

May 28, 2019
File No. 19-133

Mr. Jeremiah Jolicoeur
Alliance Realty Partners, LLC
c/o Alliance Residential Company
1325 4th Avenue, Ste. 1005
Seattle, WA 98101

Subject: Geotechnical Feasibility Report
Proposed Development – Holden of Shoreline
17127 - 15th Avenue NE, Shoreline, Washington

Dear Mr. Jolicoeur,

As requested, PanGEO Inc. prepared the following geotechnical feasibility report for the proposed Holden of Shoreline development in Shoreline, Washington. The objective of our study was to evaluate the site subsurface conditions, identify subsurface conditions that may impact the design and construction of the project, and to provide conceptual geotechnical recommendations for your feasibility evaluation of the proposed project.

Our study was performed in general accordance with our mutually agreed scope of work as outlined in our contract dated May 13, 2019. Our scope of services included:

- Reviewing the conceptual site development plan;
- Conducting a site reconnaissance;
- Reviewing readily available geologic/geotechnical data in the site vicinity;
- Drilling five test borings at the site;
- Conducting preliminary engineering analyses; and
- Preparing the following report summarizing our findings, conclusions, and recommendations.

Additional detailed engineering analyses will be performed to complete the final design, and we may refine our recommendations based on the results of the additional analyses and final design layout.

SITE AND PROJECT DESCRIPTION

The subject property is located along the west side of the intersection of 15th Avenue NE and NE 172nd Street, in Shoreline, Washington (see Figure 1, Vicinity Map). The site is rectangular in shape, and has an area of about 72,307 square-feet. The site is currently developed with a one-level building located over the majority of the western two-thirds of the site. The building is surrounded with at-grade asphalt parking areas to the east and southeast, and landscaping areas to the north, west, and southwest.

The site topography is relatively flat, with the exception of the approximately eastern one-third of the site which slopes gently down from east to west from the street elevation of 15th Avenue NE. The total topographic relief within the eastern portion of the site is about 20 feet. An approximately 5- to 6-foot high rockery is located adjacent to much of the northern property line, which allows for the change in grade between the higher northern property grade and the ground surface at the subject site.

We understand the proposed project will consist of the demolition of the existing building and the construction of a 5-level assisted living facility with a partial below-grade basement. We understand that the proposed structure will occupy the majority of the site, and will be set-back from the property lines about 20 feet. Temporary excavations for the project are expected to be less than about 10 feet deep.

CURRENT SUBSURFACE EXPLORATIONS

Five test borings (PG-1 through PG-5) were drilled at the project site on May 14, 2019. The approximate boring locations were measured in the field from onsite features, as shown on Figure 2, Site and Exploration Plan. The borings were drilled between about 7½ and 20½ feet below grade. The borings were drilled using a limited access hand-portable acker drill and an EC 95 track-mounted drill rig owned and operated by Boretec1, Inc. A geologist from PanGEO was present throughout the field exploration program to observe the drilling, assist in sampling, and to document the soil samples obtained from the borings. The completed borings were backfilled with drill cuttings and

bentonite chips, and patched. Selected soil samples were submitted for testing index properties, and the laboratory test results will be provided when available.

SUBSURFACE CONDITIONS

GEOLOGY

Based on review of *The Geologic Map of King County* (Booth, et. al. 2007), the project site is underlain by Vashon Glacial Till (Qvt). Glacial till deposits typically consist of a dense to very dense unsorted mixture of silty sand and gravel. Vashon Advance Outwash (Qva) deposits are mapped about a block west of the project site. Advance outwash deposits are described as dense to very dense, well-sorted sand and gravel that had been overridden by glacial ice. In their undisturbed state, both glacial till and advance outwash deposits exhibit low compressibility characteristics.

SOIL CONDITIONS

In general, the subject site is underlain by relatively thin layers of undocumented fill over dense to very dense glacial till, consisting of silty sand with gravel, and advance outwash deposits consisting of dense to very dense slightly silty sand. Based on the results of our subsurface explorations, we summarize the site subsurface conditions as follows:

Unit 1: Fill – All borings, with the exception of boring PG-2, encountered a layer of fill soil, which typically consisted of loose to medium dense silty sand with varying amounts of gravel and organics. The layer of fill was found to only be about 2 to 2½ feet thick in borings PG-1 and PG-3, while the fill was measured to be about 4 feet thick in PG-4, and 5 feet thick in PG-5.

Unit 2: Vashon Till – Below the fill, where present, the test borings encountered a layer of dense to very dense silty sand with some gravel, that we interpreted to be the mapped Vashon till. The Vashon till was encountered to the termination depth of borings PG-1, and PG-5. The upper approximately 2½ to 3½ feet of the till in PG-4 and PG-5 was found to be weathered, and medium dense. Layers of gravel or potentially cobbles were noted at several locations within this unit. Although not encountered in our test borings, boulders are also commonly present in Vashon till deposits.

Unit 3: Vashon Advance Outwash – Directly below the topsoil in boring PG-2, a medium dense to very dense slightly silty fine to medium sand with trace gravel was encountered to the termination depth of the boring, about 10 feet below the ground surface. This unit was also encountered below the Vashon till in borings PG-3 and PG-4, at depths of 8½ feet and 15½ below the existing ground surface, respectively, and extended to the termination depth of the borings approximately 16½ feet below the ground surface. We interpreted this unit to be Vashon advance outwash. Layers of slightly laminated fine to medium sand were observed throughout this soil unit.

GROUNDWATER

Groundwater was not encountered within the termination depth of the borings during our field exploration. However, during wet times of the year, we anticipate that perched water will form on top of the low permeability Vashon till. In addition, seepage is also common within clean sand and gravel layers within the Vashon till deposit. It should be noted that the groundwater elevations likely vary depending on the season, local subsurface conditions, and other factors. Groundwater levels are normally highest during the winter and early spring.

SEISMIC CONSIDERATIONS

SEISMIC SITE CLASS

We anticipate that the seismic design of the building will be accomplished in accordance with the 2015 International Building Code (IBC). Based on the results of our subsurface explorations, and understanding of site subsurface conditions, a Site Class C would be appropriate for the project.

SOIL LIQUEFACTION

Due to the dense to very dense soils underlying the site and lack of groundwater, the risk of soil liquefaction is negligible, and in our opinion special design considerations for soil liquefaction are not necessary for the proposed project.

PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

BUILDING FOUNDATION

In our opinion, conventional spread and strip footings will be appropriate to support the proposed structure. Based on our current understanding of the proposed development, we anticipate that the majority of the foundation of the proposed building will bear on native, dense to very dense glacial soils.

We will provide a specific soil bearing capacity once we have completed our design level study, however, for planning purposes, we anticipate that an allowable bearing capacity of about 8,000 psf may be used for footings bearing on the dense to very native soils, which are anticipated to be present about 2½ feet below the existing ground surface over much of the site, and about 7½ feet below the existing ground surface in the eastern and southeastern portion of the site near the locations of borings PG-4 and PG-5.

At locations where the dense to very dense native soils are not present at the proposed foundation elevation, the footings may be depended to reach these soils, or the footings may bear on the native medium dense soils, such as the weathered glacial till, or on properly compacted granular structural fill placed over the dense to very dense native soils. Footings may be sized using an allowable bearing capacity of 4,000 psf for foundations bearing on the native medium dense soils, or structural fill.

SLAB ON GRADE

Conventional slab-on-grade floors would be feasible for the proposed development, provided they are constructed over firm native soils or properly compacted structural fill and capillary break material.

TEMPORARY EXCAVATIONS

We anticipate that temporary excavations on the order of about 10 feet deep will be needed to construct the below-grade portions of the proposed development. Based on the anticipated set-backs from the property lines, we anticipate that there will be adequate space for temporary, unsupported open cuts. For planning purposes, we recommend temporary excavations be sloped at 1H:1V. When dense to very dense glacial till or advance outwash soils are encountered, steeper temporary cut slopes of ½H:1V will likely be feasible, provided no groundwater seepage is present in the temporary

excavation. All temporary cut slopes must be evaluated in the field by a PanGEO representative. During periods of precipitation, the temporary cuts should be protected with plastic sheeting.

TEMPORARY & PERMANENT GROUNDWATER CONTROL

Based on the results of our subsurface investigations, we do not anticipate that groundwater will significantly impact the subject site during excavation. The groundwater that may potentially be encountered in the excavation will likely consist of perched water at the base of the fill, and potentially intermittent wet sand or gravel layers within the till soils. We observed iron-oxide staining at about five feet below the ground surface in PG-4, indicating likely seasonal groundwater seepage at this depth.

Based on our observations, it is our opinion that any groundwater seepage into the site excavations would be relatively low. If groundwater seepage is encountered during excavation, temporary dewatering methods consisting of trenches, sumps and pumps would most likely be adequate for groundwater control, in our opinion.

We anticipate that a conventional drainage system consisting of wall drains and a perimeter footing drain will be appropriate for the proposed project. In addition, a limited under-slab drainage system may be incorporated into the design if groundwater seepage is observed at the bottom of the excavation.

GENERAL EARTHWORK CONSIDERATIONS

A majority of the site soils (Vashon till) are very moisture sensitive and will become disturbed and soft when exposed to inclement weather conditions. As a result, the excavated site materials will likely not be suitable for use as backfill, particularly during the winter. Additionally, the exposed subgrade at footing locations will likely need protection from water softening during winter months with crushed rock or lean-mix concrete “rat slabs”. For budgeting purposes, imported all weather fill should be assumed for backfill.

ADDITIONAL SERVICES

The geotechnical recommendations presented in this report are conceptual in nature, and are intended to aid with conceptual design and cost estimating purposes. Additional

geotechnical engineering efforts will be needed to develop the final design recommendations for the project. Modifications to our recommendations presented in this report may be necessary, based on the actual design of the proposed development and information obtained from additional engineering analyses.

CLOSURE

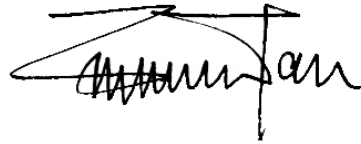
We have prepared this report for use by Alliance Realty Partners, LLC, and the project design team. Recommendations contained in this report are based on a site reconnaissance, a review of existing subsurface data, a site-specific exploration program, and our understanding of the project. The study was performed using a mutually agreed-upon scope of work.

We appreciate the opportunity to be of service.

Sincerely,



Jon C. Renkopf, P.E.
Senior Geotechnical Engineer



Siew L. Tan, P.E.
Principal Geotechnical Engineer

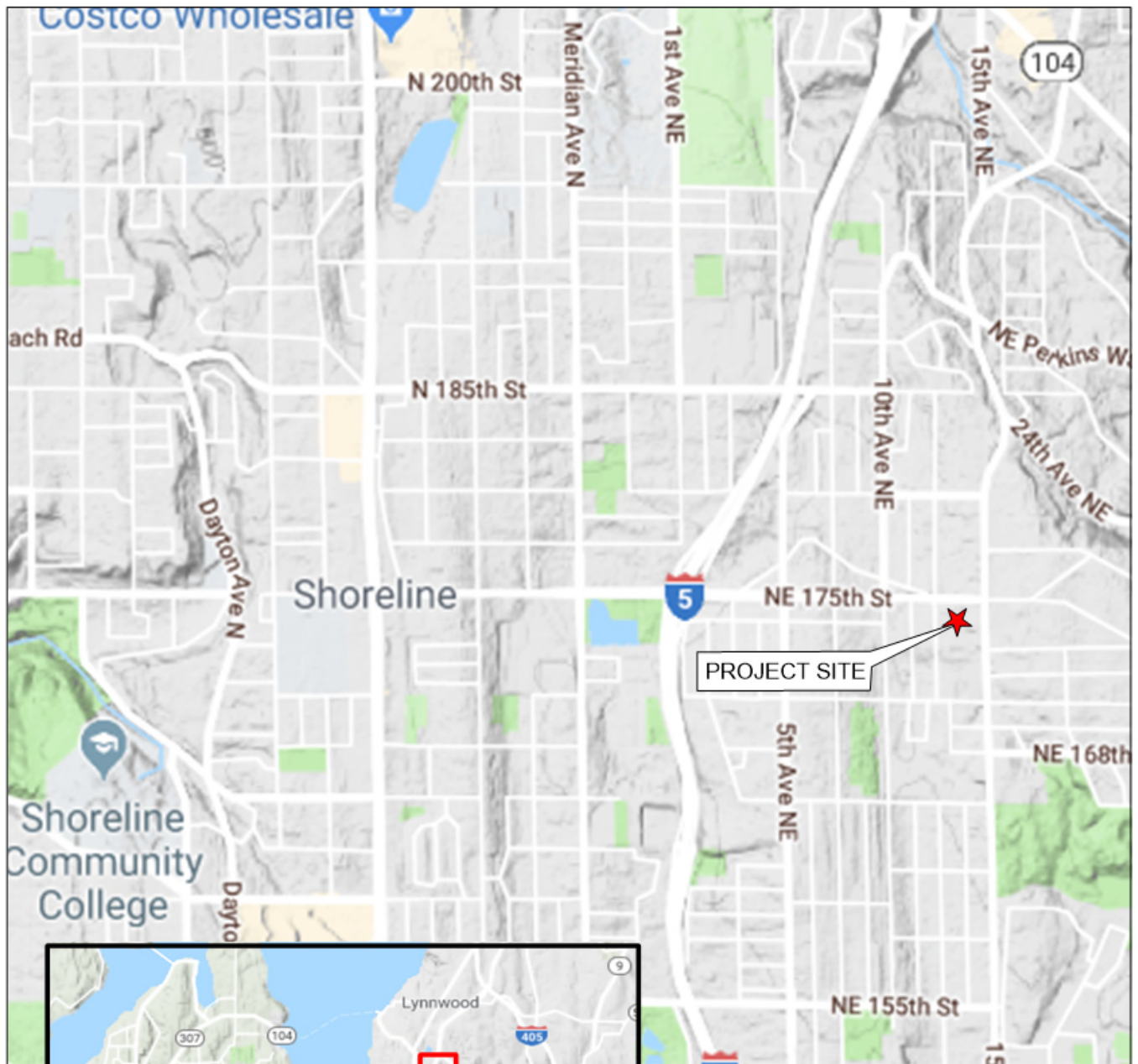
Enclosures:

- Figure 1 Vicinity Map
- Figure 2 Site and Exploration Plan
- Appendix A – Summary Boring Logs

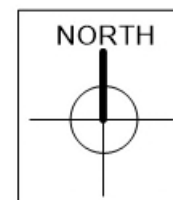
REFERENCES

Booth, D. B., Troost, K. A., and Wisher, A. P., 2007, *The Geologic Map of King County, Washington: scale 1:100,000*.

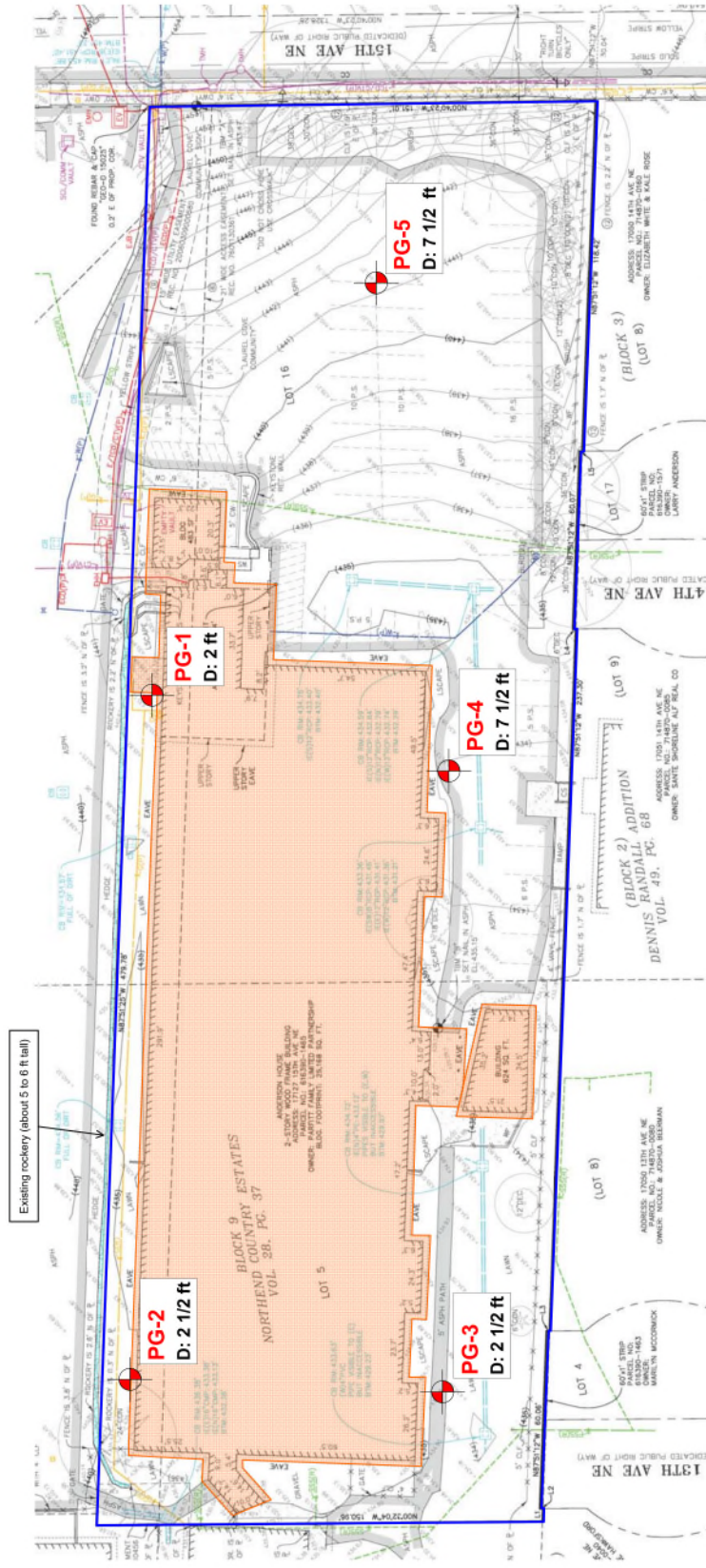
International Building Code (IBC), 2015, International Code Council.



Reference: Google Terrain Map







Not to Scale




Base map modified from topographic survey prepared by Bush, Roed & Hitchings, Inc., dated 05/15/2019.

Legend:

-  NORTH
-  Approximate PanGEO Boring Location
- D:** Approximate Depth to Top of Bearing Soil
-  Approximate Property Boundary
-  Approximate Limits of Existing Structures

Approx. Scale
1" = 40'

	Proposed Development 17127 15th Avenue NE Shoreline, WA 98155	SITE AND EXPLORATION PLAN
Project No. 19-133	Figure No. 2	
















APPENDIX A

SUMMARY BORING LOGS

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)		GW: Well-graded GRAVEL
	GRAVEL (>12% fines)		GP: Poorly-graded GRAVEL
			GM: Silty GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)		GC: Clayey GRAVEL
			SW: Well-graded SAND
	SAND (>12% fines)		SP: Poorly-graded SAND
			SM: Silty SAND
			SC: Clayey SAND
Silt and Clay 50% or more passing #200 sieve	Liquid Limit < 50		ML: SILT
			CL: Lean CLAY
			OL: Organic SILT or CLAY
	Liquid Limit > 50		MH: Elastic SILT
			CH: Fat CLAY
			OH: Organic SILT or CLAY
Highly Organic Soils			PT: PEAT

- Notes:**
- Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.
 - The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered: Units of material distinguished by color and/or composition from material units above and below	Fissured: Breaks along defined planes
Laminated: Layers of soil typically 0.05 to 1mm thick, max. 1 cm	Slickensided: Fracture planes that are polished or glossy
Lens: Layer of soil that pinches out laterally	Blocky: Angular soil lumps that resist breakdown
Interlayered: Alternating layers of differing soil material	Disrupted: Soil that is broken and mixed
Pocket: Erratic, discontinuous deposit of limited extent	Scattered: Less than one per foot
Homogeneous: Soil with uniform color and composition throughout	Numerous: More than one per foot
	BCN: Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm








TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.









ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

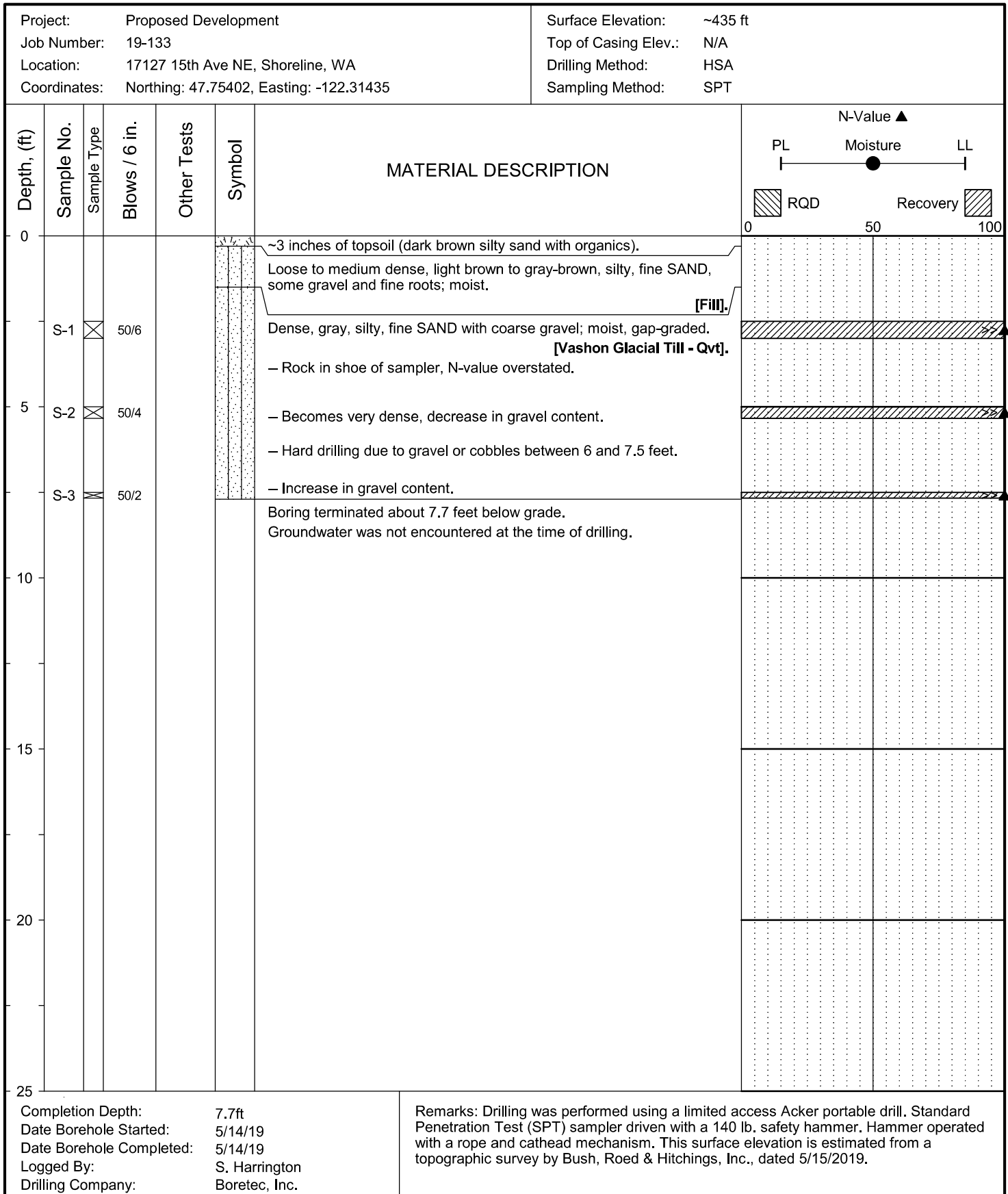
	2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
	3.25-inch OD Split Spoon (300-lb hammer, 30" drop)
	Non-standard penetration test (see boring log for details)
	Thin wall (Shelby) tube
	Grab
	Rock core
	Vane Shear

MONITORING WELL

	Groundwater Level at time of drilling (ATD)
	Static Groundwater Level
	Cement / Concrete Seal
	Bentonite grout / seal
	Silica sand backfill
	Slotted tip
	Slough
	Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

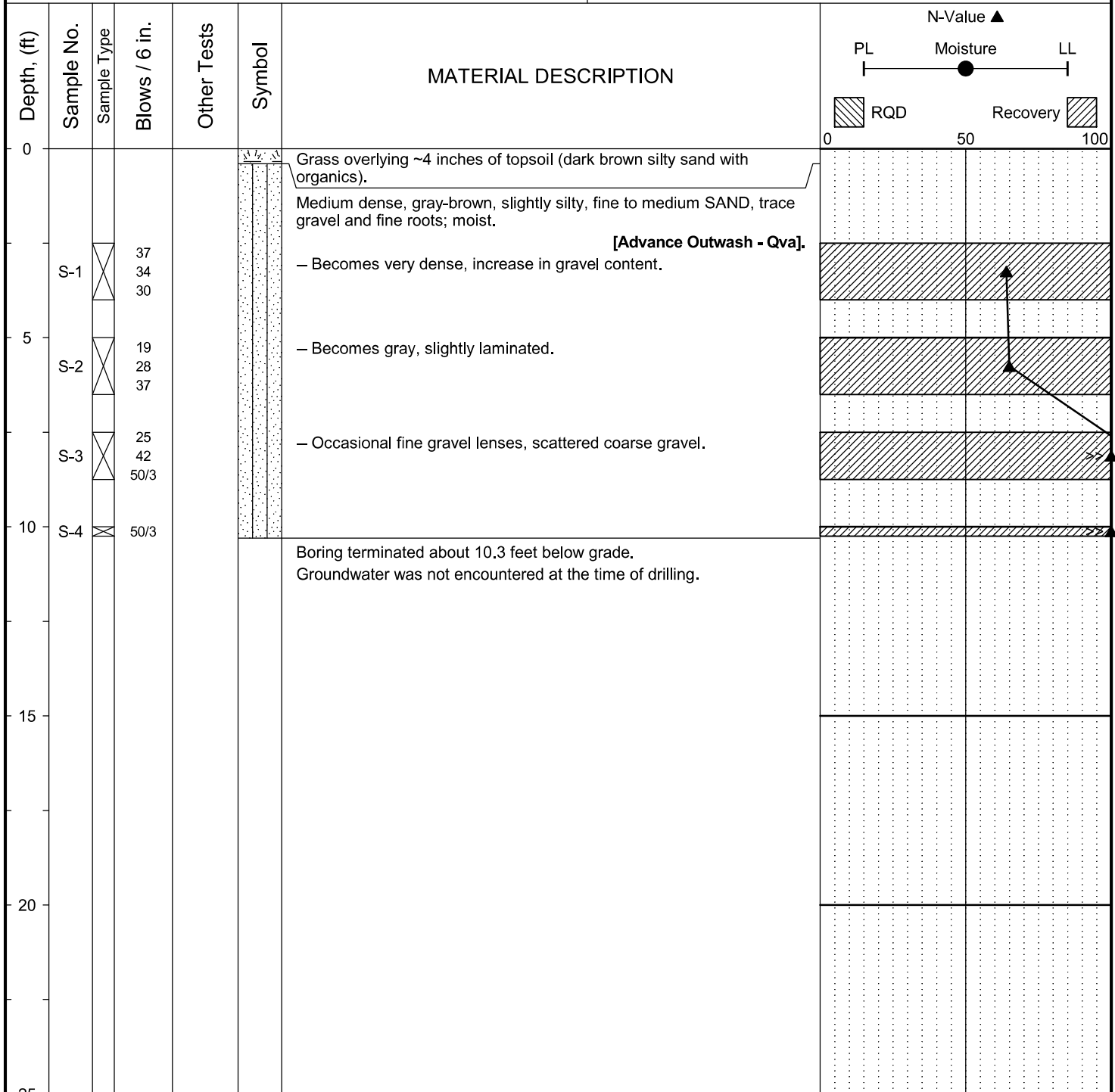


LOG OF TEST BORING PG-1

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Development	Surface Elevation:	~435 ft
Job Number:	19-133	Top of Casing Elev.:	N/A
Location:	17127 15th Ave NE, Shoreline, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.75403, Easting: -122.31521	Sampling Method:	SPT



Completion Depth: 10.3ft
 Date Borehole Started: 5/14/19
 Date Borehole Completed: 5/14/19
 Logged By: S. Harrington
 Drilling Company: Boretac, Inc.

Remarks: Drilling was performed using a limited access Acker portable drill. Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. This surface elevation is estimated from a topographic survey by Bush, Roed & Hitchings, Inc., dated 5/15/2019.

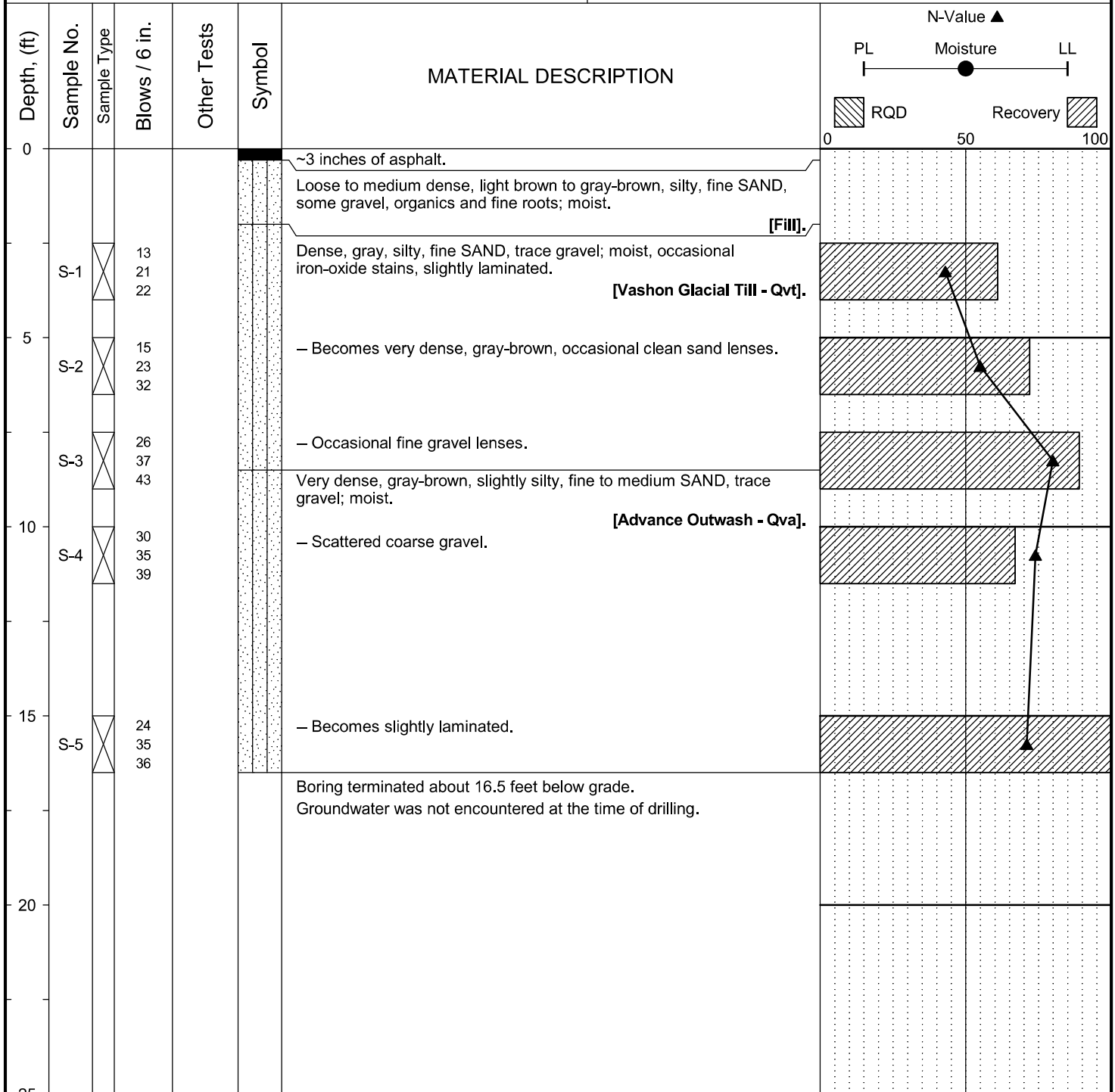


LOG OF TEST BORING PG-2

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Development	Surface Elevation:	~435 ft
Job Number:	19-133	Top of Casing Elev.:	N/A
Location:	17127 15th Ave NE, Shoreline, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.75373, Easting: -122.31528	Sampling Method:	SPT



Completion Depth: 16.5ft
 Date Borehole Started: 5/14/19
 Date Borehole Completed: 5/14/19
 Logged By: S. Harrington
 Drilling Company: Boretac, Inc.

Remarks: Drilling was performed using an EC 95 track drill. Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. This surface elevation is estimated from a topographic survey by Bush, Roed & Hitchings, Inc., dated 5/15/2019.

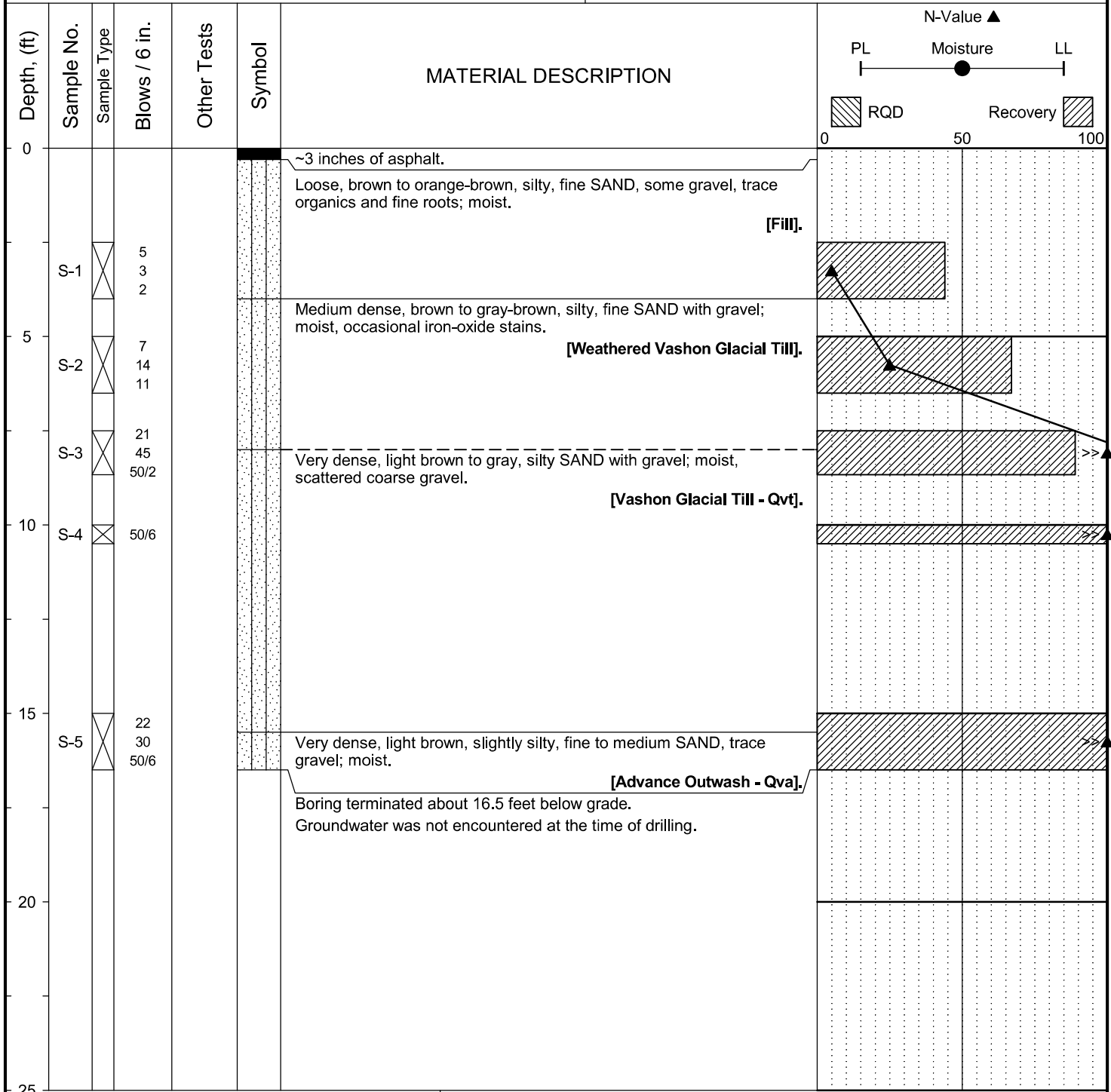


LOG OF TEST BORING PG-3

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Development	Surface Elevation:	~434 ft
Job Number:	19-133	Top of Casing Elev.:	N/A
Location:	17127 15th Ave NE, Shoreline, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.75372, Easting: -122.31443	Sampling Method:	SPT



Completion Depth: 16.5ft
 Date Borehole Started: 5/14/19
 Date Borehole Completed: 5/14/19
 Logged By: S. Harrington
 Drilling Company: Borettec, Inc.

Remarks: Drilling was performed using an EC 95 track drill. Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. This surface elevation is estimated from a topographic survey by Bush, Roed & Hitchings, Inc., dated 5/15/2019.



LOG OF TEST BORING PG-4

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

