Geotechnical Engineering Report

SAIA LTL Freight Terminal
Smokey Point Boulevard and 128th Avenue NE
Marysville, Washington

December 27, 2021
Terracon Project No. 81215171

Prepared for:

SAIA LTL Freight
Johns Creek, Georgia

Prepared by:

Terracon Consultants, Inc.
Mountlake Terrace, Washington

December 27, 2021

SAIA LTL Freight
11465 Johns Creek Parkway
Suite 330
Johns Creek, Georgia 30097

Attn: Brett Rabe – Sr. Real Estate Manager
E: brabe@saia.com

Re: Geotechnical Engineering Report
SAIA LTL Freight Terminal
Smokey Point Boulevard and 128th Avenue NE
Marysville, Washington
Terracon Project No. 81215171

Dear Mr. Rabe:

We have developed the geotechnical engineering report for the above referenced project. The study was performed in general accordance with Terracon Proposal No. P81215171 dated October 5, 2021. This report presents the findings of the subsurface explorations and provides geotechnical recommendations concerning earthwork, the design and construction of building foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

for

Dong-Soo Lee, P.E.
Senior Geotechnical Engineer

David A. Baska, Ph.D., P.E.
Senior Engineering Consultant

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REPORT TOPICS

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	The project involves the construction of a warehouse with office space and a large parking lot for trucks, trailers and cars at the proposed site which is approximately 11 acres. The project includes a single-story warehouse building with a footprint of about 19,620 square feet, which includes an office space of about 3,000 square feet. A building expansion is proposed to the east. The parking lot for the proposed development included 100 stalls for trailer trucks, 25 stalls for tractor trucks, 42 stalls for cars/vans and 2 ADA stalls. The project also involves a construction of detention pond which approximately 71,000 square feet.
Geotechnical Characterization	**Subsurface conditions prior to early site grading generally consist of the following:** ▪ 1 ft of dark brown, silty sand topsoil, generally upper ¼ ft is sod. ▪ Topsoil is underlain by a 1½ to 2½ ft of loose silty sand. ▪ Beneath the silty sand unit exists loose to medium dense sand with variable silt content to about 35 to 40 ft, and is further underlain by dense sand to roughly 61½ ft. ▪ Silty sand and sandy silt interbeds between 20 and 61½ ft. ▪ **Groundwater existed as shallow as 4½ feet** below the initial ground surface.
Earthwork	▪ **Remove** upper 1 ft of topsoil, including thicker portions of sod and organic-rich soils. ▪ Existing granular soils can be reused for engineered fill, **but may be moisture sensitive due to an appreciable fines content** (percent passing the #200 sieve). ▪ **Near-surface soils may be moisture sensitive** and could become unstable when exposed to excessive moisture and/or disturbance. ▪ **Utility trenching may require dewatering** efforts due to the shallow groundwater table.
Shallow Foundations	Summary of foundation recommendations (Refer to **Shallow Foundations**) Allowable bearing pressures for shallow foundation: ▪ Structural fill: **2,500** psf Expected static settlement: **< 1** inch total, **<** ½ inch differential Detect and remove sod as noted in **Earthwork**

Topic [1]	Overview Statement [2]
Liquefaction	**Post-liquefaction settlement of 2 to 4½ inches is estimated for the design-level event.** The differential settlement is anticipated to be about **2½** inches. Based on communication with the structural engineer, the post-liquefaction settlement estimated is tolerable for the proposed structure constructed as **spread footings with seismic ties**.
Pavements	We understand both asphalt and concrete pavement sections will be considered. Based on assumed traffic (please verify the value in pavement section of Project Description), the minimum standard pavement sections for a **20-year** design life are as follows: ▪ **Minimum 12 inches** of compacted subgrade with **minimum CBR** of **12** ▪ **4-in.** AC over **9-in.** granular base for flexible pavement – employee parking ▪ **5-in.** AC over **8-in.** granular base for flexible pavement – truck travel lanes, trailer parking areas ▪ **6½-in.** PCC over **8-in.** granular base for rigid pavement – dock aprons ▪ **7½-in.** PCC over **8-in.** granular base for rigid pavement – truck travel lanes, entry/exit aprons
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

SAIA LTL Freight Terminal
Smokey Point Boulevard and 128th Avenue NE
Marysville, Washington

Terracon Project No. 81215171
December 27, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed SAIA LTL Freight Terminal to be located at Smokey Point Boulevard and 128th Avenue NE in Marysville, Washington. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Corrosivity
- Groundwater conditions
- Seismic considerations and liquefaction
- Lateral earth pressures
- Stormwater management
- Pavement design and construction

The geotechnical engineering scope of services for this project included the advancement of 5 soil borings to depths of approximately 16½ to 61½ feet below existing grades (bgs), 8 test pits to depths ranging from approximately 5 to 7 feet bgs, and cone penetration testing (CPT) to depths ranging from 102 to 102½ ft.

Maps showing the site and exploration locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring and test pit logs and as separate graphs in the **Exploration Results** section of this report.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at the northeast corner of the intersection of Smokey Point Boulevard and 128th Street NE in Marysville, Washington. This location is approximately ¼ mile east of Interstate 5, and approximately 9 miles north of downtown Everett. Lot Size: 11 acres Latitude: 48.11196, Longitude: -122.17771 (see **Site Location**)
Existing Improvements	The site is currently undeveloped outside of a small paved parking lot near the northeast corner of the lot.
Current Ground Cover	Grass, brush and trees
Existing Topography	Approximately 4 feet of elevation change across the site with higher elevations generally along the northern and eastern property lines. In the southeast region of the site (TP-08) is about 2 to 3 feet higher than other area. Central region of the site (B-P08p and B-B03) is about 3 to 4 feet lower than other area. Further discussion is presented in the **Geotechnical Characterization**.
Geology	Our review of geologic maps indicates subsurface conditions which consist of Pleistocene continental glacial drift comprised primarily of outwash sand with variable gravel, silt and clay content (i.e., Marysville Sand Member).

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	▪ Email communication with SAIA ▪ Conceptual plan was provided by Ware Malcomb ▪ Structural loading condition was provided by email from Structural Design Group dated November 11, 2021

Item	Description
Project Description	The proposed development is located on a 11 acres lot and will include a new office and warehouse building surrounded by truck and trailer parking. The proposed dimensions of the building are about 60 feet by 277 feet for the warehouse and 60 ft by 50 ft for the office building. Pavement around the building may include a concrete apron; asphalt pavement is proposed elsewhere in the trucking yard. Street access into the site would be provided from Smokey Point Boulevard which bounds the west side of the site. A detention basin is proposed along the southern end of the site.
Proposed Structure	Warehouse building with a footprint of about 16,620 ft^2 and an office building of about 3,000 ft^2. The warehouse will be elevated about 4 feet from the surrounding grade to accommodate truck loading and unloading. Both structures are slab-on-grade (non-basement).
Building Construction	The proposed warehouse is to be constructed of concrete tilt-up panels founded on strip and spread footings with seismic ties. The proposed office building will consist of a one-story, wood or metal frame structure supported on strip and spread footings connected with seismic ties. Floors would be concrete slab-on-grade.
Finished Floor Elevation	Not known at this time, assumed to be at or near existing grades following the early grading contract.
Maximum Loads	The loading information was provided to Terracon by the structural engineer: ▪ **Columns:** 100 kips ▪ **Walls:** 5 kips per linear foot (klf) ▪ **Slabs:** 150 pounds per square foot (psf)
Grading/Slopes	Based on the November 2021 email from D.F. Chase, fill will be placed to raise grades by roughly 3 to 4 feet. In some areas along the parking area, there will be cuts of 1 ft or less and roughly 1 to 2 feet of fill will be placed.

Item	Description
Pavements	Paved drive lanes and parking will be constructed on approximately 8 acres of the parcel. We understand **20-year** designs for both rigid (concrete) and flexible (asphalt) pavement sections will be considered. **Vehicular data was not provided. Based on similar project experience, we assumed the following truck data (please confirm):** ▪ Anticipated traffic for the proposed facility: ○ Autos/light trucks: 100 vehicles per day ○ Light delivery and trash truck: 15 vehicles per week ○ Tractor-trailer trucks (5-axle, 80 kip) Heavy Duty: 50 vehicles/day, Medium Duty: 25 vehicles/day ○ Tractor-trailer trucks (3-axle, 45 kip) Heavy Duty: 100 vehicles/day, Medium Duty: 50 vehicles/day
Applicable Building Code and Minimum Design Load Standard	2018 International Building Code (2018 IBC) 2016 ASCE Standard ASCE/SEI 7-16 (ASCE 7-16)
Estimated Start of Construction	Building construction in 2022

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Topsoil**	Silty Sand (SM), with sod and organics, roots and rootlets, very dark brown, moist
2	**Silty Sand**	Brown to dark brown, moist, loose to medium dense, with organics, fine to medium grained

3	**Sand**	Mostly poorly graded sand with varying quantities of silt, trace gravel, loose to dense, fine to medium grained, occasional medium to coarse grained and well graded sand

Existing fill was not encountered in our explorations. However, **if any existing fill is encountered during construction,** this material should be removed prior to fill placement.

Groundwater Conditions

Groundwater was encountered in all borings and test pits. The level of groundwater in the boreholes was observed while drilling and after completion or installation of wells. The water levels observed in the explorations can be found on the boring logs and test pit logs in **Exploration Results** and are summarized below.

Exploration Number	Approximate Depth to Groundwater	
	While Drilling/Excavating [1, 2]	After Drilling or Observed in Well [1, 3]
B-B01	6½	--
B-B03	5	--
B-P08p	--	4½
B-D13p	6½	6
B-D14p	6½	6
TP-01	6½	--
TP-02	6	--
TP-03	6½	--
TP-04	6	--
TP-05	6	--
TP-06	6½	--
TP-07	7	--
TP-08	5	--

1. Feet below ground surface.
2. Inferred from change in sample moisture or from evidence of free water on drilling equipment.
3. Measured using water level indicator.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs.

The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

The site is underlain primarily by loose to medium dense sand to about 40 feet with shallow groundwater, **rendering the site susceptible to liquefaction during a design-level seismic event.** The free-field estimate of liquefaction-induced settlement is estimated to be about **2 to 4½ inches** for the upper 50 feet of the soil profile. The resulting differential settlement is estimated to be roughly **2½ inches**.

Our understanding through discussion with the structural engineer is that this amount of settlement is tolerable by both the office building and warehouse structures. Therefore, shallow foundations can be founded on compacted structural fill. **We recommend that spread footings be connected with seismic ties.** Further discussion is provided in the **Seismic Considerations** section.

Due to the shallow water table, **we recommend grading be limited** to only what is necessary to level the site. The upper 1 foot of the topsoil unit is largely sod and **should be removed** prior to subgrade preparation for site preparation and paving. The soils present at the subgrade elevation are **likely to be moisture sensitive due** to the significant fines content and **may become unstable** when exposed to excessive moisture and/or disturbance such as construction traffic. Therefore, we recommend earthwork be performed during warmer and drier months to facilitate more workable site conditions.

Additionally, effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If grading is performed during the winter months, **an increased risk for possible undercutting and replacement** of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

The **Shallow Foundations** section addresses support of the building bearing on native soil or compacted structural fill. The slab-on-grade support of the building is discussed in the **Floor Slabs** section of this report.

Seasonal high groundwater levels should be considered in the civil engineering design for site grading, utility construction, and pavements. A flexible pavement system and a rigid pavement system are recommended for this site. The **Pavements** section addresses the design of pavement systems.

Specific conclusions and recommendations regarding these geotechnical considerations, as well as other geotechnical aspects of design and construction of foundation systems and other earthwork related phases of the project are outlined in the following sections.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in **Exploration Results**), engineering analyses, and our current understanding of the proposed project. ASTM and Washington State Department of Transportation (WSDOT) specification codes cited herein respectively refer to the current manual published by the American Society for Testing & Materials and the current edition of the *Standard Specifications for Road, Bridge, and Municipal Construction, (M41-12)*.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on the Seismic Design Category. Site Class is required to determine the Seismic Design Category for a structure. The Site Class is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Chapter 20 of ASCE 7.

Description	Value
International Building Code (IBC) Site Classification [1, 2]	**F** [2]
Site Latitude	48.111944
Site Longitude	-122.17686
S_S – Short Period Spectral Acceleration	1.085 g
S_1 – 1-Second Period Spectral Acceleration	0.387 g
F_a – Short Period Site Coefficient for Site Class D [2]	1.066
F_v –1-Second Period Site Coefficient for Site Class D [2]	-
PGA - ASCE 7, Peak Ground Acceleration	0.46 g
F_{PGA} – Peak Ground Acceleration Site Coefficient	1.14

Description	Value

1. The IBC requires a site profile extending to a depth of 100 feet for seismic site classification. Borings were extended to a maximum depth of 51 ½ feet and later CPT probes were extended to over 100 feet. The site properties below the boring depth to 51 ½ feet were estimated based on the CPT probes.

   Site Class F applies to any profile having (1) soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays and collapsible weakly cemented soils, (2) at least 10 feet of peats and/or highly organic clays, (3) at least 25 feet of very high plasticity clays, or (4) at least 120 feet of soft to medium stiff clays.
2. These values were obtained using online seismic design maps and tools provided by OSHPD (https://seismicmaps.org/) on 11/02/2021. ASCE 7 allows site coefficients F_a and F_v to be determined assuming that liquefaction does not occur for structures with fundamental periods of vibration less than 0.5 second. Based on the results of the exploration program, Site Class D may be used to determine the values of F_a and F_v. The fundamental period of vibration for the structure should be verified by the structural engineer.

Surface-Fault Rupture

The hazard of damage from onsite fault rupture appears to be low based on review of the USGS Earthquake Hazards Program Quaternary Faults and Folds Database available online (https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf) accessed on November 2, 2021. The closest mapped fault is the Southern Whidbey Island fault zone, which lies approximately 13 miles to the southwest of the proposed project site.

Liquefaction

Liquefaction is the phenomenon where **saturated soils develop high porewater pressures during seismic shaking and lose their strength characteristics.** This phenomenon generally occurs in areas of high seismicity, where groundwater is shallow and loose granular soils or relatively non-plastic fine-grained soils are present. We evaluated liquefaction triggering using the simplified procedure originally developed by Seed and Idriss (1971) and refined over time with additional case histories (e.g., Boulanger and Idriss, 2014). The CLiq software developed by GeoLogismiki and used by Terracon on this project applies the simplified procedure to CPT data and also allows for computation of post-liquefaction settlements.

Based on our analyses, the hazard of liquefaction of the site soils is **moderate to high** during a design level earthquake and is most likely to trigger between 3 feet and 25 feet below the ground surface, with some thinner zones between the depths of 25 and 50 feet (i.e., interbedded silt and sand). We estimate approximately **2 to 4½ inches** of post-liquefaction settlement. From this total settlement, roughly **2½ inches** of differential settlement is inferred. Based on our understanding of the regional geology and the alluvial and post-glacial deposits of the site, we anticipate the liquefaction hazard is sitewide.

We evaluated the lateral spread hazard using the multilinear regression equations of Youd et al. (2002). The site appears to have a ground slope of about ½ percent. Given this ground slope condition, we estimate lateral spread displacements of about 12 inches. If a topographic survey of the site indicates a greater slope, we should be contacted to review our estimate of lateral spread displacements.

Based on our discussion with the structural engineer, the free-field, post-seismic, displacements associated with the design seismic event are deemed tolerable for the proposed structures. We recommend that spread footings be **connected with seismic ties** and any utilities connected to the proposed structures be designed with **flexible connections** to reduce damage during a seismic event. Foundation recommendations are provided in the **Shallow Foundations** section.

EARTHWORK

Earthwork will include clearing and grubbing, removal of the topsoil unit and organic-rich soils encountered above silty sand unit, fill placement for raising site grades, and excavations for foundation elements and utility trenches. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Prior to placing fill, existing vegetation, topsoil (sod and root mats), and organic-rich soils should be removed. Complete stripping of the sod portion of the topsoil should be performed in all non-landscape areas. Based on our explorations, the depth of stripping is approximately 12 inches, but greater stripping depths may be encountered during earthwork construction. This material should be either wasted from the site or re-used in proposed landscape areas.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck prior to placing fill. The proofrolling should be performed under the observation of the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and common fill. again, Stratum was not used earlier. Model layer 1 is topsoil that cannot be used as fill is material used below, or within 10 feet of structures and apertures, pavements, and constructed slopes. Common fill is material used to achieve grade outside of these areas. Earthen materials used for structural, common, and free-draining granular fill should meet the following material property requirements:

Fill Type	Recommended Materials	Acceptable Location for Placement
Structural Fill	9-03.9(1) *Ballast* [1] 9-03.9(3) *Crushed Surfacing Base Course* [1] 9-03.12(1)A *Gravel Backfill for Foundations Class A* [1] 9-03.14(1) *Gravel Borrow* [1] On-site Soils (i.e. Model Layer 3) [2, 3]	Beneath and adjacent to structural slabs, foundations, building appurtenances, and pavement subgrades
Common Fill	Section 9-03.14(3) *Common Borrow* [1] On-site Soils (i.e. Model Layer 3) [2, 3]	Grade filling, utility trench backfill outside the building foundation and appurtenances
Free-Draining Granular Fill	Structural Fill [4] 9-03.12(2) *Gravel Backfill for Walls* [1] 9-03.12(4) *Gravel Backfill for Drains* [1]	Backfilling in wet weather, drainage layers for walls, sump drains, footing drains [5]

1. WSDOT Standard Specifications.
2. Structural and common fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
3. May contain local areas of higher fines content that could make this material moisture sensitive. Particles with a nominal diameter greater than about 3 in. should be removed.
4. Material provided must be specified to be less than 5-percent passing the #200 sieve for the portion of material passing the #4 sieve.
5. Minimum particle size must be greater than drain pipe perforations.

Fill Compaction Requirements

Structural and common fill should meet the following compaction requirements.

Item	Structural and Free-Draining Fill	Common Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as Structural fill

Item	Structural and Free-Draining Fill	Common Fill
Minimum Compaction Requirements [1]	95% of max. below foundations and floor slabs and within 1 foot of finished pavement subgrade 90% of max. above foundations and more than 1 feet below finished pavement subgrade	90% of maximum dry density
Water Content Range [1]	Typically, within 2% of optimum	As required to achieve min. compaction requirements

1. Maximum density and optimum water content as determined by the **modified** Proctor test (ASTM D 1557).

Utility Trench Backfill

All trenches should be wide enough to allow for compaction around the haunches of the pipe, or material such as pea gravel (provided this is allowed by the pipe manufacturer) should be used below the spring line of the pipes to eliminate the need for mechanical compaction in this portion of the trenches. If water is encountered in the excavations, it should be removed prior to fill placement. **Due to the higher groundwater table, utility trenching may be difficult without implementing dewatering efforts.** Trench side walls may be unstable if excavations are performed below the groundwater.

Placement and compaction of recommended materials for utility trench backfill should be in accordance with the recommendations presented herein for **Earthwork**. In our opinion, the initial lift thickness should not exceed one foot unless recommended by the manufacturer to protect utilities from damage by compacting equipment. Light, hand-operated compaction equipment in conjunction with thinner fill lift thicknesses may be utilized on backfill placed above utilities if damage resulting from heavier compaction equipment is of concern. **Flexible connections for utilities that pass through building foundations are recommended to reduce potential stress associated with differential settlement that may occur** between the building foundation and the improvements located outside of the building footprint.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Due to the high groundwater table, raising of site grades was performed during the early grading efforts described previously. The contractor should **maintain effective grading** to promote drainage throughout construction. Water retained next to the building **can result in soil movements greater than those discussed** in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks.

Gutters and downspouts should be routed into tightline pipes that discharge either directly into a municipal storm drain or to an alternative drainage facility. Splash-blocks should also be considered below hose bibs and water spigots.

Site grades should be established such that surface water is directed away from foundation and pavement subgrades to prevent an increase in the water content of the soils. Adequate positive drainage diverting water from structures, open cuts, and slopes should be established to prevent erosion, ground loss, and instability. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork.

After building construction and landscaping, **final grades should be verified** to document effective drainage has been achieved. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. **Construction traffic over the completed subgrades should be avoided.** The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations.
Water collecting over, or adjacent to, construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction. If excessive deflection on the native subgrade is encountered in haul roads, a geotextile and/or quarry spalls may be necessary.

The high groundwater table may affect excavation efforts, especially for utility trenches, if advanced through to roughly 6 feet or more feet below the current ground surface. If this is the case, the high groundwater table and permeable sand **will make dewatering efforts difficult and impact trench wall stability.**

Site development should avoid or limit trenching and excavation depths that will encounter groundwater to the extent practical. If this is unavoidable, the contractor may want to consider installing groundwater monitoring wells **(piezometers).**

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations. Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations.

Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

On-going earthwork efforts to raise site grades have been observed under the observation of Terracon. Future earthwork efforts should continue to be monitored under the observation of Terracon. **Each lift of compacted fill should be tested** for density and water content, evaluated, and reworked as necessary until the specified degree of compaction is achieved prior to placement of additional lifts.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Terracon. In the event that unanticipated conditions are encountered, Terracon should recommend mitigation options.
In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Wet Weather Earthwork

The near-surface soils have variable fines content based on our visual observations and lab testing and **are considered moisture sensitive**. The soils will exhibit moderate erosion potential and may be transported by running water. Silt fences and other best-management practices will be necessary to control erosion and sediment transport during construction.

The suitability of soils used for structural fill depends primarily on their grain-size distribution and moisture content when they are placed. As the fines content (the soil fraction passing the U.S. No. 200 Sieve) increases, soils become more sensitive to small changes in moisture content.

Soils containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than 2 percentage points above or below optimum. Optimum moisture content is the moisture content at which the maximum dry density for the material is achieved in the laboratory by the ASTM D1557 test procedure.

If inclement weather or in situ soil moisture content prevents the use of on-site material as structural fill, we recommend use of materials specified in **Fill Material Types** for free-draining granular fill. Additionally, stockpiled soils should be protected with polyethylene sheeting anchored to withstand local wind conditions and preservation of the soil's moisture content.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations. We recommend that spread footings be connected with seismic ties.

Design Parameters – Compressive Loads

Description	Spread Footing with Seismic Ties	Wall Footing
Net allowable bearing pressure [1, 2] ▪ Structural fill	▪ 2,500 psf	▪ 2,500 psf
Minimum dimensions	24 inches	24 inches
Minimum thickness of structural fill under the footings	24 inches	24 inches
Minimum embedment below finished grade [3]	18 inches	18 inches
Approximate static total settlement from foundation loads for condition specified [4]	<1 inch	<1 inch
Estimated static differential settlement from foundation loads [4]	About 2/3 of total settlement	
Ultimate passive pressure [5, 6] ▪ Compacted structural fill	400 pcf (equivalent fluid unit weight)	
Ultimate coefficient of sliding friction [7]	0.40	

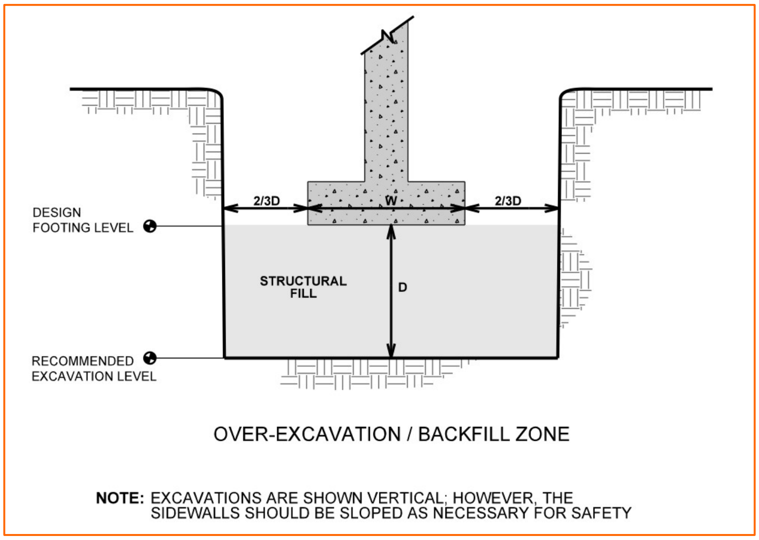
Description	Spread Footing with Seismic Ties	Wall Footing

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Assumes that exterior grades are relatively level adjacent to the structure.
2. Values provided are for maximum loads noted in **Project Description**.
3. For frost protection and to reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
4. Differential settlements are as measured over a span of 50 feet. We should review the settlement estimates after the foundation plan has been prepared by the structural engineer.
5. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
6. Passive resistance in the upper 2 feet of the soil profile should be neglected.
7. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.

Foundation Construction Considerations

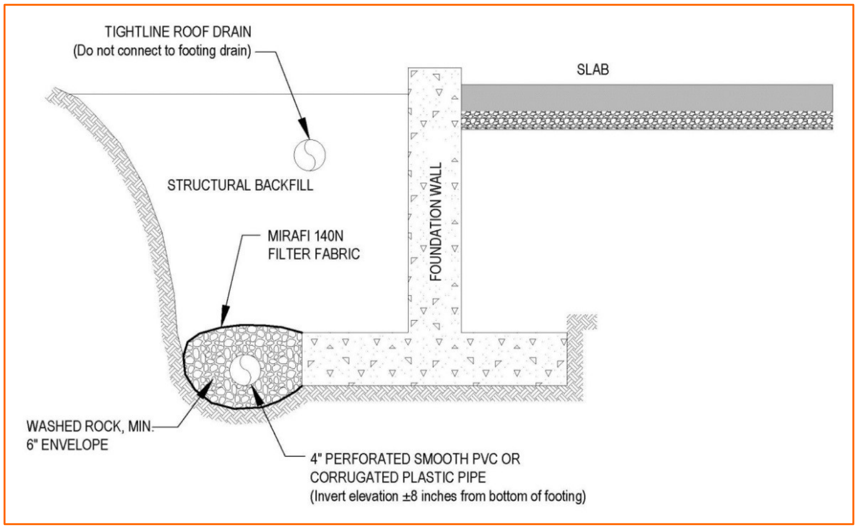
As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. **Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.**

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils. Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation as recommended in the **Earthwork** section.



Foundation Drains

We recommend the building be encircled with a perimeter foundation drain to collect exterior seepage water. This drain should consist of a 4-inch diameter perforated pipe within an envelope of washed rock, extending at least 6 inches on all sides of the pipe. The washed rock should conform to WSDOT Section 9-03.12(4), Gravel Backfill for Drains or 9-03.12(5), Gravel Backfill for Drywells. The washed rock envelope should be wrapped with filter fabric (such as Mirafi 140N, or equal) to reduce the migration of fines from the surrounding soil. Ideally, the drain invert would be installed no more than 8 inches above or below the base of the perimeter footings. The perimeter foundation drain **should not** be connected to roof downspout drains and should be constructed to discharge into the site storm water system or other appropriate outlet. These recommendations are summarized in the figure below:



FLOOR SLABS

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 6 inches of capillary break material (see **Fill Material Types** for Free-Draining Granular Fill) Compacted to at least 95% of maximum dry density (ASTM D 1557) Minimum 18 inches of structural fill under the capillary break is recommended.
Estimated Modulus of Subgrade Reaction [2]	▪ 115 pounds per square inch per inch (psi/in) for point loads ▪ 30 psi/in for distributed loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads, assume the modulus of subgrade reaction for distributed loads.

The use of a vapor retarder is recommended beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture.

When conditions warrant the use of a vapor retarder, the slab designer should **refer to ACI 302 and/or ACI 360** for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. **For additional recommendations refer to the ACI Design Manual**. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

Terracon should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

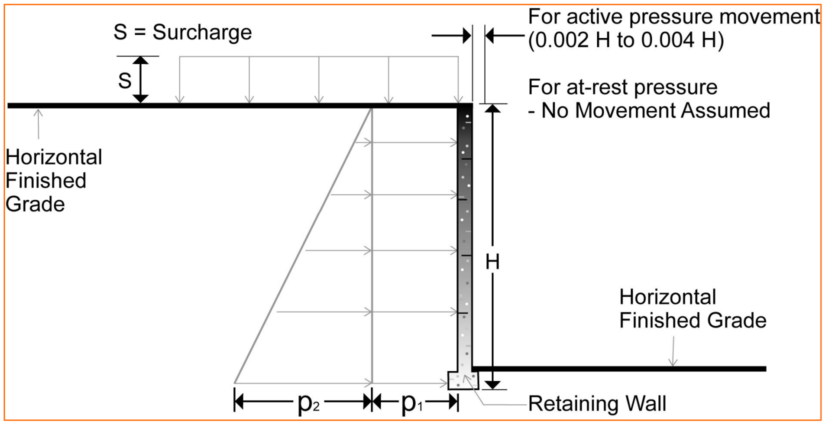
LATERAL EARTH PRESSURES

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown.

Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top.

The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters			
Earth Pressure Condition [1]	**Coefficient for Backfill Type** [2]	**Uniform Pressure** [3, 4, 5] **p_1 (psf)**	**Effective Fluid Pressures (psf)** [2, 4, 5, 6]
Active (Ka)	0.28	(0.28)S	(35)H
At-Rest (Ko)	0.44	(0.44)S	(55)H
Passive (Kp)	3.2	---	(400)H
Seismic	---	(7)H – Active (12)H – At-Rest	---

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 92 percent of the ASTM D 1557 maximum dry density, rendering a maximum unit weight of 125 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. Values are in addition to static earth pressures.

STORMWATER MANAGEMENT

Terracon attempted to perform infiltration testing per the Snohomish County Drainage Manual (Jan. 2016); however, **due to the presence of shallow groundwater, the test could not be completed** as recommended by the manual. The high ground water table **renders the site infeasible** for infiltration of stormwater.

Another option for stormwater management appears to be onsite storage with discharge into the city sewer system. **An onsite detention vault would likely need to be anchored at the base due to uplift pressures from the shallow groundwater.** Should this option be considered by SAIA, Terracon can provide recommendations for the design of ground anchors via an addendum to this geotechnical engineering report.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic loading and pavement design life presented in **Project Description**. A critical aspect of pavement performance is site preparation. Pavement designs, noted in this section, must be applied to the site, which has been prepared as recommended in the **Earthwork** section. The recommended designs of Asphaltic Concrete (AC) and Portland Cement Concrete (PCC) pavements are based on the 1993 AASHTO guidelines.

Design Traffic

Standard equivalent single-axle loads (ESALs) were estimated using the 1993 *Guideline for Design of Pavement Structures* by the American Association of State Highway and Transportation Officials (AASHTO, 1993). **Based on the assumed (please confirm) traffic loading conditions,** a 20-yr design life, an annual growth rate of 1%, and the facility operating 5 days per week, we estimate a maximum design loading of 500,000 flexible ESALs.

Site-specific vehicular data was not provided by the client. We assumed the vehicular data based on our experience with similar projects. If traffic volumes will exceed the assumed values, **Terracon should be notified to provide pavement sections designed for higher levels of traffic.**

Pavement Design

Based on laboratory testing of near-surface soils and imported fill, we have selected a design CBR value of 12. **Any imported or borrow source fill placed below the proposed pavements should have a CBR value of at least 12.**

Flexible Pavement

The binder grade for AC (asphalt) mixes was verified using the online version of LTPPBind.

Recommended Minimum Flexible (asphalt) Pavement Section			
Layer	Thickness (inches)		Material Specification
	Employee Parking	Truck Drive Lanes	
Compacted Subgrade [1]	12	12	Suitable subgrade soil (see Earthwork) compacted to 95% of Modified Proctor Maximum Dry Density; -2 to +2% Optimum Moisture Content
Crushed Aggregate Base	9	8	WSDOT: 9-03.9(3) Base Course
Hot Mix Asphalt [2]	4	5	WSDOT: 9-03.8(2) ¾-inch HMA with PG 64H-22 asphalt binder

1. May vary based on observations following proof-rolling.
2. Asphalt surface course only.

Rigid Pavement

We recommend that Portland cement concrete (PCC) pavement be used for entrance and exit apron sections, dumpster pads, loading dock aprons, and any other areas where extensive wheel maneuvering or repeated channelized loading are expected.

Recommended Minimum Rigid (concrete) Pavement Sections			
Layer	Thickness (inches)		Material Specification
	Dock Apron	Truck Drive Lanes, Entry/Exit Aprons	
Compacted Subgrade [1]	12	12	Suitable subgrade soil (see Earthwork) compacted to 95% of Modified Proctor Maximum Dry Density; -2 to +2% Optimum Moisture Content
Crushed Aggregate Base	8	8	WSDOT: 9-03.9(3) Base Course
PCC [2]	6½	7½	Minimum 28-day unconfined compressive strength of 4,000 pounds per sq. inch (psi)

1. May vary based on observations following proof-rolling.
2. Unreinforced PCC surface **with 1" smooth dowels at mid-depth of transverse joints.**

Adequate reinforcement and number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI requirements. **Smooth dowels** should be placed at mid-depth of transverse joints for truck drive lanes. For dock aprons, **the joints parallel to the dock face** shall be considered to be the transverse direction.

Although not required for structural support, the base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, subgrade "pumping" through joints, and provide a working surface for paving. These thicknesses assume the subgrade is properly prepared and compacted as noted above.

Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

The minimum pavement sections outlined above were determined based on post-construction traffic loading conditions. These pavement sections **do not account** for heavy construction traffic during development. **A partially constructed structural section that is subjected to heavy construction traffic can result in pavement deterioration and premature distress or failure.**

Our experience indicates this pavement construction practice can result in pavements that will **not perform** as intended. Considering this information, several alternatives are available to mitigate the impact of heavy construction traffic prior to pavement construction, including:

- Using thicker sections to account for the construction traffic after paving,
- Using some method of soil stabilization to improve the support characteristics of the pavement subgrade,
- Routing heavy construction traffic around paved areas, or
- Delaying paving operations until as near the end of construction as is feasible.

Dumpster Pads: The dumpster pad should be large enough to support the wheels of the truck which will bear the load of the dumpster. The **minimum thickness** of PCC pavement should be 6 inches of concrete (min. 4,000 psi strength) and underlain by a minimum of 8 inches of crushed aggregate base course (use WSDOT 9.03.9(3)).

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration.

In addition, the pavement subgrade **should be graded** to provide positive drainage within the granular base section. **Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.**

We recommend drainage improvements be included at the bottom of crushed aggregate base (when used) at the storm structures to aid in removing water that may enter this layer. Drainage could consist of small diameter weep holes excavated around the perimeter of the storm structures. The weep holes should be excavated at the elevation of the crushed aggregate base and soil interface.

The excavation should be covered with crushed aggregate encompassed in Mirafi 140NL, or an approved equal, which will aid in reducing the amount of fines that enter the storm system.

Pavement Maintenance

The pavement sections represent **minimum recommended thicknesses** and, as such, periodic maintenance should be anticipated. Therefore, **preventive maintenance should be planned and provided for** through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment.

Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program.

Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required. Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 3%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration into subgrade soils.

CORROSIVITY

The table below lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The laboratory test results are attached at the end of this report. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Analyte Tested	Test Method	Test Results [1]		
		B-B03	TP-5	TP-8
		2.5 to 6 ft	2.5 to 3 ft	2.5 to 3 ft
pH	AWWA 4500H	7.1	6.6	6.5
Water Soluble Sulfates (mg/kg)	ASTM C1580	77	56	28
Sulfides (mg/kg)	AWWA 4500-S D	0	0	0
Chlorides (mg/kg)	ASTM D512	45	28	25
Red-Ox [2]	AWWA 2580	718	717	725
Total Salts (mg/kg)	AWWA 2540	83	84	52
Resistivity (ohm-cm)	ASTM G57	18430	27160	51410

AWWA = American Water Works Association

ASTM = American Society for Testing and Materials

1. Depth below existing grades prior to early grading activities.
2. Reduction-Oxidation potential (positive values indicates an oxidizing environment).

The fill soils placed as part of the early grading efforts are generally sand with silt and silty sand with little to no-plasticity. **Resistivity and corrosivity testing were not performed on the imported fills**. If this testing is desired, **a soil sample can be obtained at any time prior to final design** and tested at our laboratory.

GENERAL COMMENTS

This report (including all attachments) should be read in its entirety. Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction.

Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken. Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended.

Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others.

If changes in the nature, design, or location of the project are planned, **our conclusions and recommendations shall not be considered valid** unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Exploration Type	Exploration Number	Exploration Depth [1]	Location
Test Pits	TP-01	6½	Parking/driveway area
	TP-02	6	
	TP-03	6 ½	
	TP-04	6	
	TP-05	6 ½	
	TP-06	6 ½	
	TP-07	7	
	TP-08	5	
Soil Borings	B-B01	41 ½	Planned building area
	B-B03	61 ½	
Groundwater Monitoring Well	B-P08p	16 ½	Parking/driveway area
	B-D13p	16 ½	Proposed Detention pond
	B-D14p	16 ½	
Seismic Cone Penetration Test [2]	C-B01	102	Planned building area
Cone Penetration Test	C-B02	102 ½	Parking/driveway area /future expansion

1. Feet below existing ground surface.
2. Shear wave velocity testing was performed during cone advancement.

Exploration Layout and Elevations: Unless otherwise noted, Terracon personnel provided the exploration layout. Coordination were obtained a handheld GPS unit (estimated horizontal accuracy of about ±2 feet) and approximate elevations were obtained by interpolation from the topographic site plan obtained from the City of Marysville GIS database (5-foot contours). If elevations and a more precise exploration layout are desired, we recommend explorations be surveyed.

Borehole Procedure: We advanced the borings with a truck-mounted drill rig using continuous flight hollow stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter.

In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels and sampling. For safety purposes, borings B-B01 and B-B03 were backfilled with bentonite chips after their completion. Groundwater monitoring wells were installed in boring B-P08p, B-D13p and B-D14p.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Test Pit Procedures: Test pits were advanced via an excavator outfitted with a toothed bucket. The test pit sidewalls and excavated soil were observed by a Terracon field engineer and characterized accordingly in the test pit logs. Groundwater seepage depths as well as fill, debris, and other deleterious materials observed are described in the logs as well.

Excavated soils were stockpiled in the vicinity of the pit for further observation and for convenient backfilling. The density/consistency of the soil was inferred through frequent probing of the base of the excavations for the upper 4 feet. Thereafter, soil density presented on the logs are inferred from probing observations and excavator level of effort during test pit advancement.

Test pits were typically terminated upon contacting groundwater. Bulk samples were collected for CBR testing and to evaluate potential reuse of onsite soils. Our exploration team prepared draft test pit logs in the field (i.e. field logs) as part of standard operations. Field logs included visual classifications of soils encountered during exploration, and our interpretation of subsurface conditions between samples. Final test pit logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory testing results.

Cone Penetration Testing (CPT) Procedures: Advancement of the cone instrument was performed through a porthole in the approximate center of a truck rig. The truck is outfitted with a hydraulic press that continuously advances a standardized and calibrated cone at a constant rate. During advancement, a near-continuous profile of data was collected for cone tip and side friction resistance exerted on the cone by the soils as well as the in-situ pore water pressure generated during cone advancement.

The tip, side friction, and pore water data are interpreted using empirical correlations to derive soil engineering properties for the full length of cone advancement. Additionally, estimates of groundwater level were made through measuring the dissipation of excess pore water pressure that is generated during cone advancement. The data collected was used to estimate a soil behavior type which is used to infer the classification of the soils encountered (i.e. sand, silt, clay, etc.) and to estimate geotechnical engineering parameters as well as to performed liquefaction analysis.

A data report of the CPT results was provided to Terracon by the CPT subcontractor and are included herein. Soil samples were not obtained during performance of CPTs. See **Supplemental Information** for the ConeTec report. CPT-B01 is a seismic cone penetration test (sCPT) in which shear wave velocity testing was performed during cone advancement.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils (Hydrometer)
- ASTM D1883 Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
- ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (part of CBR test)

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Note: All attachments are one page unless noted above.

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

SAIA LTL Freight Terminal ■ Marysville, Washington

December 27, 2021 ■ Terracon Project No. 81215171

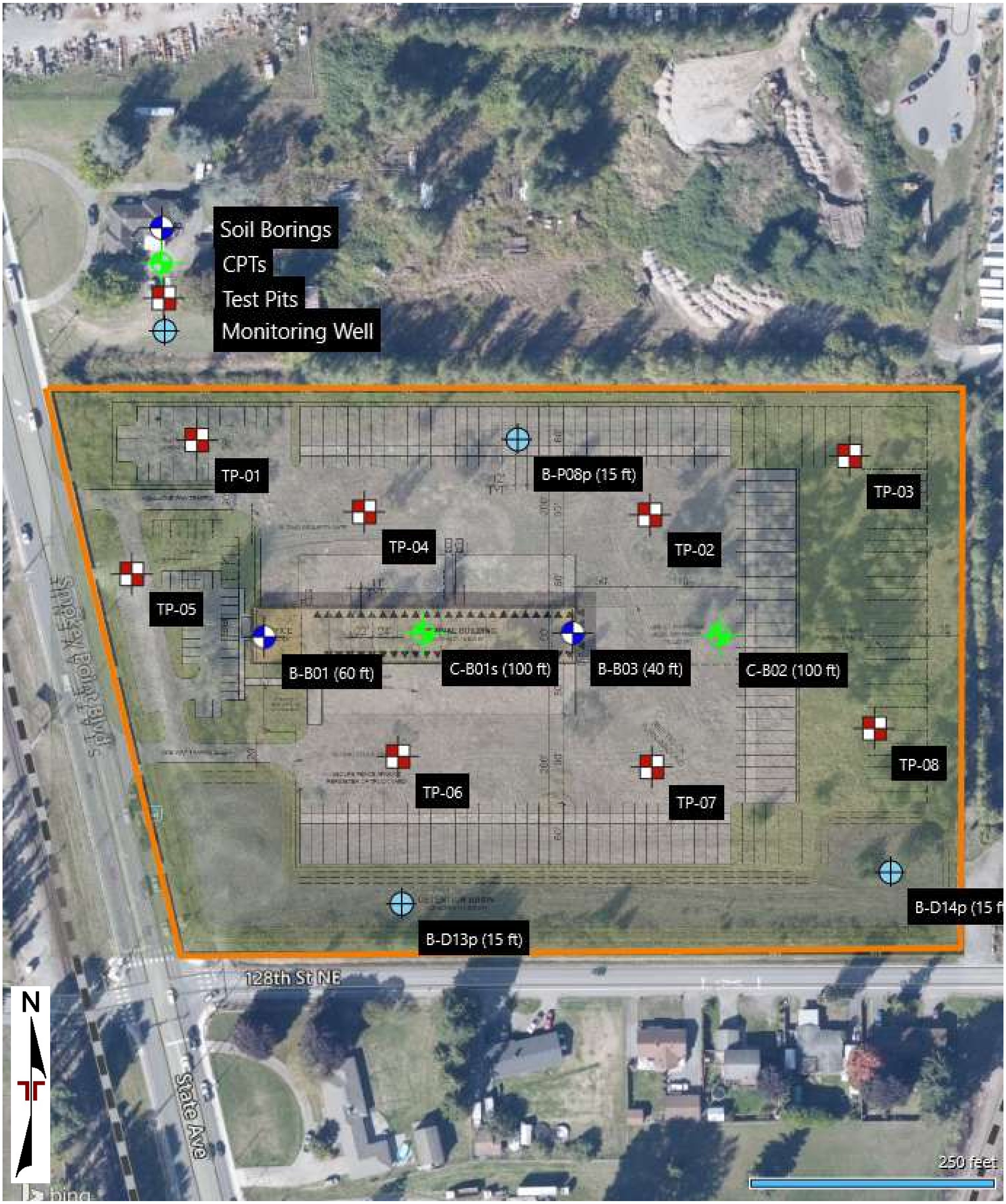


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

BORING LOG NO. B-B01

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1120° Longitude: -122.1788°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	Sample No.	WATER CONTENT (%)	PERCENT FINES
1	0.2	**TOPSOIL**, dark brown, moist, loose to medium dense, Silty Sand (SM), with roots and rootlets	85+/-								
2		**SILTY SAND (SM)**, with organics, fine grained, dark brown, moist, loose to medium dense									
	2.8	trace organics, medium dense	82+/-								
3		**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine grained, brown, moist, medium dense				X	16	3-6-5 N=11	S-1	25.6	
		fine to coarse grained, brownish gray to gray									
		fine to coarse grained sand, fine to coarse grained gravel		5	▽	X	16	3-5-9 N=14	S-2		
		wet, dense				X	15	6-13-19 N=32	S-3		
	10.0		75+/-	10							
		POORLY GRADED SAND (SP), trace gravel, fine to medium grained, brownish gray to gray, wet, medium dense				X	13	3-6-6 N=12	S-4	18.5	4
		fine grained at 15-1/2 ft		15		X	16	4-12-19 N=31	S-5		
		easy drilling									
	20.0		65+/-	20							
		SILTY SAND (SM), trace gravel, fine to medium grained, dark gray, wet, dense, sand interbedded with silt layers				X	12	5-15-27 N=42	S-6	16.1	21
	25.0		60+/-	25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-14-2021	Boring Completed: 10-14-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

BORING LOG NO. B-B01

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1120° Longitude: -122.1788°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	Sample No.	WATER CONTENT (%)	PERCENT FINES
3		**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to medium grained, dark gray, wet, medium dense			X	11	9-9-11 N=20	S-7		
			30		X	9	11-12-17 N=29	S-8		
		dense	35		X	10	6-16-16 N=32	S-9		
		41.5 / 43.5+/-	40		X	10	16-16-27 N=43	S-10		
		Boring Terminated at 41.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-14-2021	Boring Completed: 10-14-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

BORING LOG NO. B-B03

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1120° Longitude: -122.1776°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	Sample No.	WATER CONTENT (%)	PERCENT FINES
1	0.2	**TOPSOIL**, dark brown, moist, loose to medium dense, Silty Sand (SM), with roots and rootlets	85+/-								
2	1.5	**SILTY SAND (SM)**, with organics, dark brown, moist, loose to medium dense	83.5+/-								
3		**WELL GRADED SAND WITH SILT (SW-SM)**, fine grained, light brown, moist, medium dense				X	11	4-5-6 N=11	S-1		
		fine to medium grained, wet		5	▽	X	9	3-5-6 N=11	S-2	22.3	11
		gray									
	7.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to medium grained, gray, wet medium dense	77.5+/-			X	9	5-5-6 N=11	S-3	22.7	10
		medium to coarse grained		10		X	10	5-9-7 N=16	S-4		
		coarse grained, dense		15		X	5	5-9-24 N=33	S-5	19.1	6
		medium dense medium to coarse grained at 20-1/2 ft		20		X	17	5-8-13 N=21	S-6		
				25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Inferred from change in sample moisture*

Terracon

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-15-2021	Boring Completed: 10-15-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

BORING LOG NO. B-B03

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight
Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE
Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1120° Longitude: -122.1776°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	Sample No.	WATER CONTENT (%)	PERCENT FINES
3	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to medium grained, gray, wet *(continued)* fine to medium grained, gray, dense			X	17	5-10-23 N=33	S-7	24.7	6
	trace gravel, medium dense	30		X	17	2-4-16 N=20	S-8		
		35		X	17	5-6-9 N=15	S-9		
	medium to coarse grained, dense	40		X	16	10-11-23 N=34	S-10		
	fine grained, very dense	45		X	16	26-37-42 N=79	S-11		
		50							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Inferred from change in sample moisture

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-15-2021	Boring Completed: 10-15-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

BORING LOG NO. B-B03

PROJECT: SAIA Motor Freight Terminal

**CLIENT: SAIA LTL Freight
Johns Creek, GA**

**SITE: Smokey Point Blvd and 128th St NE
Marysville, WA**

LOCATION See Exploration Plan

Latitude: 48.1120° Longitude: -122.1776°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	Sample No.	WATER CONTENT (%)	PERCENT FINES
3			**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to medium grained, gray, wet *(continued)* medium to coarse grained, gray, dense				X	15	16-27-17 N=44	S-12		
		55.0	**SILTY SAND (SM)**, fine grained, gray, wet, dense	30+/-	55		X	17	18-20-23 N=43	S-13		
		60.5	**POORLY GRADED SAND (SP)**, medium grained, gray, wet, dense	24.5+/-	60		X	16	11-11-29 N=40	S-14		
		61.5		23.5+/-								

Boring Terminated at 61.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Inferred from change in sample moisture*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-15-2021	Boring Completed: 10-15-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

BORING LOG NO. B-P08p

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1125° Longitude: -122.1777°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	Sample No.	WATER CONTENT (%)	PERCENT FINES
1	0.2	**TOPSOIL**, dark brown, moist, loose to medium dense, Silty Sand (SM), with roots and rootlets	85+/-	Bentonite Chips								
2		**SILTY SAND (SM)**, with organics, fine to medium grained, dark brown, moist, loose to medium dense										
		light brown, moist, loose					X	10	4-4-4 N=8	S-1	20.9	21
	5.0		80+/-		5	▽						
3		**POORLY GRADED SAND (SP)**, light brown, wet, medium dense					X	16	5-6-8 N=14	S-2		
		medium to coarse grained, gray										
		trace gravel, coarse grained		Sand Filter			X	17	2-10-15 N=25	S-3		
		dense		Screen	10		X	18	11-20-25 N=45	S-4		
	16.5		68.5+/-		15		X	4	13-26-23 N=49	S-5		

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Groundwater monitoring well installed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

Groundwater monitoring well monument is approximately 3ft above the groundsurface

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-15-2021	Boring Completed: 10-15-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

BORING LOG NO. B-D13p

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1112° Longitude: -122.1781°

Approximate Surface Elev.: 84 (Ft.) +/-

MODEL LAYER	DEPTH	Description	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1	0.2	**TOPSOIL**, dark brown, moist, loose, Silty Sand (SM), with roots and rootlets	84+/-	Bentonite Chips			Grab		12.1
2	1.5	**SILTY SAND (SM)**, with organics, dark brown, moist, loose	82.5+/-						
3		**POORLY GRADED SAND WITH SILT (SP-SM)**, brown, moist, loose						S-1	13.0
					5	While drilling; After 24 hours		S-2	
		wet							
		medium dense		Sand Filter				S-3	
				Screen	10			S-4	
		very dense			15			S-5	
	16.5		67.5+/-						

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Groundwater monitoring well installed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

Groundwater monitoring well monument is approximately 3ft above the groundsurface

WATER LEVEL OBSERVATIONS

While drilling

After 24 hours

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-14-2021	Boring Completed: 10-14-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

BORING LOG NO. B-D14p

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1113° Longitude: -122.1760°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	DEPTH	Description	ELEVATION (Ft.)
1	0.2	**TOPSOIL**, dark brown, moist, loose to medium dense, Silty Sand (SM), with roots and rootlets	85+/-
2	1.5	**SILTY SAND (SM)**, with organics, dark brown, moist, loose to medium dense	83.5+/-
3	16.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, brown, moist, loose medium dense wet dense	68.5+/-

Boring Terminated at 16.5 Feet

INSTALLATION DETAILS: Bentonite Chips; Sand Filter; Screen

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
2.5–4		X	S-1	
5–6.5	▽ (≈6)	X	S-2	
7.5–9		X	S-3	
10–11.5		X	S-4	
15–16.5		X	S-5	

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Groundwater monitoring well installed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

Groundwater monitoring well monument is approximately 3ft above the groundsurface

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *After installation of well*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Started: 10-14-2021	Boring Completed: 10-14-2021
Drill Rig:	Driller: EDI Environmental
Project No.: 81215171	

TEST PIT LOG NO. TP-01

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight
Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE
Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1125° Longitude: -122.1790°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1		1.0	**TOPSOIL**, with organics, brown, moist, Silty Sand (SM), with roots	84+/-					
3			**POORLY GRADED SAND (SP)**, light brown to gray, transitions to gray with increasing depth						
			gray						
			trace gravel, medium to coarse grained, light gray, loose					S-1	
					5				
		6.5		78.5+/-		▽			
			Test Pit Terminated at 6.5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

TEST PIT LOG NO. TP-02

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight
Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE
Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1123° Longitude: -122.1773°

Approximate Surface Elev.: 84 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	Description	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1		1.5	**TOPSOIL**, with organics, brown, moist, Silty Sand (SM), with roots	82.5+/-					
3			**POORLY GRADED SAND (SP)**, medium grained, brownish gray, moist						
							Grab	S-1	
			trace gravel, loose		5				
		6.0	gray	78+/-		▽			
			Test Pit Terminated at 6 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

TEST PIT LOG NO. TP-03

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1125° Longitude: -122.1762°

Approximate Surface Elev.: 85.5 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1		1.0	**TOPSOIL**, with organics, dark brown, moist, Silty Sand (SM), with roots	84.5+/-					
3			**POORLY GRADED SAND (SP)**, dark brown, moist						
			trace gravel, fine to medium grained, light brown and light gray, loose to medium dense					S-1	
			trace gravel, coarse grained, brownish gray, loose to medium dense		5			S-2	
		6.5		79+/-		▽			
			Test Pit Terminated at 6.5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

TEST PIT LOG NO. TP-04

PROJECT: SAIA Motor Freight Terminal

**CLIENT: SAIA LTL Freight
Johns Creek, GA**

**SITE: Smokey Point Blvd and 128th St NE
Marysville, WA**

LOCATION See Exploration Plan

Latitude: 48.1123° Longitude: -122.1783°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
		1.0	**TOPSOIL**, with organics, brown, moist, Silty Sand (SM), with roots	84+/-					
3			**POORLY GRADED SAND (SP)**, light gray, moist						
			fine to medium grained, brown, loose to medium dense					S-1	
		6.0	trace gravel, gray	79+/-	5	▽			
			Test Pit Terminated at 6 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

TEST PIT LOG NO. TP-05

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1122° Longitude: -122.1792°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1	1.0	**TOPSOIL**, with organics, dark brown, moist, Silty Sand (SM), with roots	84+/-					
2	2.0	**SILTY SAND (SM)**, brown, moist, increasing coarse material with depth	83+/-				S-1	19.0
3		**POORLY GRADED SAND (SP)**, trace gravel, medium to coarse grained, light brown to gray, moist					S-2	
				5				
	6.5	coarse grained, gray	78.5+/-		▽		S-3	

Test Pit Terminated at 6.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

TEST PIT LOG NO. TP-06

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight
Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE
Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1116° Longitude: -122.1782°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1		1.0	**TOPSOIL**, with organics, dark brown, moist, Silty Sand (SM), with roots	84+/-					
2		2.0	**SILTY SAND (SM)**, trace gravel, light brown, moist	83+/-					
3			**POORLY GRADED SAND (SP)**, trace gravel, fine to medium grained, loose to medium dense				Grab	S-1	
					5				
		6.5	coarse grained, gray, wet	78.5+/-		▽	Grab	S-2	
			Test Pit Terminated at 6.5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

TEST PIT LOG NO. TP-07

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1116° Longitude: -122.1771°

Approximate Surface Elev.: 84 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1		1.0	**TOPSOIL**, with organics, dark brown, moist, Silty Sand (SM), with roots	83+/-					
2		1.5	**SILTY SAND (SM)**, light brown, moist	82.5+/-					
3			**POORLY GRADED SAND (SP)**, brownish gray, moist, loose to medium dense with Silty Sand lenses increased coarse grained material with depth				Grab	S-1	
					5				
		7.0	brown to gray	77+/-		▽			
			Test Pit Terminated at 7 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

TEST PIT LOG NO. TP-08

PROJECT: SAIA Motor Freight Terminal

CLIENT: SAIA LTL Freight Johns Creek, GA

SITE: Smokey Point Blvd and 128th St NE Marysville, WA

LOCATION See Exploration Plan

Latitude: 48.1117° Longitude: -122.1760°

Approximate Surface Elev.: 85 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	Sample No.	WATER CONTENT (%)
1	1.0	**TOPSOIL**, with organics, dark brown, moist, Silty Sand (SM), with roots	84+/-					
2	2.5	**SILTY SAND (SM)**, light brown, moist	82.5+/-					
3	5.0	**POORLY GRADED SAND (SP)**, fine to medium grained, light brown to gray, moist, loose	80+/-	5	▽	Grab	S-1	

Test Pit Terminated at 5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavation

Abandonment Method:
Test pit backfilled with excavated soil

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While excavating*

Terracon

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

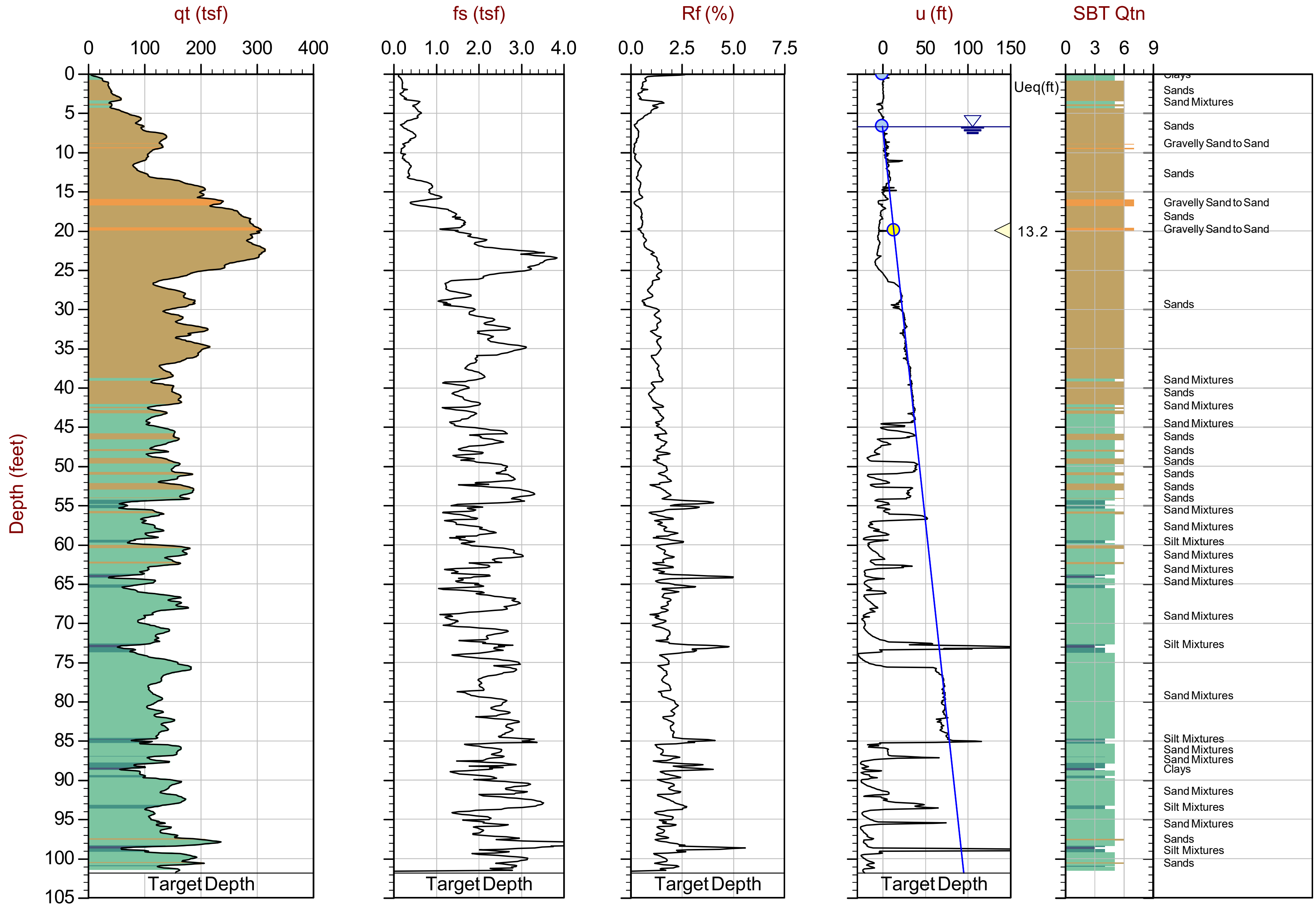
Test Pit Started: 10-14-2021	Test Pit Completed: 10-14-2021
Excavator:	Operator: Green Earthworks
Project No.: 81215171	

CONETEC

Terracon

Job No: 21-59-23130
Date: 2021-10-15 08:45
Site: SAIA Freight Terminal

Sounding: CPT-B01
Cone: 730:T1500F15U35



Max Depth: 31.050 m / 101.87 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17801

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

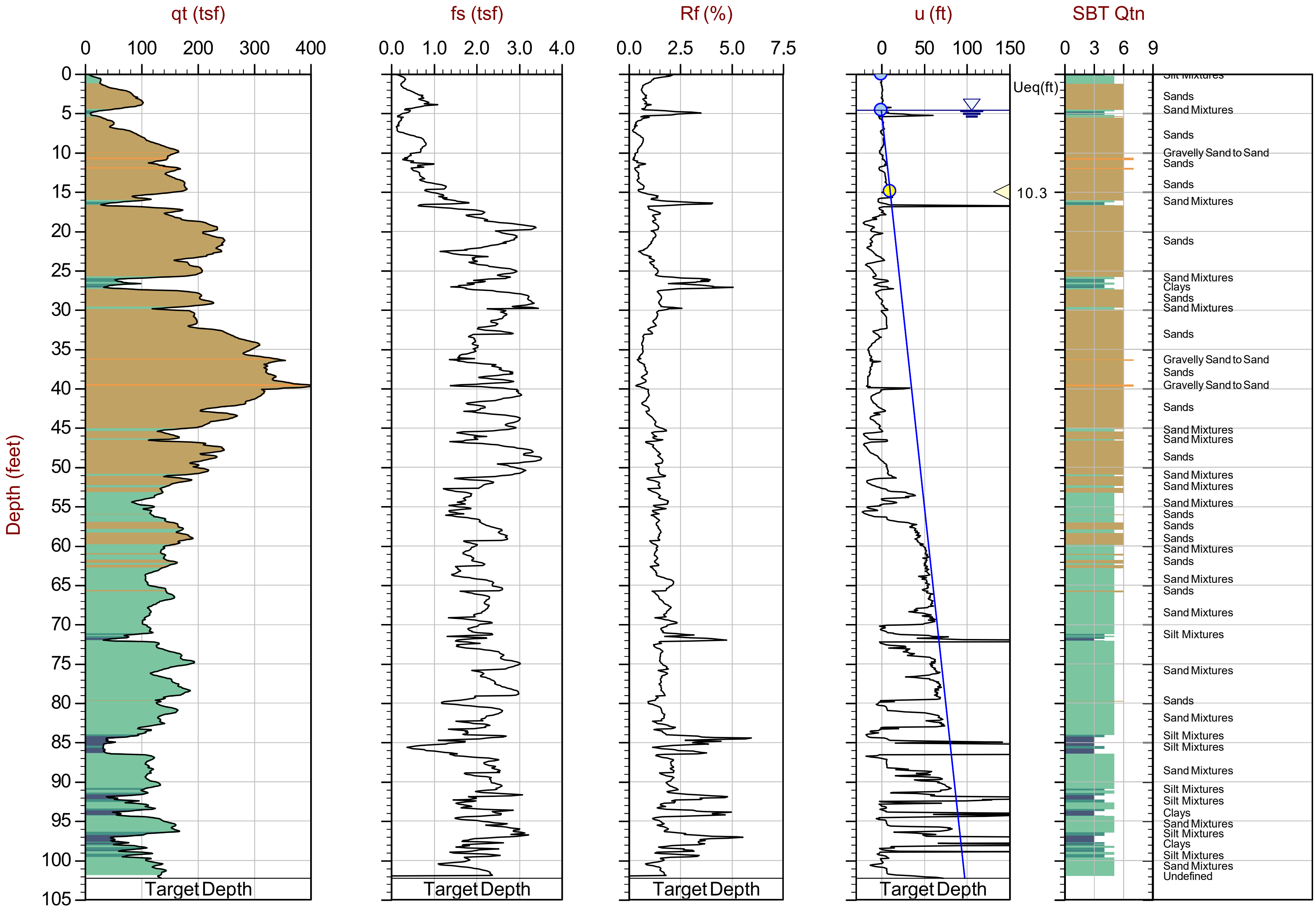
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Terracon

Job No: 21-59-23130
Date: 2021-10-15 10:19
Site: SAIA Freight Terminal

Sounding: CPT-B02
Cone: 730:T1500F15U35



Max Depth: 31.175 m / 102.28 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_CP02.COR
Unit Wt: SBTQtn (PKR2009)

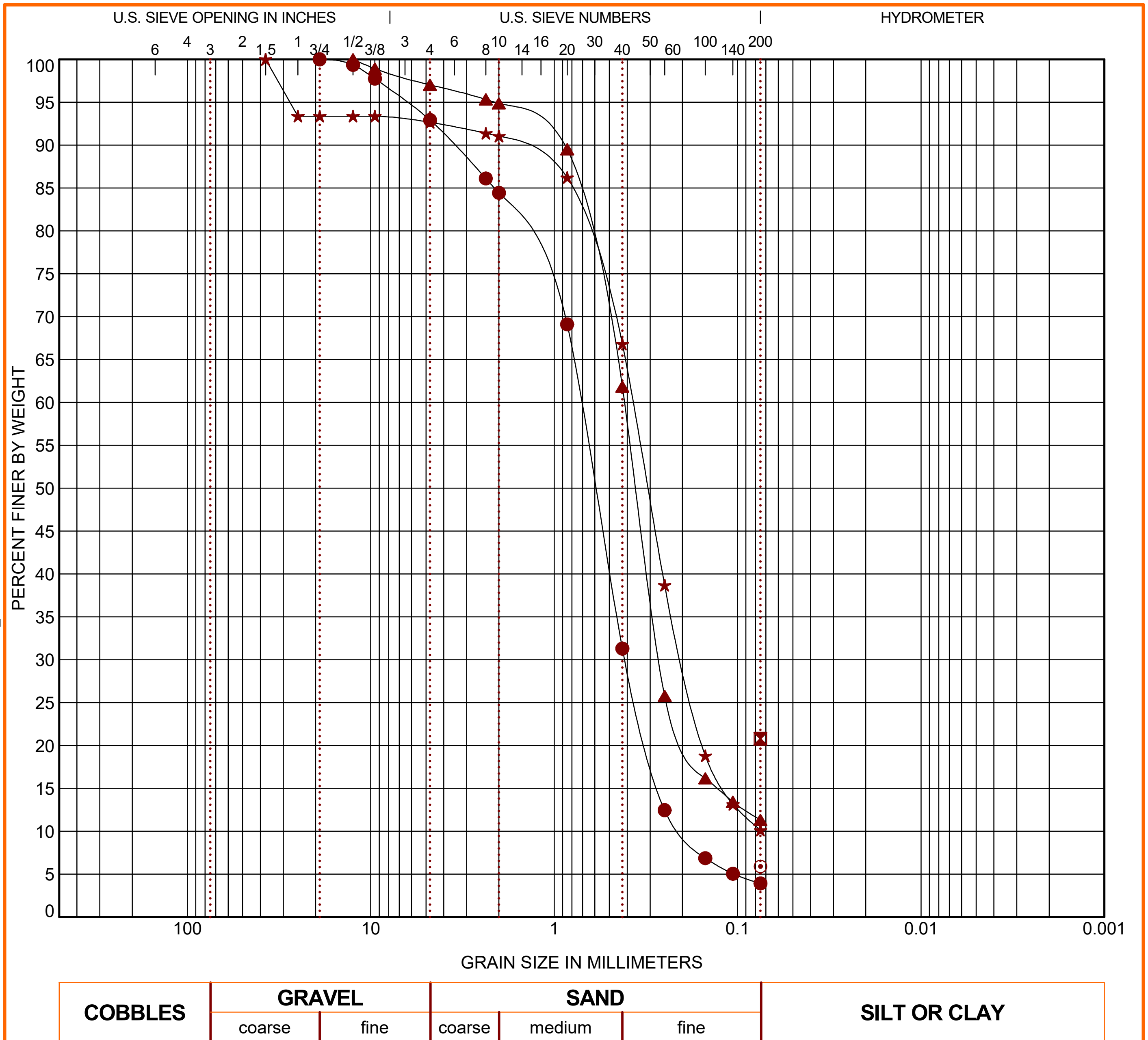
SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17686

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-B01	10 - 11.5	POORLY GRADED SAND (SP)	18.5				1.17	3.60
⊠	B-B01	20 - 21.5	SILTY SAND (SM)	16.1					
▲	B-B03	5 - 6.5	WELL GRADED SAND with SILT (SW-SM)	22.3				2.84	6.85
★	B-B03	7.5 - 9	POORLY GRADED SAND with SILT (SP-SM)	22.7				1.45	5.06
⊙	B-B03	15 - 16.5	POORLY GRADED SAND with SILT (SP-SM)	19.1					

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-B01	10 - 11.5	19	0.719	0.41	0.2	0.0	7.1	89.0		3.9	
⊠	B-B01	20 - 21.5	0.075								20.8	
▲	B-B03	5 - 6.5	12.5	0.414	0.266		0.0	3.0	85.7		11.3	
★	B-B03	7.5 - 9	37.5	0.374	0.2		0.0	7.3	82.5		10.1	
⊙	B-B03	15 - 16.5	0.075								5.9	

PROJECT: SAIA Motor Freight Terminal

SITE: Smokey Point Blvd and 128th St NE
Marysville, WA

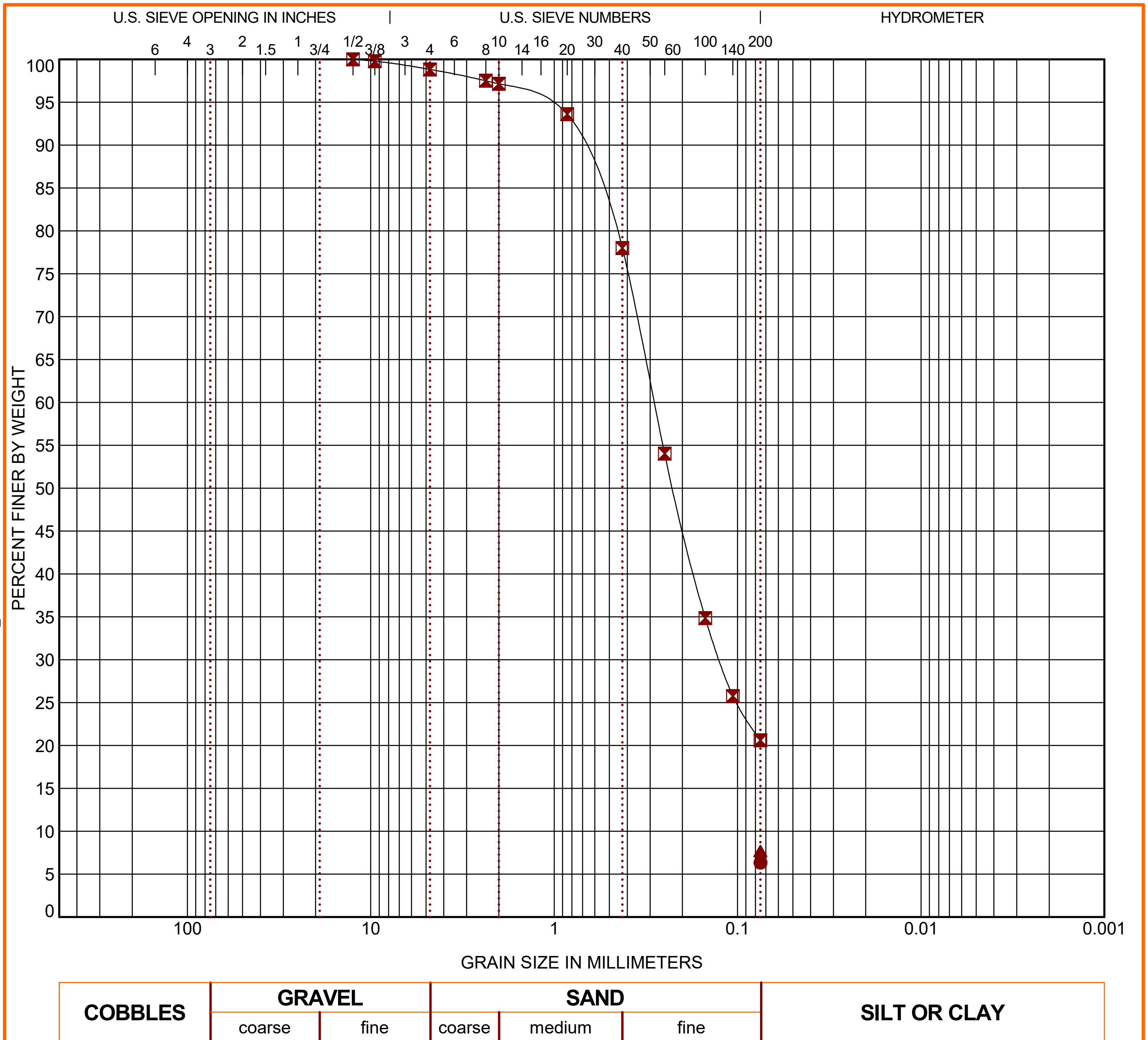
Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

PROJECT NUMBER: 81215171

CLIENT: SAIA LTL Freight
Johns Creek, GA

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-B03	25 - 26.5	POORLY GRADED SAND with SILT (SP-SM)	24.7					
⊠	B-P08p	2.5 - 4	SILTY SAND (SM)	20.9					
▲	B-D13p	2.5 - 4	POORLY GRADED SAND with SILT (SP-SM)	13.0					

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-B03	25 - 26.5	0.075								6.3	
⊠	B-P08p	2.5 - 4	12.5	0.285	0.125		0.0	1.2	78.2		20.6	
▲	B-D13p	2.5 - 4	0.075								7.7	

PROJECT: SAIA Motor Freight Terminal

SITE: Smokey Point Blvd and 128th St NE
Marysville, WA

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

PROJECT NUMBER: 81215171

CLIENT: SAIA LTL Freight
Johns Creek, GA

MATERIALS TESTING & CONSULTING, INC.

Client:	Terracon	**Date:**	November 1, 2021
Address:	21905 64th Ave W, Suite 100	**Project:**	SAIA
	Mountlake Terrace, WA 98043	**Project #:**	21B279-03
Attn:	Nithybhan Chandaresan	**Sample #:**	B21-2276
Revised on:		**Date sampled:**	October 20, 2021

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
X	Sieve Analysis	Please See Attached Report		Sulfate Soundness	
X	Proctor	116.1 pcf at 11.3%		Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count			LA Abrasion	
	Moisture Content		**X**	CBR	Please See Attached Report
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Meghan Blodgett-Carrillo
WABO Supervising Laboratory Technician

MATERIALS TESTING & CONSULTING, INC.

Sieve Report

Project:	SAIA	**Date Received:**	20-Oct-21
Project #:	21B279-03	**Sampled By:**	Client
Client:	Terracon	**Date Tested:**	21-Oct-21
Source:	Not Reported - CBR	**Tested By:**	K. Mendez
Sample#:	B21-2276		

Unified Soil Classification System, ASTM-2487
SM, Silty Sand
Sample Color:
brown

ACCREDITED
Certificate #: 1366.01

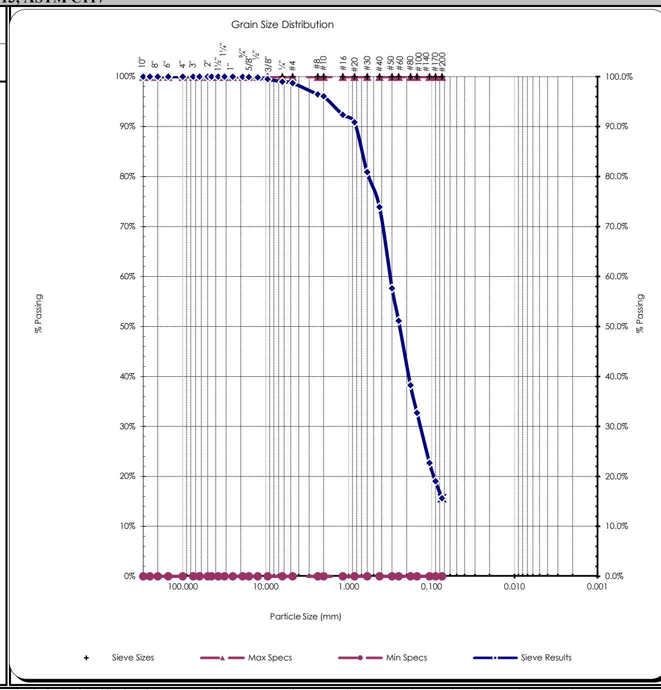
ASTM D2216, ASTM D2419, ASTM D4318, ASTM D5281

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.024 mm	% Gravel = 1.3%	Coeff. of Curvature, C_C = 1.25
$D_{(10)}$ = 0.048 mm	% Sand = 83.1%	Coeff. of Uniformity, C_U = 6.63
$D_{(15)}$ = 0.072 mm	% Silt & Clay = 15.6%	Fineness Modulus = 1.42
$D_{(30)}$ = 0.138 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 0.244 mm	Plasticity Index = n/a	Moisture %, as sampled = n/a
$D_{(60)}$ = 0.318 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 0.829 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 15/71	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C136, ASTM D6913, ASTM C117

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00	100%	100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00	100%	100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	99%	99%	100.0%	0.0%
1/4"	6.30		99%	100.0%	0.0%
#4	4.75	99%	99%	100.0%	0.0%
#8	2.36		96%	100.0%	0.0%
#10	2.00	96%	96%	100.0%	0.0%
#16	1.18		92%	100.0%	0.0%
#20	0.850	91%	91%	100.0%	0.0%
#30	0.600		81%	100.0%	0.0%
#40	0.425	74%	74%	100.0%	0.0%
#50	0.300		58%	100.0%	0.0%
#60	0.250	51%	51%	100.0%	0.0%
#80	0.180		38%	100.0%	0.0%
#100	0.150	33%	33%	100.0%	0.0%
#140	0.106		23%	100.0%	0.0%
#170	0.090		19%	100.0%	0.0%
#200	0.075	15.6%	15.6%	100.0%	0.0%



Comments:

Reviewed by: Meghan Blodgett-Carrillo

Meghan Blodgett-Carrillo

MATERIALS TESTING & CONSULTING, INC.

Proctor Report

Project: SAIA
Project #: 21B279-03
Client: Terracon
Source: Not Reported - CBR
Sample#: B21-2276

Date Received: 20-Oct-21
Sampled By: Client
Date Tested: 21-Oct-21
Tested By: K. Mendez

Unified Soils Classification System, ASTM D-2487
SM, Silty Sand
Sample Color
brown

Sample Prepared: Moist: X Dry: | Manual: Mechanical: X
Test Standard: ASTM D698: ASTM D 1557: X | AASHTO T 99: AASHTO T 180: | Method A

Assumed Sp. Gr. 2.50

Point Number	Percent Moisture	Dry Density
1	8.3 %	111.4
2	10.4 %	115.5
3	12.4 %	115.8
4	14.2 %	111.8

Uncorrected Proctor Value

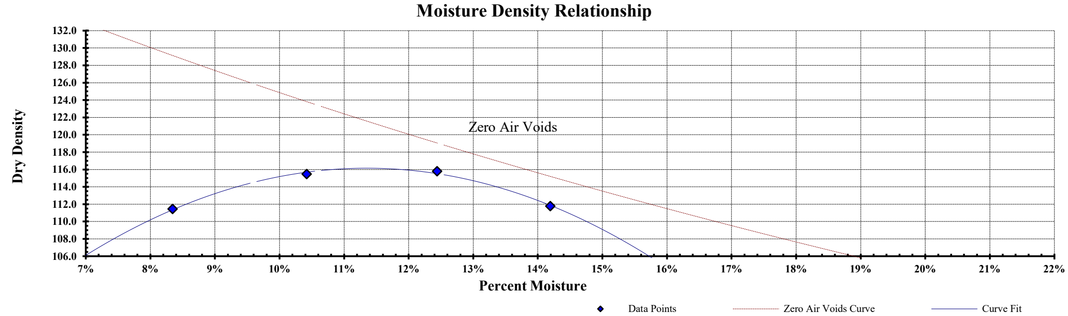
Max. Dry Density		Optimum Moist
116.1	lbs/ft³	11.3 %

Value w/ Oversize Correction Applied

Max. Dry Density		Optimum Moist
N/A	lbs/ft³	N/A

ACCREDITED
Certificate #: 1366.01

Moisture Density Relationship



ASTM C136

Sieve US	Size mm	Percent Passing	Specifications Max	Specifications Min
12.00"	300.00		100 %	0 %
10.00"	250.00		100 %	0 %
8.00"	200.00		100 %	0 %
6.00"	150.00		100 %	0 %
4.00"	100.00	100 %	100 %	0 %
3.00"	75.00		100 %	0 %
2.50"	63.00		100 %	0 %
2.00"	50.00	100 %	100 %	0 %
1.75"	45.00		100 %	0 %
1.50"	37.50		100 %	0 %
1.25"	31.50		100 %	0 %
1.00"	25.00	100 %	100 %	0 %
3/4"	19.00	100 %	100 %	0 %
5/8"	16.00		100 %	0 %
1/2"	12.50	100 %	100 %	0 %
3/8"	9.50	99 %	100 %	0 %
1/4"	6.30		100 %	0 %
#4	4.75	99 %	100 %	0 %
#8	2.36		100 %	0 %
#10	2.00	96 %	100 %	0 %
#16	1.18		100 %	0 %
#20	0.850	91 %	100 %	0 %
#30	0.600		100 %	0 %
#40	0.425	74 %	100 %	0 %
#50	0.300		100 %	0 %
#60	0.250	51 %	100 %	0 %
#80	0.180		100 %	0 %
#100	0.150	33 %	100 %	0 %
#140	0.106		100 %	0 %
#170	0.090		100 %	0 %
#200	0.075	15.6 %	100.0 %	0.0 %

ASTM D4718, Misc. Oversize Correction Values

% Oversize Mat'l: 1%

% Oversize Retained	Corrected Density	Optimum Moisture
5%	117.6	10.8%
10%	119.2	10.3%
15%	120.8	9.7%
20%	122.4	9.2%
25%	124.1	8.6%
30%	125.8	8.1%

Specs: No Specs **Meets Specs?** N/A

% Gravel: 1.3% | C_C: 1.25 | $D_{(10)}$: 0.048
% Sand: 83.1% | C_U: 6.63 | $D_{(30)}$: 0.138
% Silt&Clay: 15.6% | FM: 1.42 | $D_{(60)}$: 0.318

LL: n/a | PL: n/a | PI: n/a

Sand Equivalent: n/a | Req'd Sand Equivalent:

Fracture %, 1 Face: n/a | Req'd Fracture %, 1 Face:
Fracture %, 2+ Faces: n/a | Req'd Fracture %, 2+ Faces:

Comments:

Reviewed by: Meghan Blodgett-Carrillo

Meghan Blodgett-Carrillo

CBR Report

Project: SAIA	**Date Received:** 20-Oct-21	**Unified Soils Classification System, ASTM D-2487**	ACCREDITED
Project #: 21B279-03	**Sampled By:** Client	SM, Silty Sand	Certificate #: 1366.01
Client: Terracon	**Date Tested:** 21-Oct-21	**Sample Color**	
Source: Not Reported - CBR	**Tested By:** K. Mendez	brown	
Sample#: B21-2276			

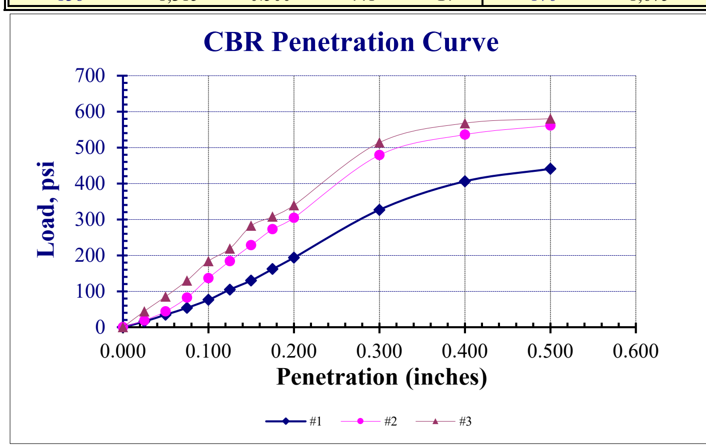
California Bearing Ratio, ASTM 1883

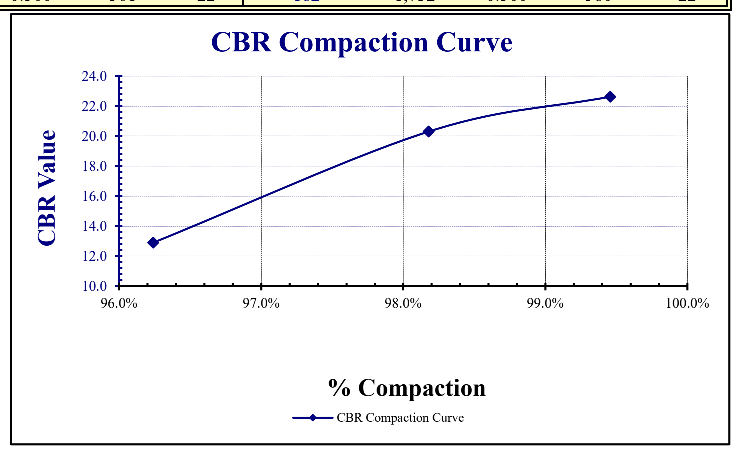
		Blows/Lift	Blows/Lift	Blows/Lift	
Test Standard		**10**	**25**	**56**	
AASHTO T 99:	Weight of Mold + Soils:	27.3	25.9	25.8	lbs
ASTM D 698:	Weight of Mold:	17.8	16.2	16.0	lbs
AASHTO T 180:	Wet Weight of Soils:	9.5	9.7	9.8	lbs
ASTM D 1557: X	Wet Density:	126.6	130.0	131.5	lbs/ft^3
Method: A	% Moisture:	13.2%	14.0%	13.8%	
	Dry Density:	**111.8**	**114.0**	**115.5**	lbs/ft^3
Sample Prepared	**% Compaction:**	**96.2%**	**98.2%**	**99.5%**	
Moist: X	Initial Swell Reading:	0.37	0.6	0.45	
Dry:	Final Swell Reading:	0.384	0.611	0.454	
Manual:	**% Swell:**	0.31%	0.24%	0.09%	
Mechanical: X	**CBR Value:**	12.9	20.3	22.6	
	Adjusted CBR Value:				

CBR Load Ring	
Calibrated 3/2/2021	
y=mx+b	
m	**b**
9.465011	9.224079

Max. Dry Density		Optimum Moist.
116.1	**lbs/ft^3**	**11.3%**

Dial Reading	#1 Load	Depth Inches	#1 psi	CBR Value	Dial Reading	#2 Load	Depth Inches	#2 psi	CBR Value	Dial Reading	#3 Load	Depth Inches	#3 psi	CBR Value
0	0	0.000	0		0	0	0.000	0		0	0	0.000	0	
4	47	0.025	16		5	57	0.025	19		13	132	0.025	44	
10	104	0.050	35		13	132	0.050	44		26	255	0.050	86	
16	161	0.075	54		25	246	0.075	82		40	388	0.075	130	
23	227	0.100	76	**8**	42	407	0.100	136	**14**	57	549	0.100	184	**18**
32	312	0.125	105		57	549	0.125	184		68	653	0.125	219	
40	388	0.150	130		71	681	0.150	228		88	842	0.150	282	
50	482	0.175	162		85	814	0.175	273		96	918	0.175	308	
60	577	0.200	193	**13**	95	908	0.200	304	**20**	106	1,013	0.200	339	**23**
102	975	0.300	327	**17**	150	1,429	0.300	479	**25**	161	1,533	0.300	514	**27**
127	1,211	0.400	406	**18**	168	1,599	0.400	536	**23**	178	1,694	0.400	568	**25**
138	1,315	0.500	441	**17**	176	1,675	0.500	561	**22**	182	1,732	0.500	580	**22**





Comments: ______________________

Reviewed by: Meghan Blodgett-Carrillo

Meghan Blodgett-Carrillo

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Terracon GeoReport

Client

SAIA LTL Freight

Project

SAIA Motor Freight Terminal

Sample Submitted By: Terracon (81) **Date Received:** 11/19/2021 **Lab No.: 21-0887**

Results of Corrosion Analysis

Sample Number	S-1	S-2	S-1
Sample Location	B-B03	TP-5	TP-8
Sample Depth (ft.)	2.5-6.0	2.5-3.0	2.5-3.0
pH Analysis, ASTM G 51	7.10	6.60	6.48
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	77	56	28
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil	Nil
Chlorides, ASTM D 512, (mg/kg)	45	28	25
Red-Ox, ASTM G 200, (mV)	+718	+717	+725
Total Salts, AWWA 2520 B, (mg/kg)	83	84	52
Saturated Minimum Resistivity, ASTM G 57, (ohm-cm)	18430	27160	51410

N. Campo

Analyzed By:

Nathan Campo
Engineering Technician II

SUPPORTING INFORMATION

Contents:

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAIA Motor Freight Terminal ■ Marysville, WA

Terracon Project No. 81215171

SAMPLING

Grab Sample

Standard Penetration Test

WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	**Group Name** [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

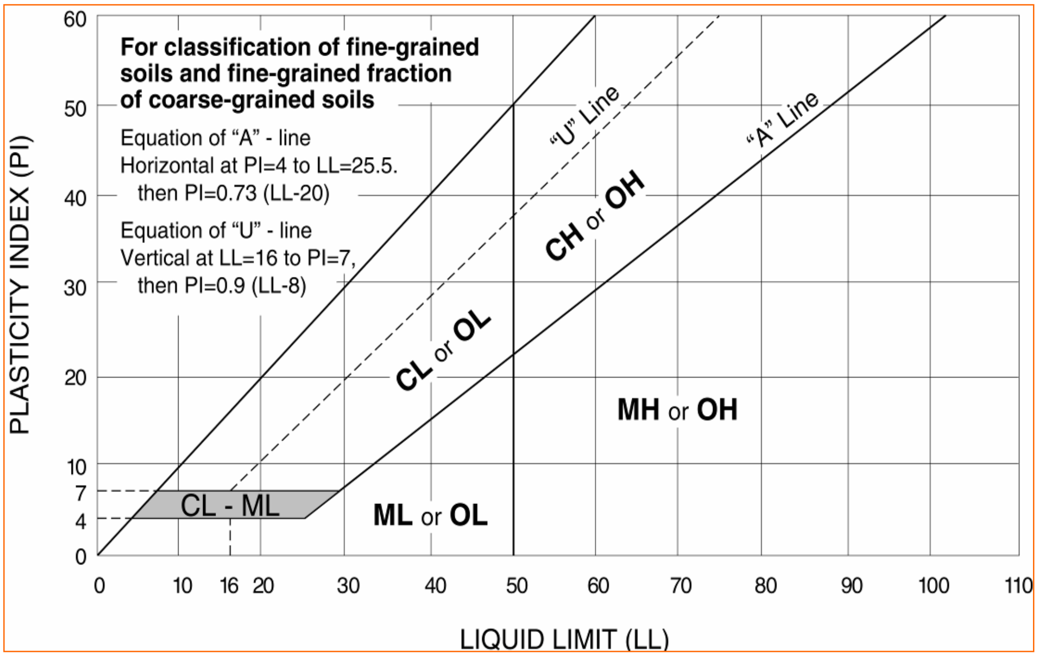
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.


For classification of fine-grained soils and fine-grained fraction of coarse-grained soils
Equation of "A" - line
Horizontal at PI=4 to LL=25.5.
then PI=0.73 (LL-20)
Equation of "U" - line
Vertical at LL=16 to PI=7,
then PI=0.9 (LL-8)
"U" Line
"A" Line
CH or OH
CL or OL
MH or OH
ML or OL
CL - ML
PLASTICITY INDEX (PI)
LIQUID LIMIT (LL)
0
4
7
10
20
30
40
50
60
0
10
16
20
30
40
50
60
70
80
90
100
110

PRESENTATION OF SITE INVESTIGATION RESULTS

SAIA Freight Terminal

Prepared for:

Terracon Consultants, Inc.

ConeTec Job No: 21-59-23130

Project Start Date: 15-OCT-2021
Project End Date: 15-OCT-2021
Report Date: 21-OCT-2021

Prepared by:

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Introduction

The enclosed report presents the results of the site investigation program conducted by ConeTec Inc. for Terracon Consultants, Inc. at 4127 128th St NE, Marysville, WA 98271. The program consisted of cone penetration tests and seismic cone penetration tests.

Project Information

Project	
Client	Terracon Consultants, Inc.
Project	SAIA Freight Terminal
ConeTec project number	21-59-23130

An aerial overview from Google Earth including the CPTu test locations is presented below.

Rig Description	Deployment System	Test Type
C20-30Ton Truck Rig	Integrated Push Cylinders	CPTu

Coordinates		
Test Type	Collection Method	EPSG Number
CPTu	Consumer grade GPS	4326

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (bar)
730: T1500F15U35	730	15.0	225	1500	15	35
Cone 730 was used for all CPTu soundings						

Cone Penetration Test (CPTu)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.
Additional plots	• Normalized plots with Qtn and Norm: Fr(%) • Advanced plots with Ic, Su, phi and N(60)/N1(60) • Soil Behaviour Type (SBT) scatter plots • Seismic shear wave (Vs) plots • Seismic shear wave (Vs) Wave Trace plots

Calculated Geotechnical Parameter Tables	
Additional information	The Normalized Soil Behaviour Type Chart based on Q_{tn} (SBT Q_{tn}) (Robertson, 2009) was used to classify the soil for this project. A detailed set of calculated CPTu parameters have been generated and are provided in Excel format files in the release folder. The CPTu parameter calculations are based on values of corrected tip resistance (q_t) sleeve friction (f_s) and pore pressure (u_2). Effective stresses are calculated based on unit weights that have been assigned to the individual soil behaviour type zones and the assumed equilibrium pore pressure profile.

Limitations

This report has been prepared for the exclusive use of Terracon Consultants, Inc. (Client) for the project titled “SAIA Freight Terminal”. The report’s contents may not be relied upon by any other party without the express written permission of ConeTec Inc. (ConeTec). ConeTec has provided site investigation services, prepared the factual data reporting and provided geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

The information presented in the report document and the accompanying data set pertain to the specific project, site conditions and objectives described to ConeTec by the Client. In order to properly understand the factual data, assumptions and calculations, reference must be made to the documents provided and their accompanying data sets, in their entirety.

Cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd., a subsidiary of ConeTec.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and two geophone sensors for recording seismic signals. All signals are amplified and measured with minimum sixteen-bit resolution down hole within the cone body, and the signals are sent to the surface using a high bandwidth, error corrected digital interface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 millimeters diameter over a length of 32 millimeters with tapered leading and trailing edges) located at a distance of 585 millimeters above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is six millimeters thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meets or exceeds those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

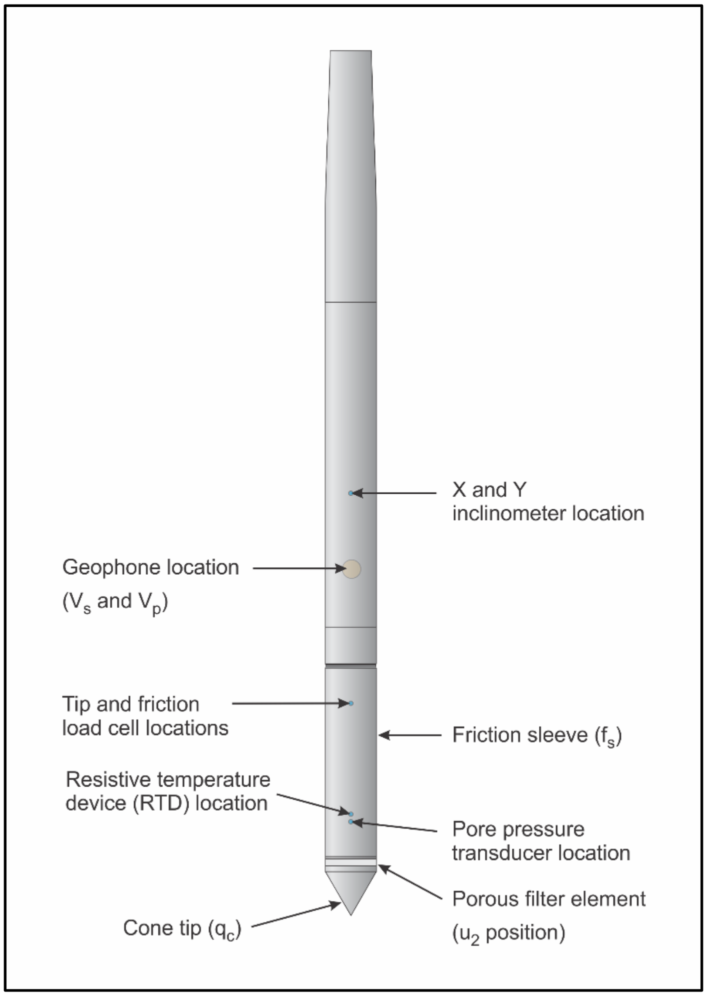

Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal interface box and power supply. The signal interface combines depth increment signals, seismic trigger signals and the downhole digital data. This combined data is then sent to the Windows based computer for collection and presentation. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording interval is 2.5 centimeters; custom recording intervals are possible.

The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPTu operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of two centimeters per second, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches (38.1 millimeters) are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil under vacuum pressure prior to use
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson et al. (1986) and Robertson (1990, 2009). It should be noted that it is not always possible to accurately identify a soil behavior type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al. (1986):

$$q_t = q_c + (1-a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (R_f) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of files with calculated geotechnical parameters were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the methods used is also included in the data release folder.

For additional information on CPTu interpretations and calculated geotechnical parameters, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

Shear wave velocity (Vs) testing is performed in conjunction with the piezocone penetration test (SCPTu) in order to collect interval velocities. For some projects seismic compression wave velocity (Vp) testing is also performed.

ConeTec's piezocone penetrometers are manufactured with one horizontally active geophone (28 hertz) and one vertically active geophone (28 hertz). Both geophones are rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip. The vertically mounted geophone is more sensitive to compression waves.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances, an auger source or an imbedded impulsive source may be used for both shear waves and compression waves. The hammer and beam act as a contact trigger that initiates the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded in the memory of the cone using a fast analog to digital converter. The seismic trace is then transmitted digitally uphole to a Windows based computer through a signal interface box for recording and analysis. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

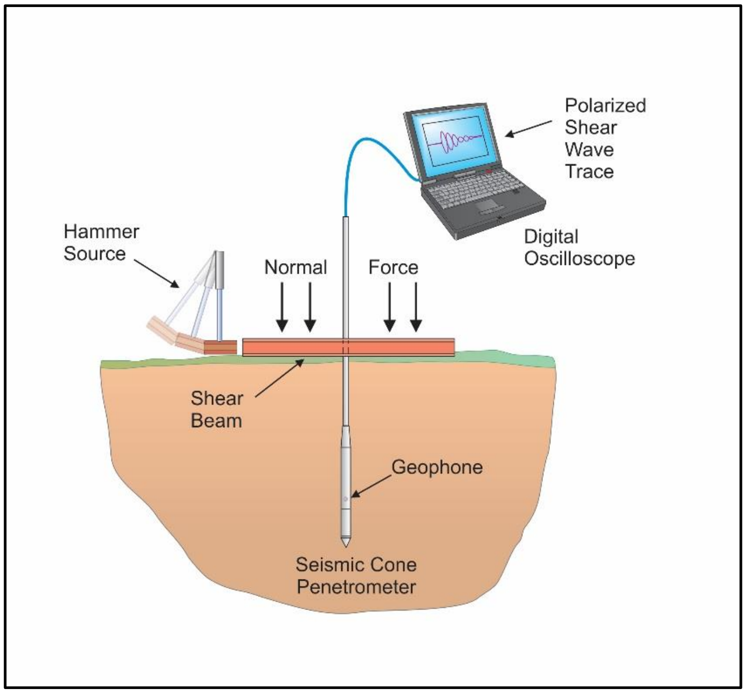

Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to ConeTec's SCPTu operating procedures which are in general accordance with the current ASTM D5778 and ASTM D7400 standards.

Prior to the start of a SCPTu sounding, the procedures described in the Cone Penetration Test section are followed. In addition, the active axis of the geophone is aligned parallel to the beam (or source) and the horizontal offset between the cone and the source is measured and recorded.

Prior to recording seismic waves at each test depth, cone penetration is stopped and the rods are decoupled from the rig to avoid transmission of rig energy down the rods. Typically, five wave traces for each orientation are recorded for quality control and uncertainty analysis purposes. After reviewing wave traces for consistency the cone is pushed to the next test depth (typically one meter intervals or as requested by the client). Figure SCPTu-2 presents an illustration of a SCPTu test.

For additional information on seismic cone penetration testing refer to Robertson et al. (1986).

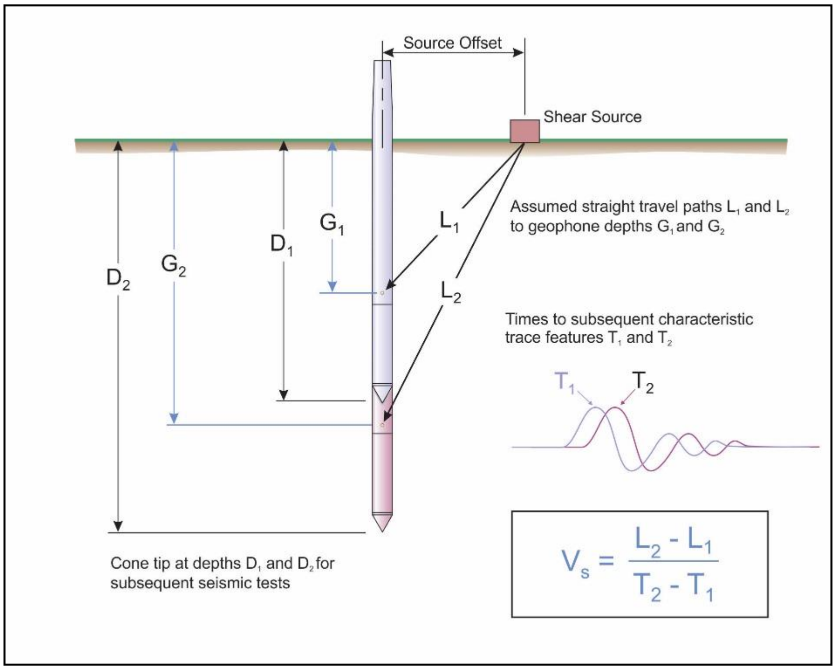

Figure SCPTu-2. Illustration of a seismic cone penetration test

Calculation of the interval velocities are performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the recorded wave sets and taking the difference in ray path divided by the time difference between subsequent features. Ray path is defined as the straight line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

For all SCPTu soundings that have achieved a depth of at least 100 feet (30 meters), the average shear wave velocity to a depth of 100 feet ($\bar{v}_s$) has been calculated and provided for all applicable soundings using the following equation presented in ASCE (2010).

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

where: $\bar{v}_s$ = average shear wave velocity ft/s (m/s)

d_i = the thickness of any layer between 0 and 100 ft (30 m)

v_{si} = the shear wave velocity in ft/s (m/s)

$\sum_{i=1}^{n} d_i$ = the total thickness of all layers between 0 and 100 ft (30 m)

Average shear wave velocity, $\bar{v}_s$ is also referenced to V_{s100} or V_{s30}.

The layer travel times refers to the travel times propagating in the vertical direction, not the measured travel times from an offset source.

Tabular results and SCPTu plots are presented in the relevant appendix.

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

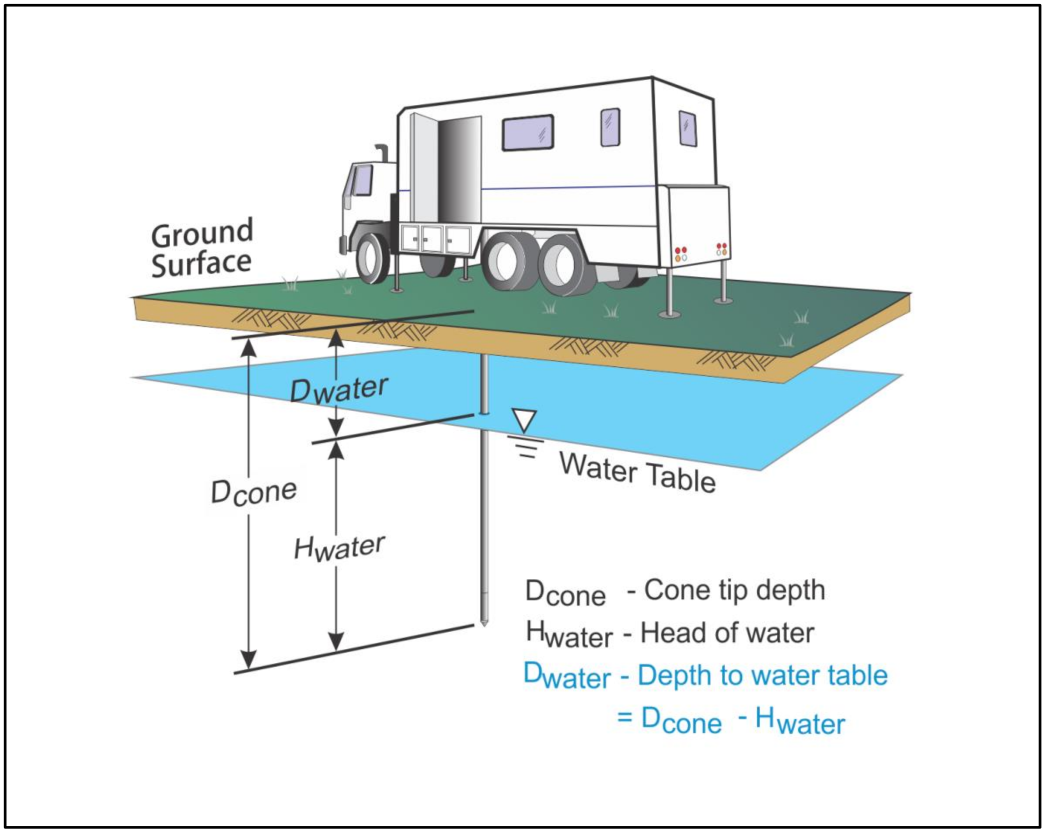

Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behavior.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

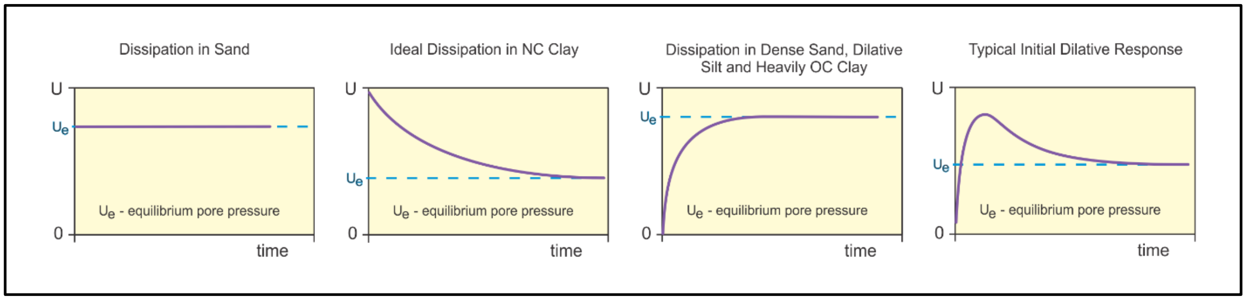

Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve in Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:
T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby (1991))

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby (1991)), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

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Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G., 1992, “Estimating coefficient of consolidation from piezocone tests”, Canadian Geotechnical Journal, 29(4): 539-550. DOI: 10.1139/T92-061.

Robertson, P.K., 2009, "Interpretation of cone penetration tests – a unified approach", Canadian Geotechnical Journal, Volume 46: 1337-1355. DOI: 10.1139/T09-065.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils", Canadian Geotechnical Journal, 36(2): 369-381. DOI: 10.1139/T98-105.

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The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Normalized Cone Penetration Test Plots
- Advanced Cone Penetration Test Plots with Ic, Su(Nkt), Phi and N(60)Ic/N1(60)Ic
- Seismic Cone Penetration Test Plots
- Seismic Cone Penetration Test Shear Wave (Vs) Tabular Results
- Seismic Cone Penetration Test Shear Wave (Vs) Traces
- Soil Behavior Type (SBT) Scatter Plots
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

	Job No:	21-59-23130
	Client:	Terracon Consultants, Inc.
	Project:	SAIA Freight Terminal
	Start Date:	15-Oct-2021
	End Date:	15-Oct-2021

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed [1] Phreatic Surface (ft)	Final Depth (ft)	Shear Wave Velocity Tests	Latitude[2] (deg)	Longitude[2] (deg)
CPT-B01	21-59-23130_SP01	15-Oct-2021	730: T1500F15U35	6.7	101.9	31	48.11194	-122.17801
CPT-B02	21-59-23130_CP02	15-Oct-2021	730: T1500F15U35	4.6	102.3		48.11194	-122.17686
Totals	2 soundings				204.2	31		

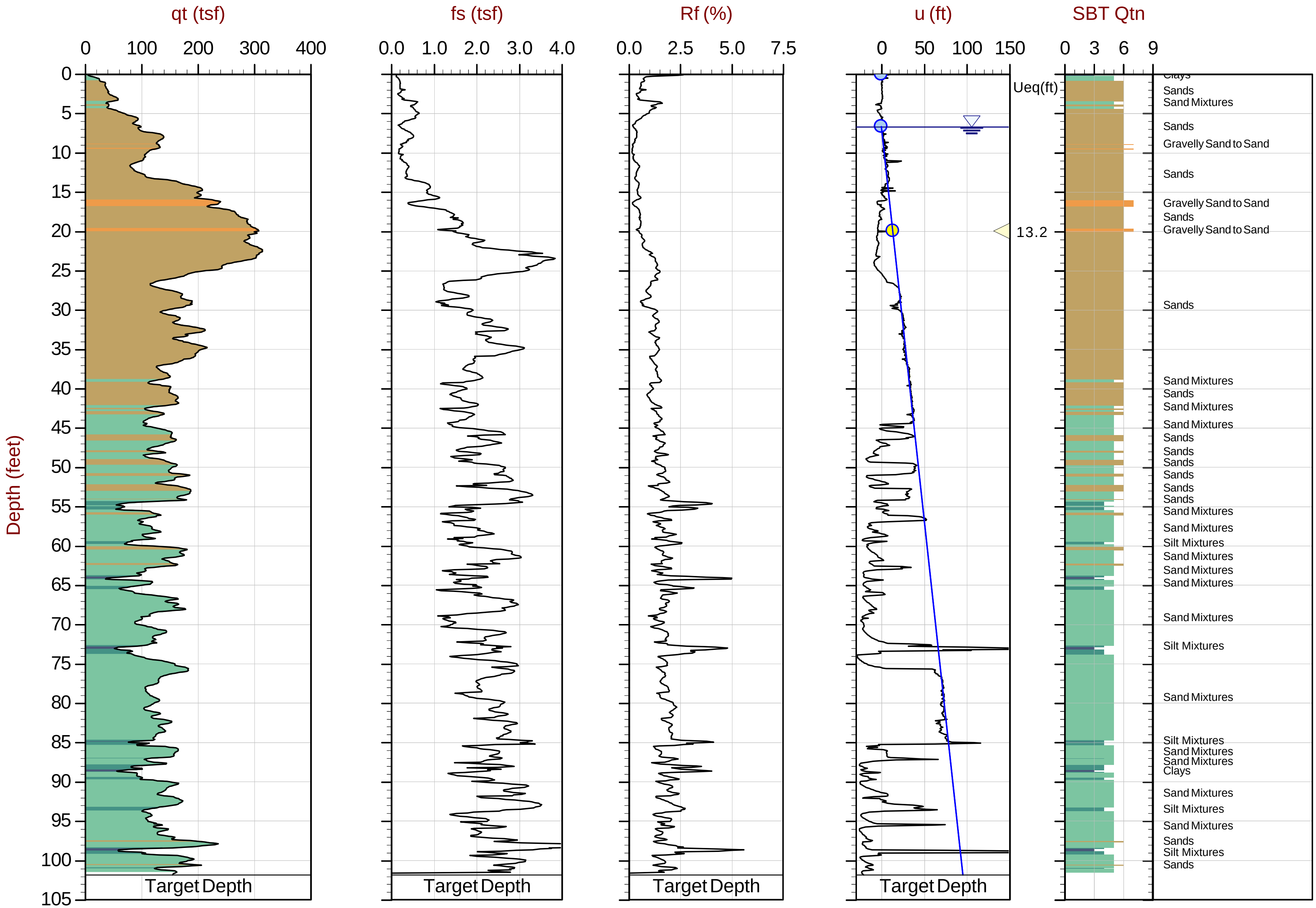
1. Phreatic surface based on pore pressure dissipation test unless otherwise noted. Hydrostatic profile applied to interpretation tables
2. Coordinates were collected using a handheld GPS - WGS 84 Lat/Long

CONETEC

Terracon

Job No: 21-59-23130
Date: 2021-10-15 08:45
Site: SAIA Freight Terminal

Sounding: CPT-B01
Cone: 730:T1500F15U35



Max Depth: 31.050 m / 101.87 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17801

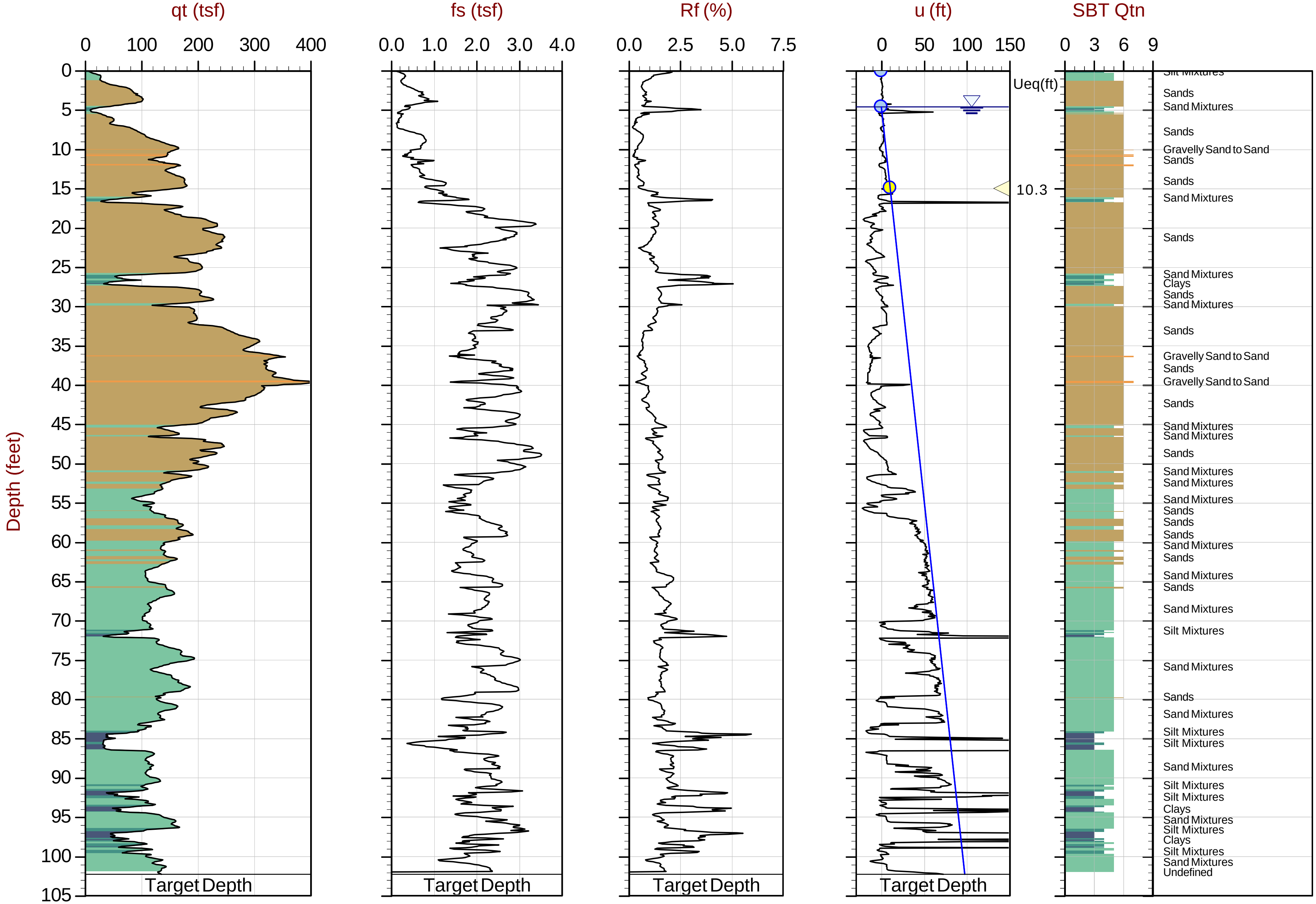
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Terracon

Job No: 21-59-23130
Date: 2021-10-15 10:19
Site: SAIA Freight Terminal
Sounding: CPT-B02
Cone: 730:T1500F15U35



Max Depth: 31.175 m / 102.28 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17686

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

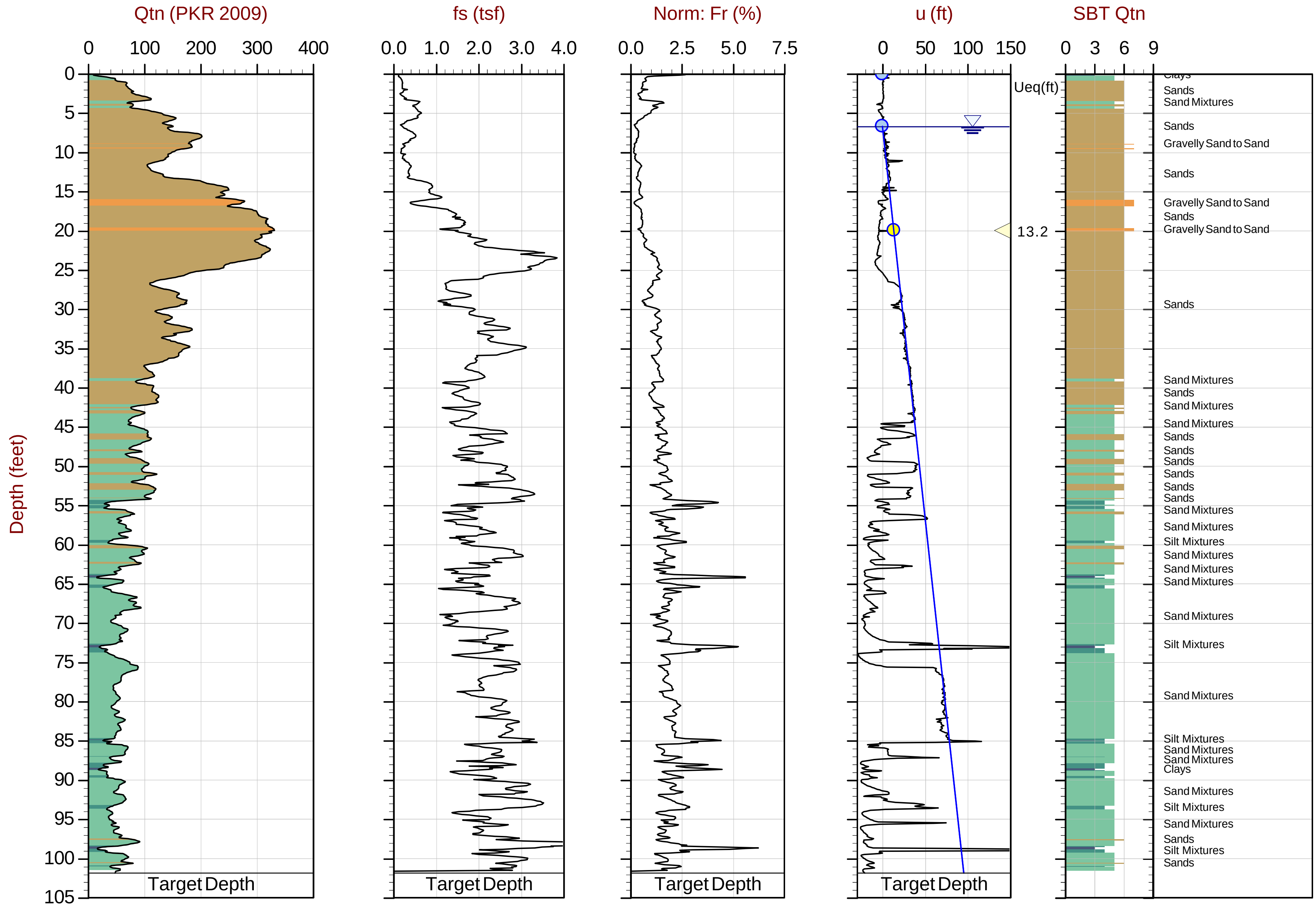
Normalized Cone Penetration Test Plots

CONETEC

Terracon

Job No: 21-59-23130
Date: 2021-10-15 08:45
Site: SAIA Freight Terminal

Sounding: CPT-B01
Cone: 730:T1500F15U35



Max Depth: 31.050 m / 101.87 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17801

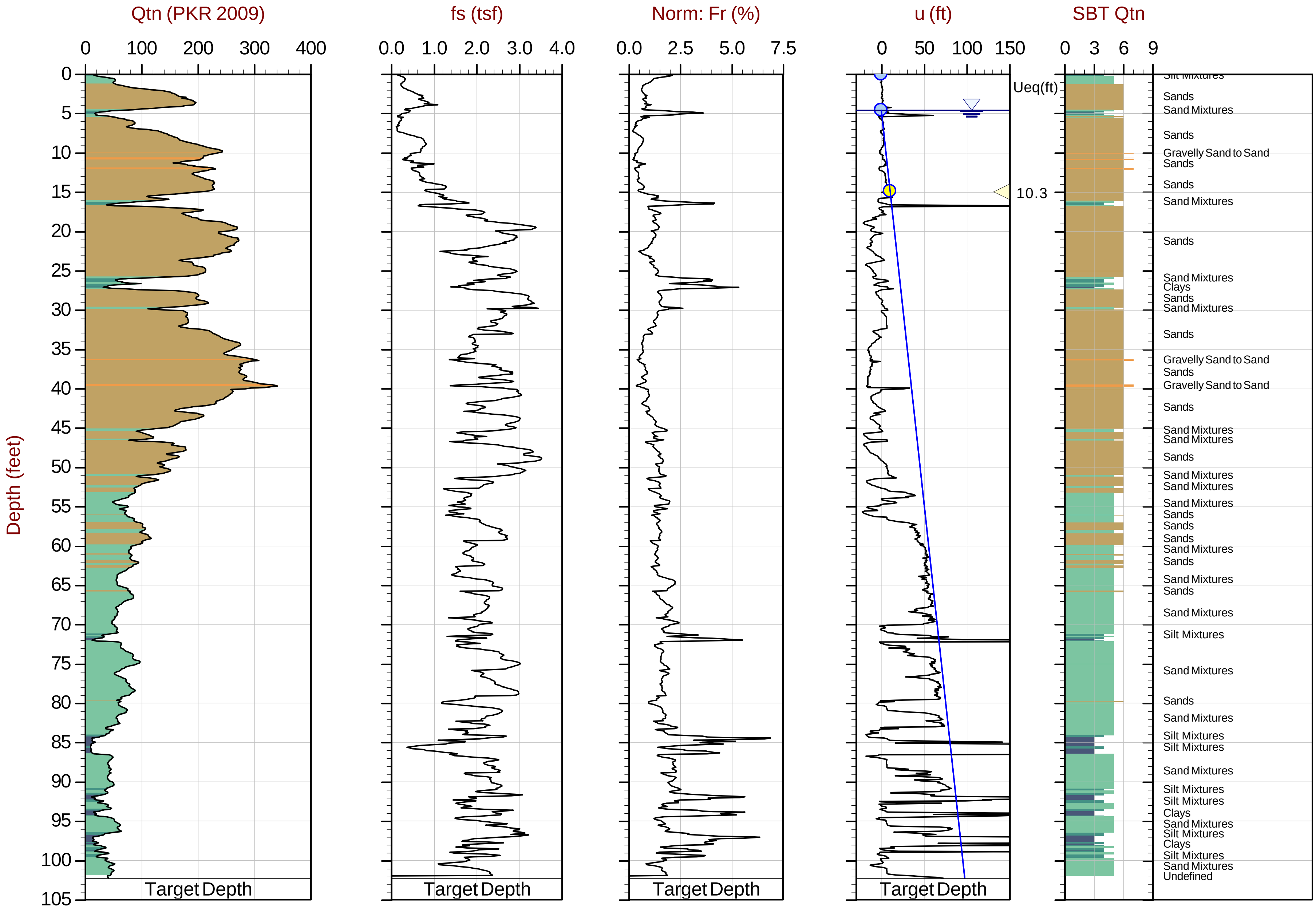
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Terracon

Job No: 21-59-23130
Date: 2021-10-15 10:19
Site: SAIA Freight Terminal
Sounding: CPT-B02
Cone: 730:T1500F15U35



Max Depth: 31.175 m / 102.28 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17686

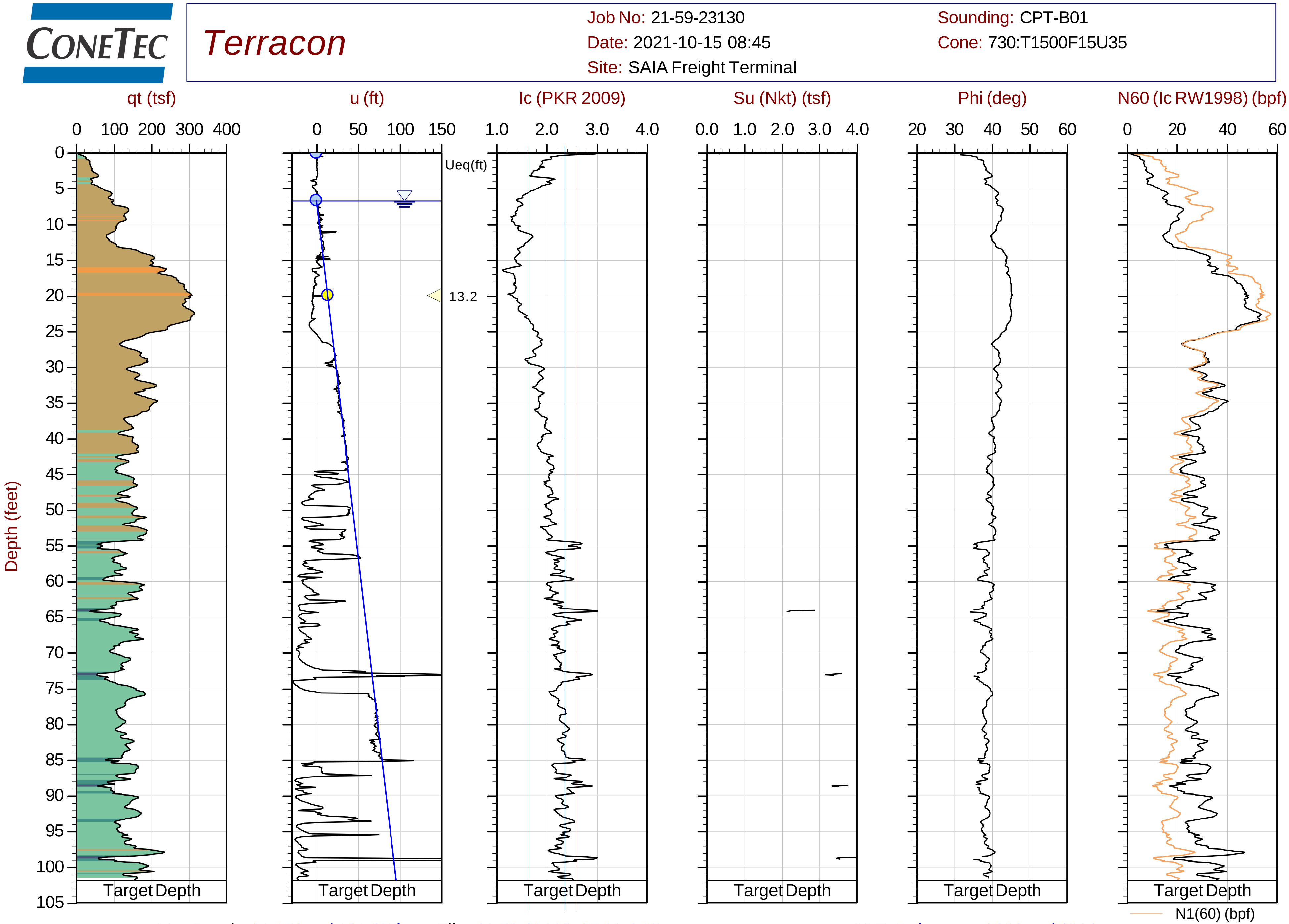
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Advanced Cone Penetration Test Plots with Ic, Su, Phi and N(60)/N1(60)

ConeTec

Job No: 21-59-23130
Date: 2021-10-15 08:45
Site: SAIA Freight Terminal
Sounding: CPT-B01
Cone: 730:T1500F15U35



Max Depth: 31.050 m / 101.87 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_SP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17801

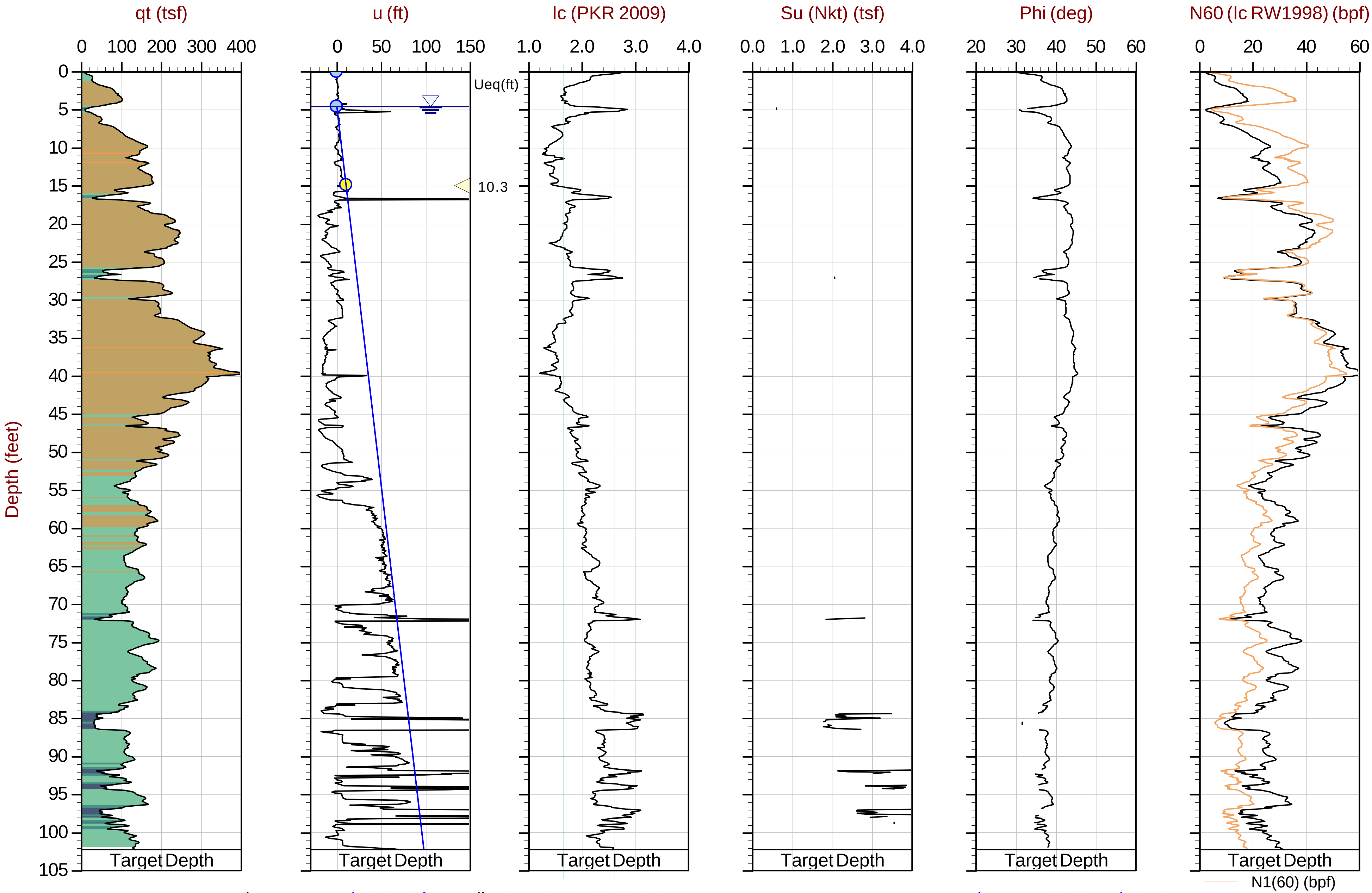
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Terracon

Job No: 21-59-23130
Date: 2021-10-15 10:19
Site: SAIA Freight Terminal

Sounding: CPT-B02
Cone: 730:T1500F15U35



Max Depth: 31.175 m / 102.28 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_CP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17686

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

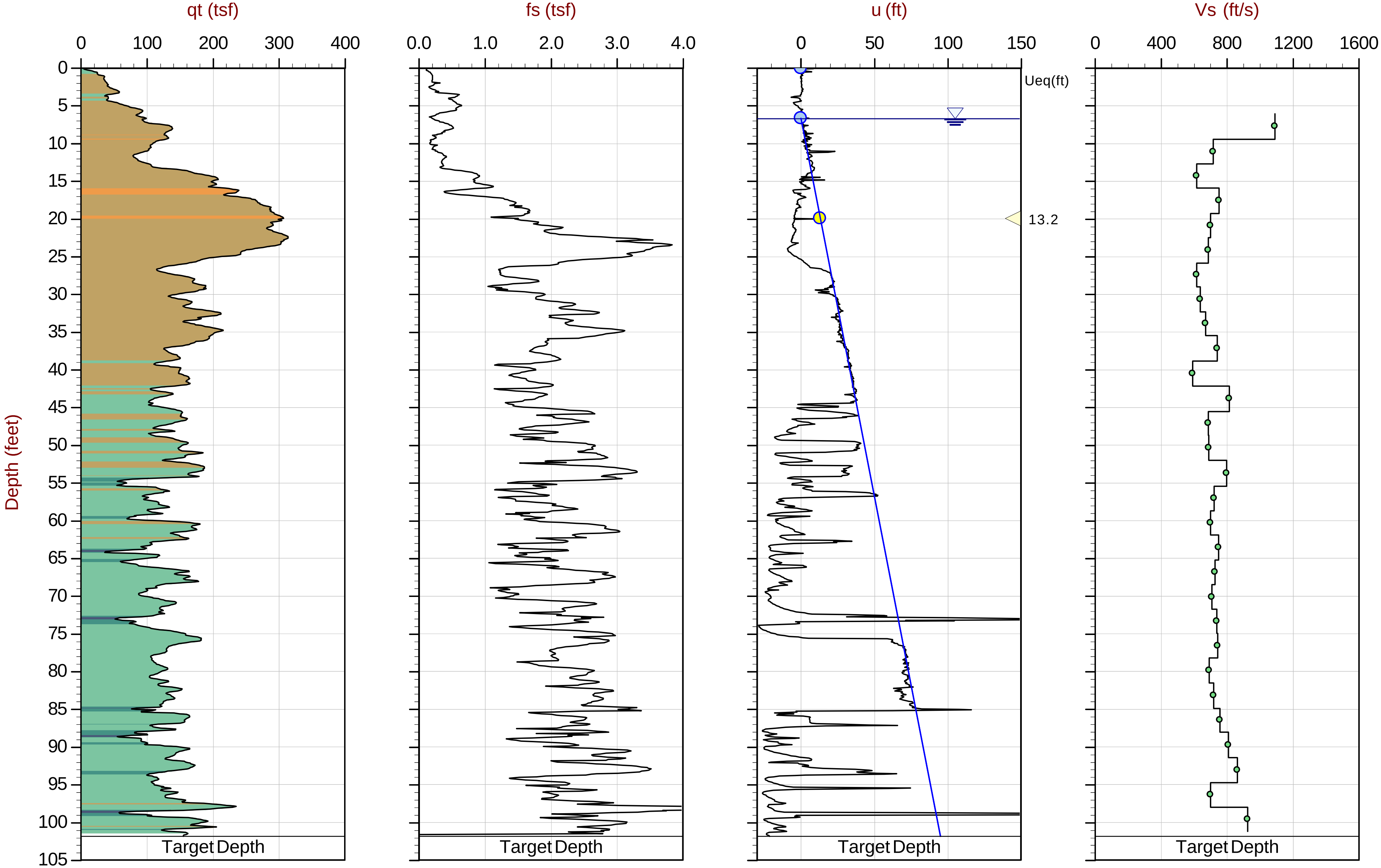
Seismic Cone Penetration Test Plots

CONETEC

Terracon

Job No: 21-59-23130
Date: 2021-10-15 08:45
Site: SAIA Freight Terminal

Sounding: CPT-B01
Cone: 730:T1500F15U35



Max Depth: 31.050 m / 101.87 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-23130_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 48.11194 Long: -122.17801

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Shear Wave (Vs) Tabular Results

Job No: 21-59-23130
Client: Terracon Consultants, Inc.
Project: SAIS Freight Terminal
Sounding ID: CPT-B01
Date: 15-Oct-2021

Seismic Source: Beam
Source Offset (ft): 8.69
Source Depth (ft): 0.00
Geophone Offset (ft): 0.66

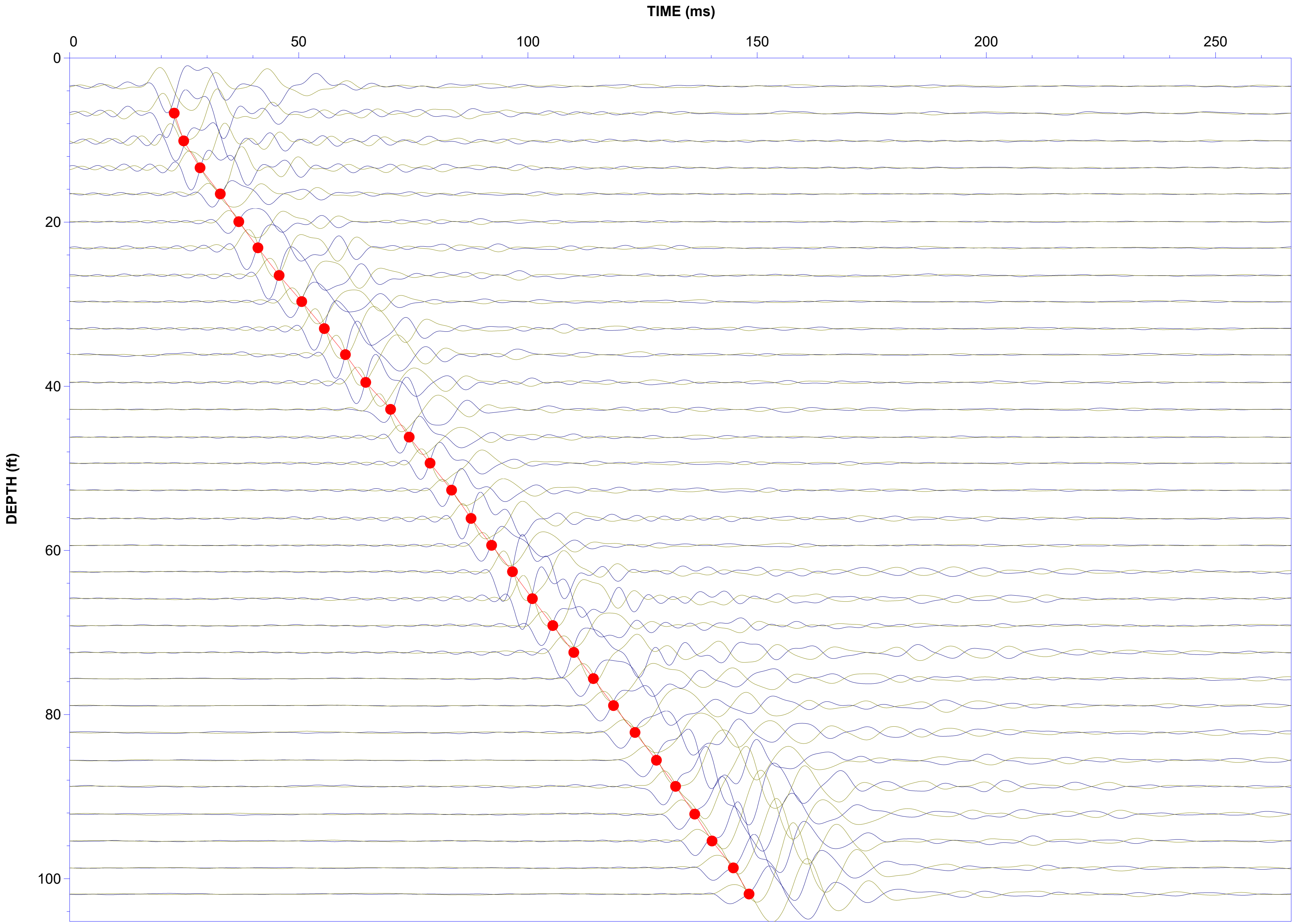
SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
6.73	6.07	10.60			
10.10	9.45	12.84	2.24	2.05	1092
13.39	12.73	15.41	2.58	3.59	718
16.57	15.91	18.13	2.72	4.40	617
19.95	19.29	21.16	3.03	4.03	752
23.13	22.47	24.10	2.94	4.20	700
26.51	25.85	27.27	3.18	4.62	687
29.69	29.04	30.31	3.03	4.91	618
32.97	32.32	33.46	3.16	4.94	638
36.15	35.50	36.55	3.08	4.59	671
39.53	38.88	39.84	3.29	4.43	743
42.81	42.16	43.05	3.21	5.42	592
46.19	45.54	46.36	3.31	4.06	816
49.38	48.72	49.49	3.13	4.56	686
52.66	52.00	52.72	3.23	4.69	690
56.10	55.45	56.12	3.40	4.26	798
59.38	58.73	59.37	3.24	4.48	723
62.60	61.94	62.55	3.18	4.54	701
65.88	65.22	65.80	3.25	4.34	749
69.16	68.50	69.05	3.25	4.46	729
72.44	71.78	72.31	3.26	4.58	710
75.62	74.97	75.47	3.16	4.27	740
78.90	78.25	78.73	3.26	4.38	744
82.18	81.53	81.99	3.26	4.70	694
85.56	84.91	85.35	3.36	4.67	720
88.75	88.09	88.52	3.17	4.18	757
92.13	91.47	91.88	3.36	4.16	809
95.41	94.75	95.15	3.27	3.78	863
98.69	98.03	98.42	3.27	4.66	702
101.87	101.21	101.59	3.17	3.42	926

Seismic Cone Penetration Test Shear Wave (Vs) Traces

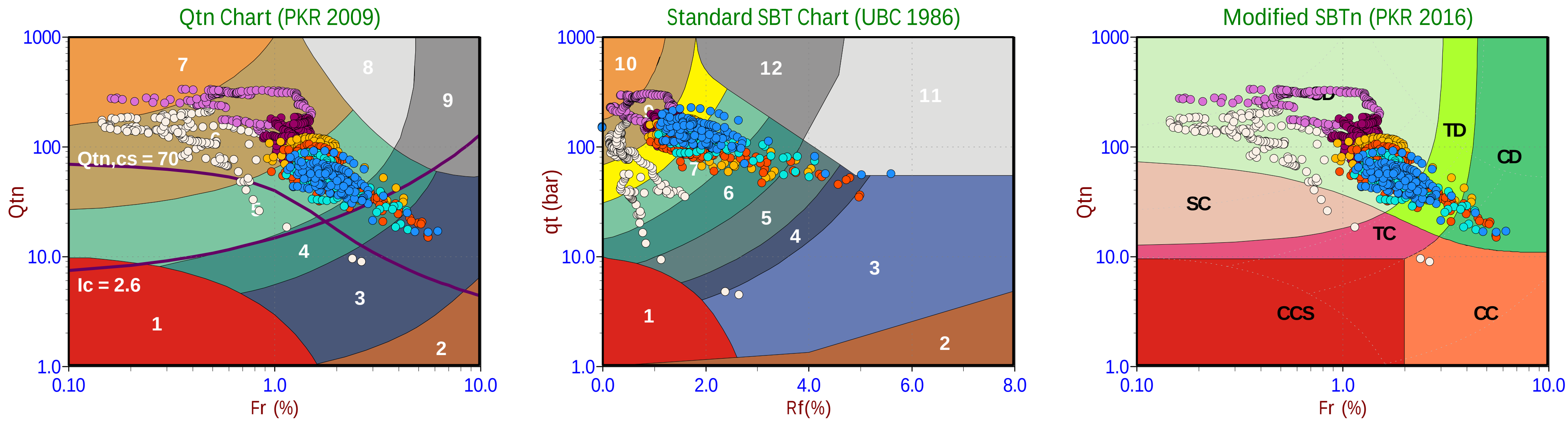
ConeTec

Job No: 21-59-23130 Client: Terracon Consultants, Inc. Project: SAIA Freight Terminal Sounding: CPT-B01 Filter: 10 - 180 Hz
Date: 15-OCT-2021



Soil Behavior Type (SBT) Scatter Plots

Terracon	Job No: 21-59-23130 Date: 2021-10-15 08:45 Site: SAIA Freight Terminal	Sounding: CPT-B01 Cone: 730:T1500F15U35



Depth Ranges
- >0.0 to 15.0 ft
- >15.0 to 30.0 ft
- >30.0 to 45.0 ft
- >45.0 to 60.0 ft
- >60.0 to 75.0 ft
- >75.0 to 90.0 ft
- >90.0 to 105.0 ft
- >105.0 to 120.0 ft
- >120.0 to 135.0 ft
- >135.0 to 150.0 ft
- >150.0 ft

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

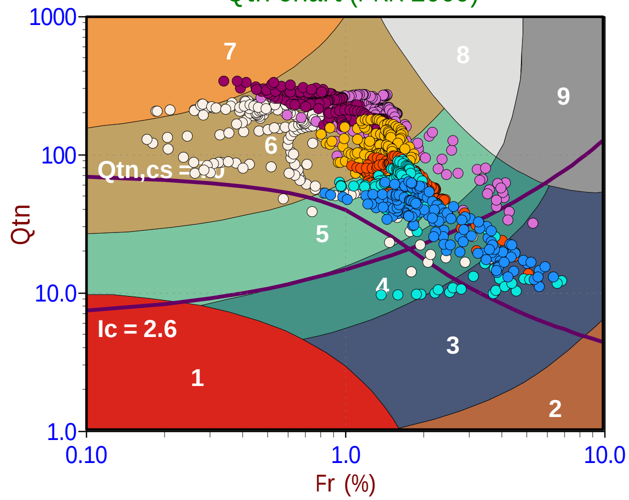
CONETEC

Terracon

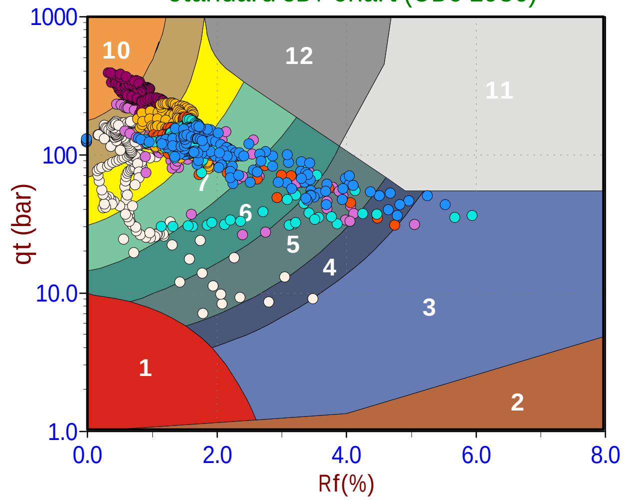
Job No: 21-59-23130
Date: 2021-10-15 10:19
Site: SAIA Freight Terminal

Sounding: CPT-B02
Cone: 730:T1500F15U35

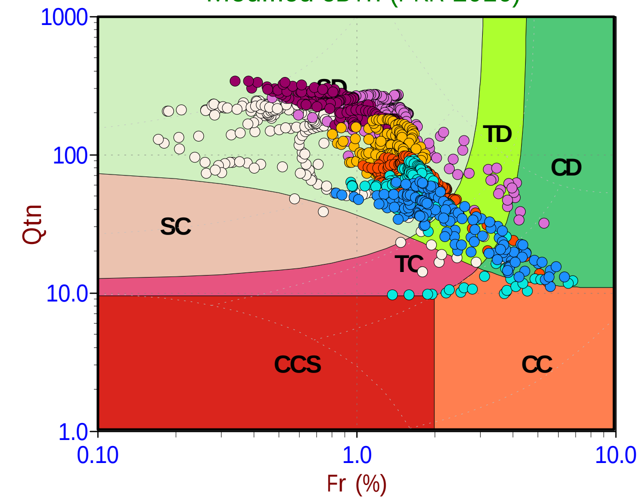
Qtn Chart (PKR 2009)



Standard SBT Chart (UBC 1986)



Modified SBTn (PKR 2016)



Depth Ranges
- >0.0 to 15.0 ft
- >15.0 to 30.0 ft
- >30.0 to 45.0 ft
- >45.0 to 60.0 ft
- >60.0 to 75.0 ft
- >75.0 to 90.0 ft
- >90.0 to 105.0 ft
- >105.0 to 120.0 ft
- >120.0 to 135.0 ft
- >135.0 to 150.0 ft
- >150.0 ft

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Job No: 21-59-23130
Client: Terracon Consultants, Inc.
Project: SAIA Freight Terminal
Start Date: 15-Oct-2021
End Date: 15-Oct-2021

CPTu PORE PRESSURE DISSIPATION SUMMARY

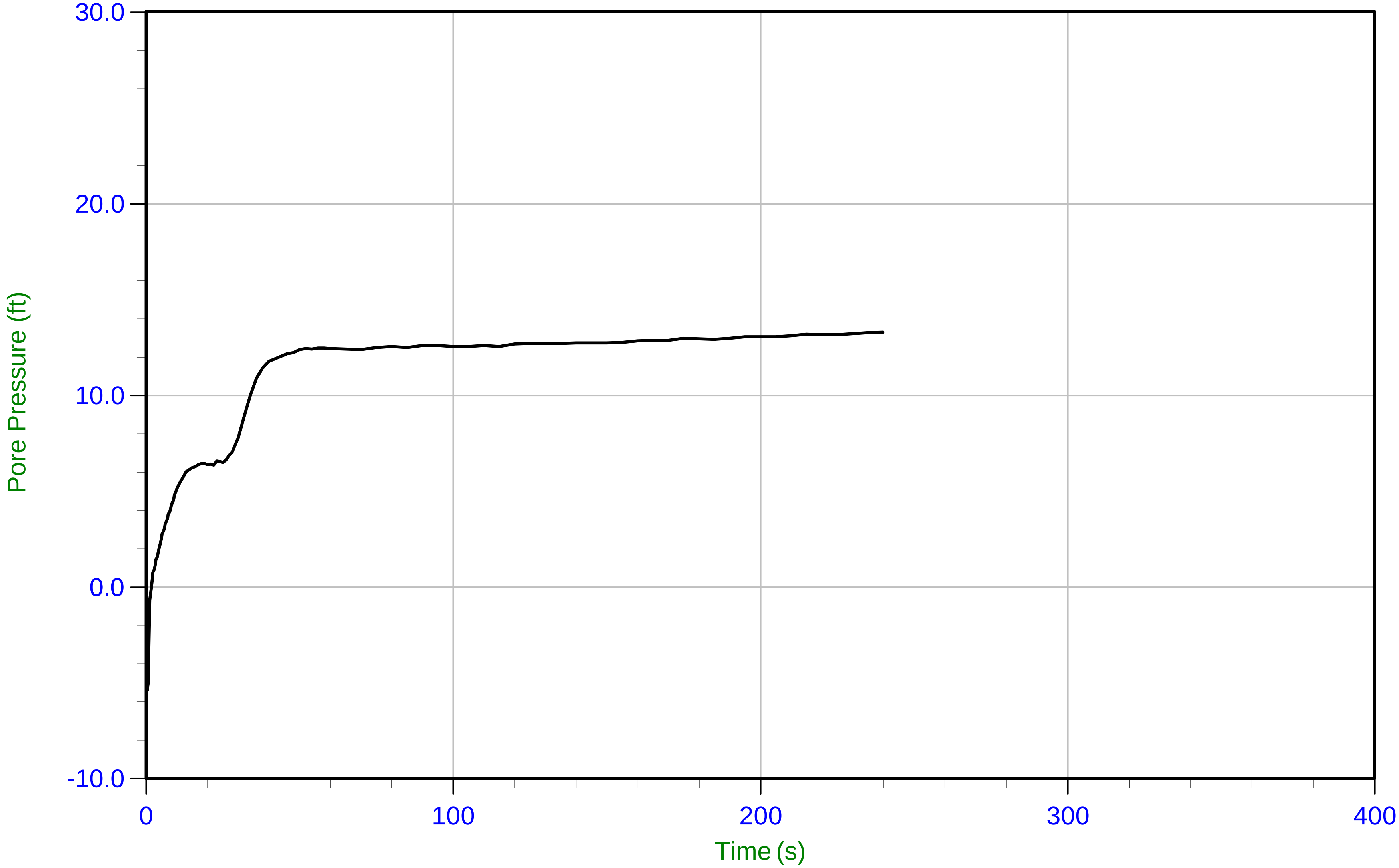
Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)
CPT-B01	21-59-23130_SP01	15.0	240.0	19.9	13.3	6.7
CPT-B02	21-59-23130_CP02	15.0	780.0	14.9	10.3	4.6
Total Duration			17.0 min			

CONETEC

Terracon

Job No: 21-59-23130
Date: 10/15/2021 08:45
Site: SAIA Freight Terminal

Sounding: CPT-B01
Cone: 730:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 21-59-23130_SP01.ppd2
Depth: 6.075 m / 19.931 ft
Duration: 240.0 s

u Min: -5.4 ft
u Max: 13.3 ft
u Final: 13.3 ft

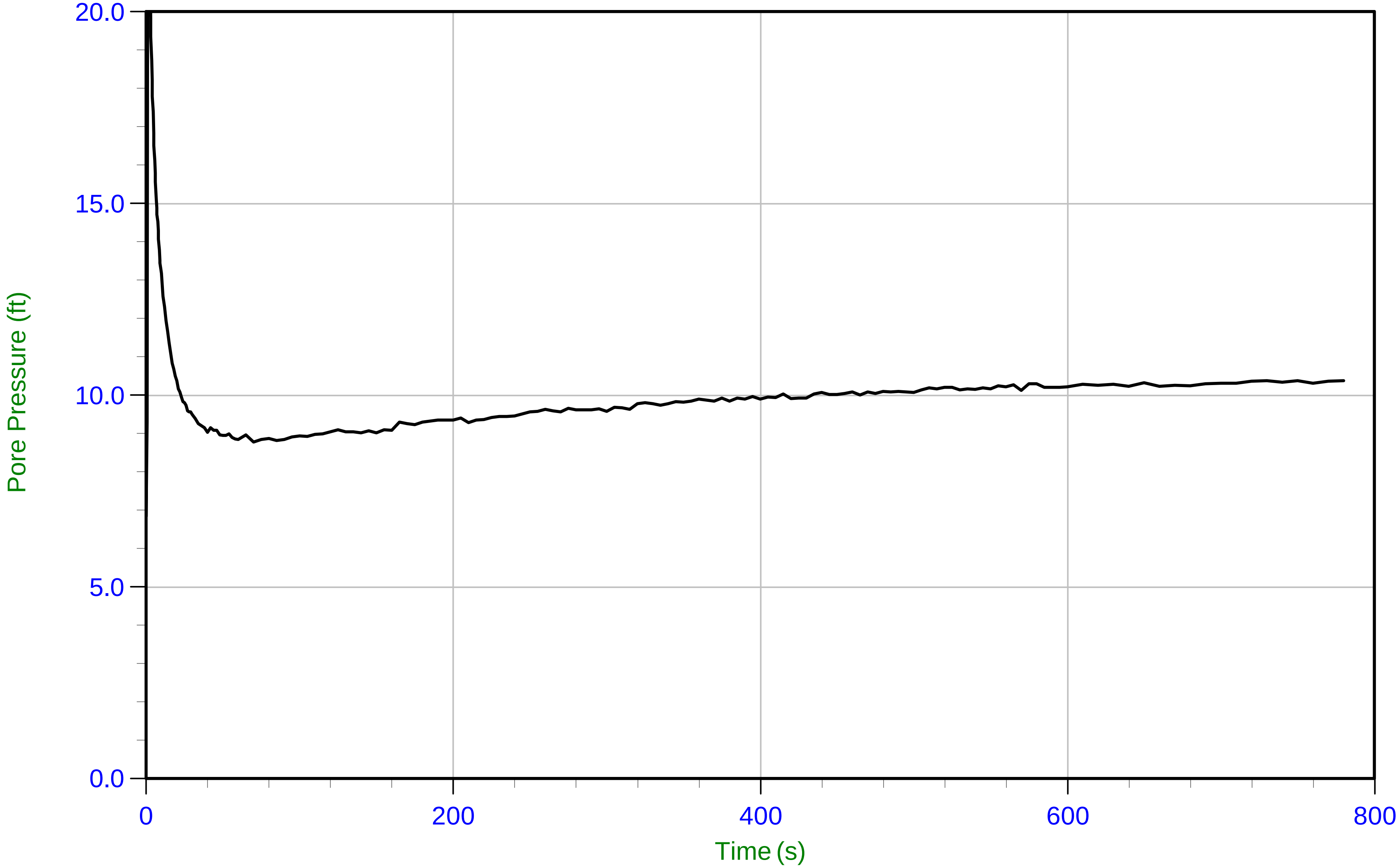
WT: 2.034 m / 6.673 ft
Ueq: 13.3 ft

CONETEC

Terracon

Job No: 21-59-23130
Date: 10/15/2021 10:19
Site: SAIA Freight Terminal

Sounding: CPT-B02
Cone: 730:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 21-59-23130_CP02.ppd2
Depth: 4.550 m / 14.928 ft
Duration: 780.0 s

u Min: 6.8 ft
u Max: 24.0 ft
u Final: 10.4 ft

WT: 1.398 m / 4.587 ft
Ueq: 10.3 ft