detail is provided as 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 program if the markers are damaged or destroyed by construction equipment. As a result, 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 program, with foundations designed as recommended in Section 4.5 of this report, you should expect maximum total and differential post-construction static settlements of 0.5 inches for perimeter foundations and 1 inch for interior columns.

4.4 Excavations

All excavations at the site associated with confined spaces, such as lower building level retaining walls, must be completed in accordance with local, state, or federal requirements. Based on current Washington Industrial Safety and Health Act (WISHA) regulations, the site soils would be classified as a Type C soil.

For properly dewatered excavations in Type C soils that are greater than 4 feet and less than 20 feet in depth, the side slopes should be laid back at an inclination of 1.5:1 (Horizontal:Vertical) or flatter. If there is insufficient room to complete the excavations in this manner, or if excavations greater than 20 feet in depth are planned, using temporary shoring to support the excavations may need to be considered.

Based on our study, groundwater seepage should be anticipated within excavations extending below depths of about 2.5 to 5 feet. Excavations extending below these depths will likely encounter groundwater seepage with volumes and flow rates sufficient to require some level of dewatering. Shallow excavations that do not extend more than 2 feet below the groundwater table can likely be dewatered by conventional sump-pumping procedures along with a system of collection trenches. Deeper excavations will likely 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 will be an especially critical consideration for any deep excavations such as stormwater detention vaults, lift stations, and sanitary sewer tie-ins.

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.

4.5 Foundations

In our opinion, following the completion of a successful preload program, the building may be supported on conventional spread footing foundations bearing on a minimum of 2 feet of structural fill placed and compacted as recommended in Section 4.2 of this report. Foundations exposed to the weather should bear at a minimum depth of 1.5 feet below adjacent grades for frost protection.

We recommend designing foundations for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. With the expected building loads and this bearing stress applied, in general, total and differential settlements should not exceed 0.5 inches for perimeter foundations and 1 inch for interior column supports.

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 pounds per cubic foot (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 constructed neat against competent native soil or backfilled with structural fill, as described in Section 4.2 of this report. The values recommended include a safety factor of 1.5.

4.6 Lateral Earth Pressures for Retaining Walls

The magnitude of earth pressure development on below-grade walls, such as basement or retaining 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 4.2 of this report. To guard against hydrostatic pressure development, drainage must be installed behind the wall. A typical wall drainage detail is shown on Figure 4.

With wall backfill placed and compacted as recommended and drainage properly installed, unrestrained walls can be designed for an active earth pressure equivalent to a fluid weighing 35 pcf. For restrained walls, an additional uniform lateral pressure of 100 psf should be included. For evaluating the walls under seismic loading, a uniform earth pressure equivalent to 8H psf, where H is the height of the retained earth in feet, can be used. These values assume a horizontal backfill condition and that no other surcharge loading, such as traffic, 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 the wall foundation and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 4.5.

4.7 Slab-on-Grade Floors

Slab-on-grade floors may be supported on subgrades prepared as recommended in Section 4.2 of this report. Immediately below the floor slabs, we recommend placing a 4-inch thick capillary break layer of clean, free-draining, coarse sand or fine gravel that has less than 5 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 in 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 American Concrete Institute (ACI) Manual of Concrete Practice for further information regarding vapor barrier installation below slab-on-grade floors.

For design of the floor slabs on grade, a subgrade modulus (k_s) of 100 pounds per cubic inch (pci) can be used.

4.8 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the building at all times. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building area. We recommend providing positive gradient away from the building perimeter.

Subsurface

We expect that building floor elevations will be above existing surface grades and that permanent hard surfaces will extend to the building over most of its perimeter. With these conditions, it is our opinion that building foundation drains would not be required; however, footing drains associated with retaining wall drainage, such as loading dock walls, and where landscaping is adjacent the building.

4.9 Infiltration Feasibility

Based on the shallow seasonal water table and the fine-grained nature of the soils observed across the site, it is our opinion that infiltration is not a feasible option for stormwater management.

4.10 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Associates (APWA) or local jurisdictional specifications. As a minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. At the time of our study, soil moisture contents were generally above optimum; therefore, drying back or other means to condition the material will probably be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling.

For any structure installed below a depth of about 2.5 feet, buoyancy effects must be considered. Buoyancy or uplift will be resisted by the weight of the structure and the weight of the soil overlying its foundation or cover. For backfill placed as structural fill, a soil unit weight of 110 pcf can be used.

Buoyancy, or an unbalanced hydrostatic head, will also impact the trench bottom stability. Where an unbalanced hydrostatic head exists in the trench excavation, the trench bottom can heave and, subsequently, become unstable causing installed utility pipes to settle when overburdened stresses from utility trench backfill are replaced.

Two methods for stabilizing the trench bottoms can be considered. The first involves using well point dewatering systems to lower the groundwater table adjacent to utility excavation and prevent development of an unbalanced hydrostatic head. Single-stage well point dewatering systems are typically effective for utility excavations occurring to depths of 15 to 20 feet. The second method that can be used to mitigate heave or unstable soil conditions at the trench bottom involves overexcavation of the affected soils and replacement with additional free-draining bedding material. As a general rule, the depth of overexcavation below the pipe invert and replacement with free-draining bedding material would be equivalent to 1 foot for every 2 feet of unbalanced hydrostatic head.

4.11 Pavements

Pavements should be constructed on subgrades prepared as recommended in Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. Proofrolling the subgrade with heavy construction equipment should be completed 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 300,000 would be representative of the expected loading. These ESALs represent loading approximately equivalent to 3 and 18, loaded (80,000-pound GVW) tractor-trailer rigs traversing the pavement daily in each area, respectively.

With a stable subgrade prepared as recommended, for the design ESAL values, we recommend the following pavement sections:

Light Traffic/Car Access:

- 2 inches of hot mix asphalt (HMA) over 6 inches of crushed rock surfacing (CRS)
- 4 inches full depth HMA

Heavy Traffic/Truck Access:

- 3 inches of HMA over 8 inches of CRS
- 6 inches full depth HMA

For exterior Portland cement concrete (PCC) pavement, we recommend the following:

- 6 inches of PCC over 2 inches of CRS
    - 28-day compressive strength – 4,000 psi
    - Control joints spaced at a maximum of 15 feet

Soil cement stabilization or constructing a soil cement base for support of the pavement section can also be considered as an alternate to the above conventional pavement sections. Assuming a properly constructed soil cement base having a minimum thickness of 12 inches and a minimum 7-day compressive strength of 100 pounds per square inch (psi), the following pavement sections are recommended:

Light Traffic/Car Access:

- 2 inches of HMA over 12 inches of soil cement base (SCB)

Heavy Traffic/Truck Access:

- 3 inches of HMA over 12 inches of SCB
- 6 inches of PCC over 12 inches of SCB

The design of the soil cement base should be completed using samples of the subgrade exposed at the time of construction.

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for ½-inch class HMA and CRS.

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 pavement 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.

5.0 ADDITIONAL SERVICES

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

6.0 LIMITATIONS

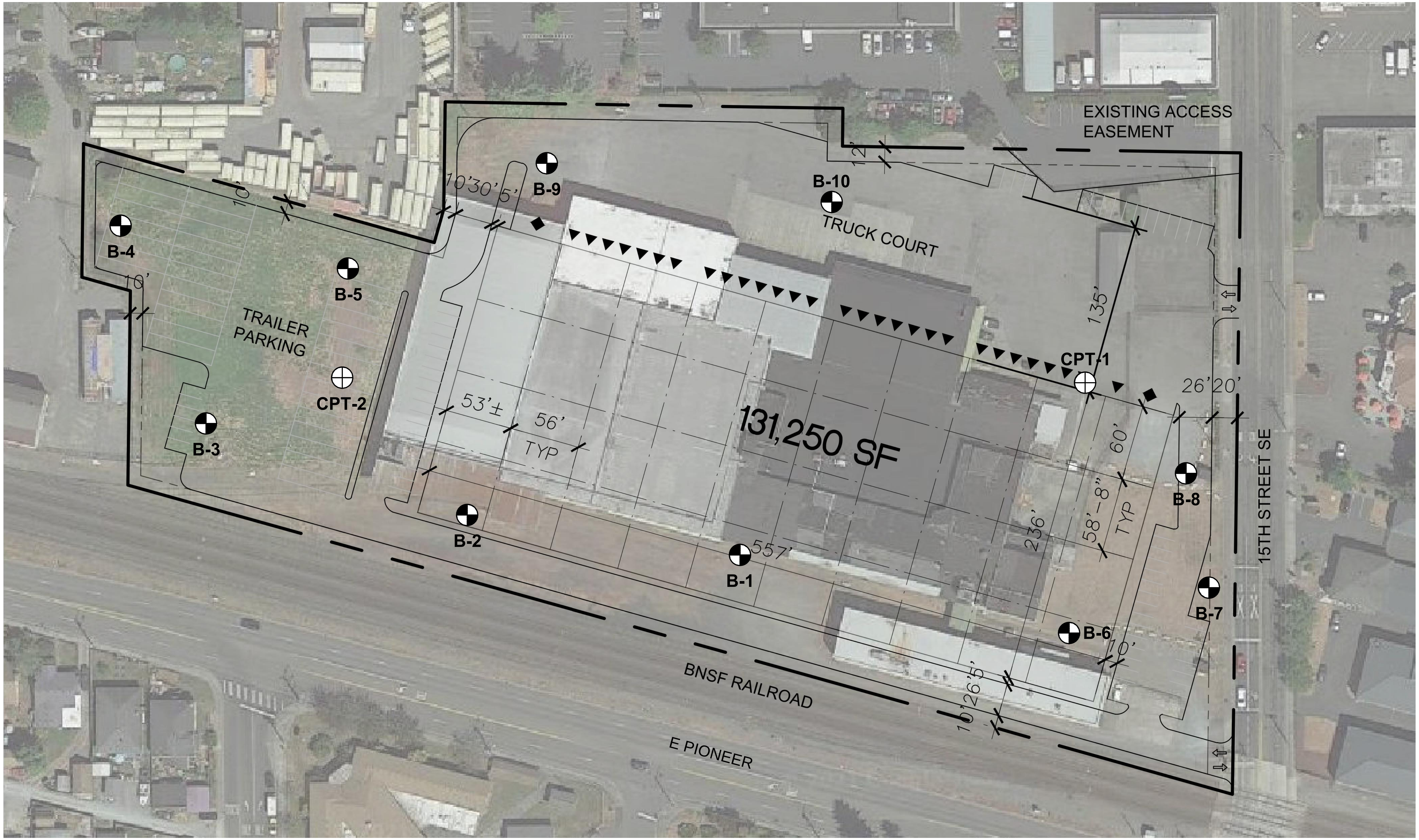
We prepared this report in accordance with generally accepted geotechnical engineering practices. This report is the property of Terra Associates, Inc. and is intended for specific application to the 240 – 15th Street SE Industrial project in Puyallup, Washington. This report is for the exclusive use of Cref3 Puyallup Owner, LLC, and its authorized representatives.

The analyses and recommendations presented in this report are based upon data obtained from the subsurface explorations completed onsite. 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: WSDOT GEOPORTAL

NOT TO SCALE

Terra Associates, Inc. Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences	VICINITY MAP 240 - 15TH STREET SE INDUSTRIAL PUYALLUP, WASHINGTON	
Proj. No.T-8661	Date JAN 2022	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:

MACKENZIE

LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE CPT LOCATION

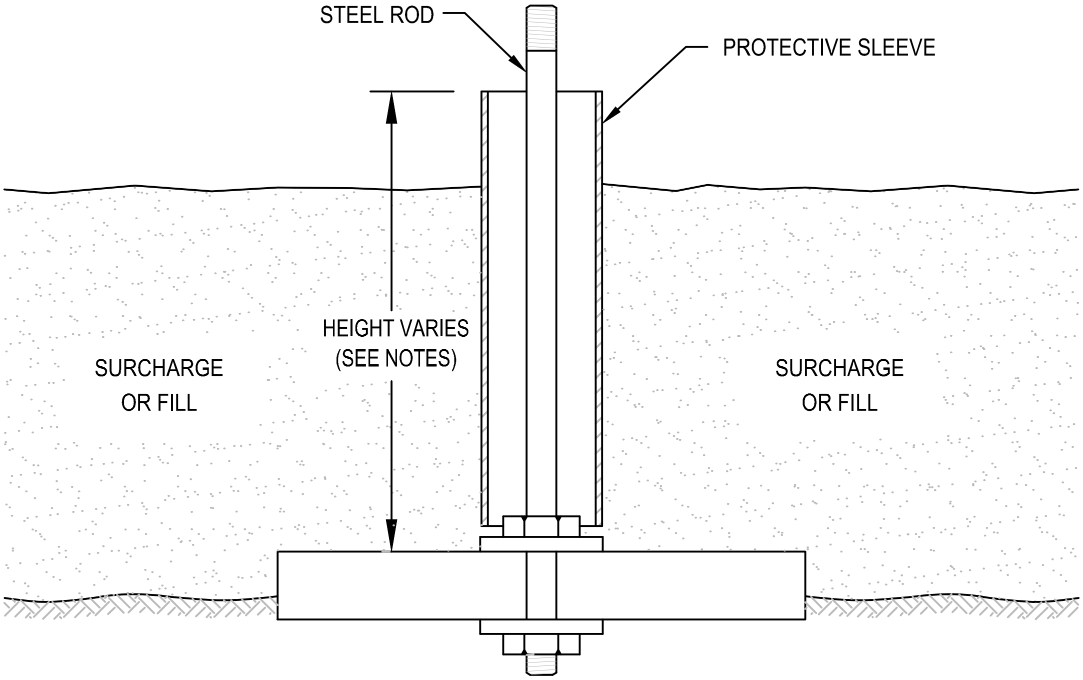
0 80 160

APPROXIMATE SCALE IN FEET

Terra Associates, Inc.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

EXPLORATION LOCATION PLAN
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661	Date JAN 2022	Figure 2



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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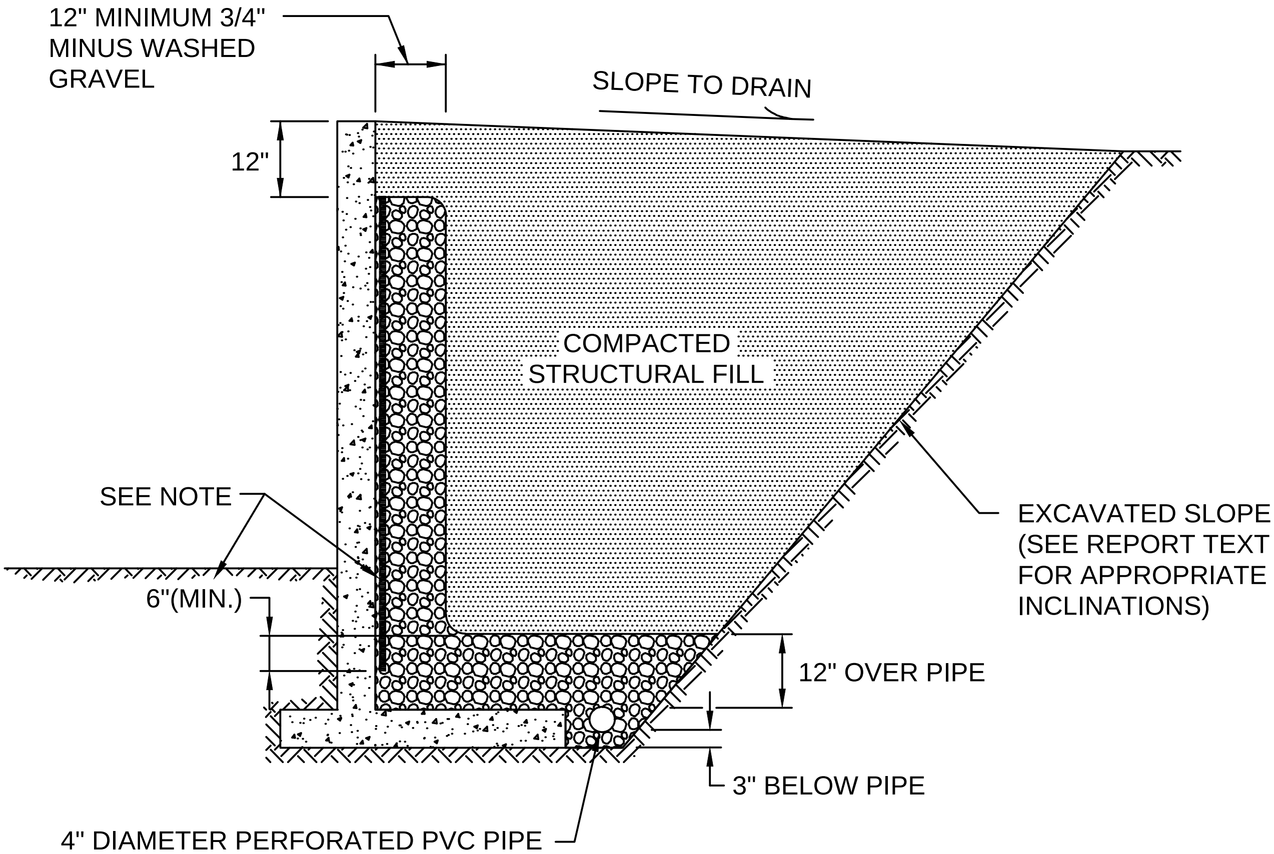
TYPICAL SETTLEMENT MARKER DETAIL
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661	Date JAN 2022	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.

Terra Associates, Inc. Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences	TYPICAL WALL DRAINAGE DETAIL 240 - 15TH STREET SE INDUSTRIAL PUYALLUP, WASHINGTON		
	Proj. No.T-8661	Date JAN 2022	Figure 4

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

240 – 15th Street SE Industrial
Puyallup, Washington

We explored subsurface conditions at the site by drilling six 31.5-foot deep test borings and four 6.5-foot deep test borings with a track-mounted drill rig using hollow-stem auger drilling methods, and by conducting two cone penetration tests (CPTs) to maximum depths of about 60 feet and about 84 feet. The test boring and CPT locations were approximately determined in the field by pacing and sighting from existing site features. The test boring and CPT locations are shown on Figure 2. The Boring Logs are presented as Figures A-2 through A-11.

An engineering geologist from our office conducted the field exploration. Our representative classified the soil conditions encountered, maintained a log of each boring, obtained representative soil samples, and recorded groundwater levels observed during drilling. Soil samples were obtained during drilling 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. 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 borings were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Boring Logs. Grain size analyses were performed on eight soil samples. The results are shown on Figures A-12 through A-14.

In Situ Engineering, under subcontract to Terra Associates, Inc., performed the CPTs at locations selected by Terra Associates, Inc. The CPT consists of pushing an instrumented, approximately 1 1/2-inch diameter cone 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 the generated groundwater or pore water pressure. 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

Symbol	Definition
I	2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
‖	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

Terra Associates, Inc.
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Geology and
Environmental Earth Sciences

UNIFIED SOIL CLASSIFICATION SYSTEM
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661	Date JAN 2022	Figure A-1

LOG OF BORING NO. 1

Figure No. A-2

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot	Moisture Content (%)
0–12	Dark brown to gray-brown SAND, fine grained, moist. (SP) - Becomes fine to medium grained and wet below 5 feet. - Trace of brown silt seams and gray silt pockets below 8.5 feet.	Medium Dense	12 10 12 12	23.9 24.3 23.7 23.9
12–15.5	Dark gray-brown silty SAND, fine grained, wet, trace of dark brown fine organic particles and wood fragments. (SM)	Medium Dense	22 12	35.4
15.5–18	Dark gray-brown sandy SILT, fine sand, wet. (ML)	Medium Dense		30.1
18–23	Dark gray-brown SAND, fine grained, wet, scattered layers containing numerous fine pumice fragments, trace of silt seams. (SP)	Medium Dense	12	24.7
23–25.5	Dark gray-brown silty SAND to sandy SILT, fine sand, wet. (SM/ML)	Medium Dense	14	26.5
25.5–28	Dark gray-brown SAND, fine to medium grained, wet. (SP)	Medium Dense		
28–31.5	Dark gray-brown SAND with silt to silty SAND, fine sand, wet, scattered brown silt seams, trace of wood fragments and gray-brown silt pockets. (SP-SM/SM)	Loose	6	64.8
31.5–35	Boring terminated at 31.5 feet. Groundwater encountered below 5 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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LOG OF BORING NO. 2

Figure No. A-3

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density
0	Dark brown to dark gray-brown SAND, fine grained, moist, scattered silty fine sand seams and layers. (SP)	Loose
5	- Becomes wet below 5 feet.	Medium Dense
	- Numerous silty fine sand seams and trace of dark brown organic partings and seams below 8 feet.	
10		
15	Dark gray-brown silty SAND, fine grained, wet. (SM)	
	Interbedded dark gray-brown silty fine SAND to fine sandy SILT and fine to medium grained SAND, wet, trace of fine dark brown organic fragments. (SM/ML and SP)	
20	Dark gray-brown SAND, fine grained, wet, numerous fine pumice fragments. (SP)	
	Dark gray SILT, wet, trace of fine black organic fragments. (ML)	
25	Dark gray-brown silty SAND, fine grained, wet. (SM)	
	Dark gray-brown SAND, fine grained, wet. (SP)	Loose
30	Dark gray-brown SILT, wet. (ML)	
	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet.	
35		
40		

Sample Depth (ft, approx.)	SPT (N) Blows/foot	Moisture Content (%)
2.5	9	27.2
5	10	26.4
7.5	12	31.6
10	13	25.7
12.5	27	29.1
15	15	33.9
20	12	27.4
25	13	39.4 25.7
30	6	31.0

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. 3

Figure No. A-4

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 3 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
2.5	I	Dark gray-brown SAND with silt, fine grained, moist (wet below 3 feet), trace of gray silty fine sand layers, mottled above 3 feet. (SP-SM)	Medium Dense	11	25.2
5	I	- Scattered iron-oxide stained pockets below 5 feet.	Loose	9	28.8
		Dark gray SILT, wet. (ML)			
		Boring terminated at 6.5 feet. Groundwater encountered below about 3 feet.			
10					

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

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LOG OF BORING NO. 4

Figure No. A-5

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 2.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
▼		Dark gray-brown SAND, fine to medium grained, wet. (SP)	Loose	8	25.5
5				5	
		Dark gray-brown SILT to sandy SILT, fine sand, wet, coarse wood fragment at 6.5 feet. (ML)			44.0
		Boring terminated at 6.5 feet. Groundwater encountered below about 2.5 feet.			
10					

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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Geology and
Environmental Earth Sciences

LOG OF BORING NO. 5

Figure No. A-6

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 2.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
▼ 2.5	I	No recovery at 2.5 feet. Sampler wet.	Medium Dense	21	
5	I	Dark gray-brown SAND, fine to medium grained, wet. (SP)	Medium Dense	13	22.2
		Boring terminated at 6.5 feet. Groundwater encountered below about 2.5 feet.			
10					

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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Consultants in Geotechnical Engineering
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LOG OF BORING NO. 6

Figure No. A-7

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot	Moisture Content (%)
0	Dark brown SAND, fine grained, moist. (SP)	Medium Dense		
			12	23.8
5	Dark gray-brown SAND to SAND with silt, fine to medium grained, wet. (SP/SP-SM)		10	24.1
			10	23.2
10			10	21.6
			29	26.1
	Dark gray-brown silty SAND, fine grained, wet. (SM)			
15	Interbedded dark gray-brown fine to medium SAND and silty fine SAND, wet. (SP and SM)		10	23.4
				25.6
	Dark gray SILT, wet, wood fragments in tip of sampler. (ML)			
20	Dark gray SAND to SAND with silt, fine grained, wet, numerous fine pumice fragments. (SP/SP-SM)		22	27.6
25	Interbedded dark gray-brown fine SAND and gray SILT, wet, trace of wood fragments. (SP and ML)	Loose	7	31.6
30	Dark gray SAND, fine grained, wet. (SP)	Medium Dense	25	25.4
	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet.			
35				
40				

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. 7

Figure No. A-8

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 2.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
▼ 2.5	I	Fill: Dark brown silty SAND, fine grained, wet, numerous wood fragments. (SM)	Loose	9	
		Brown to gray-brown sandy SILT to silty SAND, fine grained, wet, mottled. (ML/SM)			30.8
5	I	Dark gray-brown SAND, fine grained, wet, scattered silty fine sand seams, trace of wood fragments. (SP)		8	25.2
		Boring terminated at 6.5 feet. Groundwater encountered below about 2.5 feet.			
10					

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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Geology and
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LOG OF BORING NO. 8

Figure No. A-9

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot	Moisture Content (%)
0–4.5	Gray-brown SAND with silt to silty SAND, fine grained, moist, mottled. (SP-SM/SM) (Possible fill)	Loose	6	21.1
4.5–7	Dark brown SAND, fine grained, wet, numerous silty fine sand seams below 6 feet. (SP)	Loose	7	28.4
7–14	Dark gray-brown to dark gray SAND, fine to medium grained, wet, trace of fine to coarse gravel above 9 feet. (SP) - Scattered brown silt pockets below 10 feet. - Scattered wood fragments at 13 feet.	Medium Dense	15 11 20	20.0 27.8 31.6
14–18	Interbedded dark gray-brown fine SAND and gray SILT, wet. (SP and ML)	Medium Dense	12	27.5
18–21	Gray sandy SILT, fine sand, moist to wet, trace of dark brown organic fragments. (ML)	Loose	9	38.2
21–23	Dark gray-brown SAND, fine grained, wet. (SP)	Loose		
23–28	Gray to gray-brown sandy SILT, fine sand, wet, trace of dark brown organic fragments. (ML)	Loose	6	36.1
28–31.5	Dark gray SAND with silt to silty SAND, fine grained, wet, scattered gray silt seams. (SP-SM/SM)	Medium Dense	10	28.4

Boring terminated at 31.5 feet.
Groundwater encountered below 5 feet.
Installed 2-inch diameter monitoring well to 30 feet.
DOE Well ID - BMR-595

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.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

LOG OF BORING NO. 9

Figure No. A-10

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** December 1, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density
0–4	Brown silty SAND, fine grained, moist, scattered fine to coarse angular gravel. (SM) (Possible fill/disturbed)	Medium Dense
4–14.5	Brown to dark gray-brown SAND, fine grained, moist (wet below 5.5 feet), scattered brown silt to silty fine sand seams and layers above 9 feet. (SP) - Trace of organic partings and fine pumice graines between 10 and 11.5 feet. - Scattered brown silt seams below 12.5 feet.	Medium Dense
14.5–18	Interbedded dark gray-brown SAND and gray silty SAND to sandy SILT, fine sand, wet. (SP and SM/ML)	Loose
18–26	Dark gray to green-gray SILT, wet, scattered dark gray-brown fine sand seams and layers. (ML)	Loose / Medium Dense
26–31.5	Dark gray-brown SAND, fine grained, wet. (SP) - Scattered clayey silt layers between 30 and 30.5 feet.	Medium Dense / Loose
31.5	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet. Installed 2-inch diameter monitoring well to 30 feet. DOE Well ID - BMR-596	

Sample Depth (ft)	SPT (N) Blows / foot	Moisture Content (%)
2.5	14	13.7
5	12	24.2
7.5	13	22.5
10	10	29.4
12.5	28	28.4
15	8	30.8
20	9	33.9
25	13	35.9 30.7
30	5	30.4

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. 10

Figure No. A-11

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** December 1, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

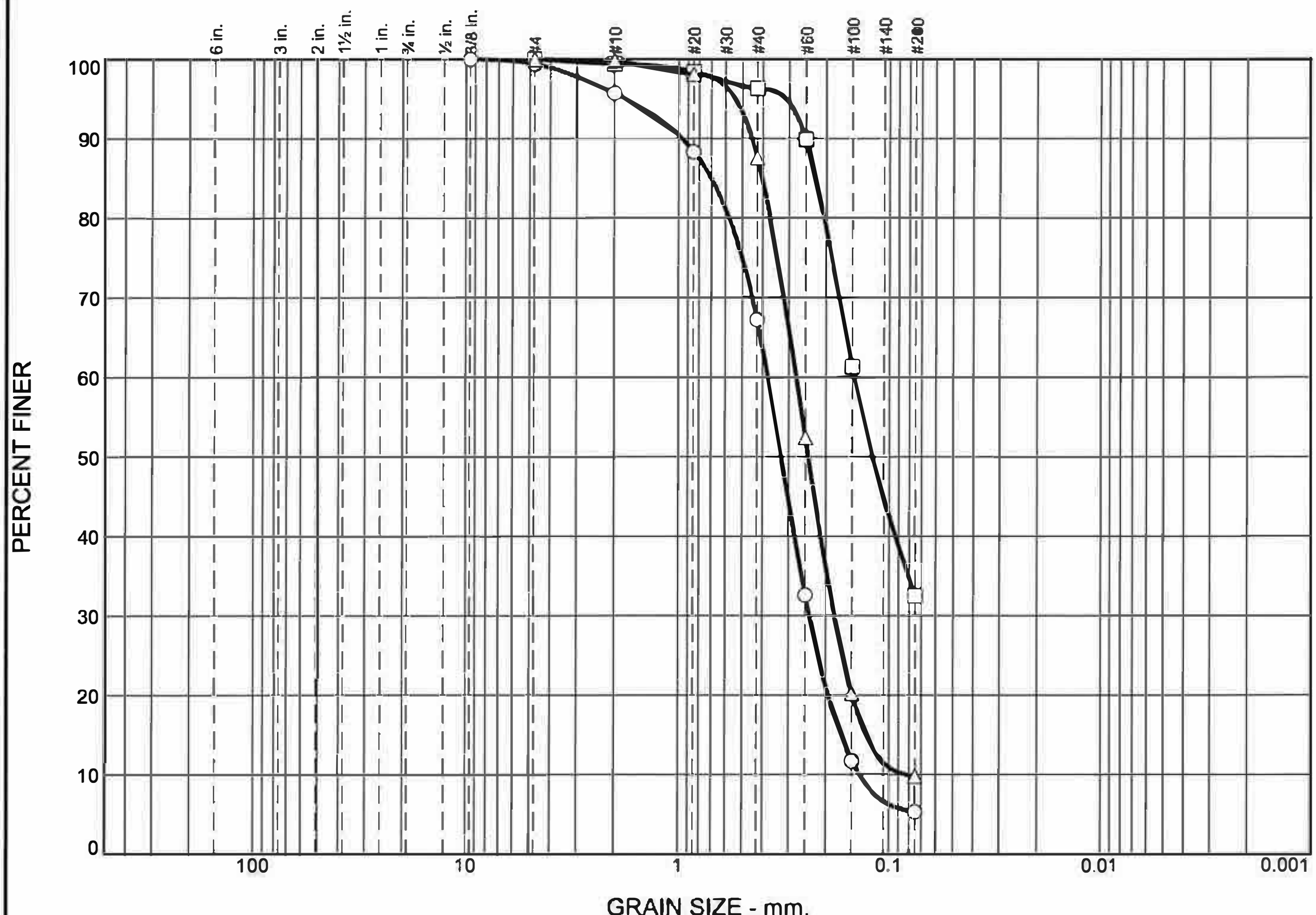
Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot	Moisture Content (%)
0	Fill: Dark brown to tan silty SAND with gravel, fine sand, fine to coarse gravel, moist to wet, numerous wood shavings. (SM)	Medium Dense	11	16.0
5	Gray-brown SAND, fine grained, moist, mottled. (SP)	Loose	8	25.7
	Dark gray-brown SAND, fine grained, wet, mottled. (SP)	Medium Dense	12	26.1
10	- 1-inch silt layer at 10.5 feet. - Trace of wood fragments below 10.5 feet		20	26.9
			11	27.6
15	Dark gray sandy SILT to silty SAND, fine sand, wet, trace of wood fragments. (ML/SM)		17	28.7
20	Gray-brown SAND, fine to medium grained, wet, scattered fine pumice grains. (SP)		12	21.6
25	Interbedded gray SILT to sandy SILT and dark gray-brown SAND, fine sand, wet, trace of wood fragments. (ML and SP)		10	26.2
30			10	28.1
35	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet.			
40				

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.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.6	3.7	28.5	61.9	5.3	
□	0.0	0.0	0.0	0.6	3.1	63.8	32.5	
△	0.0	0.0	0.0	0.2	12.2	77.8	9.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7016	0.3770	0.3250	0.2390	0.1692	0.1384	1.09	2.72
□			0.2237	0.1466	0.1198					
△			0.4026	0.2764	0.2421	0.1812	0.1285	0.0836	1.42	3.31

Material Description	USCS	AASHTO
○ SAND with silt	SP-SM	
□ silty SAND	SM	
△ SAND with silt	SP-SM	

Project No. T-8661 **Client:** Fortress,LLC

Project: 240 - 15 Street SE Industrial

○ **Location:** B-1 **Depth:** 5'

□ **Location:** B-1 **Depth:** 12.5'

△ **Location:** B-3 **Depth:** 2.5'

Remarks:

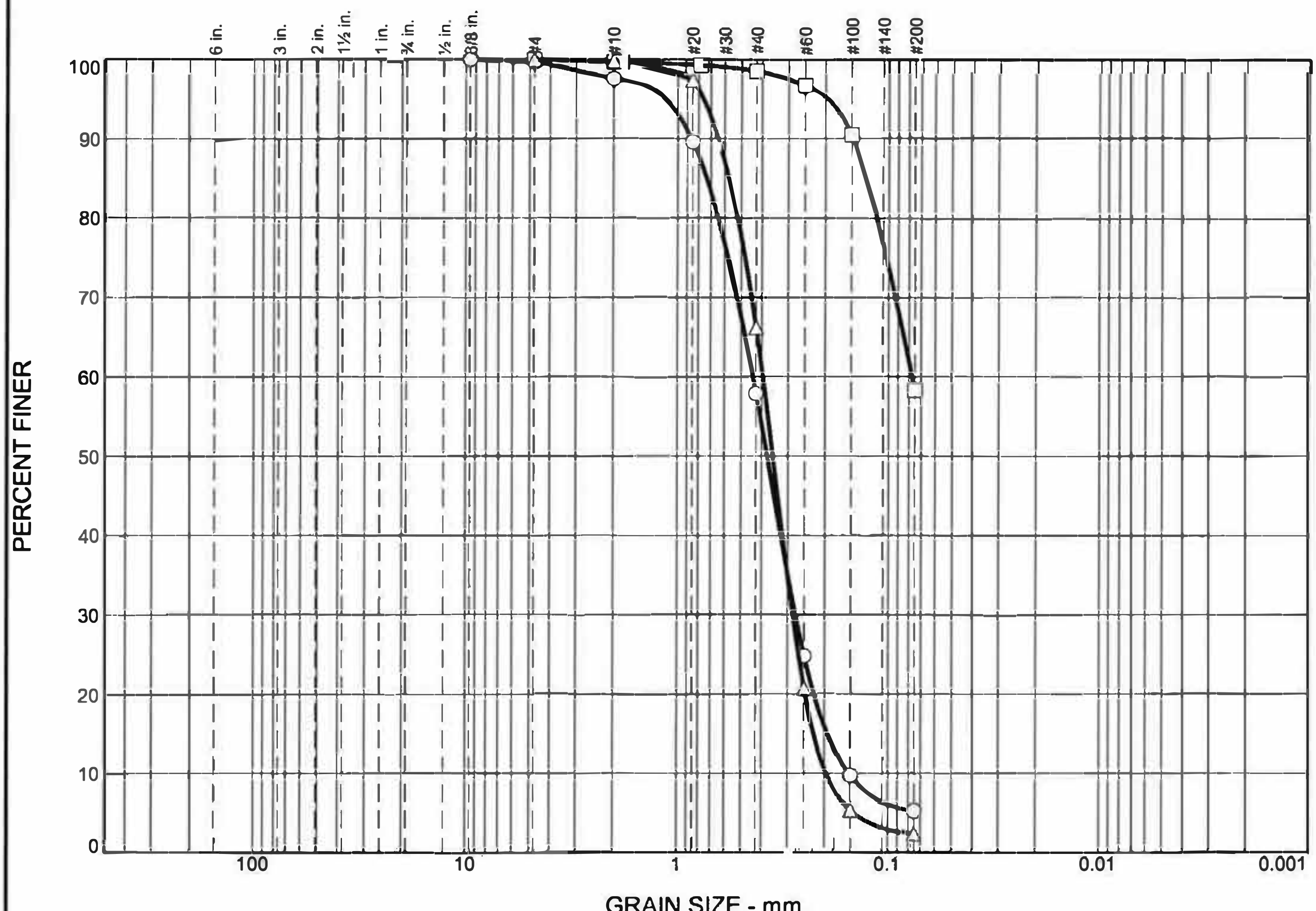
Terra Associates, Inc.

Kirkland, WA

Figure A-12

Tested By: FQ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.3	2.1	39.7	52.6	5.3	
□	0.0	0.0	0.0	0.3	1.2	40.2	58.3	
△	0.0	0.0	0.0	0.2	33.6	63.8	2.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7323	0.4396	0.3765	0.2755	0.1932	0.1530	1.13	2.87
□			0.1275	0.0773						
△			0.5722	0.3949	0.3538	0.2835	0.2252	0.1964	1.04	2.01

Material Description	USCS	AASHTO
○ SAND with silt	SP-SM	
□ sandy SILT	ML	
△ SAND	SP	

Project No. T-8661 **Client:** Fortress,LLC

Project: 240 - 15 Street SE Industrial

○ **Location:** B-6 **Depth:** 7.5'

□ **Location:** B-7 **Depth:** 3'

△ **Location:** B-8 **Depth:** 10'

Remarks:

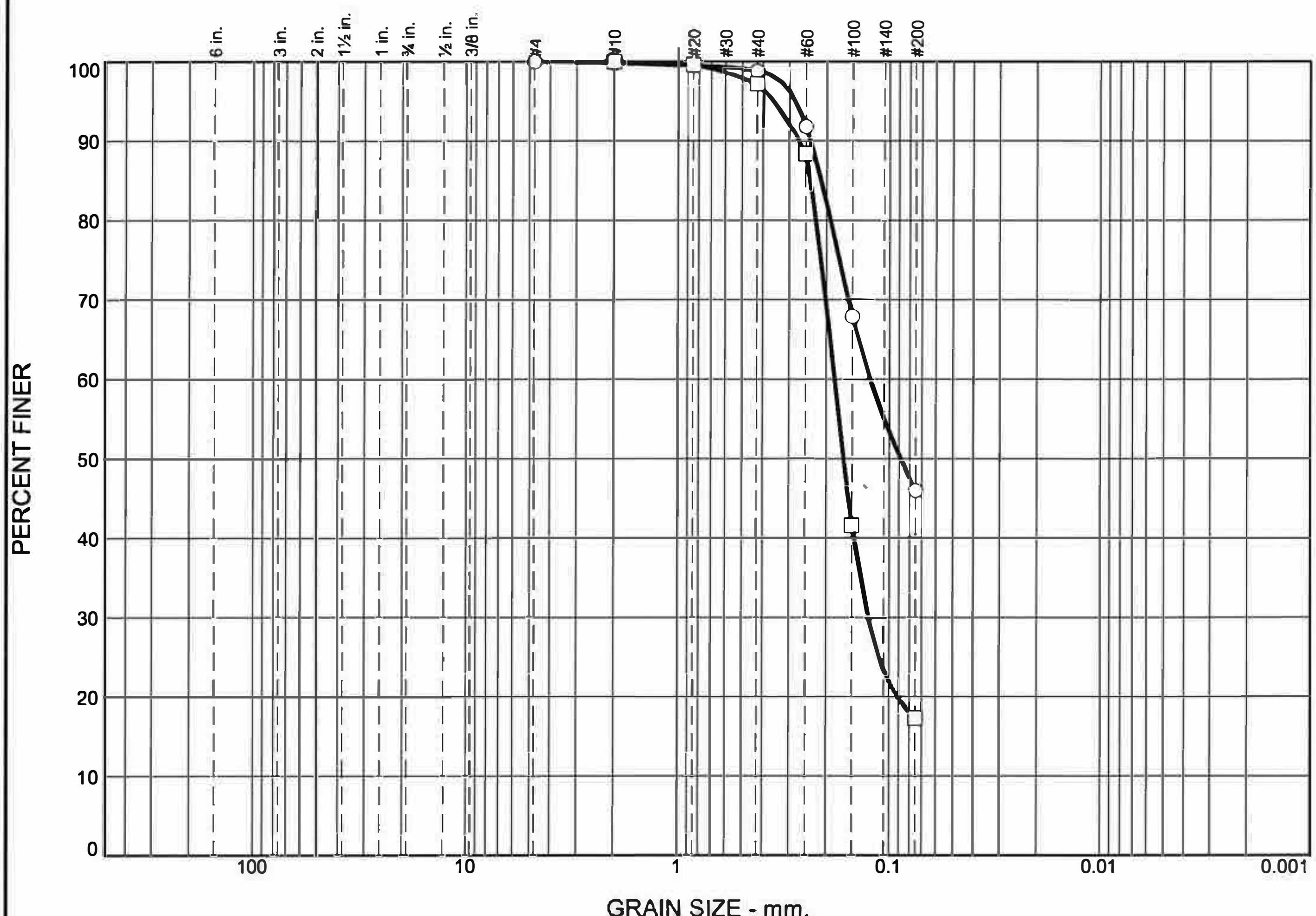
Terra Associates, Inc.

Kirkland, WA

Figure A-13

Tested By: FQ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	1.0	52.8	46.0	
□	0.0	0.0	0.0	0.0	2.8	79.9	17.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2117	0.1233	0.0881					
□			0.2379	0.1822	0.1648	0.1254				

Material Description	USCS	AASHTO
○ silty SAND	SM	
□ silty SAND	SM	

Project No. T-8661 **Client:** Fortress,LLC
Project: 240 - 15 Street SE Industrial

○ **Location:** B-8 **Depth:** 30'
□ **Location:** B-9 **Depth:** 10'

Remarks:

Terra Associates, Inc.

Kirkland, WA

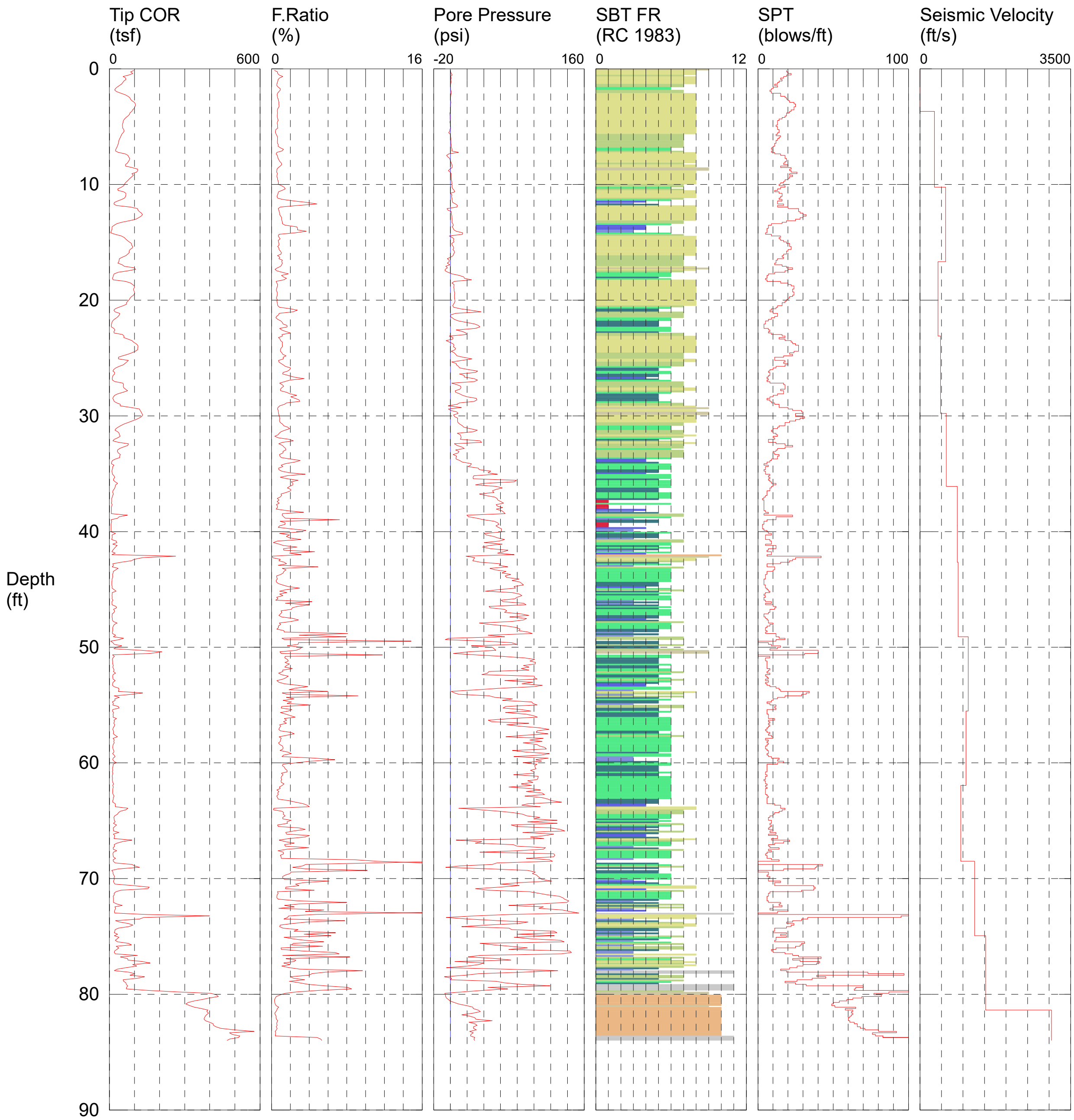
Figure A-14

Tested By: FQ

CPT- 01

CPT CONTRUCTOR: In Situ Engineering
CUSTOMER: Terra Asso
LOCATION: Puyallup
JOB NUMBER: T-8661
COMMENT: 240 - 15th St SE
COMMENT:

OPERATOR: Okbay
CONE ID: DDG1369
TEST DATE: 12/8/2021 9:38:13 AM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: None



TOTAL DEPTH: 83.990 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

HOLE NUMBER: CPT- 01

OPERATOR: Okbay

CUSTOMER: Terra Asso

LOCATION: Puyallup

JOB NUMBER: T-8661

CPT CONTRUCTOR: In Situ Engineering

CONE ID: DDG1369

TEST DATE: 12/8/2021 9:38:13 AM

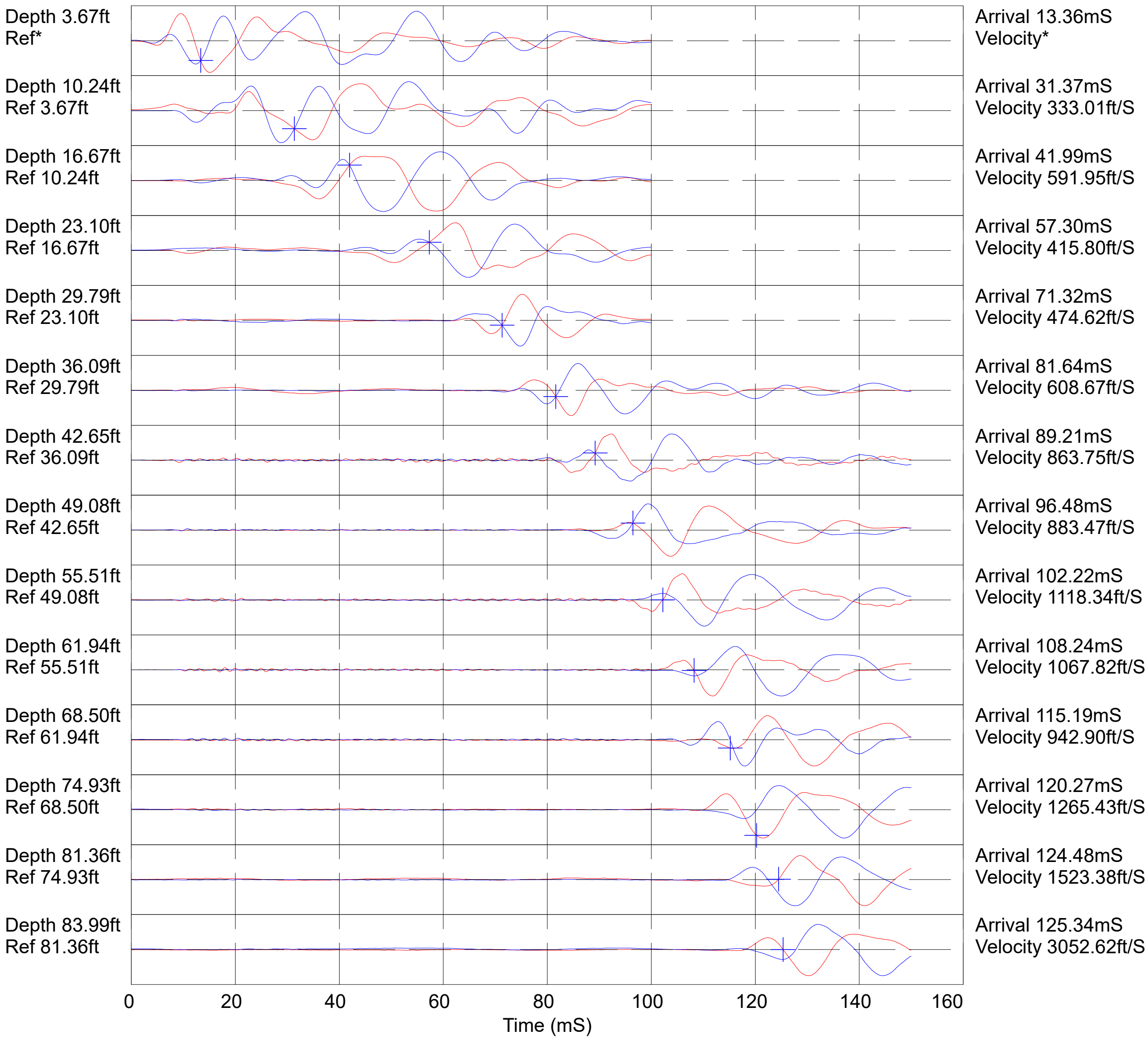
COMMENT: 240 - 15th St SE

PREDRILL0 ft

BACK FILL: 20% Grout + Bentonite Chips

SURFACE PATCH: none

HOLE NUMBER: CPT- 01



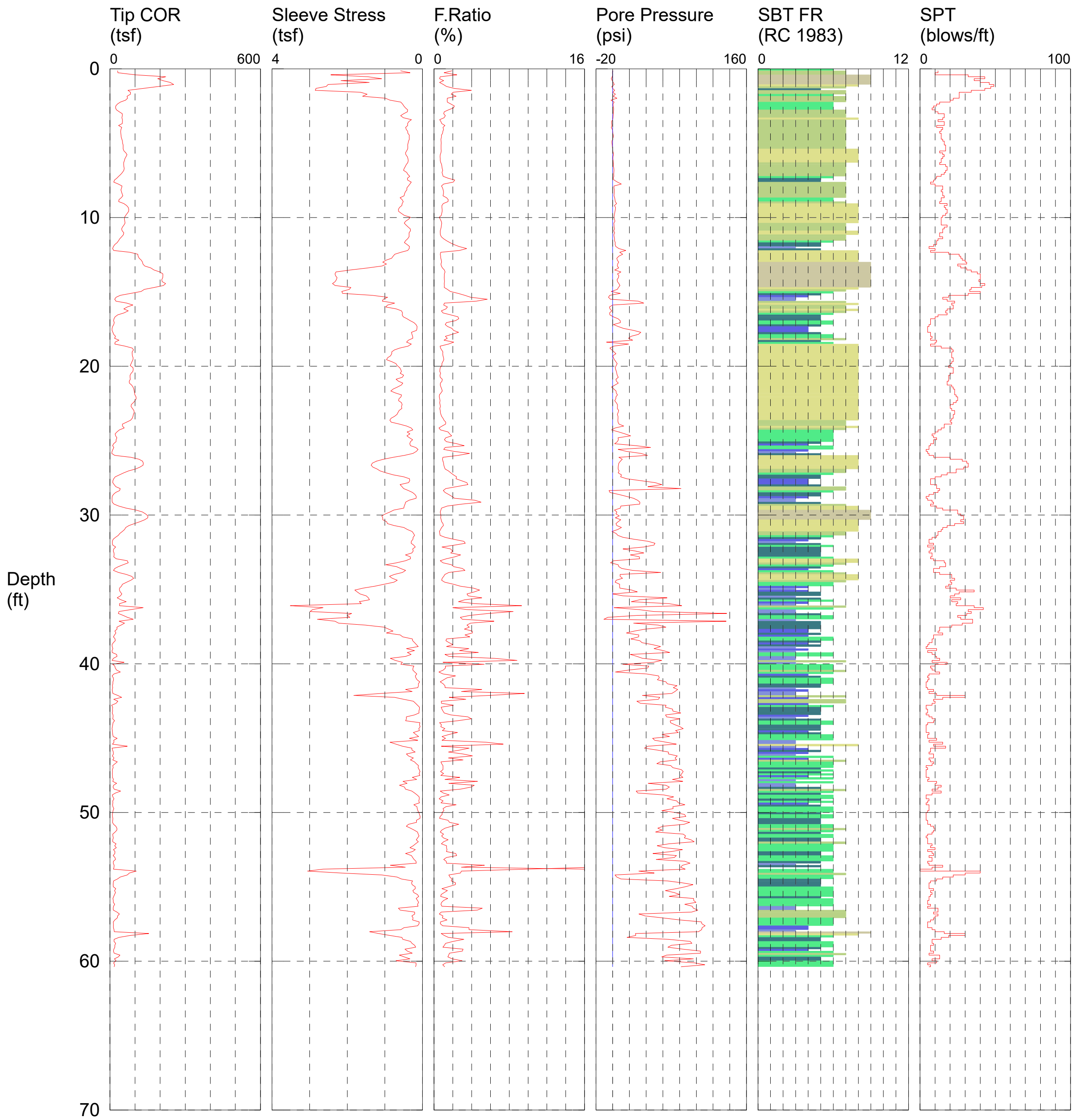
Hammer to Rod String Distance (ft): 2.79
* = Not Determined

COMMENT: 240 - 15th St SE

CPT- 02

CPT CONTRUCTOR: In Situ Engineering
CUSTOMER: Terra Asso
LOCATION: Puyallup
JOB NUMBER: T-8661
COMMENT: 240 - 15th St SE
COMMENT:

OPERATOR: Okbay
CONE ID: DDG1369
TEST DATE: 12/8/2021 12:37:48 PM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: None



TOTAL DEPTH: 60.367 ft

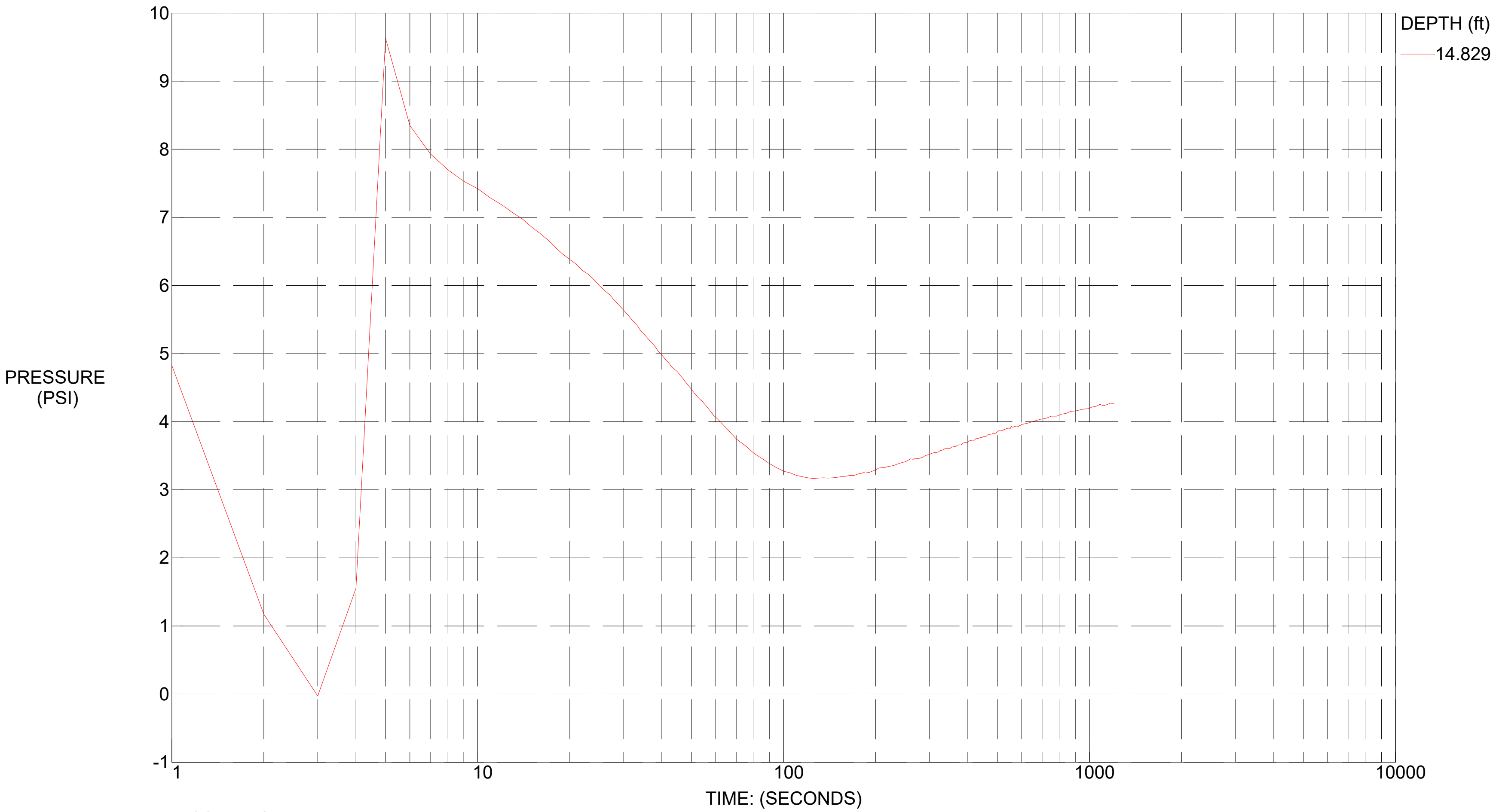
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

CPT- 02

CPT CONTRUCTOR: In Situ Engineering
CUSTOMER: Terra Asso
LOCATION: Puyallup
JOB NUMBER: T-8661

OPERATOR: Okbay
CONE ID: DDG1369
TEST DATE: 12/8/2021 12:37:48 PM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: Cold Patch



DISSIPATION

APPENDIX B

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSIS

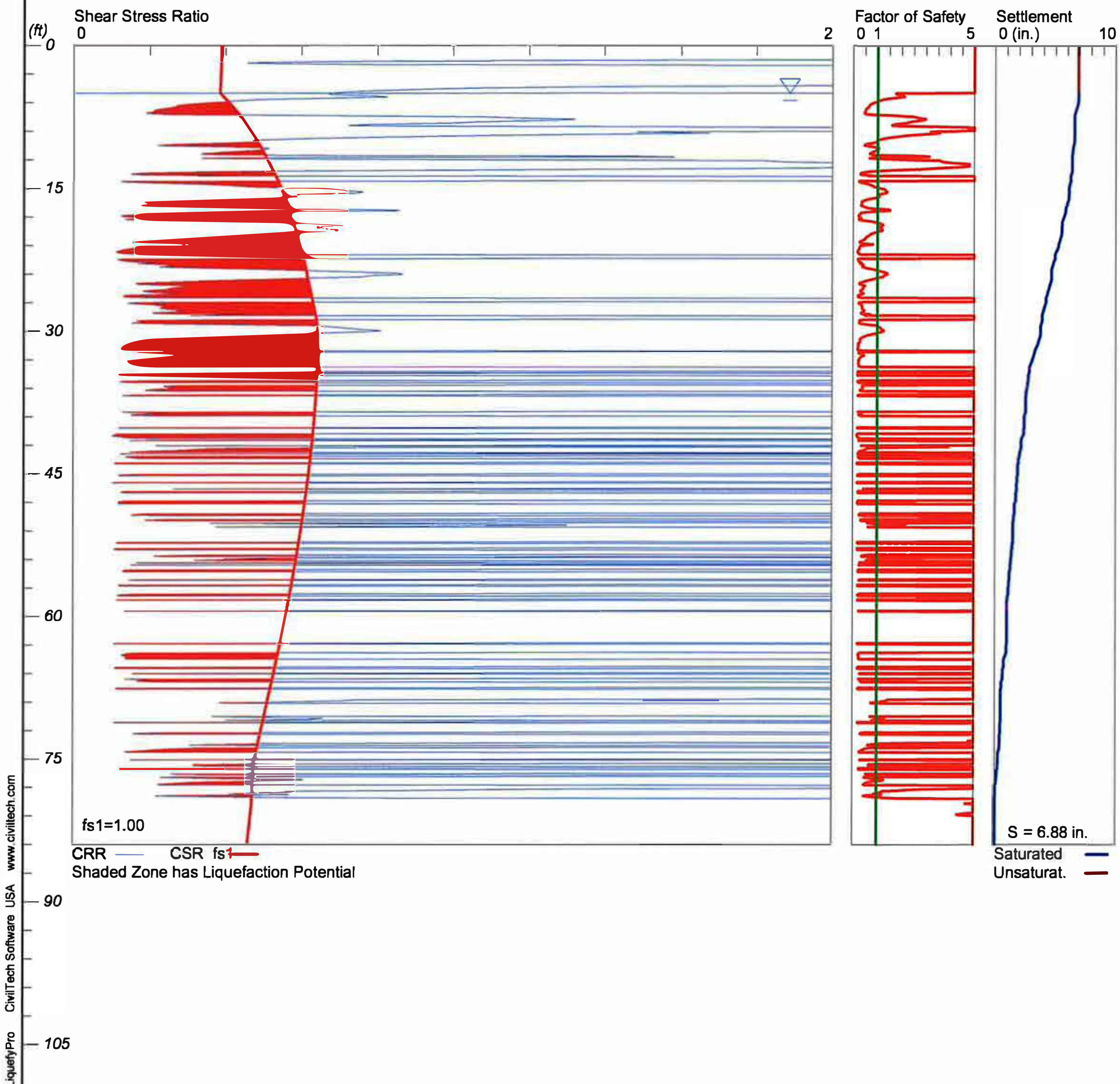
240 - 15th St SE Industrial

Hole No.=CPT-1 Water Depth=5.0 ft

Ground Improvement of Fill=3 ft

Magnitude=7

Acceleration=0.6g



LIQUEFACTION ANALYSIS

240 - 15th St SE Industrial

Hole No.=CPT-2 Water Depth=5.0 ft

Ground Improvement of Fill=3 ft

Magnitude=7

Acceleration=0.6g