Geotechnical Engineering Services Report

Port of Tacoma Terminal 3 and Terminal 4 Shore Power Upgrades
Tacoma, Washington

for
KPFF Consulting Engineers

October 26, 2021

GeoEngineers

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Port of Tacoma Terminal 3 and Terminal 4 Shore Power Upgrades Tacoma, Washington

File No. 0454-164-00

October 26, 2021

Prepared for:

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October 26, 2021

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1.0 INTRODUCTION AND PROJECT UNDERSTANDING

This report presents our geotechnical engineering services for the Port of Tacoma (Port) Terminal 3 and Terminal 4 Shore Power Upgrades Project. The project site is located at 710 Port of Tacoma Road on the southwestern side of the Blair Waterway. A Vicinity Map is provided as Figure 1. Our understanding of the project is based on our communications, conceptual site plans showing the locations of the proposed improvements and information provided in the project Request for Qualifications.

We understand that new infrastructure and expansions of existing substation systems are planned to provide shore power for vessels docked at Terminal 3 and Terminal 4. Improvements will be located within and around the existing electrical substations at Terminal 3 and Terminal 4. Improvements are expected to include installation of new switchgear equipment, transformer vaults and electrical conduits between new and existing infrastructure. The work also includes installation of new duct banks and vaults between the Pier 3 Substation and the north end of the existing wharf. The new electrical equipment will be supported on reinforced concrete slabs established at existing grade. Anticipated gross bearing pressures for the slabs are expected to be around 350 pounds per square foot (psf). Concrete vaults extending about 5 to 9 feet below existing grade are also envisioned. We understand that the project will be designed in accordance with the 2018 International Building Code (IBC); however, mitigating seismically induced hazards such as liquefaction and lateral spreading will not be required for these improvements.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to review existing subsurface information at the site as a basis for providing geotechnical recommendations for design and construction. Our services have been completed in accordance with our signed agreement for this project dated November 9, 2020. Our specific scope of services is summarized in our proposal dated June 30, 2020.

3.0 SITE CONDITIONS

3.1. Surface Conditions

The Terminal 3 substation is located near the northern point of the upland terminal area. The western side of the substation boundary is located adjacent to the shoreline slope of the Blair Peninsula. The upland area surrounding the substation is relatively flat, paved with asphalt concrete and is primarily used as driveways, equipment parking and shipping container staging/storage. The existing substation area is delineated with bollards.

We anticipate that some excavation in and around the existing Pier 3 substation will occur within the Slip 1 Nearshore Confined Disposal (NCD) facility. In 2005, Slip 1 located at the north end of the peninsula, was closed and filled with contaminated dredge material. Starting at about Elevation 9 feet mean lower low water (MLLW), a primary containment cap of noncontaminated soil was placed over the dredge fill. Any excavation below about Elevation 9 feet (below the primary containment cap) should anticipate the presence of contaminated soil requiring special precautions and disposal. This report does not address the extent of contaminated material or provide guidance for handling or disposal. It is anticipated that the

majority of excavation/ trenching at the Pier 3 substation will be relatively shallow and that the only potential exposure of contaminated material could be associated with deeper electrical vault excavation.

The Terminal 4 substation is located to the south of the Pier 4 Marine Operations building. The Pier 4 substation and surrounding area is surfaced with asphalt concrete and the substation footprint Is delineated with bollards. The topography in the surrounding area is relatively flat.

3.2. Subsurface Conditions

3.2.1. Geologic Setting

Soils at the Port of Tacoma (Port) consist primarily of alluvium deposited by the Puyallup River and Hylebos River. Prior to human modification, the Puyallup delta consisted of a tidal marsh extending to approximately between present-day Lincoln Avenue and 11th Street, and a tidal flat that was exposed only during the lowest tides extending approximately to the line formed by the ends of the present-day peninsulas. As part of the growth of Tacoma and the Port, much of the Puyallup delta was developed to establish usable upland. The Puyallup River and creeks throughout the delta were channelized and/or re-routed to facilitate development and control flooding. The waterways (including the Blair Waterway) were dredged and built to their current configurations to improve shipping access and increase deep water shoreline. Fill, much of which was derived from dredging of the waterways, has been placed over most of the natural ground surface in the Port. The Pier 3 and Pier 4 area has been modified multiple times over its history to create the current configuration, which included infilling of historic ship slips and realigning Pier 3 and Pier 4.

3.2.2. Literature Review

We reviewed several existing geotechnical reports prepared for prior projects at Pier 3 and Pier 4 including: "Geotechnical Engineering Services Report, Port of Tacoma Pier 3 Upgrade" prepared by GeoEngineers dated January 29, 2013 and "Geotechnical Data Report Port of Tacoma: Pier 4 Reconfiguration" prepared by HartCrowser dated September 18, 2014. These reports contain summary explorations logs for borings, cone penetration tests and other explorations completed in the project vicinity, laboratory testing results from collected samples and other subsurface information.

Select explorations from these studies are included in this report as Appendix A and their locations are shown on the Site Plan, Figure 2. The selected exploration logs are those located closest to the substations and are the most relevant to this study. Additional subsurface information is available in the project vicinity and can be found in the reports referenced above.

3.2.3. Anticipated Subsurface Conditions

The reviewed subsurface information did not include measurements of the existing asphalt concrete sections around the substations. However, record drawings indicate that pavements sections within terminal areas consist of 10 inches of asphalt over 12 inches of gravel base course. Because of the industrial use of the site, we expect that around the substation pavement thicknesses are on the order of 6 inches or greater and are likely underlain by a gravel base course section.

Below the pavement section, soils at the site are expected to consist of fill underlain by natural alluvial soils. Based on our review of the referenced exploration logs, fill soils are expected to consist of loose to medium dense sand with variable silt and gravel content. Fill soils likely extend 10 to 15 feet below existing

site grade. Alluvial soils are expected to consist of loose to medium dense sand and very soft to medium stiff silt.

Groundwater levels on the reviewed exploration logs were typically within 10 feet of existing site grades. Based on our experience in the area, seasonal high groundwater levels could be within about 5 feet of existing ground surface. Groundwater levels will fluctuate seasonally and will likely closely match the water surface elevation in Commencement Bay, which is tidally influenced. Perched groundwater could also be present within the fill soils above the regional groundwater table. Interfaces between different material types or at the contact between fill and alluvial soils are likely locations for perched groundwater to collect.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. Seismic Design Considerations

We used map-based methods in conjunction with the reviewed explorations to develop seismic design parameters in general accordance with the 2018 IBC. The recommended seismic design parameters are shown in Table 1.

TABLE 1. SEISMIC DESIGN CRITERIA

2018 IBC Seismic Design Parameters	
Site Class	D
Spectral Response Acceleration at Short Periods (S_S)	1.354 g
Spectral Response Acceleration at 1-Second Periods (S_1)	0.467 g
Design Peak Ground Acceleration (PGA_M)	0.574 g
Design Spectral Response Acceleration at Short Periods (S_{DS})	0.903 g
Design Spectral Response Acceleration at 1-Second Periods (S_{D1})	0.311 g

We understand that design of the proposed improvements will not consider the effects of seismically induced liquefaction, lateral spreading, or surface fault rupture. Based on our review of subsurface information and our experience in the area, in our opinion there is a risk of liquefaction and lateral spreading occurring at this site. Liquefaction can result in soil strength loss and ground surface settlements. We expect that liquefaction-induced ground surface settlements at this site could be on the order of 6 inches or greater during the design seismic event. Because of the proximity of the substations to the nearby waterway slopes, lateral spreading and associated lateral deformations could occur during the design seismic event. We expect that in the vicinity of the substations lateral deformations in excess of 12 inches could occur during a lateral spreading event. In our opinion the risk of surface fault rupture occurring at the site is low as bedrock in the area is overlain by hundreds of feet of glacial and alluvial soils. We can provide additional information on seismic hazards at this site, if requested.

4.2. Foundation Support

4.2.1. General

Proposed improvements are expected to be founded on isolated footings and/or reinforced concrete slabs supported on existing or new gravel base course. Isolated footings should have a minimum width of

24 inches. In our opinion drainage systems around or below foundations are not necessary to maintain bearing support.

4.2.2. Bearing Surface Preparation

Foundation excavations should be performed using a smooth-edged bucket to limit bearing disturbance. Foundations should be bear on a minimum 6 inch thick layer of compacted base course. New base course should be placed over proof compacted existing site soils. We recommend that base course extend at least 6 inches laterally beyond the foundation perimeter.

Prior to placement of new base course, the underlying subgrade should be proof compacted to a firm and unyielding condition using vibratory compaction equipment. Loose or disturbed materials present at the base of foundation excavations should be removed or compacted. If soft or otherwise unsuitable areas are exposed and cannot be compacted to a stable and uniformly firm condition the following options may be considered: (1) the exposed soils should be moisture conditioned and recompacted; or (2) the unsuitable soils should be overexcavated and replaced with compacted structural fill, as needed. For the anticipated loads, we recommend that overexcavation of soft or unsuitable soils be limited to 18 inches. If persistently soft conditions are still present at this depth, we recommend that a layer of quarry spalls be pushed into the subgrade of the overexcavation to create a firm surface and a non-woven geotextile separation fabric be placed across the subgrade prior to placement of structural fill.

Foundation bearing surfaces should not be exposed to standing water. If water is present in the excavation, it must be removed before placing formwork and reinforcing steel. We recommend that a member of our firm observe foundation excavations before placement of reinforcing steel in order to confirm that bearing surfaces have been prepared in accordance with our recommendations, or to provide recommendations for compaction or removal and replacement of unsuitable soil.

4.2.3. Allowable Soil Bearing Resistance

We recommend that shallow foundations designed as isolated footings bearing on surfaces prepared as described above be designed using an allowable soil bearing resistance of 1,500 pounds per square foot (psf). Vaults embedded more than about 4 feet below existing site grades can be designed using an allowable soil bearing resistance of 2,500 psf.

These bearing resistances apply to the total of dead and long-term live loads and may be increased by one-third when considering total loads, including earthquake or wind loads. These are net bearing pressures. The weight of the footing and overlying backfill can be ignored in calculating footing sizes.

4.2.4. Foundation Settlement

As discussed above, loose or disturbed soil must be removed from the base of footing excavations and the bearing surface should be prepared as recommended. Provided these measures are taken, we estimate the total settlement of foundations will be on the order of ½ to 1 inch for the bearing resistances presented above. Differential settlements are expected to be less than ¼ inch between opposite edges of the foundation. The settlements should occur rapidly, essentially as loads are applied. Settlements could be greater than estimated if subgrades are not prepared as recommended.

4.2.5. Lateral Resistance

The ability of the soil to resist lateral loads is a function of the base friction, which develops on the base of footings and slabs, and the passive resistance, which develops on the face of below-grade elements of the structure as these elements move into the soil. For footings founded in accordance with the recommendations presented above, the allowable frictional resistance on the base of the footing may be computed using a coefficient of friction of 0.35 applied to the vertical dead-load forces.

The allowable passive resistance on the face of the footing or other embedded foundation elements may be computed using an equivalent fluid density of 250 pounds per cubic foot (pcf) for drained conditions, assuming that the footings and below-grade elements are backfilled with structural fill placed and compacted as recommended.

These values include a factor of safety of about 1.5. The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total. The top foot of soil should be neglected when calculating passive lateral earth pressure unless the area adjacent to the foundation is covered with pavement or a slab-on-grade.

4.2.6. Slab-on-Grade

We recommend that a modulus of subgrade reaction of 200 pounds per cubic inch (pci) be used for design of reinforced concrete slabs on grade. Slabs on grade should bear on existing or new base course underlain by subgrades prepared in accordance with Section 4.2.2 “Bearing Surface Preparation” of this report.

Settlement for slabs-on-grade designed and constructed as recommended is estimated to be less than ½ inch for loads up to 500 psf. We estimate that differential settlement of slabs will be ¼ inch or less between opposite edges of the slab.

4.3. Below-Grade Structures

We recommend that below-grade structures be designed using the lateral earth pressures provided below. Unless a drainage system is included behind the structure, portions of below-grade structures extending deeper than 5 feet below existing grade should be designed for saturated conditions and hydrostatic pressures. The active soil pressure condition assumes the walls of the below-grade structure are free to move laterally 0.001 H (where H is the wall height). The at-rest condition is applicable where walls are restrained from movement.

- Active soil pressure may be estimated using an equivalent fluid density of 40 pcf for the level backfill and drained/unsubmerged condition.
- Active soil pressure may be estimated using an equivalent fluid density of 82 pcf for the level backfill undrained/submerged condition; this value includes hydrostatic pressures.
- At-rest soil pressure may be estimated using an equivalent fluid density of 60 pcf for the level backfill and drained/unsubmerged condition.
- At-rest soil pressure may be estimated using an equivalent fluid density of 92 pcf for the level backfill undrained/submerged condition; this value includes hydrostatic pressures.
- For seismic considerations, a uniform lateral pressure of 10D psf (where D is the depth of a structure below ground surface) should be added to the lateral earth pressure.

- An additional 2 feet of fill representing a typical traffic surcharge of 250 psf should be included if vehicles are allowed to operate within ½ the height of the below grade structure. Other surcharge loads should be considered on a case-by-case basis. We can provide additional surcharge loads for specific loading conditions once known.

The above-recommended lateral soil pressures do not include other surcharge loads than described or the effects of sloping backfill surfaces. Over-compaction of fill placed directly behind below-grade structures must be avoided. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet of below-grade structures.

Foundations for below-grade structures should be prepared and designed following Section 4.2 "Foundation Support" of this report.

4.4. Earthwork Considerations

4.4.1. General

We anticipate that site development and earthwork will include demolition of existing improvements including pavements, excavating for foundations, slabs, vaults, utilities and other improvements, establishing subgrades for foundations and placing and compacting fill and backfill materials. We expect that site grading and earthwork can be accomplished with conventional earthmoving equipment. The following sections provide specific recommendations for site development and earthwork.

We recommend that the existing pavement sections be completely removed from below new foundation areas. During demolition of existing pavements or hardscaping, excessive disturbance of surficial soils may occur, especially if left exposed to wet conditions. Disturbed soils may require additional remediation during construction and grading.

4.4.2. Temporary Excavations, Support and Dewatering

Excavations deeper than 4 feet must be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). The contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures.

If temporary cut slopes are required, they should be inclined no steeper than about 1½H:1V (horizontal:vertical). This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope, the excavation does not extend below the water table and that seepage is not present on the slope face. Flatter cut slopes will be necessary where seepage occurs or if surcharge loads are anticipated. Temporary covering with heavy plastic sheeting should be used to protect these slopes during periods of wet weather.

Groundwater could be encountered in excavations extending deeper than about 5 feet below ground surface (bgs). Controlling groundwater with sumps, pumps, or diversion ditches will likely be adequate for shallow excavations that are only open for a short amount of time. For deeper excavations or excavations required to be open for an extended period of time, dewatering using well points or other methods should

be anticipated. We anticipate that a dewatering system could be required in order to complete excavations that extend more than about 7 feet bgs. We recommend that the contractor performing the work be made responsible for developing a dewatering plan and collecting and controlling groundwater at the site.

Based on our understanding of subsurface conditions at the site we anticipate that soil heave or "quick" soil conditions could occur in the base of excavations that extend below the groundwater level. The contractor performing the work should be prepared to deal with these conditions during excavation activities.

4.4.3. Erosion and Sedimentation Control

Potential sources or causes of erosion and sedimentation can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an Erosion and Sedimentation Control Plan will reduce the project impact on erosion-prone areas. The plan should be designed in accordance with applicable city, county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure.
- Re-vegetating or mulching denuded areas.
- Directing runoff away from denuded areas.
- Reducing the length and steepness of slopes with exposed soils.
- Decreasing runoff velocities.
- Preparing drainage ways and outlets to handle concentrated or increased runoff.
- Confining sediment to the project site.
- Inspecting and maintaining control measures frequently.

Some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving or landscape planting.

Until the permanent erosion protection is established and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provision for modifications to the erosion control system based on monitoring observations should be included in the Erosion and Sedimentation Control Plan.

4.4.4. Subgrade Protection and Wet Weather Considerations

We anticipate that near-surface soils at the site will contain a significant amount of fines and will be susceptible to disturbance during periods of wet weather. Soil with high fines content is very sensitive to small changes in moisture and is susceptible to disturbance from construction traffic when wet or if earthwork is performed during wet weather. The wet weather season generally begins in October and continues through May in western Washington; however, periods of wet weather can occur during any

month of the year. In our opinion, earthwork at the site should take place during the summer months or during periods of extended dry weather. If wet weather earthwork is unavoidable, we offer the following recommendations.

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing exposed soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with pavements or materials not susceptible to wet weather disturbance.

4.5. Fill Materials

4.5.1. Structural Fill

The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines increases, soil becomes increasingly sensitive to small changes in moisture content. **We recommend that washed crushed rock or select granular fill, as described below, be used for structural fill during the rainy season**. If prolonged dry weather prevails during the earthwork phase of construction, materials with a somewhat higher fines content may be acceptable. Weather and site conditions should be considered when determining the type of import fill materials purchased and brought to the site for use as structural fill.

Material used for structural fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. For most applications, we recommend that structural fill material consist of material similar to “Select Borrow” or “Gravel Borrow” as described in Section 9-03.14 of the Washington State Department of Transportation (WSDOT) Standard Specifications.

4.5.2. Select Granular Fill

Select granular fill should consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material with gradation characteristics similar to WSDOT Specification 9-03.9 “Aggregates for Ballast and Crushed Surfacing”, or 9-03.14 “Borrow” is suitable for use as select granular fill, provided that the fines content (material passing

the U.S. No. 200 sieve) is less than 5 percent (based on the minus ¾-inch fraction) and the maximum particle size is 6 inches.

4.5.3. Pipe Bedding

Trench backfill for the bedding and pipe zone should consist of well-graded granular material similar to "gravel backfill for pipe zone bedding" described in Section 9-03.12(3) of the WSDOT Standard Specifications. The material must be free of roots, debris, organic matter and other deleterious material. Other materials may be appropriate depending on manufacturer specifications and/or local jurisdiction requirements.

4.5.4. Trench Backfill

Trench backfill must be free of debris, organic material and rock fragments larger than 6 inches. We recommend that trench backfill material consist of material similar to "Select Borrow" or "Gravel Borrow" as described in Section 9-03.14 of the WSDOT Standard Specifications. Where excavations occur in the wet, alternative materials such as select granular fill should be considered.

4.5.5. On-Site Soil

We anticipate that soils generated during excavation will consist primarily of sand with variable silt and gravel content. In our experience it is possible to reuse these soils as trench backfill and structural fill provided that they can be adequately moisture conditioned, placed and compacted as recommended and does not contain organic or other deleterious material. **Existing site soils should not be reused as the 6-inch structural fill layer recommended below foundations**.

We anticipate the near-surface existing soils will be moisture sensitive and will be very difficult or impossible to properly compact when wet. In addition, it is possible that existing soils will be generated at moisture contents above optimum. If earthwork occurs during a typical wet season, or if the soils are persistently wet and cannot be dried back due to prevailing wet weather conditions, we recommend the use of imported structural fill or select granular fill, as described above.

4.5.6. Fill Placement and Compaction

To obtain proper compaction, fill soil should be compacted near optimum moisture content and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Silty soil or other fine granular soil may be difficult or impossible to compact during persistent wet conditions. Generally, 12-inch loose lifts are appropriate for steel-drum vibratory roller compaction equipment. Compaction should be achieved by mechanical means. In general, during fill and backfill placement, sufficient testing of in-place density should be conducted to check that adequate compaction is being achieved.

We understand that most excavation and backfill placement will occur in areas where patches of existing asphalt pavement are sawcut and removed for utility trenches or equipment slab installations. We recommend that fill and backfill materials be compacted to at least 95 percent of the theoretical maximum dry density (MDD) per ASTM International (ASTM) D 1557. Over-compaction of fill placed directly behind below-grade structures must be avoided. Backfill behind below-grade structures should be compacted to

between 90 and 92 percent of the MDD. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet of below-grade structures.

5.0 LIMITATIONS

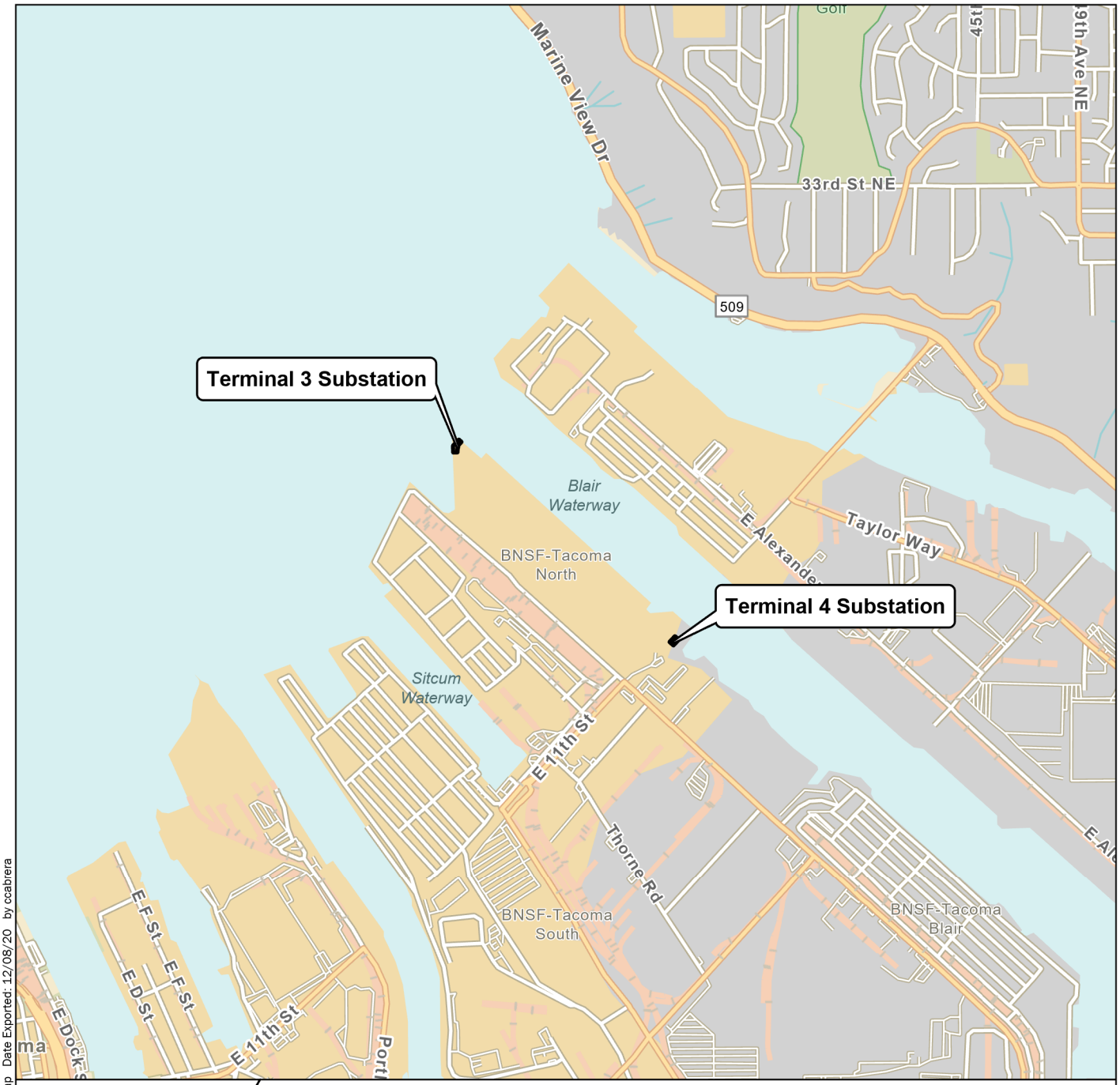
We have prepared this report for KPFF Consulting Engineers for the Port of Tacoma Terminal 3 and Terminal 4 Shore Power Upgrades project in Tacoma, Washington. KPFF Consulting Engineers may distribute copies of this report to owner and owner's authorized agents and regulatory agencies as may be required for the Project.

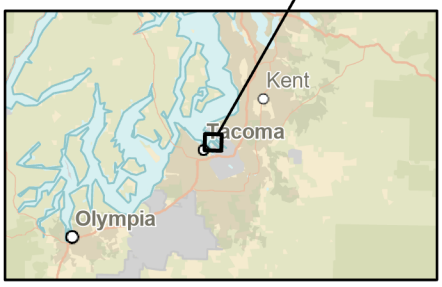
Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Please refer to Appendix B, Report Limitations and Guidelines for Use, for additional information pertaining to use of this report.

FIGURES

GeoEngineers





N
W E
S

2,000 0 2,000

Feet

Vicinity Map

Port of Tacoma Terminal 3 and Terminal 4 Shore Power Upgrades
Tacoma, Washington

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Figure 1

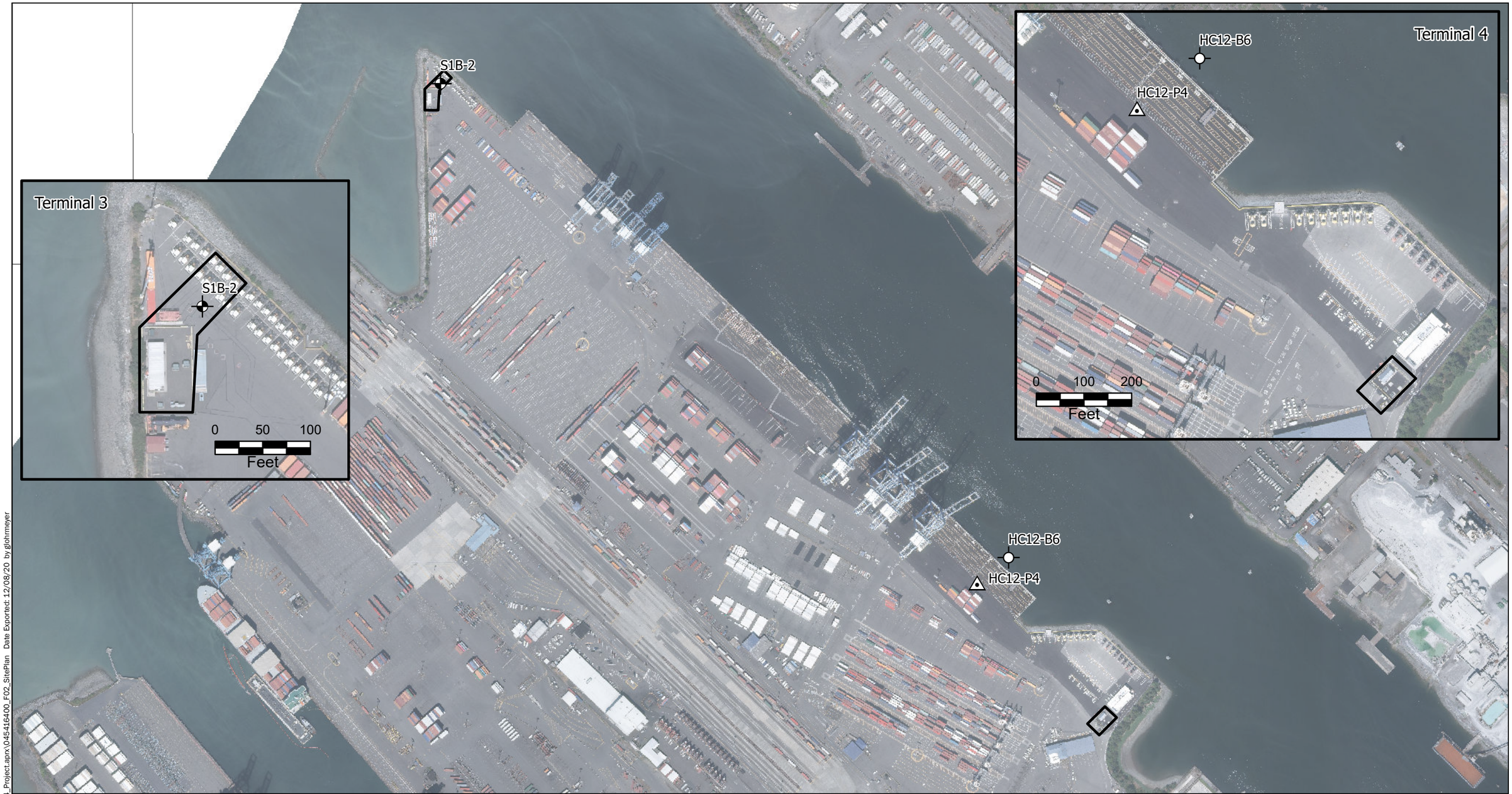
Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 UTM Zone 10N

P:\0\0454164\GIS\Data\0504164\0504164.aprx\045416400_F01_VicinityMap Date Exported: 12/08/20 by ccabrera



Notes:
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Data Source: Imagery from City of Tacoma, 2018.

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- S1B-2 - Boring by HartCrowser 2003
- HC12-B6 - Boring by HartCrowser 2014
- HC12-P4 - CPT by HartCrowser 2014
- Project Boundary

N
W
E
S

400 0 400
Feet

Site Plan

Port of Tacoma Terminal 3 and
Terminal 4 Shore Power Upgrades
Tacoma, Washington

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Figure 2

P:\0\0454164\GIS\0454164_Project\0454164_Project.aprx\0454164_F02_SitePlan Date Exported: 12/08/20 by glohrmeyer

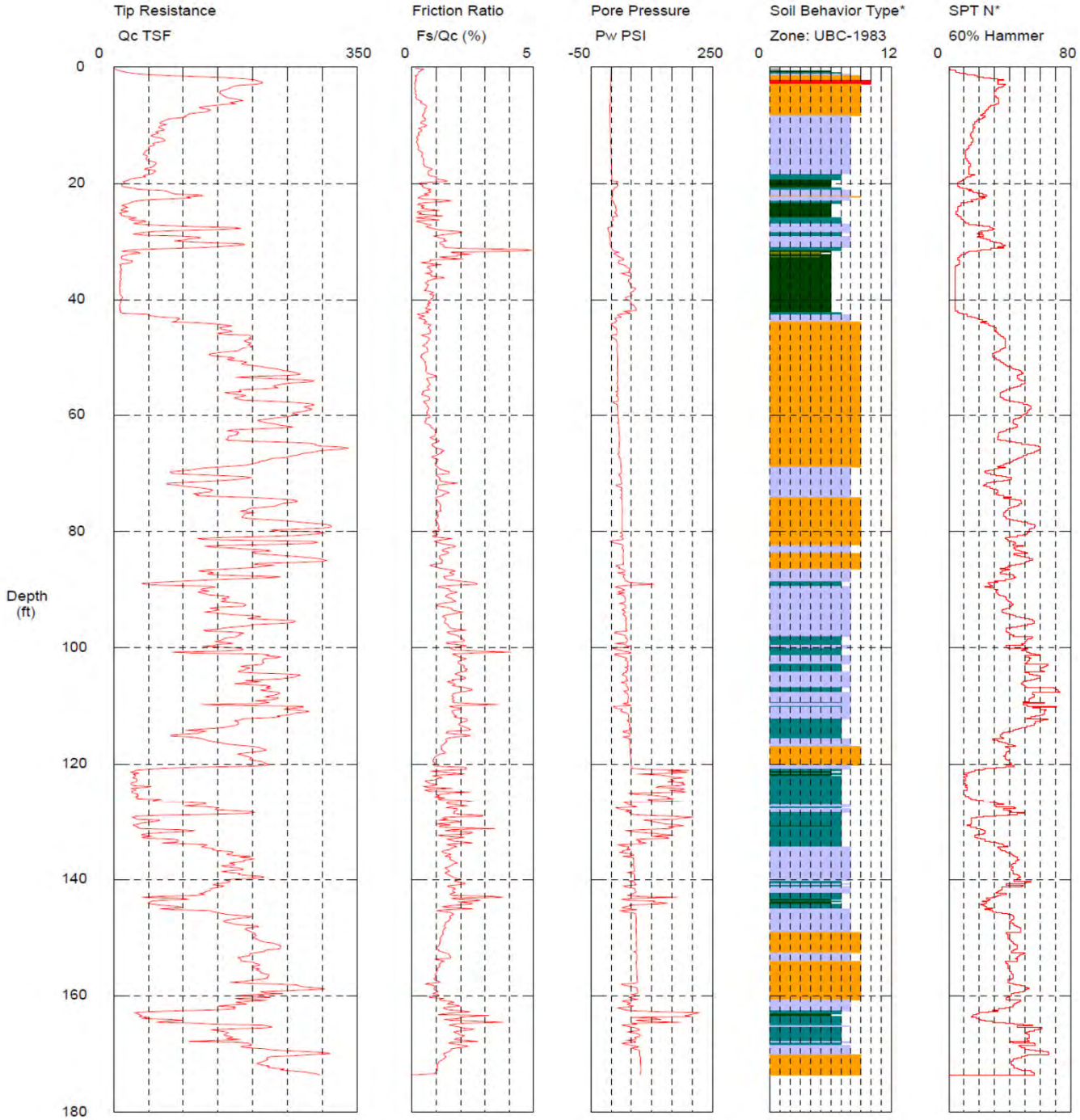
APPENDICES

GeoEngineers

APPENDIX A
Referenced Subsurface Explorations

Operator: Gerdes
Sounding: HC 12-P4
Cone Used: DPG1186

CPT Date/Time: 12/12/2012 11:25:55 AM
Location: Port of Tacoma
Job Number:

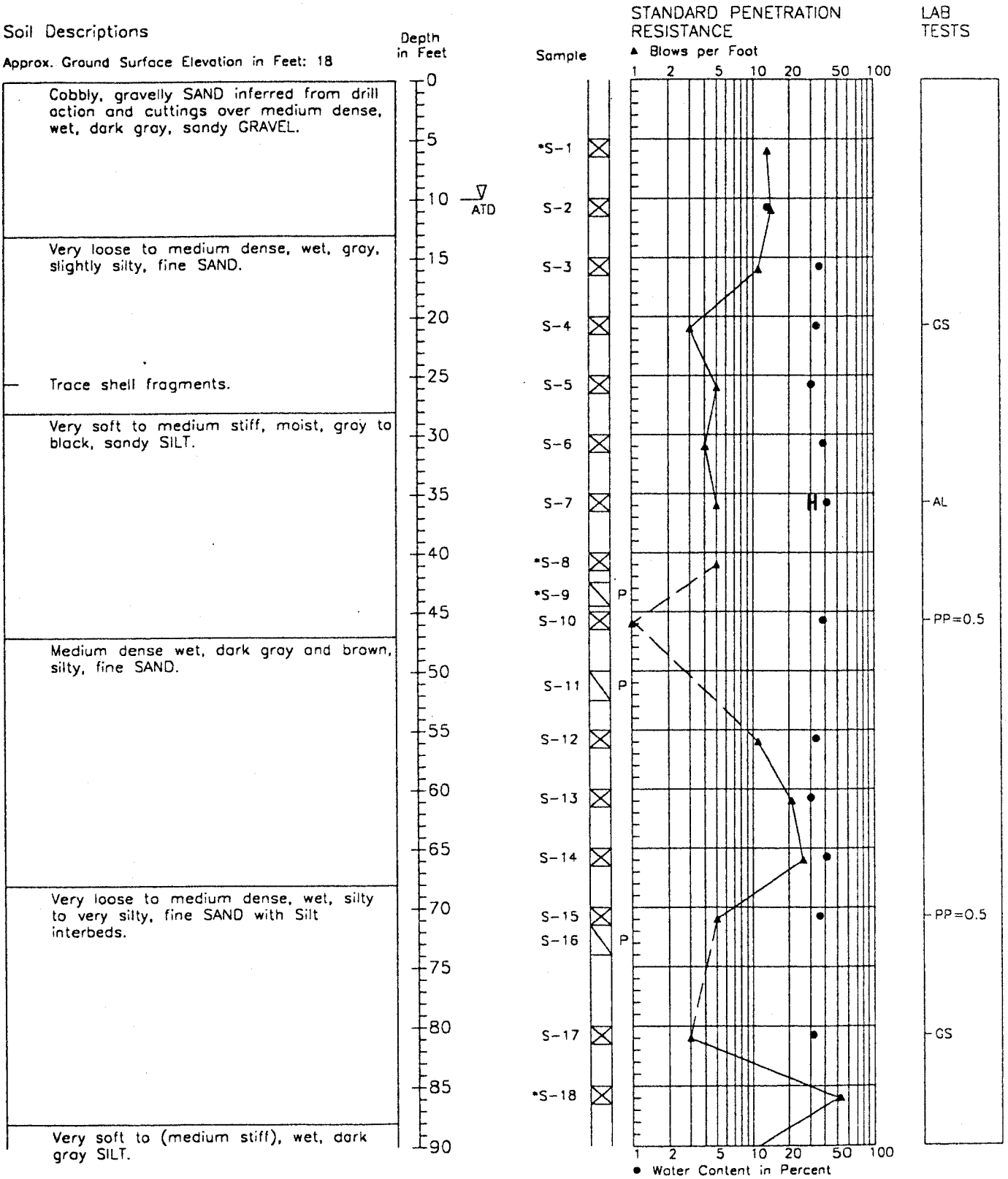


*Soil behavior type and SPT based on data from UBC-1983

HARTCROWSER
17916-00 3/13
Figure A-13 1/1

MKH 3/27/2013 U:\SPU\time\7_4_2014 to 7_4_2015\[Time and expense sheets 9_1.xls]daytimer

Boring Log S1B-2



1. Refer to Figure A–1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-7278-03 5/01

Figure A-21

DTN 5/17/01 1=1 charlie-8.pc2 LOGS

Boring Log S1B-2

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 18

Depth in Feet

90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180

Very soft to (medium stiff), wet, dark gray SILT.

Medium dense to dense, wet, dark gray, slightly silty to silty, fine SAND with trace shell fragments.

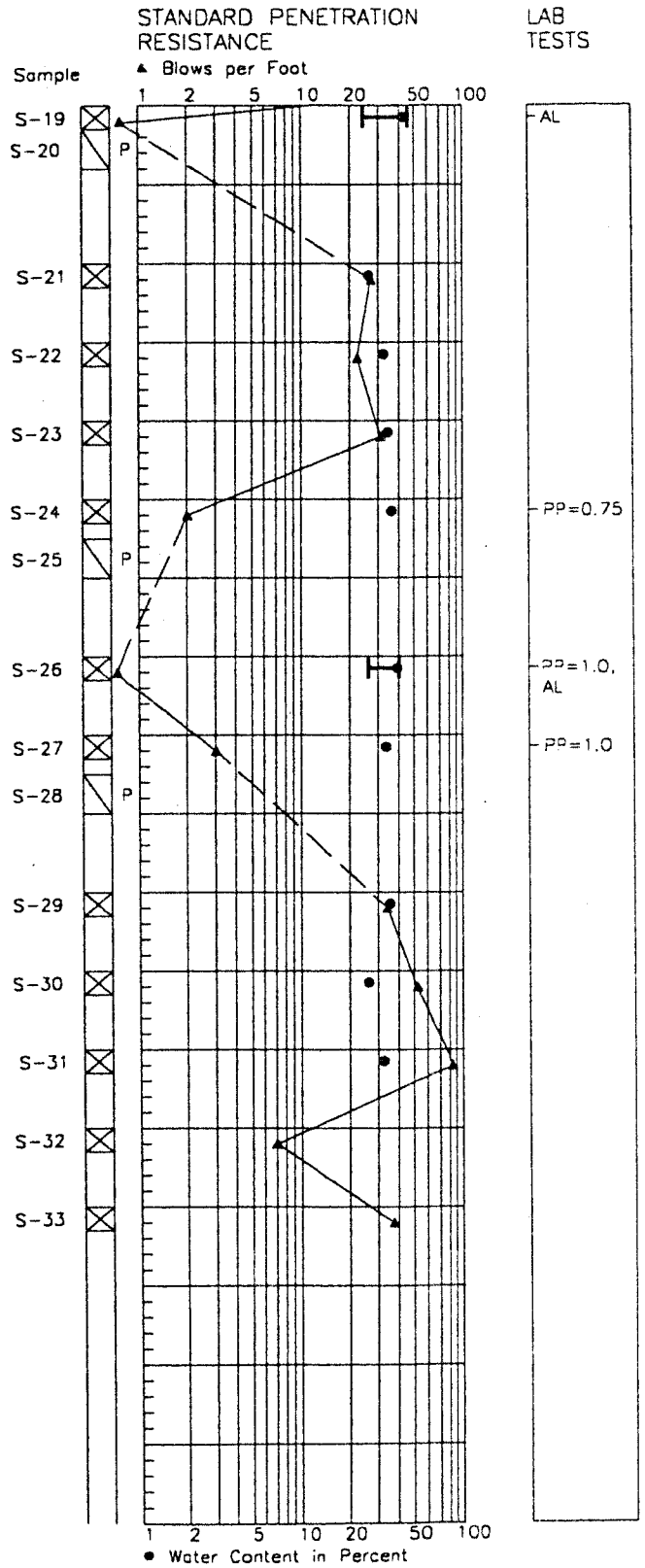
Very soft, moist, dark gray SILT.

Hard, wet, dark gray, slightly sandy SILT.

Dense to very dense, moist to wet, black, slightly silty to silty, fine SAND.

Loose, moist, dark gray SILT layer.

Bottom of Boring at 161.5 Feet. Completed 3/30/00.



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J-7278-03 5/01

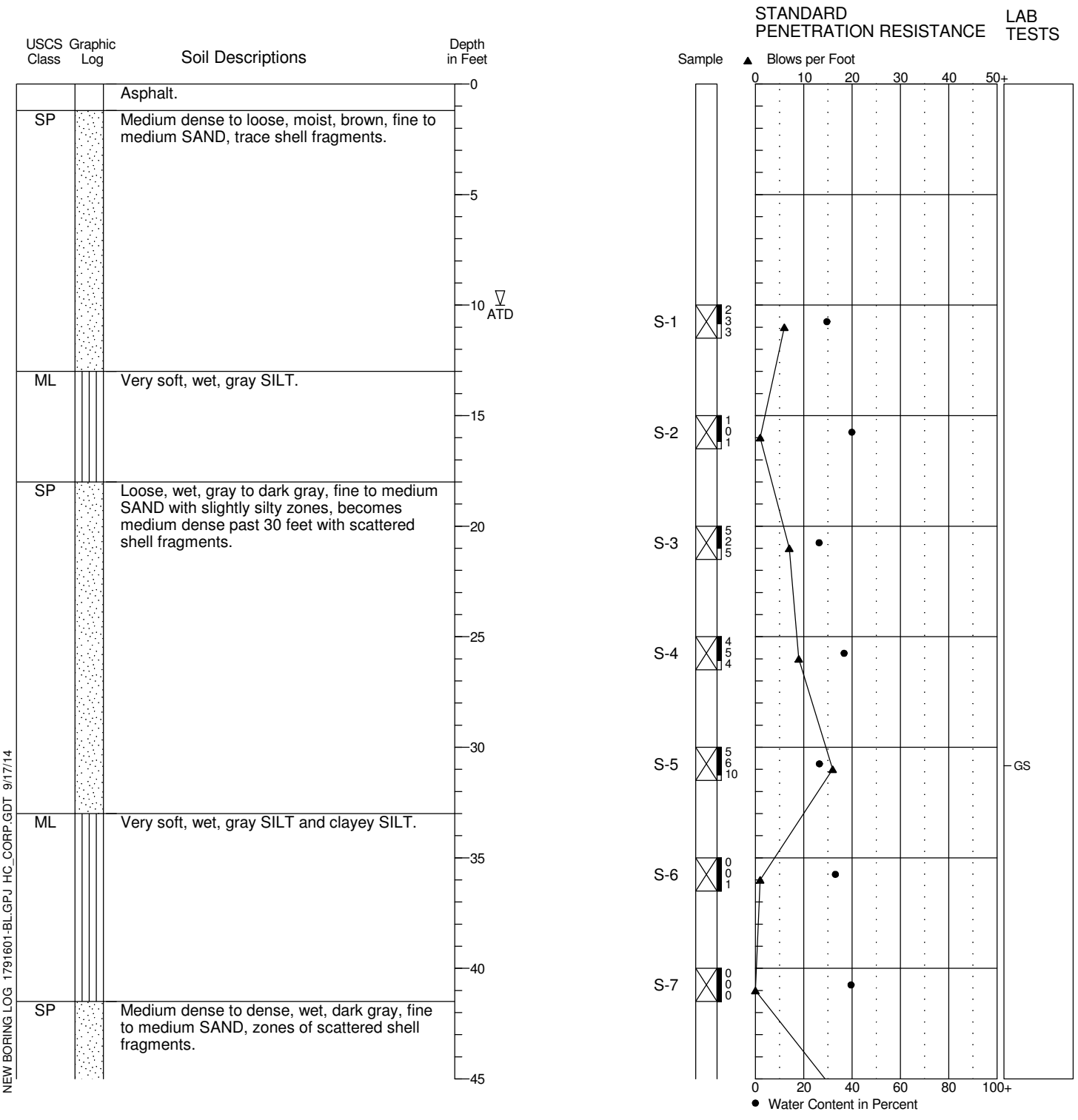
Figure A-21

DTN 5/17/01 1=1 carlie-B.pc2 LOGS

Boring Log HC12-B6

Location: See Figure 2.
Approximate Ground Surface Elevation: 19 Feet
Horizontal Datum:
Vertical Datum: MLLW

Drill Equipment: Mud Rotary
Hammer Type: SPT w/140 lb. Automatic hammer
Hole Diameter: 6 inches
Logged By: B. McDonald Reviewed By: B. Cook



NEW BORING LOG 1791601-BL.GPJ HC_CORP.GDT 9/17/14

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

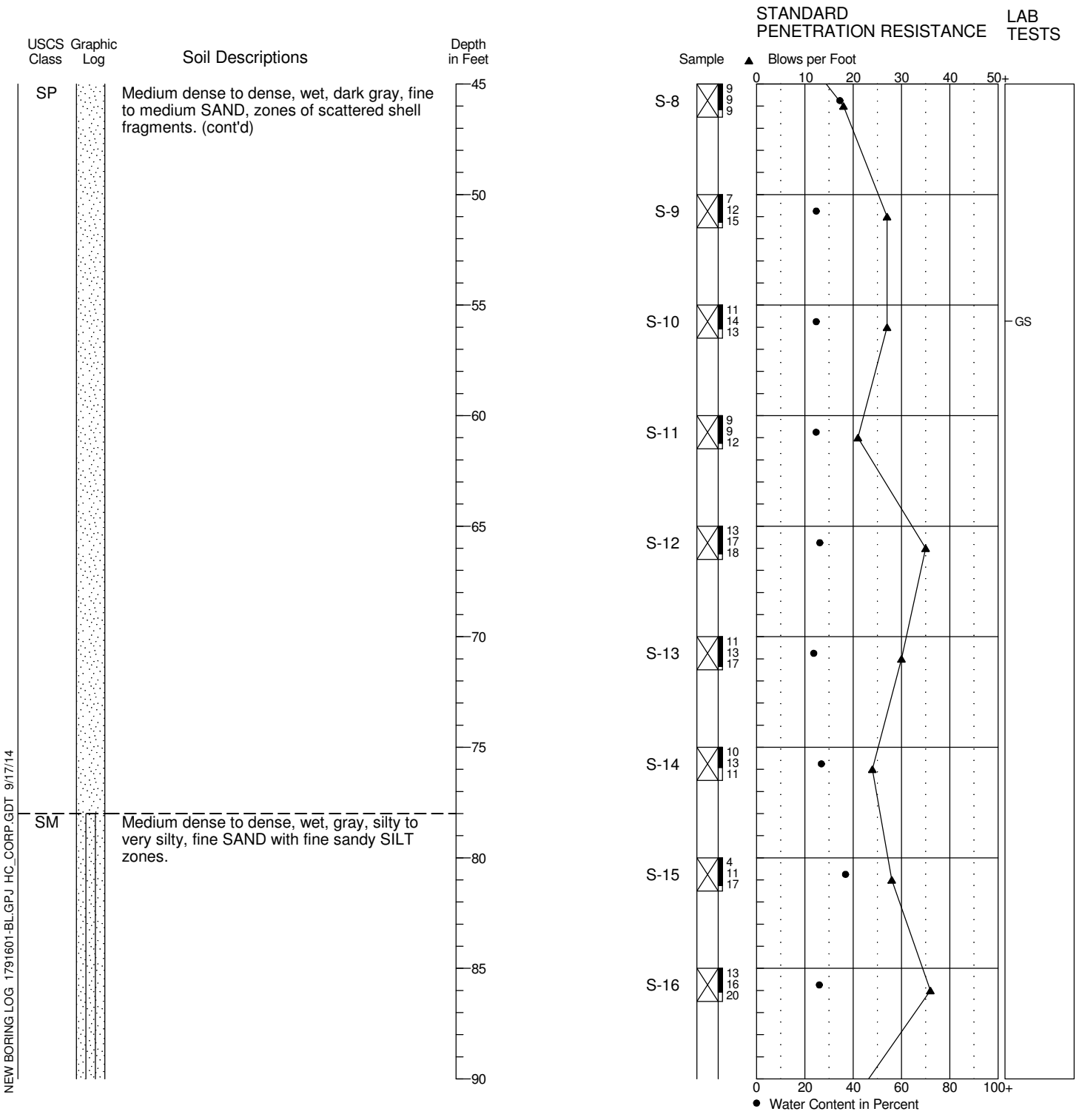
HARTCROWSER

17916-01 ***12/12***
Figure A-9 ***1/6***

Boring Log HC12-B6

Location: See Figure 2.
Approximate Ground Surface Elevation: 19 Feet
Horizontal Datum:
Vertical Datum: MLLW

Drill Equipment: Mud Rotary
Hammer Type: SPT w/140 lb. Automatic hammer
Hole Diameter: 6 inches
Logged By: B. McDonald Reviewed By: B. Cook



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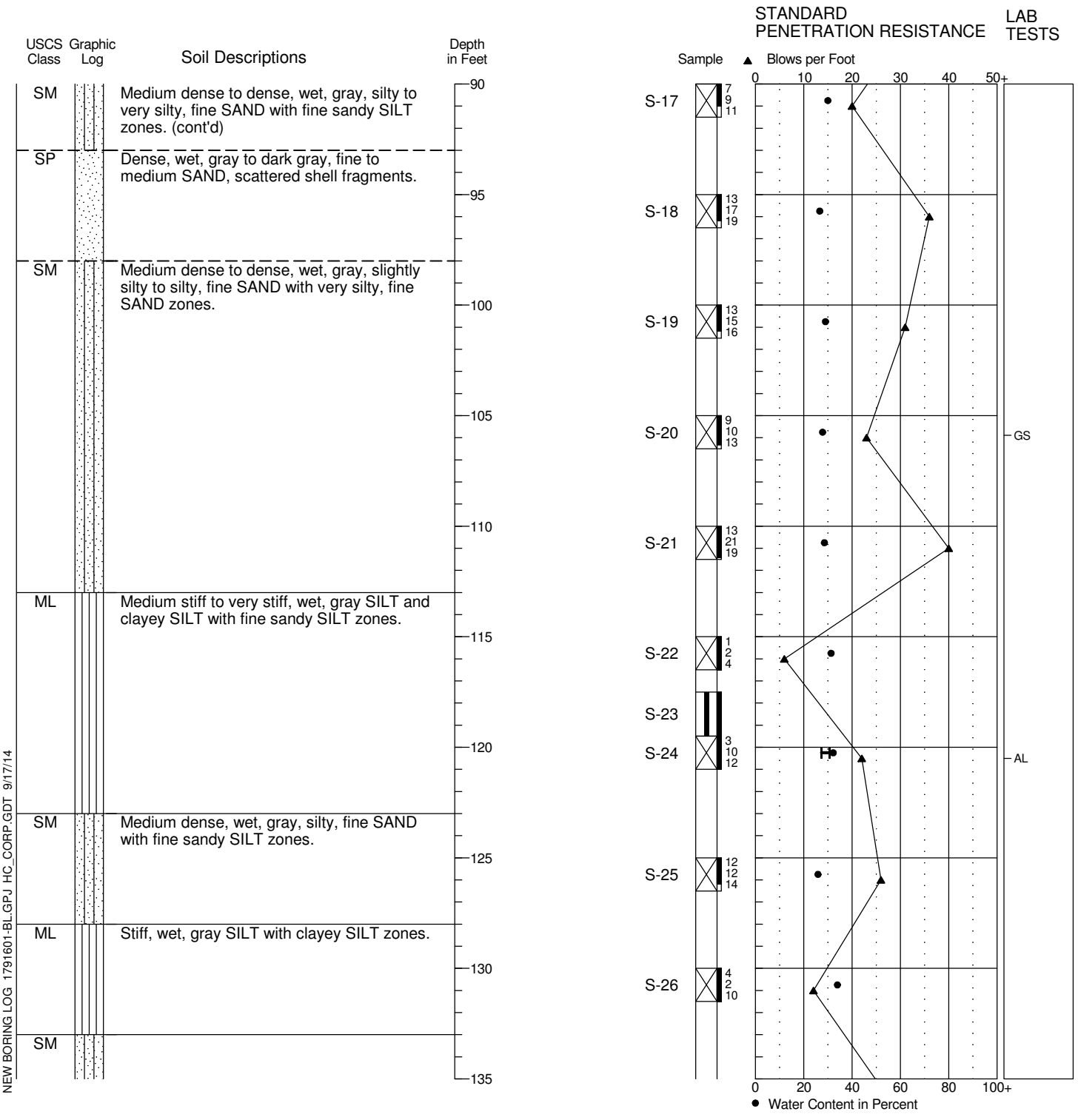
HARTCROWSER

17916-01 ***12/12***
Figure A-9 ***2/6***

Boring Log HC12-B6

Location: See Figure 2.
Approximate Ground Surface Elevation: 19 Feet
Horizontal Datum:
Vertical Datum: MLLW

Drill Equipment: Mud Rotary
Hammer Type: SPT w/140 lb. Automatic hammer
Hole Diameter: 6 inches
Logged By: B. McDonald Reviewed By: B. Cook



NEW BORING LOG 1791601-BL.GPJ HC_CORP.GDT 9/17/14

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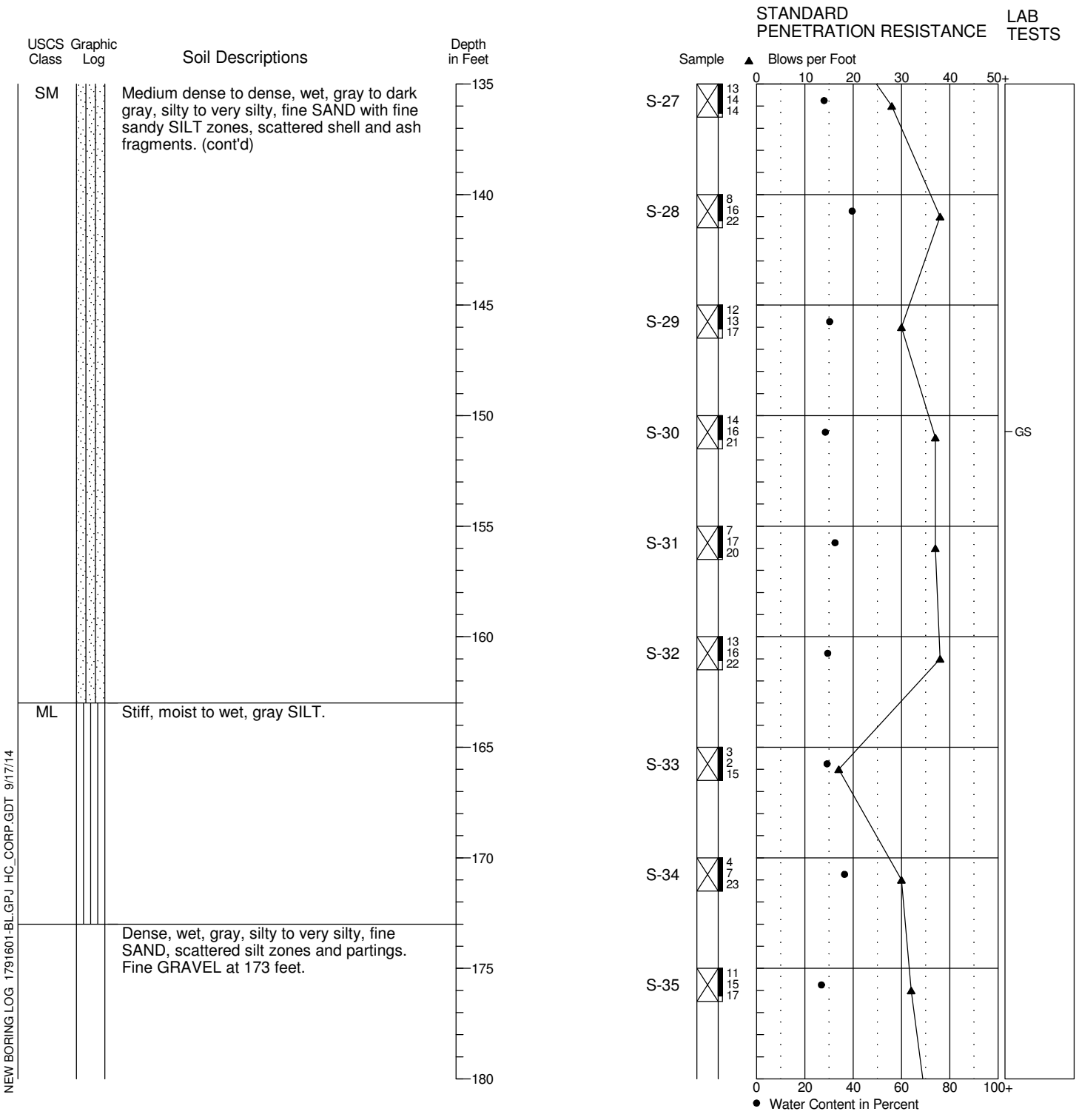
HARTCROWSER

17916-01 ***12/12***
Figure A-9 ***3/6***

Boring Log HC12-B6

Location: See Figure 2.
Approximate Ground Surface Elevation: 19 Feet
Horizontal Datum:
Vertical Datum: MLLW

Drill Equipment: Mud Rotary
Hammer Type: SPT w/140 lb. Automatic hammer
Hole Diameter: 6 inches
Logged By: B. McDonald Reviewed By: B. Cook



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HARTCROWSER

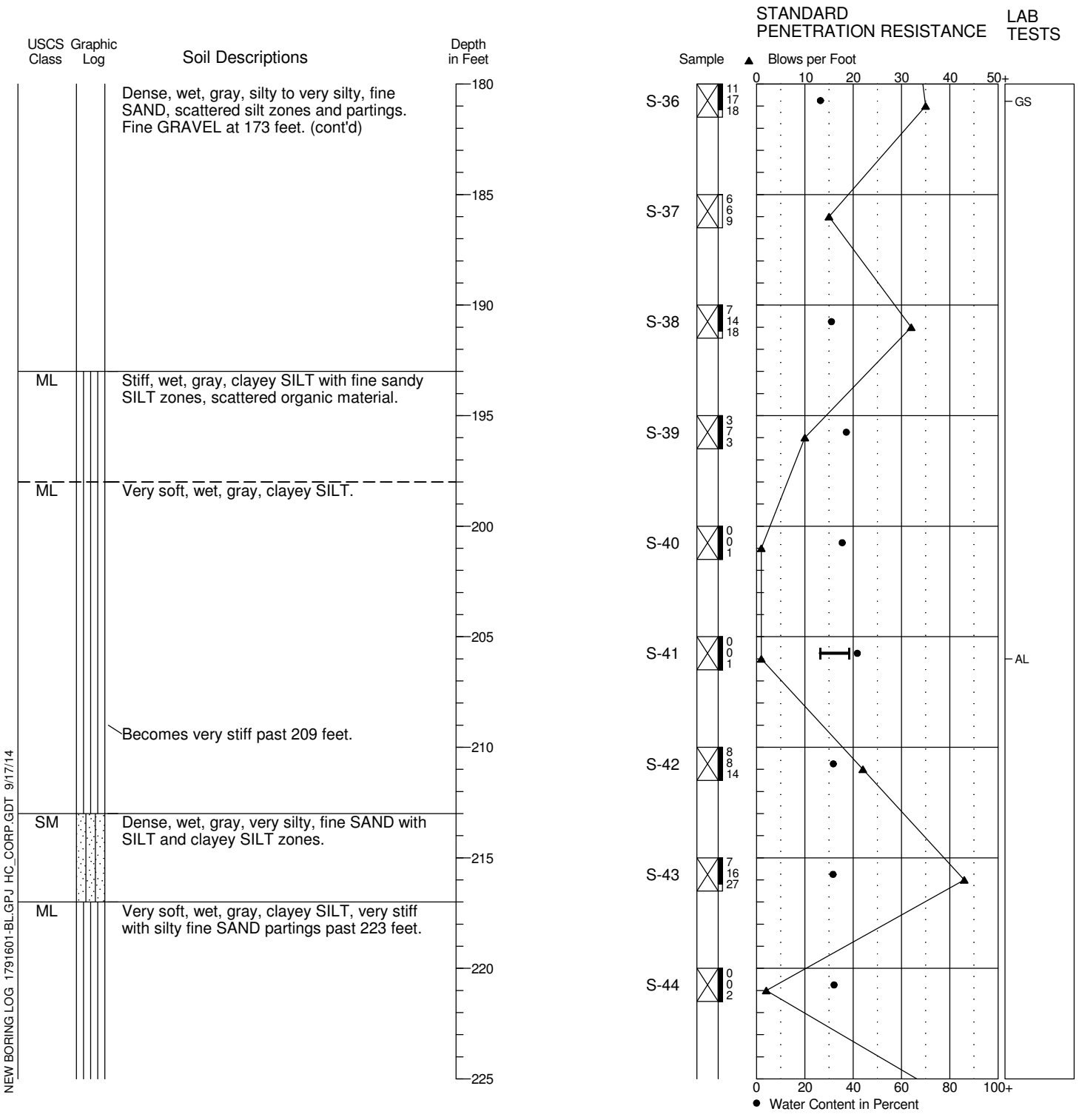
17916-01 ***12/12***

Figure A-9 ***4/6***

Boring Log HC12-B6

Location: See Figure 2.
Approximate Ground Surface Elevation: 19 Feet
Horizontal Datum:
Vertical Datum: MLLW

Drill Equipment: Mud Rotary
Hammer Type: SPT w/140 lb. Automatic hammer
Hole Diameter: 6 inches
Logged By: B. McDonald Reviewed By: B. Cook



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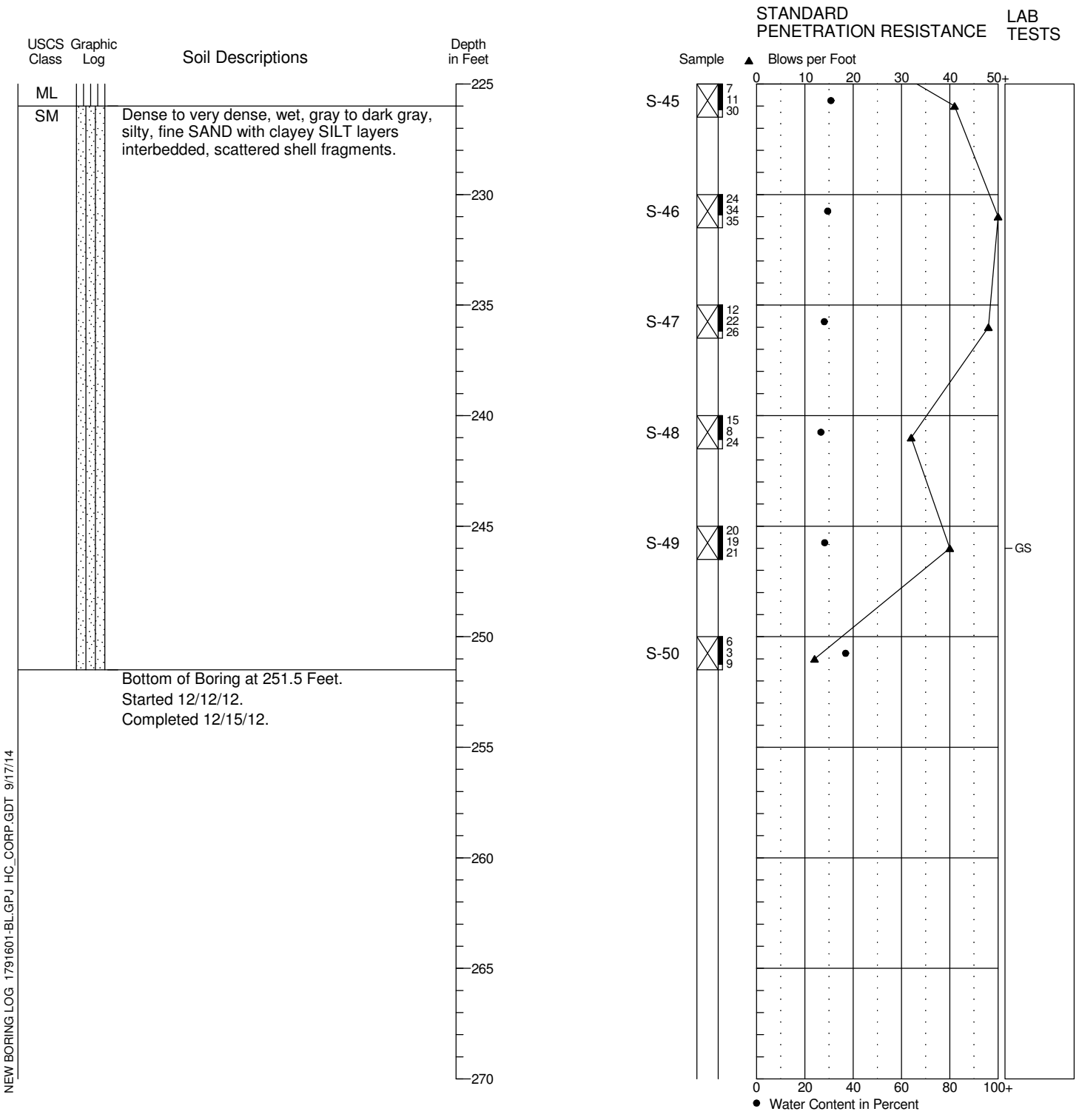
HARTCROWSER

17916-01 ***12/12***
Figure A-9 ***5/6***

Boring Log HC12-B6

Location: See Figure 2.
Approximate Ground Surface Elevation: 19 Feet
Horizontal Datum:
Vertical Datum: MLLW

Drill Equipment: Mud Rotary
Hammer Type: SPT w/140 lb. Automatic hammer
Hole Diameter: 6 inches
Logged By: B. McDonald Reviewed By: B. Cook



NEW BORING LOG 1791601-BL.GPJ HC_CORP.GDT 9/17/14

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HARTCROWSER

17916-01 ***12/12***
Figure A-9 ***6/6***

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for KPFF Consulting Engineers and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with KPFF Consulting Engineers dated November 9, 2020 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for Port of Tacoma Terminal 3 and Terminal 4 Shore Power Upgrades. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

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

For example, changes that can affect the applicability of this report include those that affect:

1 Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and

accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

1. advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
2. encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

GeoEngineers