HWA GEOSCIENCES INC.
DBE/MWBE

April 26, 2021
HWA Project No. 2019-016 Task 8

City of Sammamish
801 228th Ave SE
Sammamish, Washington 98075

Attn: **Jed Ireland, P.E.**

Subject: **CITY OF SAMMAMISH ON-CALL**
212th Avenue SE Borings
Geotechnical Investigation
Sammamish, Washington

Mr. Ireland:

In accordance with your request, HWA GeoSciences Inc. (HWA) completed a geotechnical investigation as part of an on-call contract with the City of Sammamish. This phase of work supported an investigation along a portion of 212th Avenue SE, in the vicinity of Ebright Creek. The purpose of our investigation was to assess subsurface conditions along this portion of the roadway to provide preliminary recommendations for a bridge planned here in the future.

BACKGROUND

On July 23, 2020, Bryan Hawkins, P.E. met with Ben Ressler at the project location where several sinkholes had formed below portions of the sidewalk on the west side of the road. Portions of the undermined sidewalk had started settling and it appeared that the sinkhole could be extending below the southbound travel lane. During our site visit we observed that the roadway shoulder/sidewalk along the west side of the road is supported by a gabion basket wall, which had either sunk/settled into the surrounding wetland or had corroded and disintegrated at the locations of the sinkholes/voids below the sidewalk allowing materials below the sidewalk and road to wash out into the wetland resulting in the voids below the sidewalk and road. It was further observed that quarry spalls existed below the pavement section, placed as part of embankment construction. At that time, we provided recommendations for filling the voids using CDF, or similar flowable materials. We understand that the City used some type of foam to repair these areas. The City then requested we perform seven drilled boreholes along the portion of roadway passing through the wetland in order to assess conditions for a bridge to replace the embankment supported roadway sometime in the future.

PROJECT DESCRIPTION

It is our understanding that the City of Sammamish intends to construct a bridge where 212th Avenue SE crosses the Ebright Creek marsh/wetland sometime in the future. Our investigation to assess subsurface conditions in the vicinity proposed bridge alignment consisted of performing seven geotechnical boreholes to depths of 30 to 50 feet below the roadway surface. Figure 1, Vicinity Map, shows the general location of the project. The locations of the boreholes are shown on Figure 2, Site & Exploration Plan.

GENERAL GEOLOGY

During the most recent glaciation in North America, the Puget lobe of the Cordilleran Ice Sheet covered most of western Washington between approximately 19,000 and 16,000 years before present. This period is known as the Vashon Stade of the Fraser glaciation. The ice sheet deposited advance outwash sands and gravels ahead of an advancing glacier in streams, rivers, and lakes. Advance outwash typically has minimal quantities of silt and clay; however, the base of the unit tends to have higher concentration of fine-grained sediments due to deposition in slower moving sediment choked meltwater streams and rivers. As the glacier continued to advance from north to south across the state, glacial till was deposited atop the advance outwash deposits. Glacial till consists of silts, sands, and gravels with varying amounts of clay that had become entrained in the base of the glacier and pulverized during movement and deposition. Both advance outwash and glacial till are dense to very dense having been overridden by an ice sheet up to 5,000-feet thick. At approximately 16,000 years before present the ice sheet had been receding for about 600 years and Lake Sammamish formed a connected drainage with Lake Washington, draining to the west through Lake Union. Meltwater from the receding glacier deposited recessional outwash on top of glacial till and advance outwash deposits in topographic lows and along newly formed drainage channels, some of which only existed during the recessional event. Recessional outwash consists of sands, gravels, silts, and clays deposited in streams and lakes and is typically loose to medium dense as it is normally consolidated. Many of the lakes and ponds we see today are relicts of the most recent recessional event. Over the last 16,000 years, alluvium, similar to recessional outwash, has been deposited on top of recessional outwash deposits as rivers and streams continue to work the existing glacial soil strata.

Surficial geologic information for this project was obtained from the *Geologic Map of the East Half of the Bellevue South 7.5' x 15' Quadrangle, Issaquah Area, King County, Washington* (Booth et. al., 2012). The project area is mapped as Quaternary wetland deposits in the Ebright creek drainage, surrounded by glacial till to the north, west, and south. Further east and northeast, recessional outwash deposits that have not yet been eroded away are present. Wetland deposits consist of alluvium as described above and may contain peat bogs and other organic deposits such as organic silts and clays in environments with standing water and vegetation growth.

Our boreholes confirmed the presence of alluvial deposits consisting of silt, clay, sand, and peat in the Ebright creek drainage below a layer of roadway embankment fill. The thickness of the alluvium ranged from about 7 to 30 feet in total thickness, with a peat deposit ranging from about 2 to 18 feet thick on top of clay. Glacial till, as mapped around the drainage, was not encountered in the borings and may have been eroded away during glacial recession. Advance outwash deposits were encountered below alluvium. Figure 3, Geologic Cross Section, shows the approximate spatial distribution of these deposits across the project site.

GEOTECHNICAL BOREHOLES

Seven geotechnical boreholes, designated BH-1 through BH-7, were performed between November 23 and 25, 2020 by Holt Services, of Edgewood, Washington, under subcontract to HWA. The borings were drilled to depths of approximately 30 to 50 feet using a track-mounted Terrasonic TSi 150 drill rig employing sonic drilling techniques. Sonic drilling was used due to the observed presence of quarry spalls below the pavement section during our original site investigation.

Continuous samples were collected using this drilling method. Standard Penetration Testing (SPT) was performed in accordance with ASTM D1586 using a 2-inch outside diameter (OD), split-spoon sampler advanced with a 140-pound auto hammer at intervals of about 5 to 20 feet to obtain density characteristics of the soils. During the SPT, samples were obtained by driving the sampler 18 inches into the soil with the hammer free falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The Standard Penetration Resistance ("N-value") of the soil was taken to be the number of blows required for the final 12 inches of penetration. If a total of 50 blows was recorded within a single 6-inch interval, the test was terminated, and the blow count was recorded as 50 blows for the number of inches of actual penetration. This resistance, or N-value, provides an indication of the relative density of granular soils and the relative consistency of cohesive soils.

In addition, two Shelby tube samples were taken in the peat to obtain relatively undisturbed soil samples for consolidation testing. Shelby tube samplers are 3-foot long, thin-walled, hollow steel tubes, which are pushed into the ground to extract a relatively undisturbed soil sample for use in laboratory testing. Each tube has one end that is chamfered to form a cutting edge and the upper end includes holes for securing the tube to a drive head. Shelby tubes are useful for collecting soils that are particularly sensitive to sampling disturbance, including fine cohesive soils, clays and peat. Since the Shelby tubes collect samples by being pushed continuously into the undisturbed soil, no N-values are obtained at depths where the Shelby tubes were used.

A geologist from HWA logged each of the explorations and recorded pertinent information, including sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence. Soil samples obtained from the explorations were classified in the field and reviewed at HWA laboratory where representative portions were placed in plastic bags for laboratory testing.

A Legend of Terms and Symbols Used on Exploration Logs is presented in Figure A-1, Appendix A. Summary borehole logs are presented in Figures A-2 and A-8. It should be noted that the stratigraphic contacts shown on the individual exploration logs represent the approximate boundaries between soil types; actual transitions may be more gradual. The soil and groundwater conditions depicted are only for the specific date and locations reported and, therefore, are not necessarily representative of other locations or times.

LABORATORY TESTING

Representative soil samples obtained from the boreholes were taken to the HWA laboratory for examination and testing. Laboratory tests were conducted on selected soil samples to characterize engineering properties of the soils. Laboratory tests, as described below, included moisture content determination, grain size distribution, Atterberg limits and consolidation testing. The results of the laboratory testing are presented in Appendix B.

Moisture Content and Organic Content of Soil: Selected samples were tested in general accordance with method ASTM D 2974, using moisture content method ‘A’ (oven dried at 105 C) and ash content method ‘C’ (burned at 440 C). The test results are summarized on the borehole logs in Appendix A and Figures B-1 through B-5, Appendix B.

Particle Size Analysis of Soils: Selected soil samples were tested to determine the particle size distribution of material in general accordance with ASTM D 6913 (wet sieve). The results are summarized on the Summary of Material Properties report, Figure B-1, and the Particle Size Analysis of Soils reports, Figures B-2 through B-5, Appendix B, which also provide information regarding the classification of the samples and the moisture content at the time of testing.

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits): Selected soil samples were tested to determine the liquid limit, plastic limit, and plasticity index of soils in general accordance with ASTM D 4318, multi-point method. The results are summarized on the Summary of Material Properties report, Figure B-1 and the Liquid Limit, Plastic Limit and Plasticity Index of Soils report, Figure B-6, Appendix B.

One-Dimensional Consolidation Properties of Soil: The consolidation properties of two select soil samples obtained in the organic silt/peat deposit were measured in general accordance with ASTM D 2435. Saturation was maintained by inundation of the sample throughout the test. The samples were subjected to increasing increments of total stress, the duration of which was selected to exceed the time required for completion of primary consolidation as defined in the Standard, Method B. Unloading of the sample was carried out incrementally. The test results are presented on the attached One-Dimensional Consolidation Properties of Soil reports, Figures B-7 and B-8, which contain both primary and secondary consolidation results.

The results of consolidation testing indicate the very soft peat is highly compressible and we anticipate that the very soft clay below the peat is highly compressible as well. The test performed on Sample S-2 from borehole BH-3 was run on very soft, dark brown organic silt with a moisture content of 325%. The organic content of a sample taken just above was 41.5%.

Consolidation testing indicated approximately 63% strain at the maximum loading of 32 kips per square foot (ksf). Test results indicate the material is normally consolidated with a preconsolidation pressure (maximum pressure the soils have experienced) of about 1,200 psf. If the soils at the sample depth experience any loading above this value, additional consolidation/settlement will occur.

The test performed on Sample S-2 from borehole BH-6 was run on very soft peat with a natural moisture content of 700%. The organic content of the peat was 81.6%. Consolidation testing indicated approximately 78% strain at the maximum loading of 32 kips per square foot (ksf). Test results indicate the material is normally consolidated with a preconsolidation pressure of about 800 psf.

Given the amount of time that the existing roadway embankment has been in place, we anticipate that most of the primary consolidation (due to increased loading) has taken place, although small magnitudes of settlement are likely ongoing. Given the thickness of the peat deposit is it likely that ongoing secondary consolidation, due to biodegradation/decay of the organic materials will continue indefinitely.

SEISMIC CONSIDERATIONS

Design Parameters

Earthquake loading for the site was developed in accordance with Section 3.4 of the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, 2nd Edition, 2011 and the Washington State Department of Transportation (WSDOT) amendments to the AASHTO *Guide Specifications* provided in the *Bridge Design Manual (BDM)* (WSDOT, 2020). For seismic analysis, the Site Class is required to be established and is determined based on the average soil properties in the upper 100 feet below the ground surface. Based on our explorations and understanding of site geology, we conclude that the site generally classifies as Site Class F. For borings BH-1, BH-2, BH-3 and BH-7, this is due to the presence of liquefiable soils and for borings BH-4 and BH-5, this is due to the presence of more than 10 feet of peat soils. Classification as Site Class F would typically require a site-specific analysis; however, these analyses typically amplify structural periods above about 0.5 seconds. If structural periods are less than about 0.5 seconds it would likely be conservative to use the Site Class that would be assigned if no liquefiable or peat deposits are present. Without peat or liquefiable soils, the site would classify as Site Class C, and design values associated with this Site Class are provided.

The design parameters for the design level event (equal to a return period of 1,000 years) were obtained from the USGS Uniform Hazard Tool website using the U.S. 2014 Dynamic Conterminous edition (v4.2.0), a tool that provides the probabilistic seismic hazard parameters from the *2014 Updates to the National Hazard Maps* (Peterson, et al., 2014). Site coefficients were developed following the WSDOT BDM that adopts the site coefficients provided in ASCE 7-16. Table 1 presents the design coefficients to use assuming Site Class C for the site.

The applicability of these parameters should be evaluated once the bridge structure is designed, and the structural periods are determined to confirm they are less than about 0.5 seconds.

Table 1: Design Seismic Coefficients for Evaluation Using AASHTO 2011 with Modifications per WSDOT 2020
(Return period of 1,000-year)

Period (sec)	Mapped AASHTO LRFD Spectral Response Acceleration (g)		Site Coefficients		Design Spectral Response Acceleration (g)	
0.0	PGA	0.399	F_{PGA}	1.200	A_s	0.479
0.2	S_s	0.921	F_a	1.200	S_{DS}	1.105
1.0	S_1	0.246	F_v	1.500	S_{D1}	0.369

Transition Point	Period (sec)
T_0	0.067
T_S	0.334

Seismic Design Category
C

Notes: **5% Probability of Exceedance in 50 years for Latitude 47.59538° and Longitude -122.05684°*
PGA = Peak ground acceleration F_{PGA} = PGA site coefficient
As = Design Acceleration Coefficient, the design PGA adjusted for Site Class effects
S_S = Short period (0.2 second) Mapped Spectral Acceleration
S_1 = 1.0 second period Mapped Spectral Acceleration
S_{MS} = Spectral Response adjusted for site class effects for short period = Fa • S_S
S_{M1} = Spectral Response adjusted for site class effects for 1-second period = F_V • S_1
S_{DS} = Design Spectral Response Acceleration for short period =2/3 • S_{MS}
S_{D1} = Design Spectral Response Acceleration for 1-second period =2/3 • S_{M1}
Fa = Short Period Site Coefficients
F_V = Long Period Site Coefficients
$T_0 = 0.2 \cdot S_{D1}/S_{DS}$
$T_S = S_{D1}/S_{DS}$

Liquefaction Considerations

Liquefaction is a temporary loss of soil shear strength due to earthquake shaking. Loose, saturated cohesionless soils are highly susceptible to earthquake-induced liquefaction. Certain silts and low-plasticity clays are also susceptible. Primary factors controlling the development of liquefaction include the intensity and duration of strong ground motions, the characteristics of subsurface soils, in-situ stress conditions and the depth to groundwater. To evaluate the liquefaction susceptibility of the soils along the project alignment, the simplified procedure originally developed by Seed and Idriss (1971), updated by Youd et. Al., (2001), and by Idriss and Boulanger (2004, 2006) was used.

The preliminary evaluation indicates that loose to medium dense fill and alluvial soils, where encountered below the groundwater table are susceptible to liquefaction under the design seismic event. The dense to very dense advance outwash deposits are not considered susceptible to liquefaction. Impacts of liquefaction depend on the site topography, the depths and extents of liquefied materials, and the sizes and locations of the proposed improvements. At this time, we understand a bridge is planned in the future; however, no details of the layout of the bridge and associated slopes and walls are currently available. Once the proposed improvements are selected, the existing data should be reviewed to determine the potential impacts of liquefaction to the structures.

Generally, liquefaction results in vertical settlement, particularly differential settlement, and can also result in horizontal displacement of the ground where the improvements are near existing or newly created slopes. For bridge foundations, the presence of liquefaction can result in downdrag loads acting on deep foundations such as piles or drilled shafts. Potential for development of slope instability impacting walls and abutments due to either lateral spreading or flow sliding would also need to be considered. Depending on the impacts, the bridge can either be designed to withstand the anticipated loads, or some method of ground improvement could be implemented. Suitable methods for mitigating for effects of liquefaction will need to be evaluated during future design phases of the projects.

FOUNDATION RECOMMENDATIONS

Based on the results of our borings it appears that drilled shafts bearing in the advance outwash would likely be the most economical foundation type for the subsurface conditions encountered. These foundations would obtain capacity from both the skin friction along the sides of the drilled shafts (within the advance outwash soils) as well as the end bearing at the bottom of the shafts. Depths to reach the advance outwash vary with the greatest depths near the middle to the wetland, in the vicinity of BH-4. The depth to the top of the advance outwash layer in BH-4 is approximately 40 feet in BH-4, while in BH-1 the depth to the top of the advance outwash layer is only about 13 feet. Drilled shaft diameters and depths of the foundations into the advance outwash layer will depend on structural loading but we anticipate shaft diameters of about 6 to 8 feet and depths of embedment within the advance outwash of about 20 feet.

CONDITIONS AND LIMITATIONS

We have prepared this report for the City of Sammamish for use in preliminary evaluations for this project. Experience shows that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions may occur between explorations that may not be detected by a geotechnical study of this nature. Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental assessments, pavement engineering, or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

* * *

We appreciate this opportunity to provide geotechnical and pavement engineering services on this project. If you have any questions or if we may be of further assistance, please contact the undersigned at (425) 774-0106.

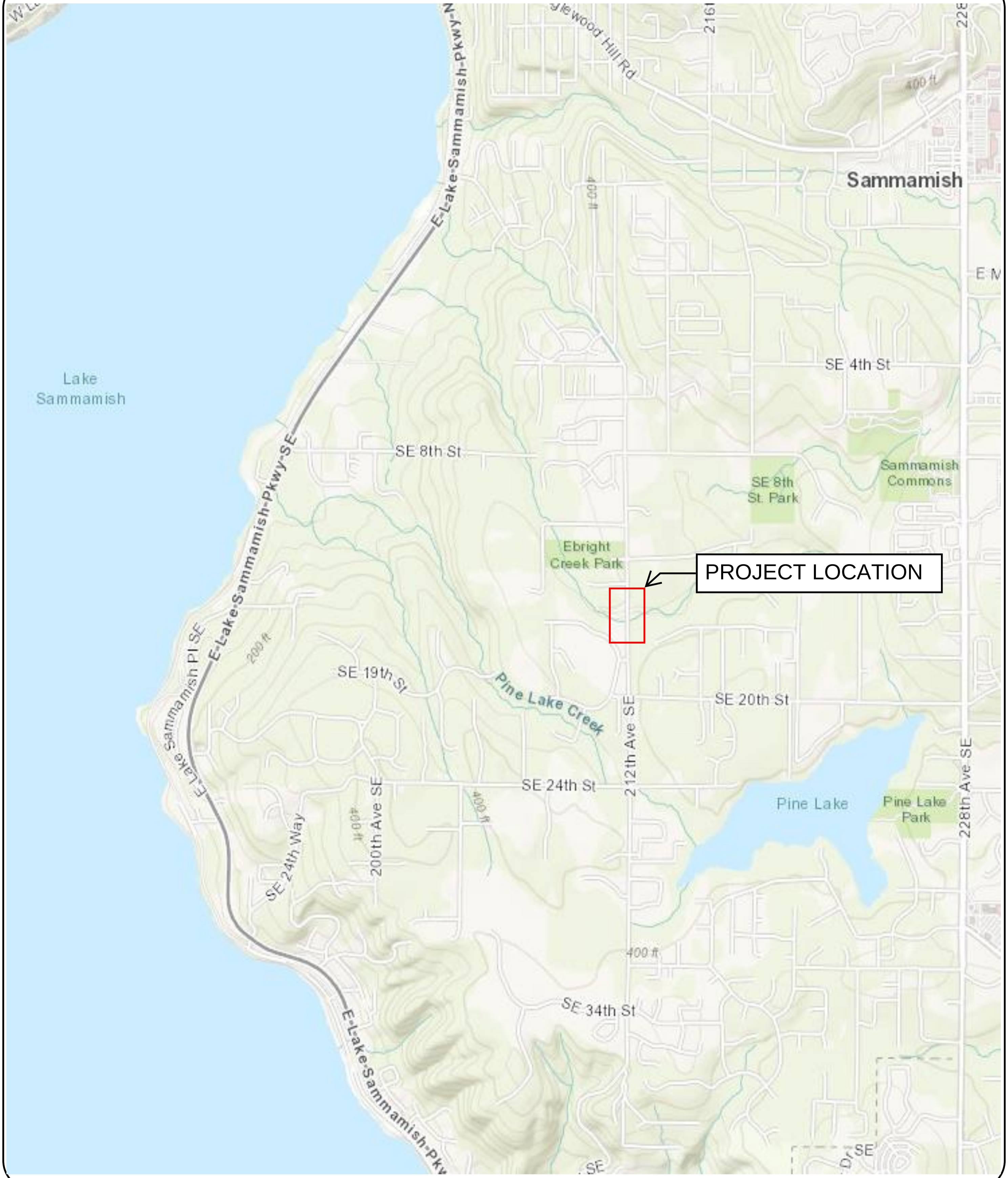
Sincerely,

HWA GEOSCIENCES INC.

Bryan K. Hawkins, P.E.
Senior Geotechnical Engineer

ATTACHMENTS:

Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Figure 3	Geologic Cross Section
Appendix A	Borehole Logs
Appendix B	Laboratory Testing



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VICINITY MAP

CITY OF SAMMAMISH ON-CALL
212TH AVENUE SE BORINGS
GEOTECHNICAL INVESTIGATION
SAMMAMISH, WASHINGTON

FIGURE NO.
1

PROJECT NO.
2019-016 TO8

County of King, Bureau of Land Management, Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, EPA, USDA, King County, EagleView Technologies, Inc.

LEGEND

◎ BH-1 APPROXIMATE BOREHOLE LOCATION & DESIGNATION

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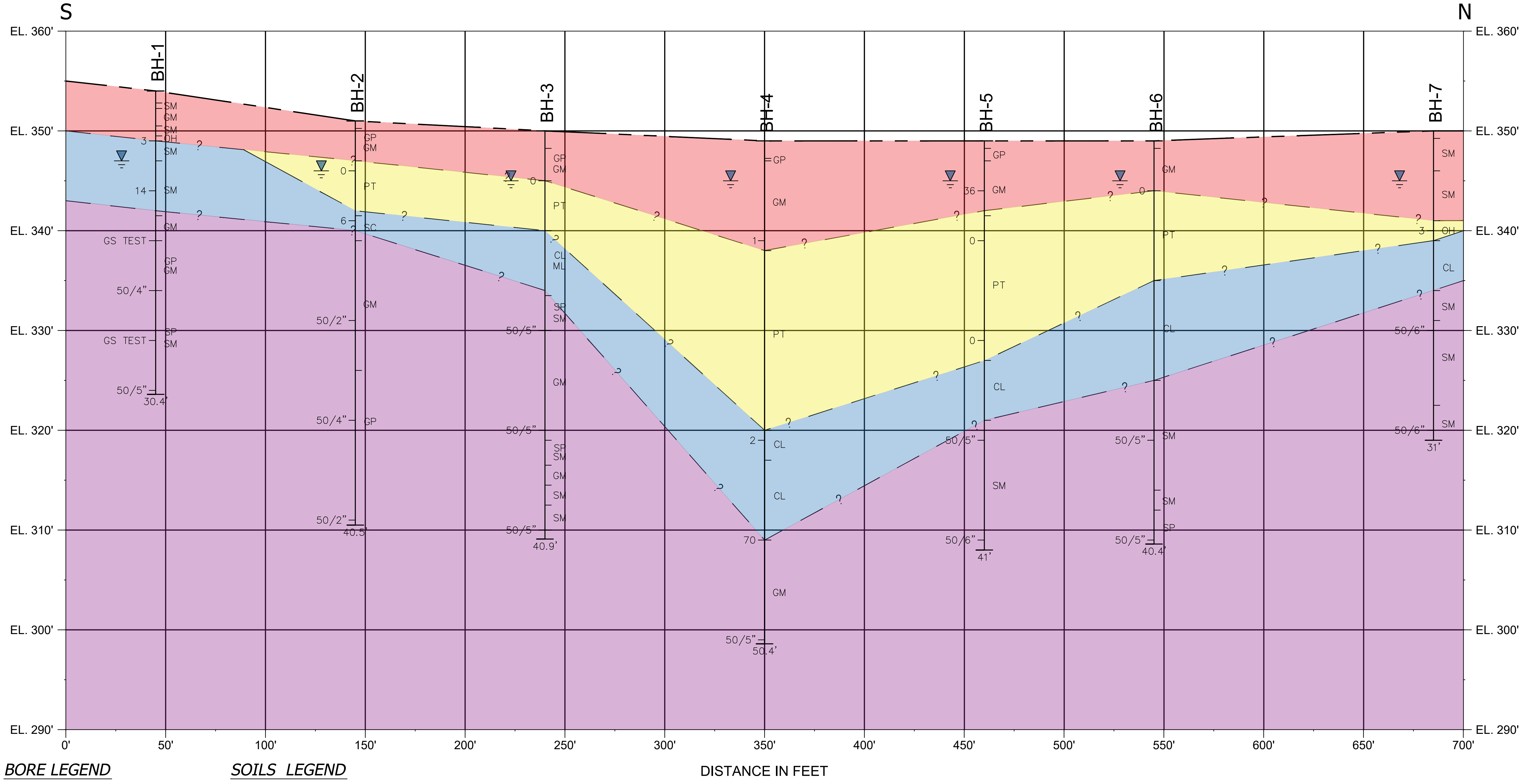
SITE & EXPLORATION PLAN

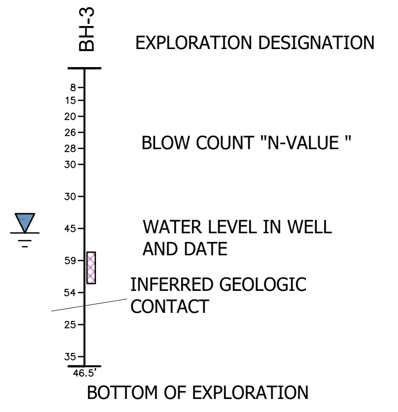
CITY OF SAMMAMISH ON-CALL TASK ORDER-08
212th AVE SE BORINGS
SAMMAMISH, WASHINGTON

FIGURE NO.
2

PROJECT NO.
2019-016 T08

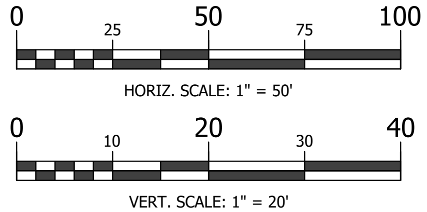


BORE LEGEND



SOILS LEGEND

🟥 FILL
🟨 PEAT
🟦 ALLUVIUM
🟪 VASHON ADVANCE OUTWASH



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CITY OF SAMMAMISH ON-CALL
212TH AVE SE BORINGS
SAMMAMISH, WASHINGTON

GEOLOGIC CROSS SECTION

DRAWN BY: CF	FIGURE NO.: 3
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Appendix A
Borehole Logs

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

TEST SYMBOLS

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
PID	Photoionization Device Reading
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)
SG	Specific Gravity
TC	Triaxial Compression
TV	Torvane Approx. Shear Strength (tsf)
UC	Unconfined Compression

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils More than 50% Retained on No. 200 Sieve Size	Gravel and Gravelly Soils More than 50% of Coarse Fraction Retained on No. 4 Sieve	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
			GP	Poorly-graded GRAVEL
		Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
	Sand and Sandy Soils 50% or More of Coarse Fraction Passing No. 4 Sieve	Clean Sand (little or no fines)	SW	Well-graded SAND
			SP	Poorly-graded SAND
		Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils 50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY
	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILT/Organic CLAY
Highly Organic Soils			PT	PEAT

SAMPLE TYPE SYMBOLS

☒	2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
I	Shelby Tube
▣	3-1/4" OD Split Spoon with Brass Rings
○	Small Bag Sample
▚	Large Bag (Bulk) Sample
▯	Core Run
▱	Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

▽	Groundwater Level (measured at time of drilling)
▼	Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation. Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

HWA GeoSciences Inc.

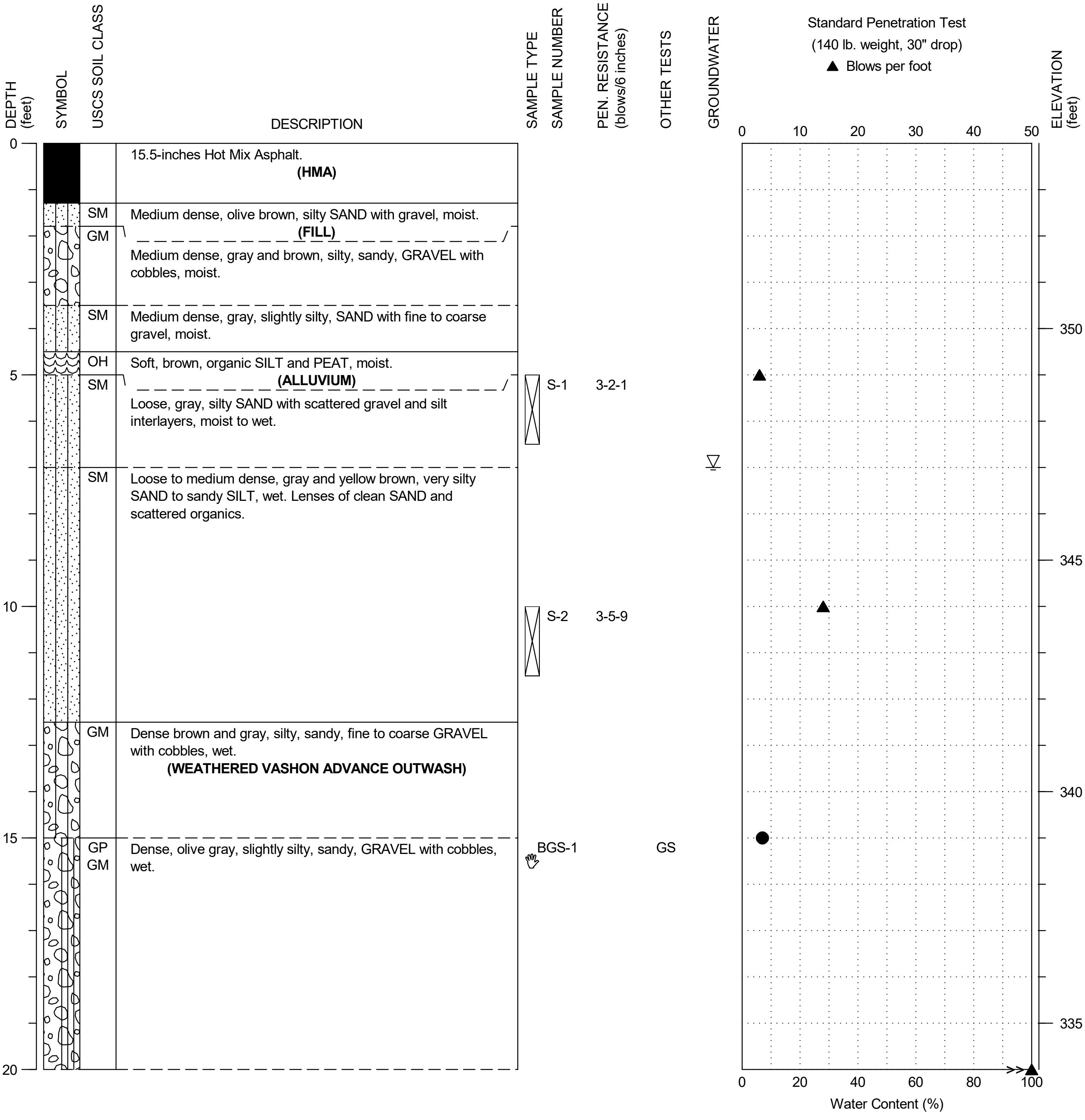
City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 2019-016 T8 FIGURE: A-1

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/23/2020
DATE COMPLETED: 11/23/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 354.0 ± feet



USCS SOIL CLASS	DESCRIPTION	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
	15.5-inches Hot Mix Asphalt. **(HMA)**			
SM	Medium dense, olive brown, silty SAND with gravel, moist. **(FILL)**			
GM	Medium dense, gray and brown, silty, sandy, GRAVEL with cobbles, moist.			
SM	Medium dense, gray, slightly silty, SAND with fine to coarse gravel, moist.			
OH	Soft, brown, organic SILT and PEAT, moist. **(ALLUVIUM)**			
SM	Loose, gray, silty SAND with scattered gravel and silt interlayers, moist to wet.	S-1	3-2-1	
SM	Loose to medium dense, gray and yellow brown, very silty SAND to sandy SILT, wet. Lenses of clean SAND and scattered organics.	S-2	3-5-9	
GM	Dense brown and gray, silty, sandy, fine to coarse GRAVEL with cobbles, wet. **(WEATHERED VASHON ADVANCE OUTWASH)**			
GP GM	Dense, olive gray, slightly silty, sandy, GRAVEL with cobbles, wet.	BGS-1		GS

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

BORING:
BH-1

PAGE: 1 of 2

PROJECT NO.: 2019-016 T8

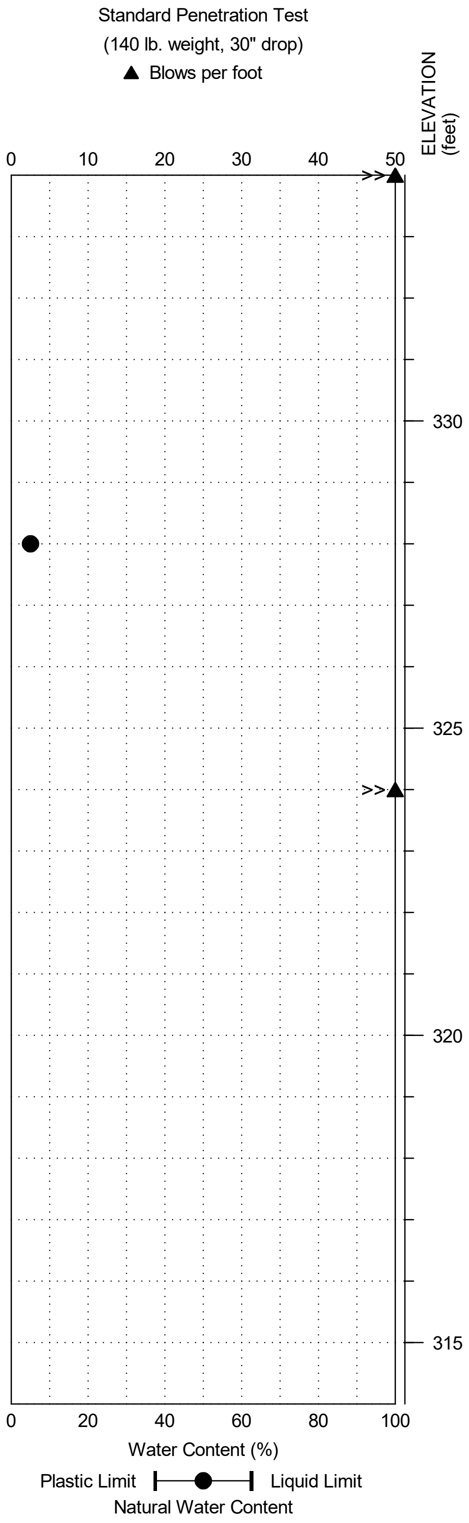
FIGURE: A-2

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/23/2020
DATE COMPLETED: 11/23/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 354.0 ± feet

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
20		GW GM	Very dense, olive gray, slightly silty, sandy, fine to coarse GRAVEL with cobbles, moist to wet.	☒	S-3	39-50/4"		
25				✋	BGS-2		GS	
30				☒	S-4	50/5"		
35								
40								

Borehole was terminated at 30.4-feet below ground surface.
Ground water was observed at 7.0-feet below ground surface.



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

BORING:
BH-1

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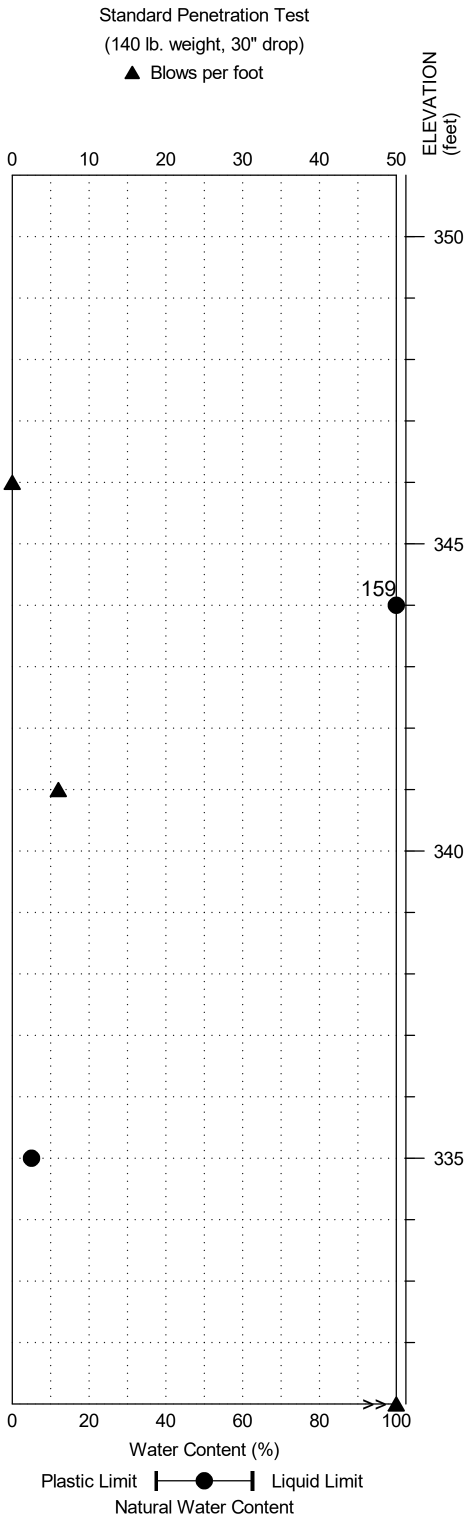
PROJECT NO.: 2019-016 T8
FIGURE: A-2

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/23/2020
DATE COMPLETED: 11/23/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 351.0 ± feet

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
0	■		8.0-inches Hot Mix Asphalt. **(HMA)**					
		GP GM	Medium dense, grayish brown, silty, sandy, GRAVEL with cobbles, moist. **(FILL)**					
		PT	Very soft, dark brown, organic SILT and PEAT, wet. **(PEAT)**					▽
5				☒	S-1	0-0-0		
			Organic Content = 22.2%	✋	BGS-1		OC	
	▨	SC	Medium stiff, gray, silty, clayey, SAND to sandy CLAY with fine to coarse gravel, wet. **(ALLUVIUM)**					
10				☒	S-2	5-4-2		
		GW GM	Dense, brown and gray, silty, sandy, fine to coarse GRAVEL with cobbles, moist to wet. **(WEATHERED VASHON ADVANCE OUTWASH)**					
15								
				✋	BGS-2		GS	
20								



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

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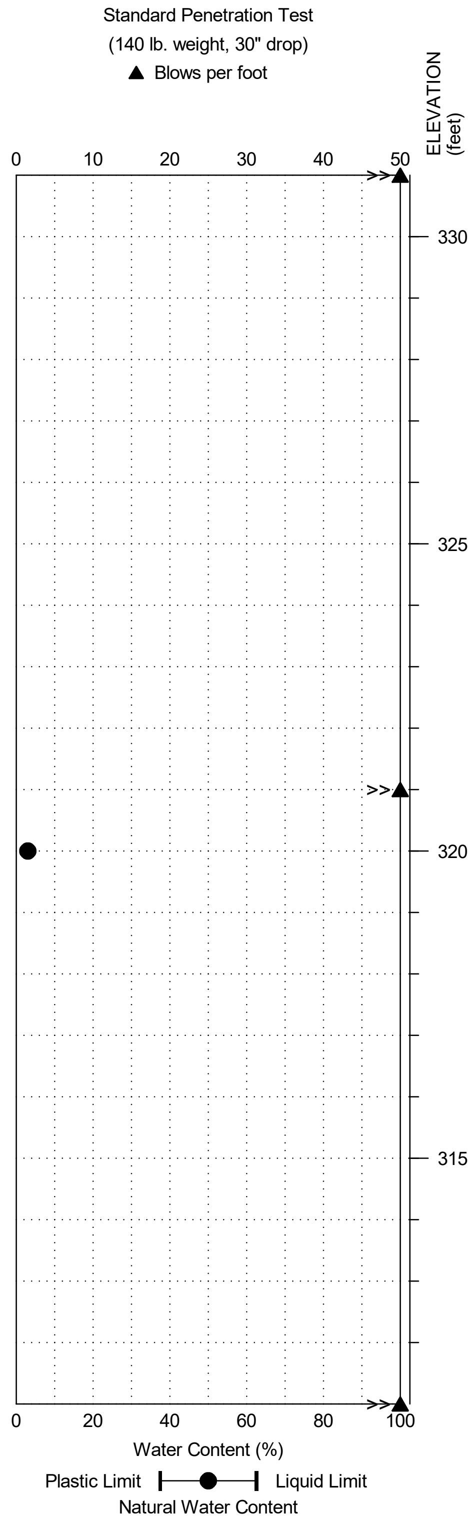
FIGURE: A-3

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/23/2020
DATE COMPLETED: 11/23/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 351.0 ± feet

DEPTH (feet)	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
20	GM	Very dense, brown and gray, silty, sandy, fine to coarse GRAVEL with cobbles, moist. **(VASHON ADVANCE OUTWASH)**	☒	S-3	25-50/2"		
25	GP	Very dense, grayish brown, slightly silty to clean, sandy, fine to coarse GRAVEL with cobbles, moist.					
30			☒	S-4	50/4"		
				BGS-3		GS	
35							
40							



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

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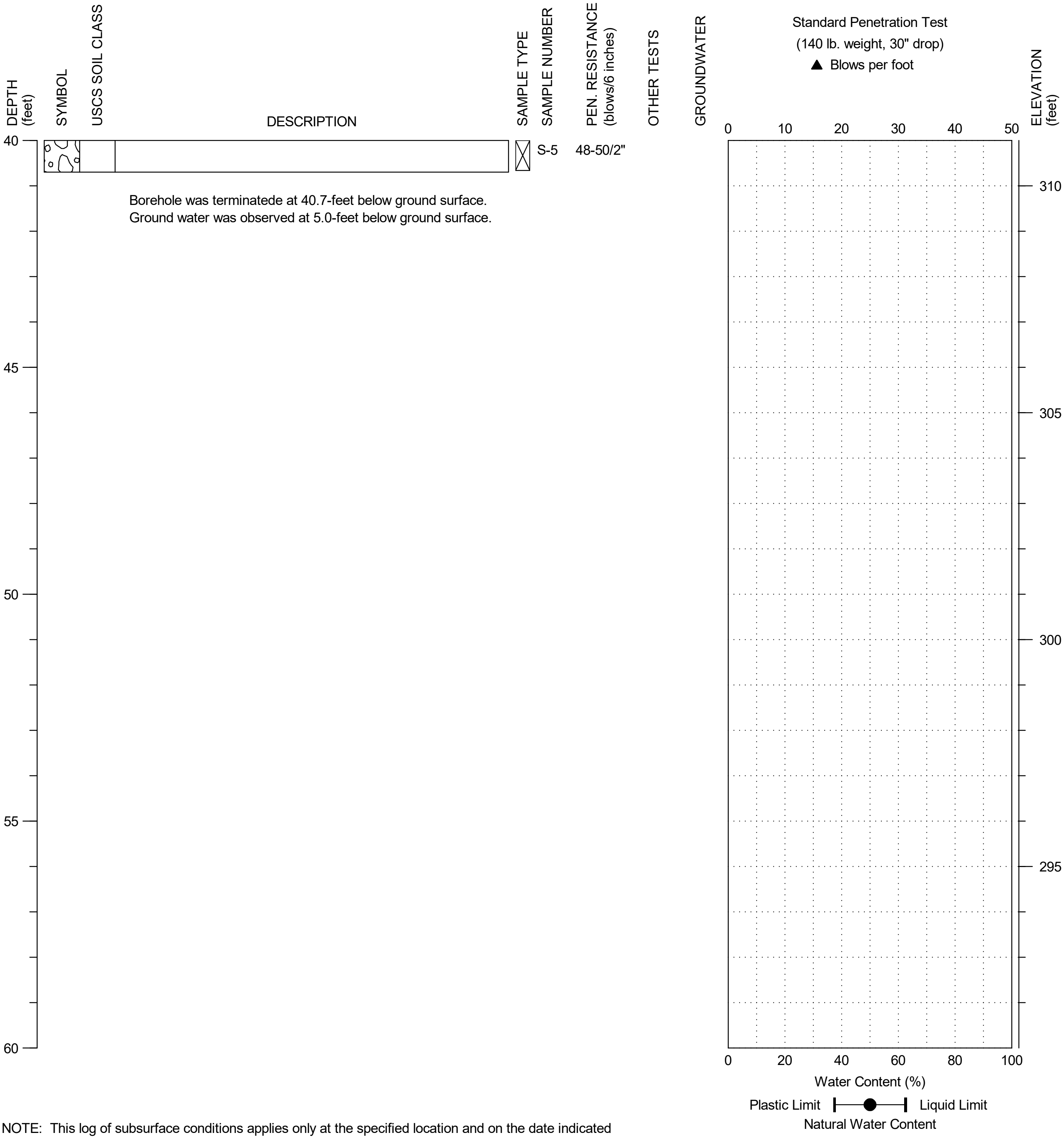
PROJECT NO.: 2019-016 T8 FIGURE: A-3

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/23/2020
DATE COMPLETED: 11/23/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 351.0 ± feet



Borehole was terminatede at 40.7-feet below ground surface.
Ground water was observed at 5.0-feet below ground surface.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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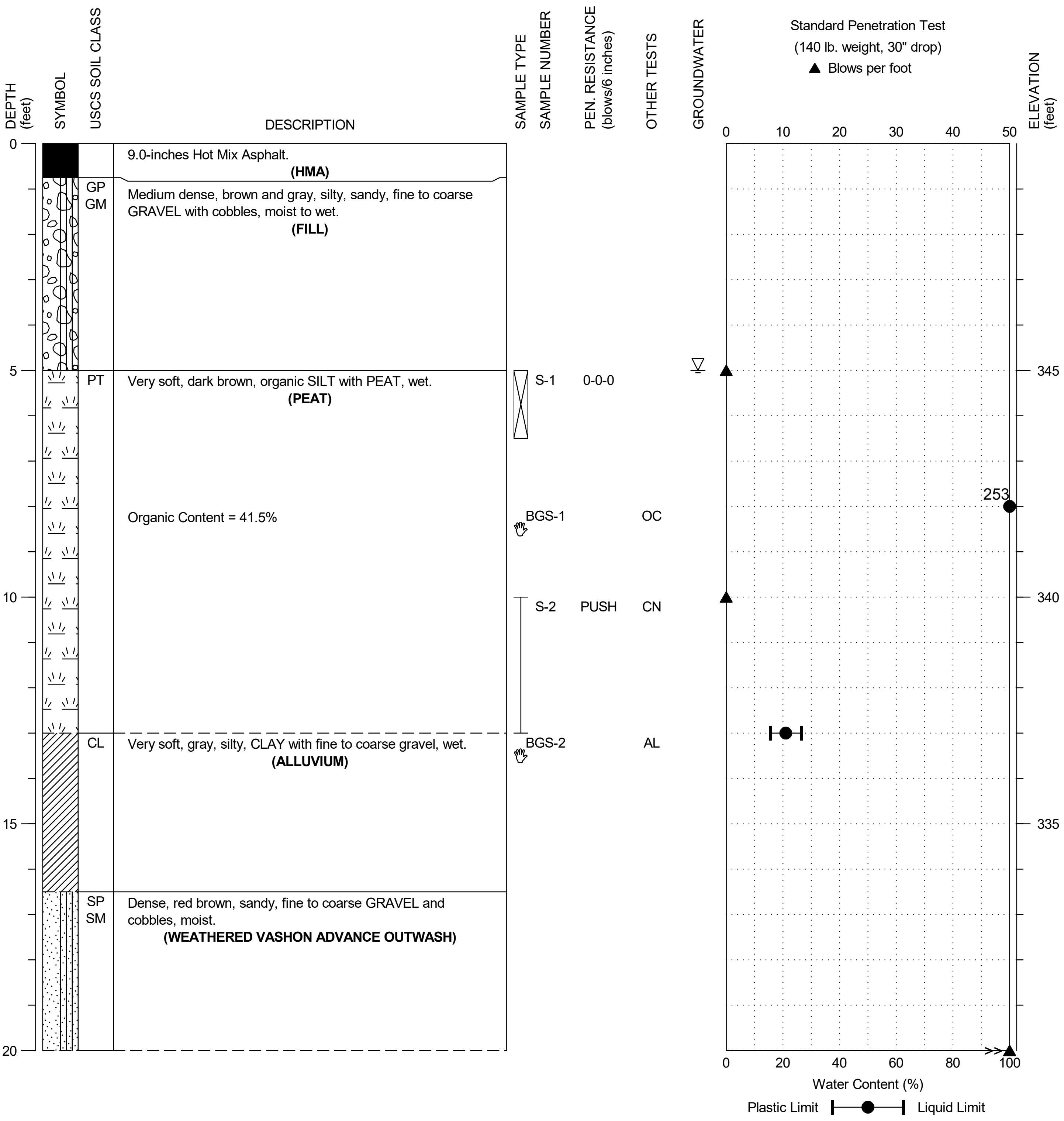
FIGURE: A-3

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/24/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 350.0 ± feet



USCS SOIL CLASS	DESCRIPTION	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
	9.0-inches Hot Mix Asphalt. **(HMA)**			
GP GM	Medium dense, brown and gray, silty, sandy, fine to coarse GRAVEL with cobbles, moist to wet. **(FILL)**			
PT	Very soft, dark brown, organic SILT with PEAT, wet. **(PEAT)**	S-1	0-0-0	
	Organic Content = 41.5%	BGS-1		OC
		S-2	PUSH	CN
CL	Very soft, gray, silty, CLAY with fine to coarse gravel, wet. **(ALLUVIUM)**	BGS-2		AL
SP SM	Dense, red brown, sandy, fine to coarse GRAVEL and cobbles, moist. **(WEATHERED VASHON ADVANCE OUTWASH)**			

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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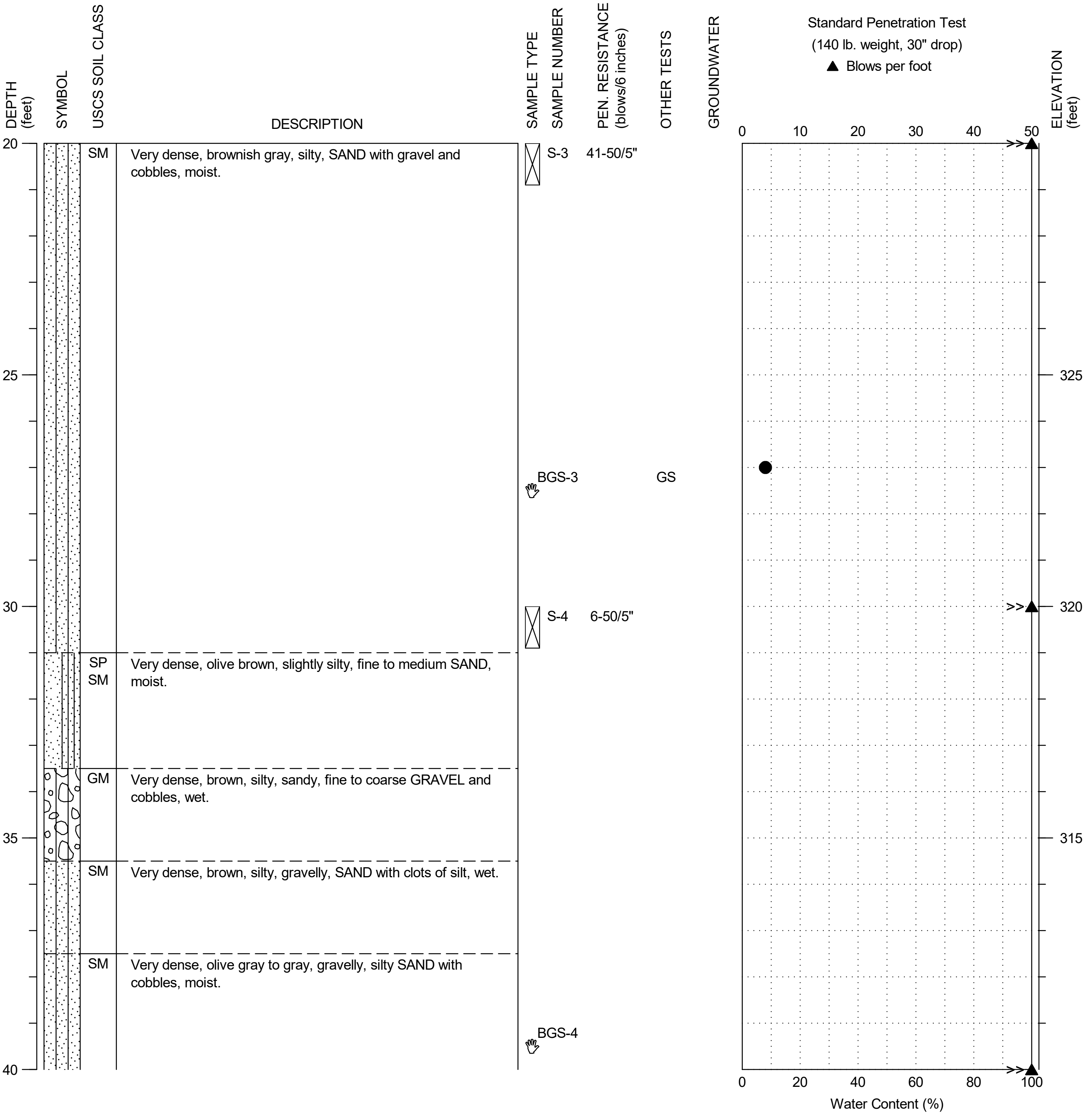
PROJECT NO.: 2019-016 T8

FIGURE: A-4

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/24/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 350.0 ± feet



USCS SOIL CLASS	DESCRIPTION	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
SM	Very dense, brownish gray, silty, SAND with gravel and cobbles, moist.	S-3	41-50/5"	
		BGS-3		GS
		S-4	6-50/5"	
SP SM	Very dense, olive brown, slightly silty, fine to medium SAND, moist.			
GM	Very dense, brown, silty, sandy, fine to coarse GRAVEL and cobbles, wet.			
SM	Very dense, brown, silty, gravelly, SAND with clots of silt, wet.			
SM	Very dense, olive gray to gray, gravelly, silty SAND with cobbles, moist.	BGS-4		

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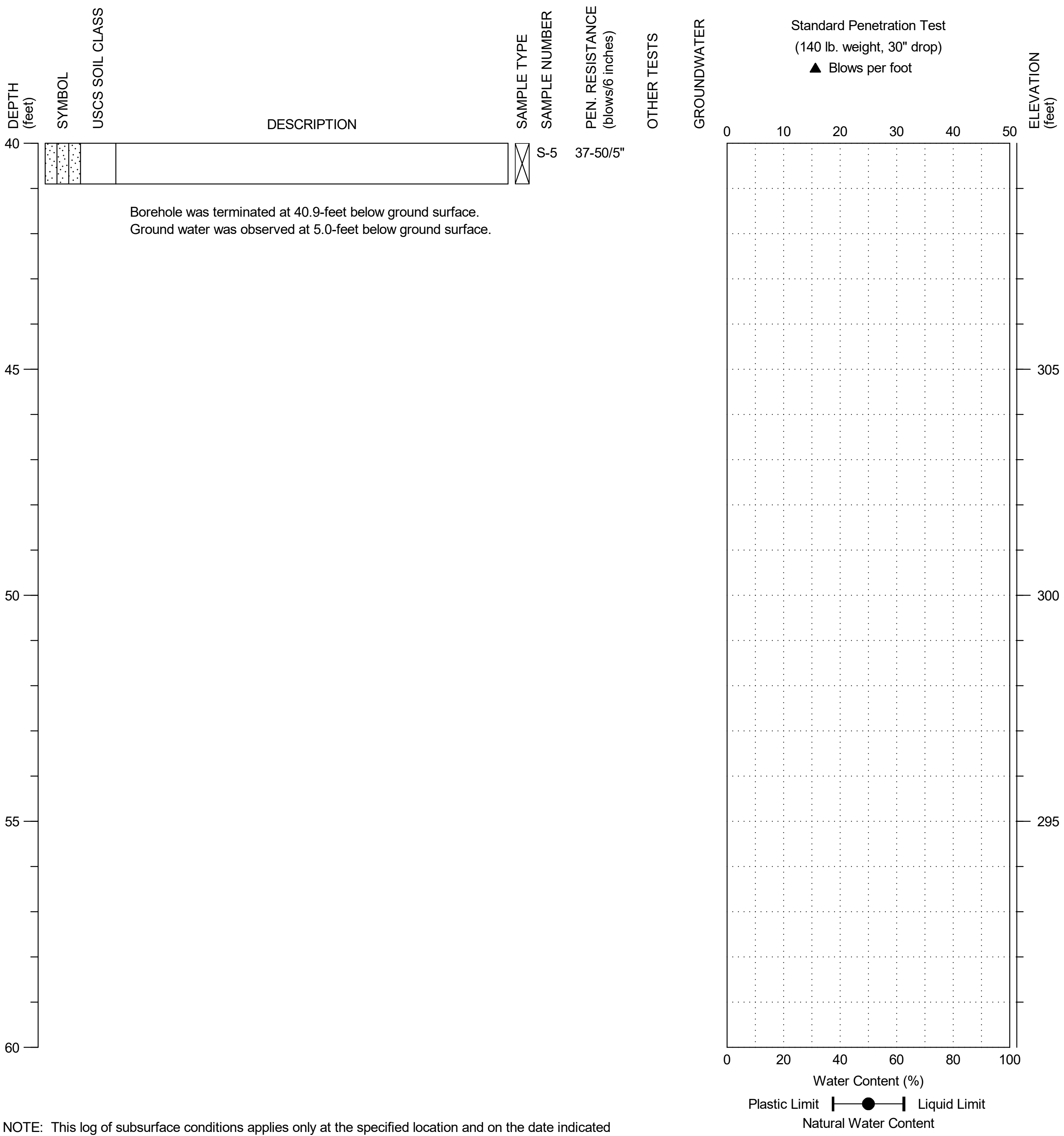
FIGURE: A-4

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 4

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/24/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 350.0 ± feet



Borehole was terminated at 40.9-feet below ground surface.
Ground water was observed at 5.0-feet below ground surface.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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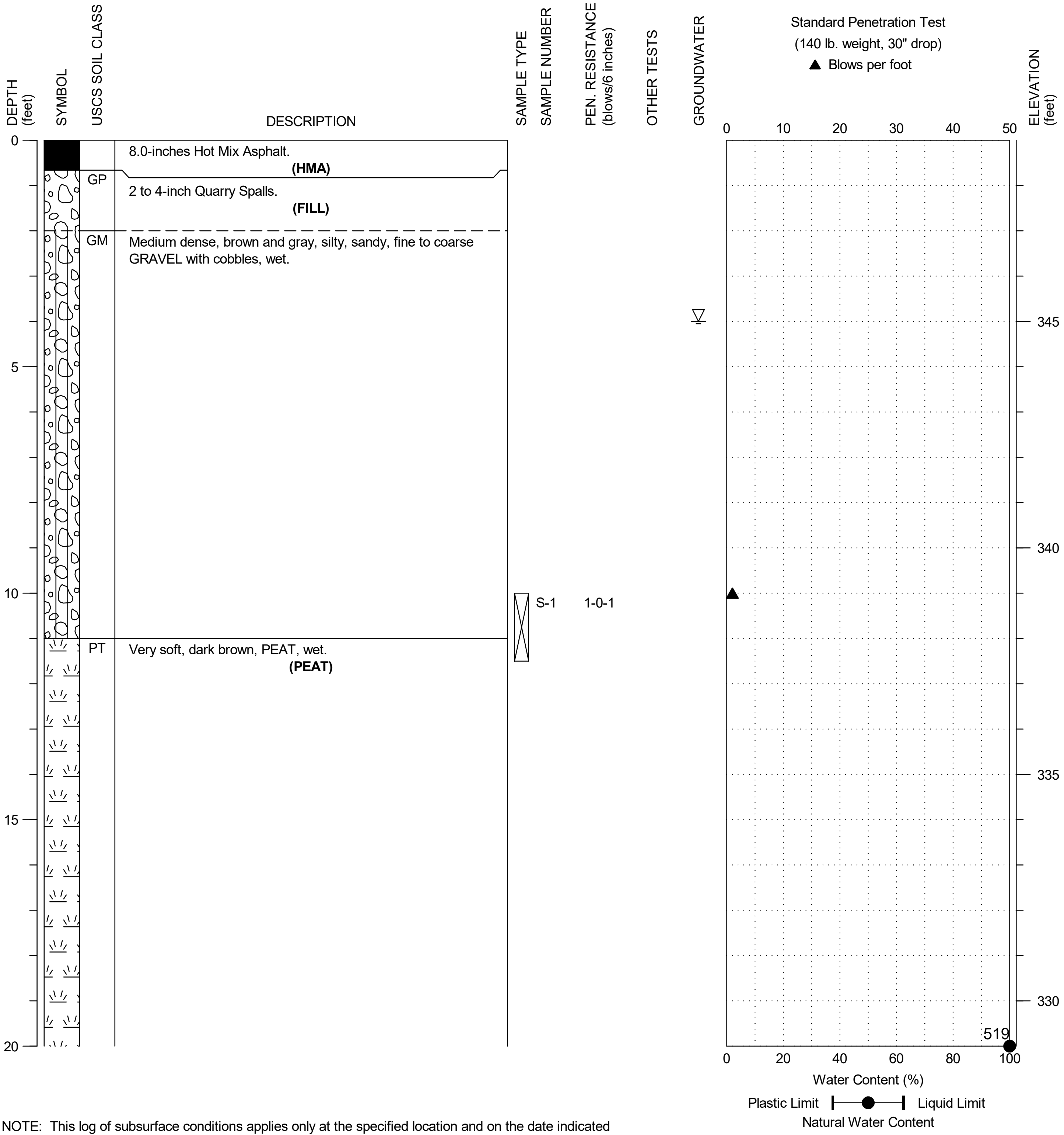
PROJECT NO.: 2019-016 T8 FIGURE: A-4

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 3

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/24/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet

USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
	8.0-inches Hot Mix Asphalt. **(HMA)**					
GP	2 to 4-inch Quarry Spalls. **(FILL)**					
GM	Medium dense, brown and gray, silty, sandy, fine to coarse GRAVEL with cobbles, wet.	☒	S-1	1-0-1		▽
PT	Very soft, dark brown, PEAT, wet. **(PEAT)**					



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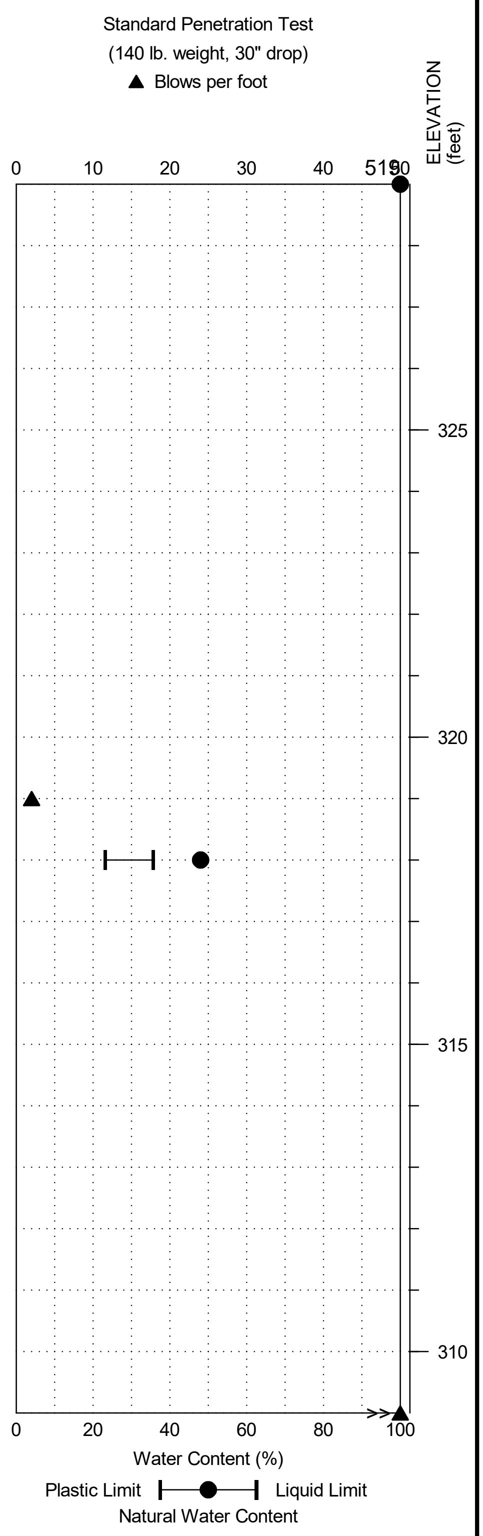
PROJECT NO.: 2019-016 T8

FIGURE: A-5

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 3

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/24/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet

DEPTH (feet)	USCS SOIL CLASS	DESCRIPTION	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
20		Organic Content = 96.7%	BGS-1		OC	
25						
	CL	Very soft, gray, CLAY, wet. **(ALLUVIUM)**				
30			S-2	1-1-1		
			BGS-2		AL	
	CL	Medium stiff, gray, SILT and CLAY with sand and gravel, wet.				
35						
40						



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PROJECT NO.: 2019-016 T8 FIGURE: A-5

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 3

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/24/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
40		GM	Very dense, orange brown, silty, sandy, fine to coarse GRAVEL with cobbles, moist. **(WEATHERED VASHON ADVANCE OUTWASH)**	☒	S-3	14-30-40		
45								
50				☒	S-4	50/5"		

Borehole was terminated at 50.4-feet below ground surface.
Ground water was observed at 4.0-feet below ground surface.

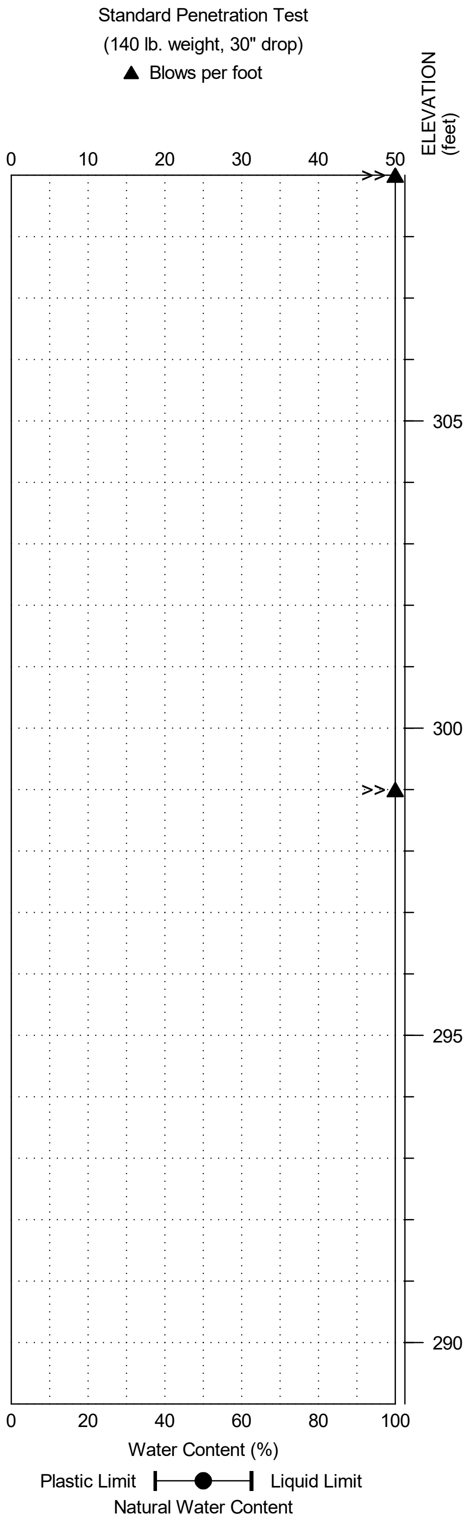

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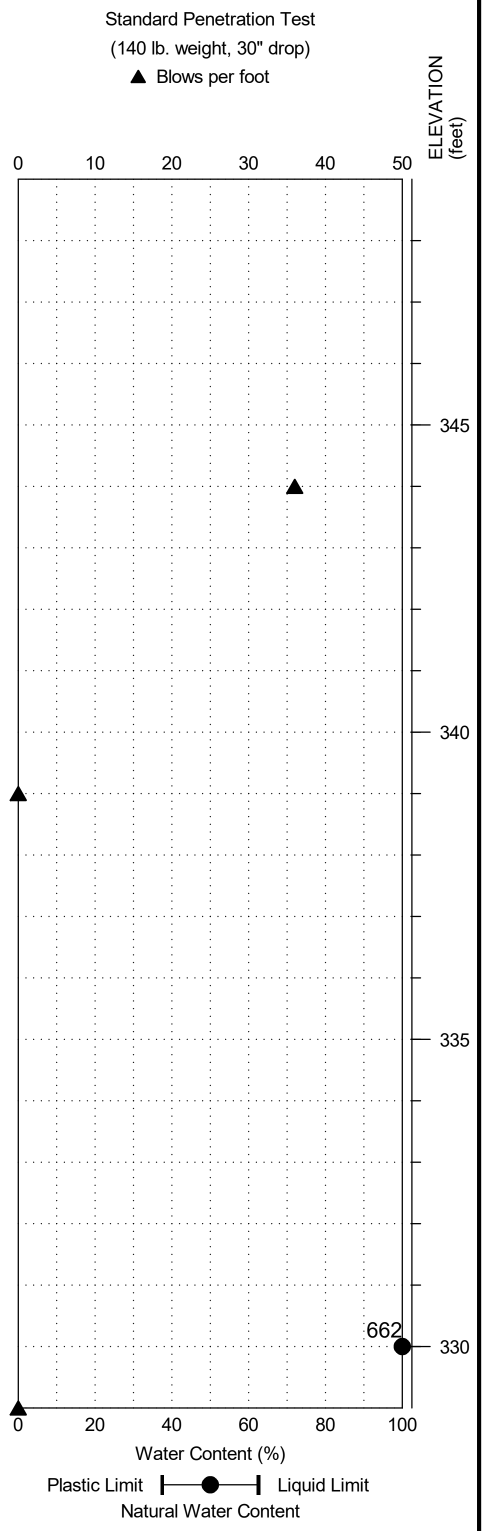
FIGURE: A-5

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 3

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
0			8.0-inches Hot Mix Asphalt. **(HMA)**					
		GP	2.0 to 4.0-inch Quarry Spalls. **(FILL)**					
		GM	Medium dense to dense, brown and gray, silty, sandy, fine to coarse GRAVEL with cobbles, wet.					∇
5				☒	S-1	5-16-20		
		PT	Very soft, dark brown, PEAT, moist. **(PEAT)**					
10				☒	S-2	0-0-0		
15								
			Organic Content = 95.4%	✋	BGS-1		OC	
20								



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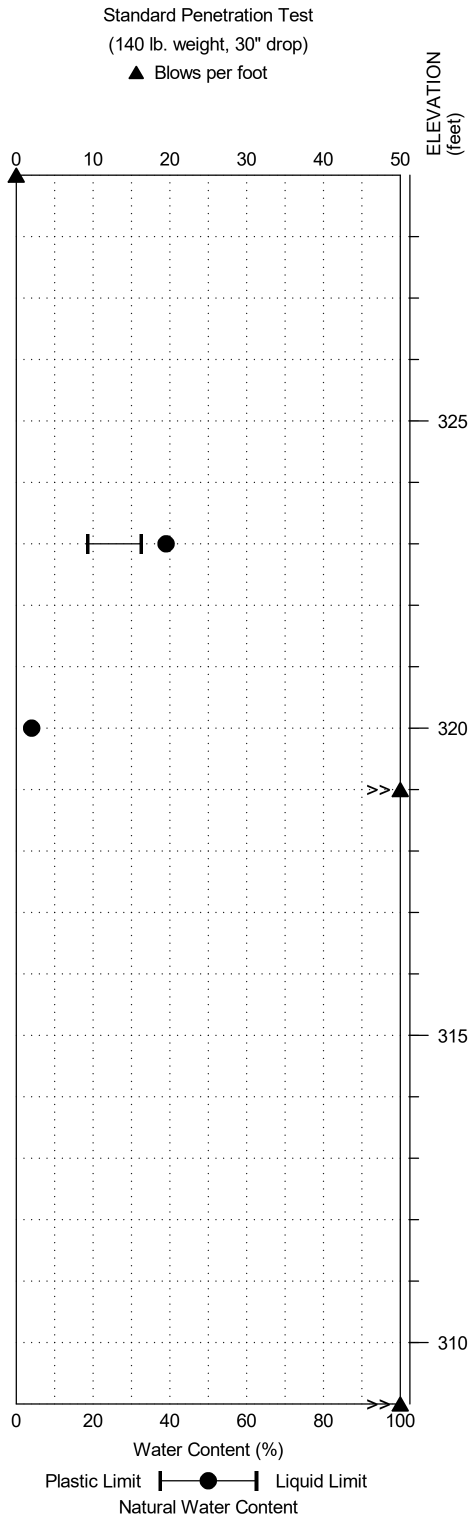
PROJECT NO.: 2019-016 T8 FIGURE: A-6

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 3

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet

DEPTH (feet)	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
20			☒	S-3	0-0-0		
	CL	Very soft, gray, CLAY with silt and occasional sand and gravel, wet. **(ALLUVIUM)**					
25			✋	BGS-2		AL	
	GM	Very dense, gray, silty, GRAVEL with cobbles and sand, moist. Brown sand with silt laminations. **(VASHON ADVANCE OUTWASH)**	✋	BGS-3		GS	
30			☒	S-4	35-19-50/5"		
35							
40							



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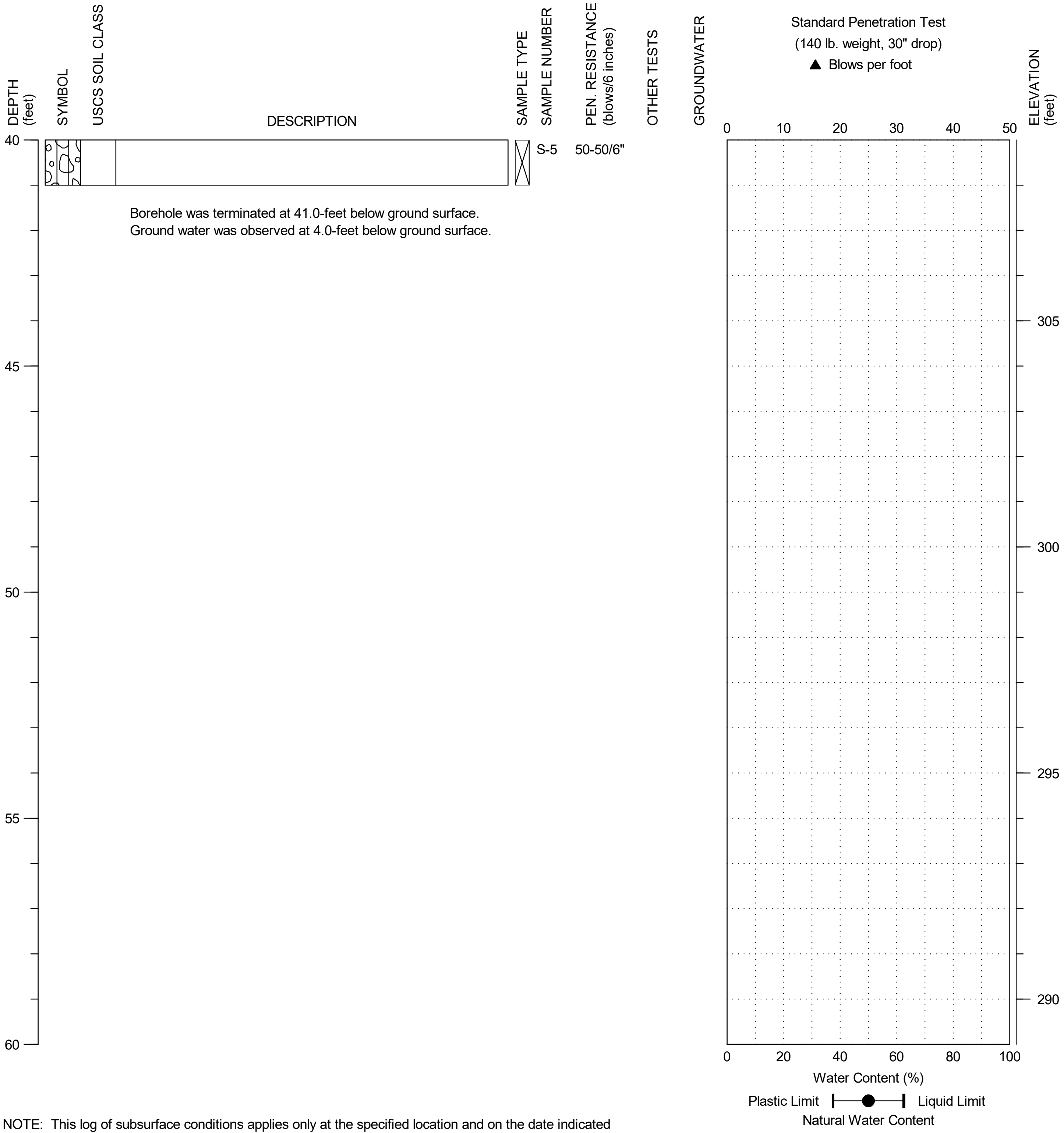
PROJECT NO.: 2019-016 T8

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 3

DATE STARTED: 11/24/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet



Borehole was terminated at 41.0-feet below ground surface.
Ground water was observed at 4.0-feet below ground surface.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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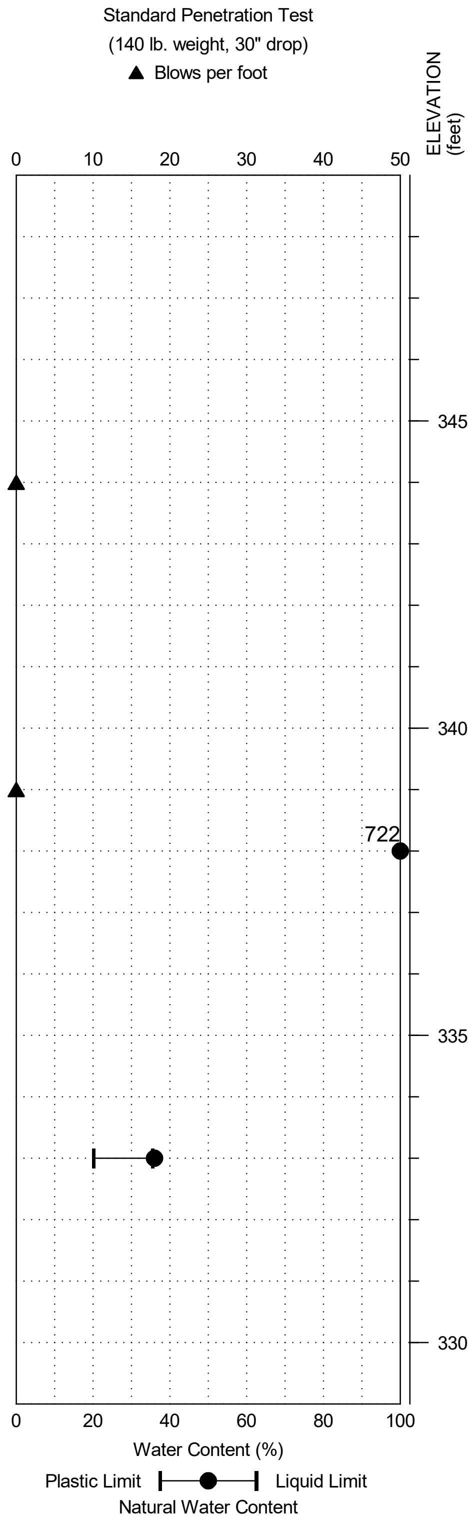
FIGURE: A-6

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 2

DATE STARTED: 11/25/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
0	■		8.0-inches Hot Mix Asphalt. **(HMA)**					
		GM	Medium dense, brown and gray, silty, sandy, fine to coarse GRAVEL with cobbles, moist to wet. **(FILL)**					∇
5		PT	Very soft, dark brown, PEAT and organic SILT, wet. **(PEAT)**	☒	S-1	0-0-0		
10					S-2	PUSH	CN	
			Organic Content = 81.6%		BGS-1		OC	
		CL	Very soft, gray, CLAY, wet. Fine to coarse gravel from 20 to 24-feet. **(ALLUVIUM)**					
					BGS-2		AL	
15								
20								



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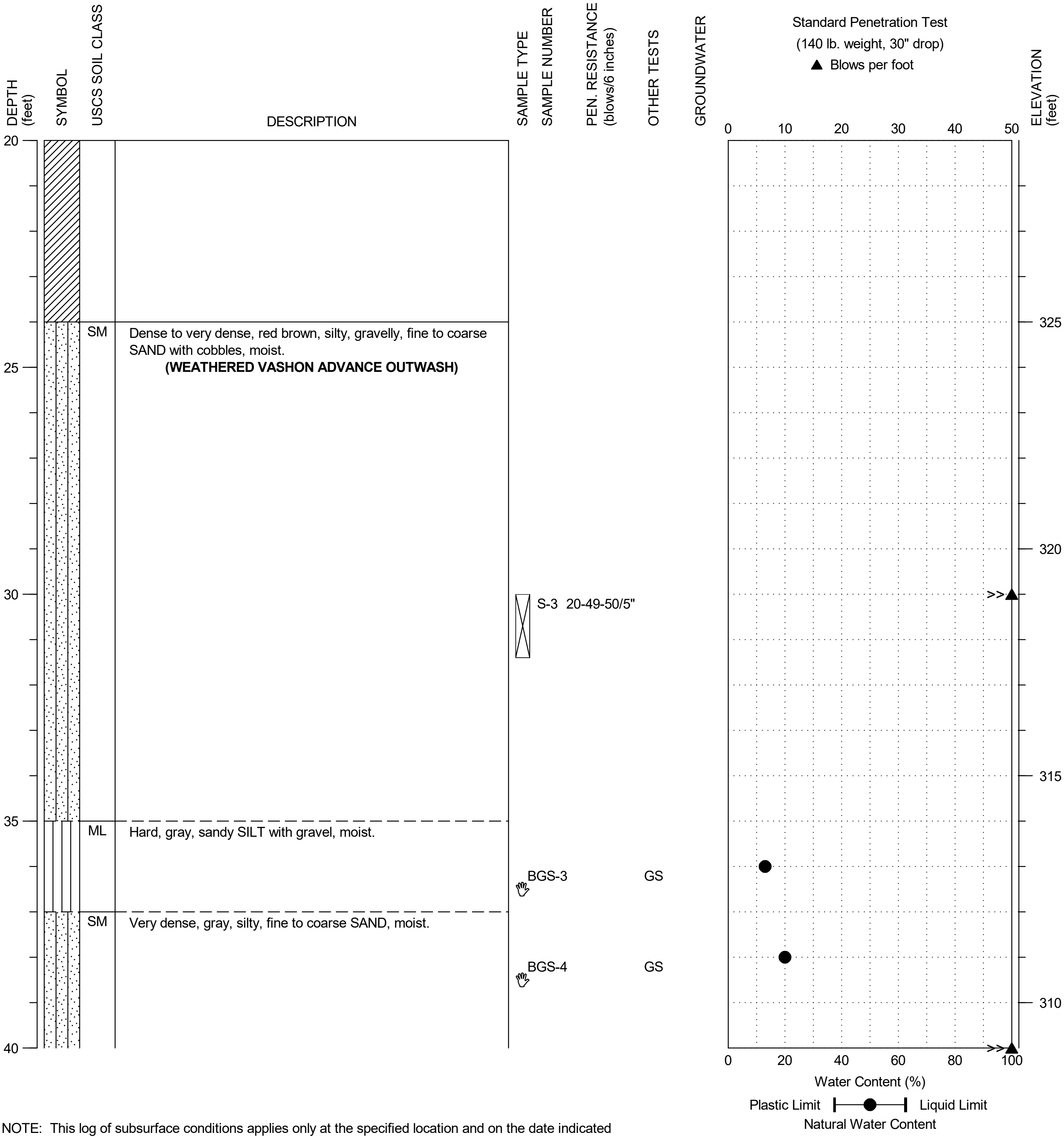
PROJECT NO.: 2019-016 T8 FIGURE: A-7

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 2

DATE STARTED: 11/25/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet



SM Dense to very dense, red brown, silty, gravelly, fine to coarse SAND with cobbles, moist.

(WEATHERED VASHON ADVANCE OUTWASH)

S-3 20-49-50/5"

ML Hard, gray, sandy SILT with gravel, moist.

BGS-3 GS

SM Very dense, gray, silty, fine to coarse SAND, moist.

BGS-4 GS

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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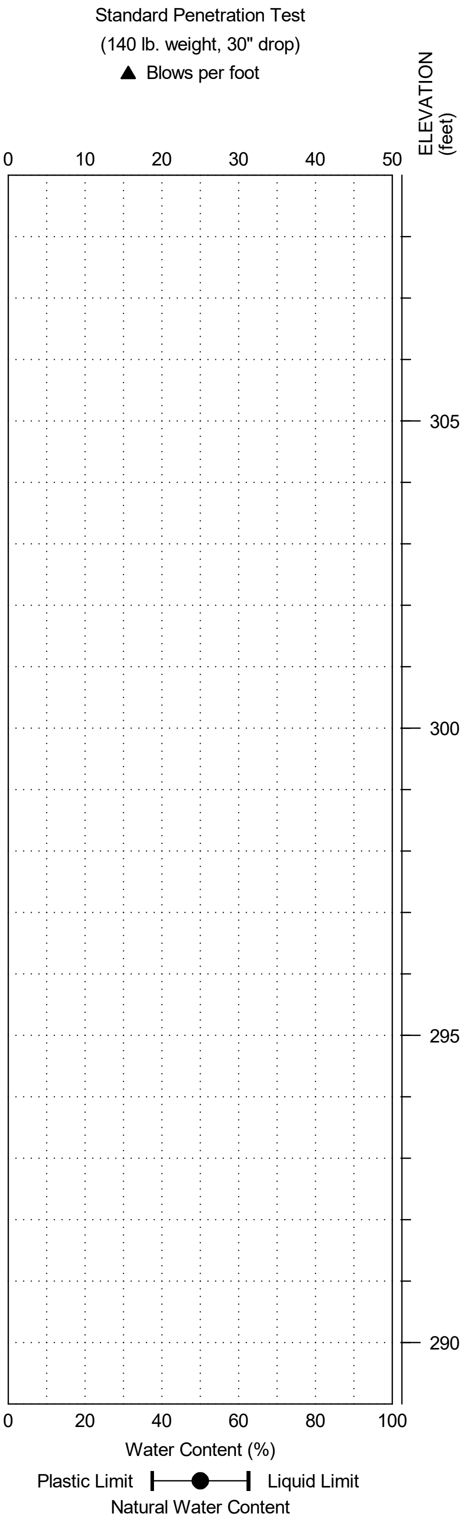
PROJECT NO.: 2019-016 T8 FIGURE: A-7

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 2

DATE STARTED: 11/25/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 349.0 ± feet

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
40	▨			☒	S-4	50/5"		
45								
50								
55								
60								

Borehole was terminated at 40.4-feet below ground surface.
Ground water was observed at 4.0-feet below ground surface.



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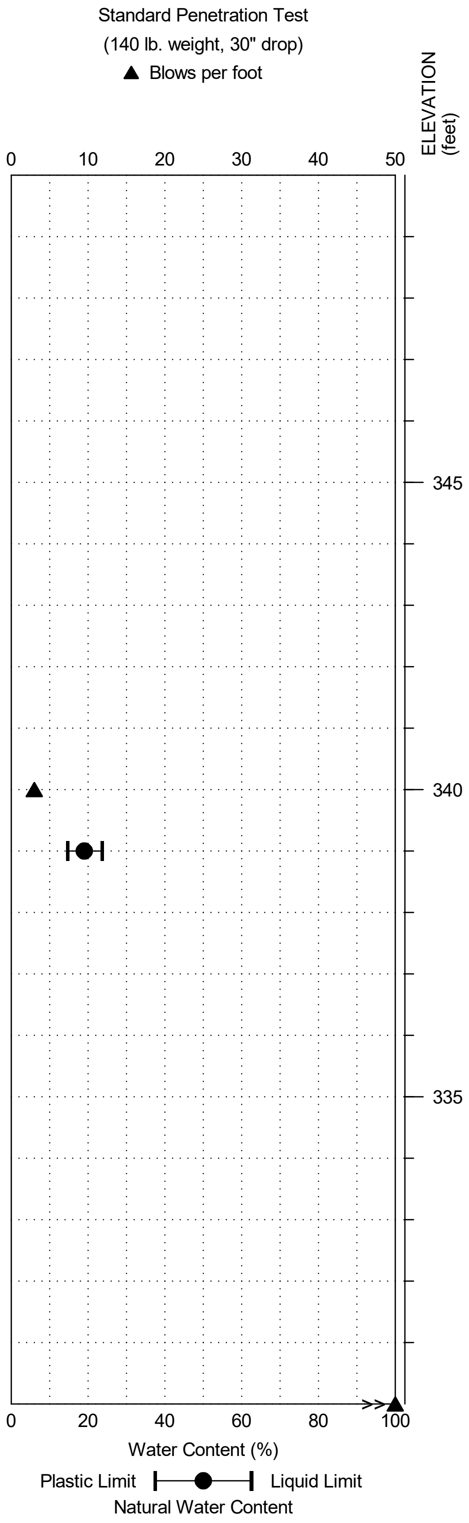
PROJECT NO.: 2019-016 T8

FIGURE: A-7

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 2

DATE STARTED: 11/25/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 350.0 ± feet

DEPTH (feet)	USCS SOIL CLASS	DESCRIPTION	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER	ELEVATION (feet)
0		8.0-inches Hot Mix Asphalt. **(HMA)**					
	SM	Dense, gray, crushed, GRAVEL, moist. **(CSBC)**					
		Medium dense, brown, gravelly, silty SAND, moist to wet. **(FILL)**					
		Loose to medium dense, gray, angular GRAVEL and CONCRETE debris, wet.				▽	
5							345
	OH	Soft, dark brown, organic SILT and PEAT, wet. **(PEAT)**					
10			S-1	4-2-1			340
	CL	Soft, gray, CLAY with gravel, wet. **(ALLUVIUM)**	BGS-1		AL GS		
15							335
	SM	Dense, red brown, silty, fine to medium SAND with gravel, moist to wet. **WEATHERED VASHON ADVANCE OUTWASH)**					
	SM	Very dense, olive brown, silty, fine to medium SAND with gravel and cobbles, moist.					
20							



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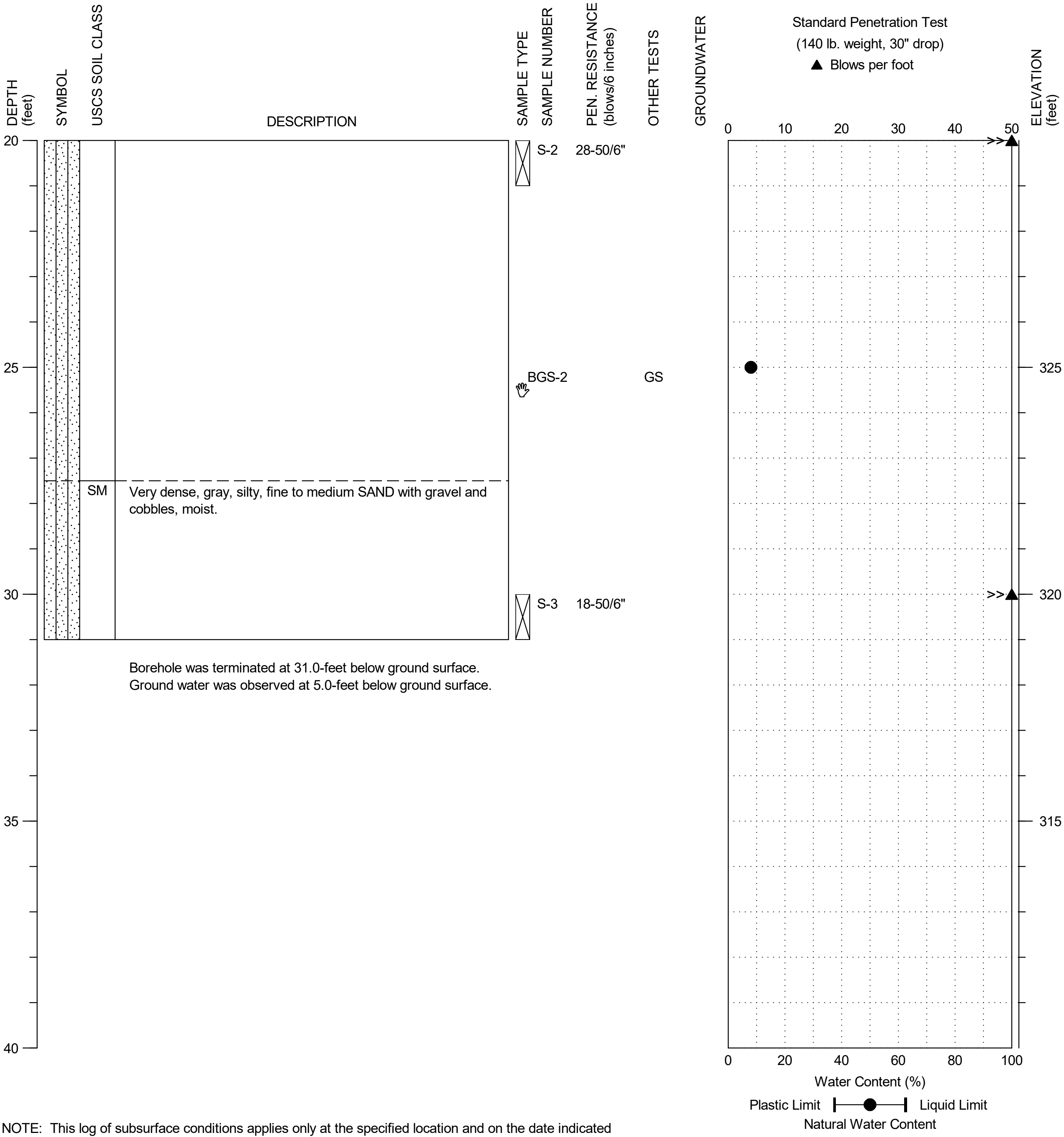
PROJECT NO.: 2019-016 T8 FIGURE: A-8

DRILLING COMPANY: Holt Services Inc.
DRILLING METHOD: Terra Sonic TSi 150
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 2

DATE STARTED: 11/25/2020
DATE COMPLETED: 11/25/2020
LOGGED BY: S. Pemble
SURFACE ELEVATION: 350.0 ± feet



SM Very dense, gray, silty, fine to medium SAND with gravel and cobbles, moist.

Borehole was terminated at 31.0-feet below ground surface.
Ground water was observed at 5.0-feet below ground surface.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

BORING:
BH-7

PAGE: 2 of 2

PROJECT NO.: 2019-016 T8

FIGURE: A-8

Appendix B
Laboratory Testing

EXPLORATION DESIGNATION	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)	SPECIFIC GRAVITY	ATTERBERG LIMITS (%)			% GRAVEL	% SAND	% FINES	ASTM SOIL CLASSIFICATION	SAMPLE DESCRIPTION
						LL	PL	PI					
BH-1,BGS-1	15.0	16.0	6.9						48.3	42.0	9.8	GP-GM	Olive-brown, poorly graded GRAVEL with silt and sand
BH-1,BGS-2	26.0	27.0	5.4						54.1	37.8	8.1	GW-GM	Olive-brown, well-graded GRAVEL with silt and sand
BH-2,BGS-1	7.0	8.0	158.9	22.2								PT	Very dark brown, PEAT
BH-2,BGS-2	16.0	17.0	4.8						46.8	44.4	8.8	GW-GM	Dark olive-brown, well-graded GRAVEL with silt and sand
BH-2,BGS-3	31.0	32.0	2.6						52.1	44.5	3.4	GP	Olive-brown, poorly graded GRAVEL with sand
BH-3,BGS-1	8.0	9.0	253.4	41.5								PT	Very dark brown, PEAT with gravel
BH-3,BGS-2	13.0	14.0	21.3			27	16	11				CL	Olive-brown, sandy lean CLAY with gravel
BH-3,BGS-3	27.0	28.0	8.1						18.2	57.5	24.3	SM	Olive-brown, silty SAND with gravel
BH-4,BGS-1	20.0	21.0	519.0	96.7								PT	Very dark grayish-brown, PEAT
BH-4,BGS-2	31.0	32.0	48.3			36	23	13				CL	Gray, lean CLAY
BH-5,BGS-1	19.0	20.0	661.9	95.4								PT	Very dark brown, PEAT
BH-5,BGS-2	26.0	27.0	39.1			32	19	13				CL	Dark gray, lean CLAY with sand
BH-5,BGS-3	29.0	30.0	4.1						41.1	37.9	21.1	GM	Gray, silty GRAVEL with sand
BH-6,BGS-1	11.0	12.0	721.9	81.6								PT	Very dark brown, PEAT
BH-6,BGS-2	16.0	17.0	35.9			35	20	15				CL	Dark gray, lean CLAY
BH-6,BGS-3	36.0	37.0	12.8						9.5	33.8	56.7	ML	Dark gray, sandy SILT
BH-6,BGS-4	38.0	39.0	19.7						0.8	83.9	15.3	SM	Dark gray, silty SAND
BH-7,BGS-1	11.0	12.0	19.5			24	15	9	5.8	39.2	55.0	CL	Dark gray, sandy lean CLAY
BH-7,BGS-2	25.0	26.0	8.5						13.7	41.9	44.4	SM	Dark grayish-brown, silty SAND

Notes:
1. This table summarizes information presented elsewhere in the report and should be used in conjunction with the report test, other graphs and tables, and the exploration logs.
2. The soil classifications in this table are based on ASTM D2487 and D2488 as applicable.

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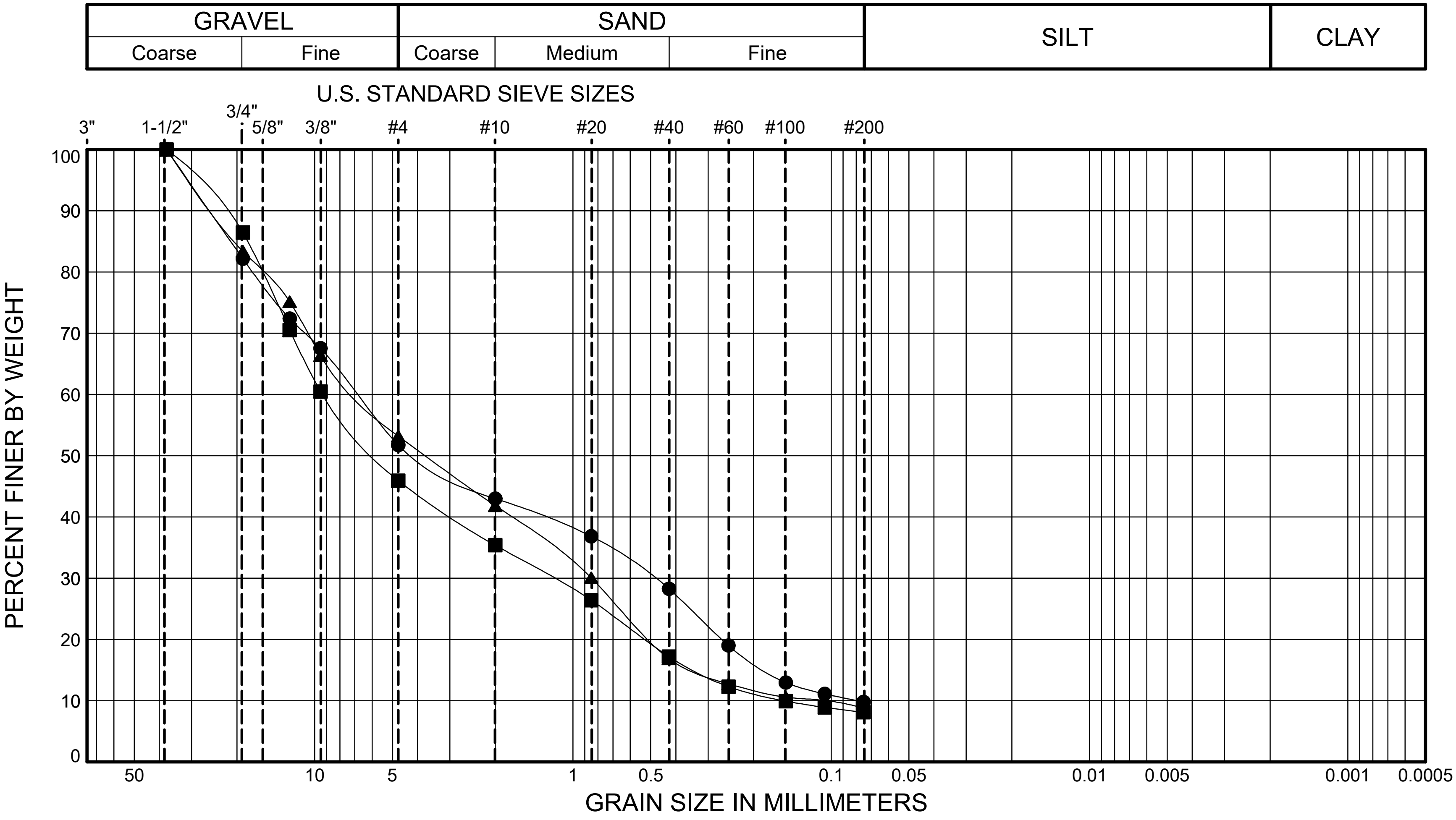
City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

SUMMARY OF MATERIAL PROPERTIES

PAGE: 1 of 1

PROJECT NO.: 2019-016 T8

FIGURE: B-1



SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-1	BGS-1	15.0 - 16.0	(GP-GM) Olive-brown, poorly graded GRAVEL with silt and sand	7				48.3	42.0	9.8
■	BH-1	BGS-2	26.0 - 27.0	(GW-GM) Olive-brown, well-graded GRAVEL with silt and sand	5				54.1	37.8	8.1
▲	BH-2	BGS-2	16.0 - 17.0	(GW-GM) Dark olive-brown, well-graded GRAVEL with silt and sand	5				46.8	44.4	8.8

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City of Sammamish On-Call
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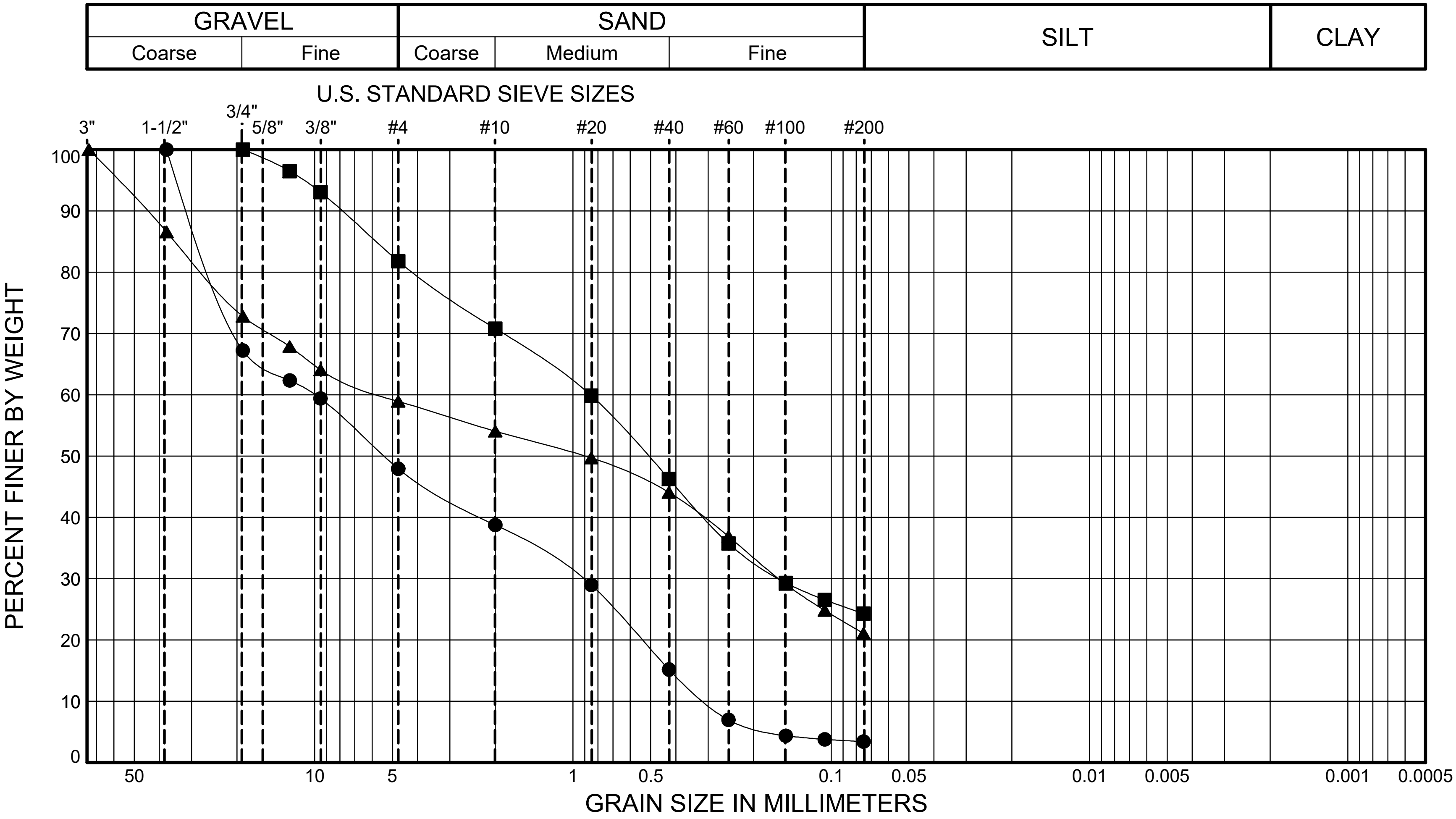
Sammamish, Washington

PARTICLE-SIZE ANALYSIS OF SOILS METHOD ASTM D6913

PROJECT NO.: 2019-016 T8 FIGURE: B-2



SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-2	BGS-3	31.0 - 32.0	(GP) Olive-brown, poorly graded GRAVEL with sand	3				52.1	44.5	3.4
■	BH-3	BGS-3	27.0 - 28.0	(SM) Olive-brown, silty SAND with gravel	8				18.2	57.5	24.3
▲	BH-5	BGS-3	29.0 - 30.0	(GM) Gray, silty GRAVEL with sand	4				41.1	37.9	21.1

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212th Ave SE Borings
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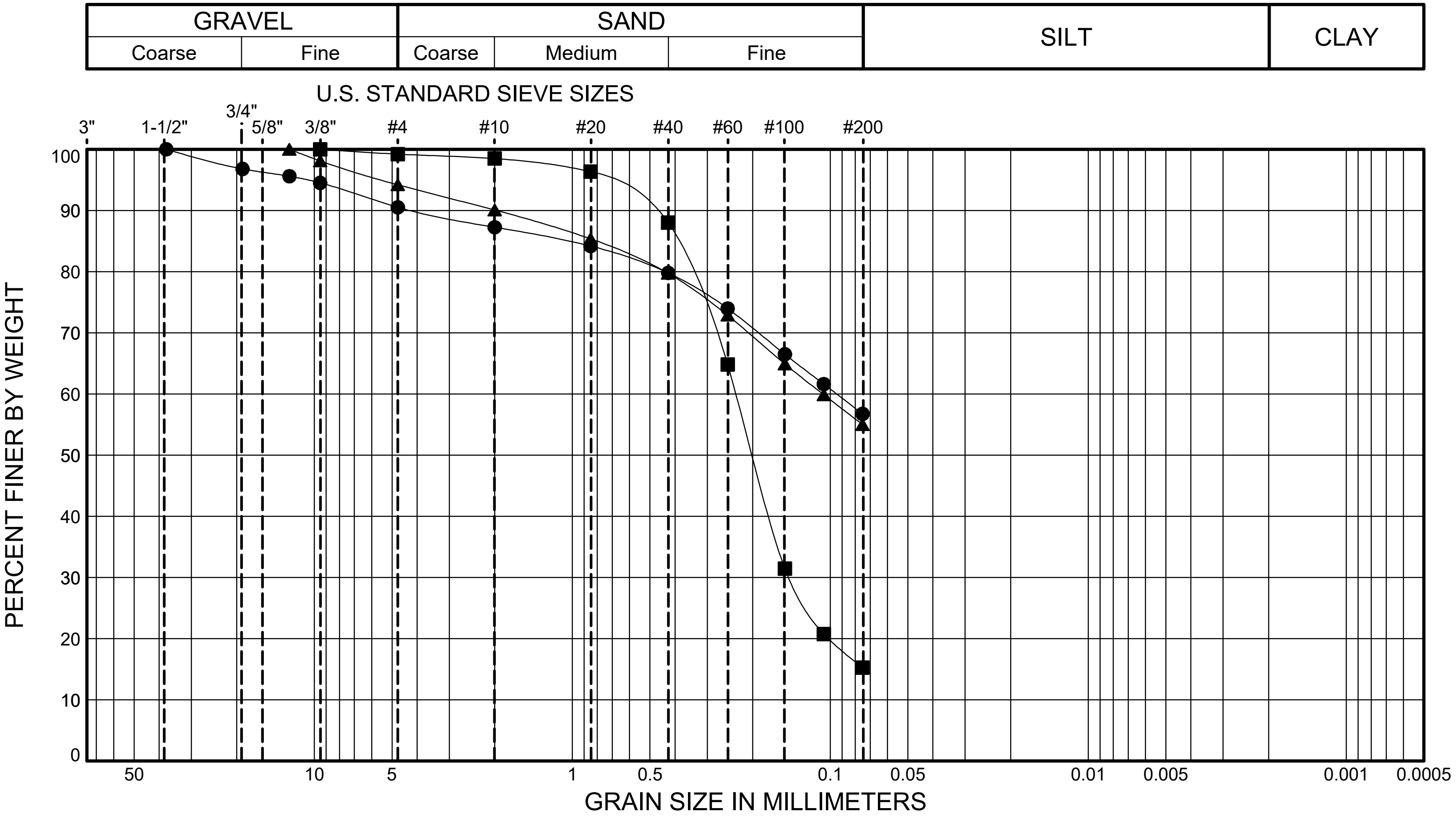
Sammamish, Washington

PARTICLE-SIZE ANALYSIS OF SOILS METHOD ASTM D6913

PROJECT NO.: 2019-016 T8 FIGURE: B-3



SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-6	BGS-3	36.0 - 37.0	(ML) Dark gray, sandy SILT	13				9.5	33.8	56.7
■	BH-6	BGS-4	38.0 - 39.0	(SM) Dark gray, silty SAND	20				0.8	83.9	15.3
▲	BH-7	BGS-1	11.0 - 12.0	(CL) Dark gray, sandy lean CLAY	19	24	15	9	5.8	39.2	55.0

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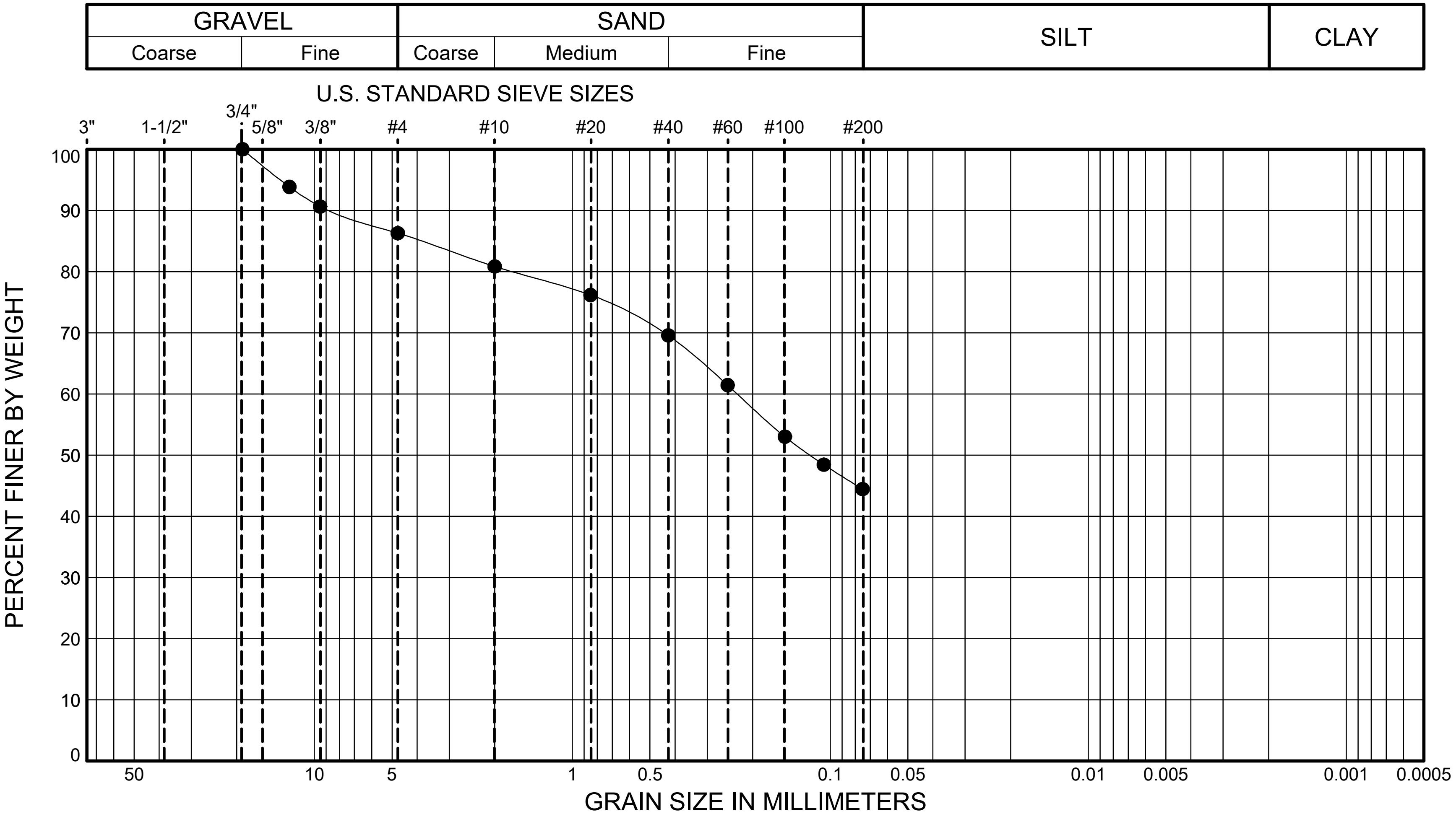
City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

PARTICLE-SIZE ANALYSIS OF SOILS METHOD ASTM D6913

PROJECT NO.: 2019-016 T8 FIGURE: B-4



SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-7	BGS-2	25.0 - 26.0	(SM) Dark grayish-brown, silty SAND	8				13.7	41.9	44.4

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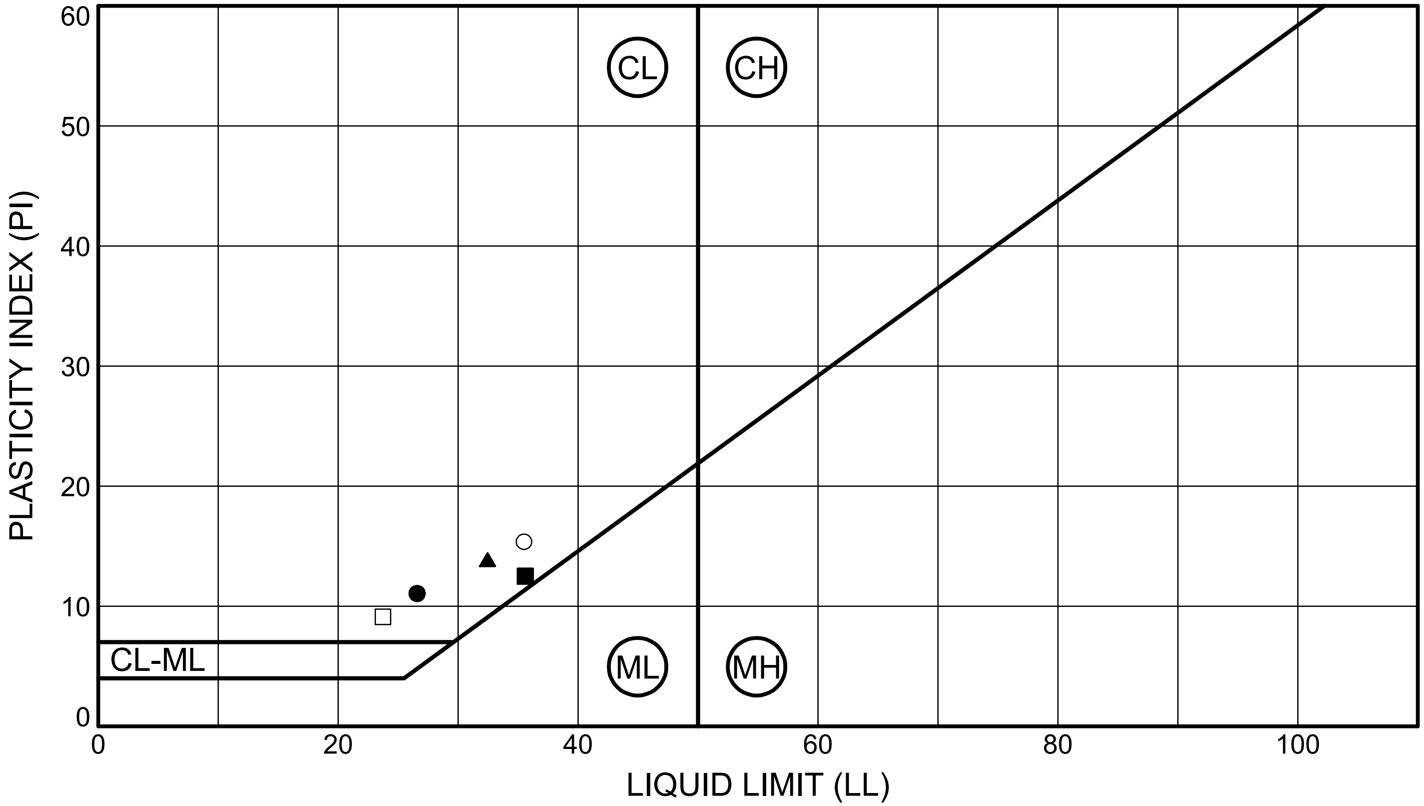
City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

PARTICLE-SIZE ANALYSIS OF SOILS
METHOD ASTM D6913

PROJECT NO.: 2019-016 T8 FIGURE: B-5

HWAGRSZ 2019-016 T8.GPJ 12/18/20



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	BH-3	BGS-2	13.0 - 14.0	(CL) Olive-brown, sandy lean CLAY with gravel	21	27	16	11	
■	BH-4	BGS-2	31.0 - 32.0	(CL) Gray, lean CLAY	48	36	23	13	
▲	BH-5	BGS-2	26.0 - 27.0	(CL) Dark gray, lean CLAY with sand	39	32	19	13	
○	BH-6	BGS-2	16.0 - 17.0	(CL) Dark gray, lean CLAY	36	35	20	15	
□	BH-7	BGS-1	11.0 - 12.0	(CL) Dark gray, sandy lean CLAY	19	24	15	9	55.0

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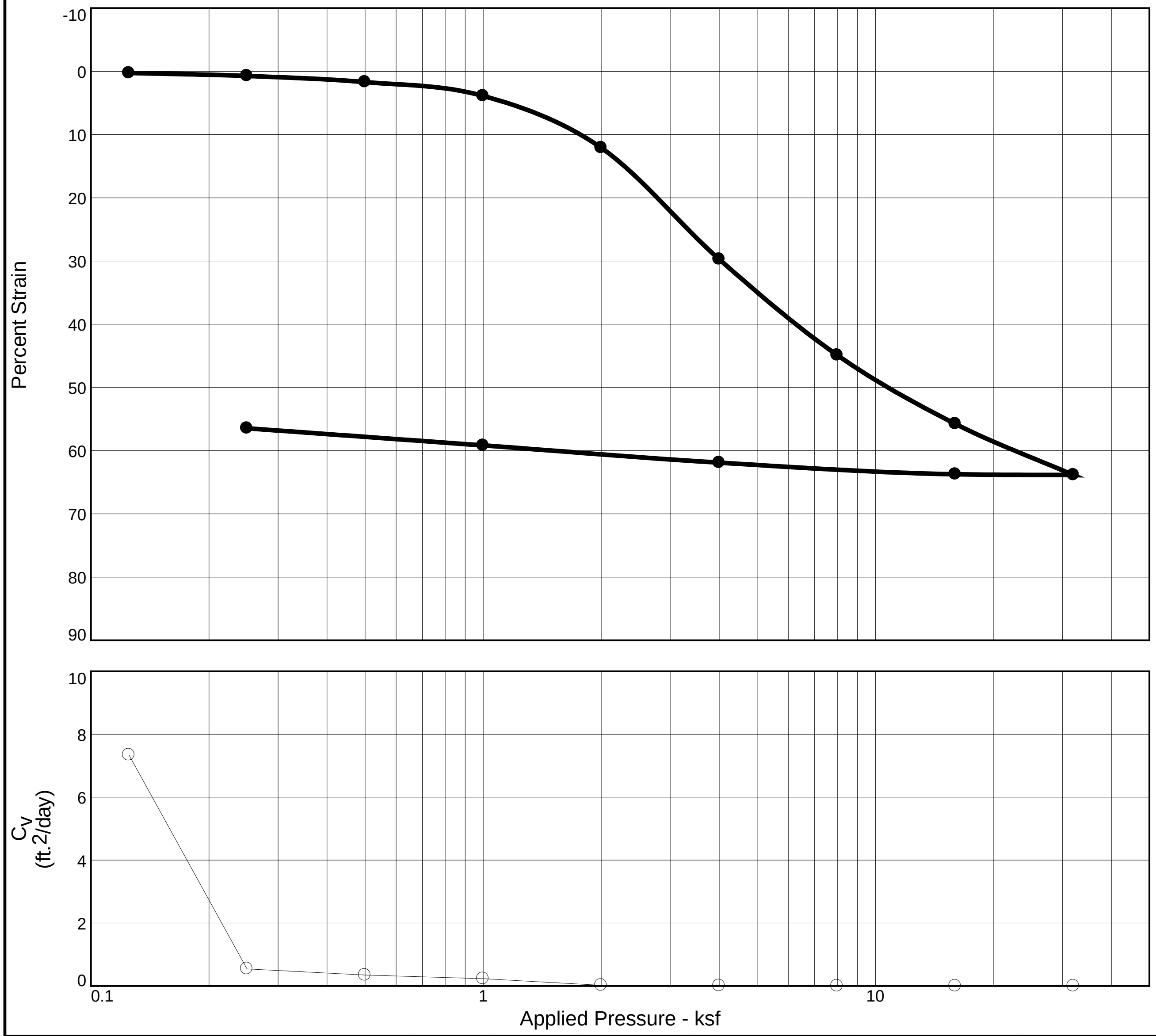
City of Sammamish On-Call
212th Ave SE Borings
Geotechnical Investigation
Sammamish, Washington

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS METHOD ASTM D4318

PROJECT NO.: 2019-016 T8 FIGURE: B-6

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.1 %	324.9 %	15.8			1.5	OL/OH		4.919

MATERIAL DESCRIPTION

Dark brown, organic SILT

Project No. 2019-016 T8 **Client:**

Project: Sammamish On-Call 212 Avenue SE Failures

Source of Sample: BH-3 **Depth:** 10 **Sample Number:** S-2

HWA GEOSCIENCES INC.
DBE/MWBE

Remarks:
*Specific Gravity is Assumed

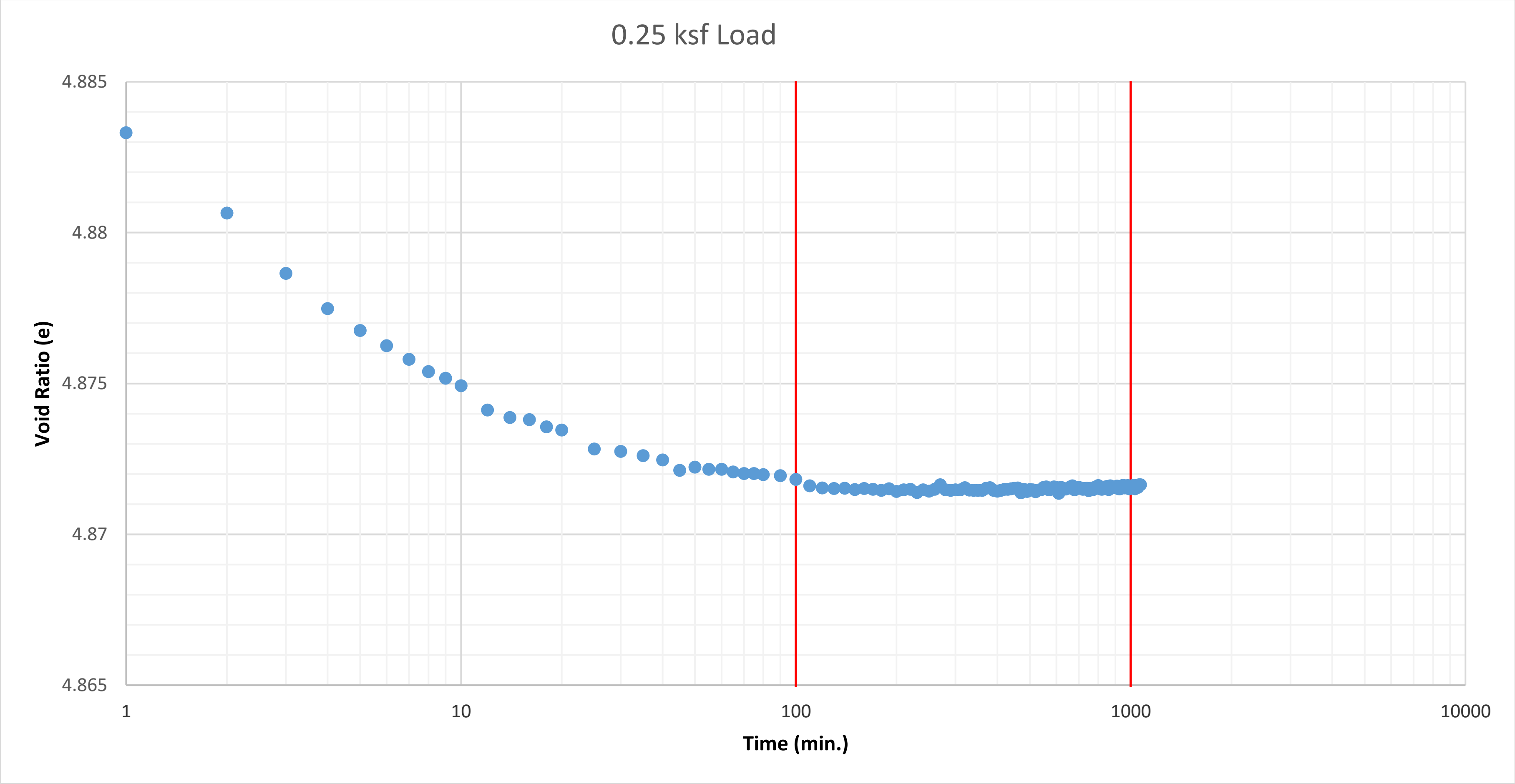
Figure B-7

Tested By: DW **Checked By:** SEG

GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

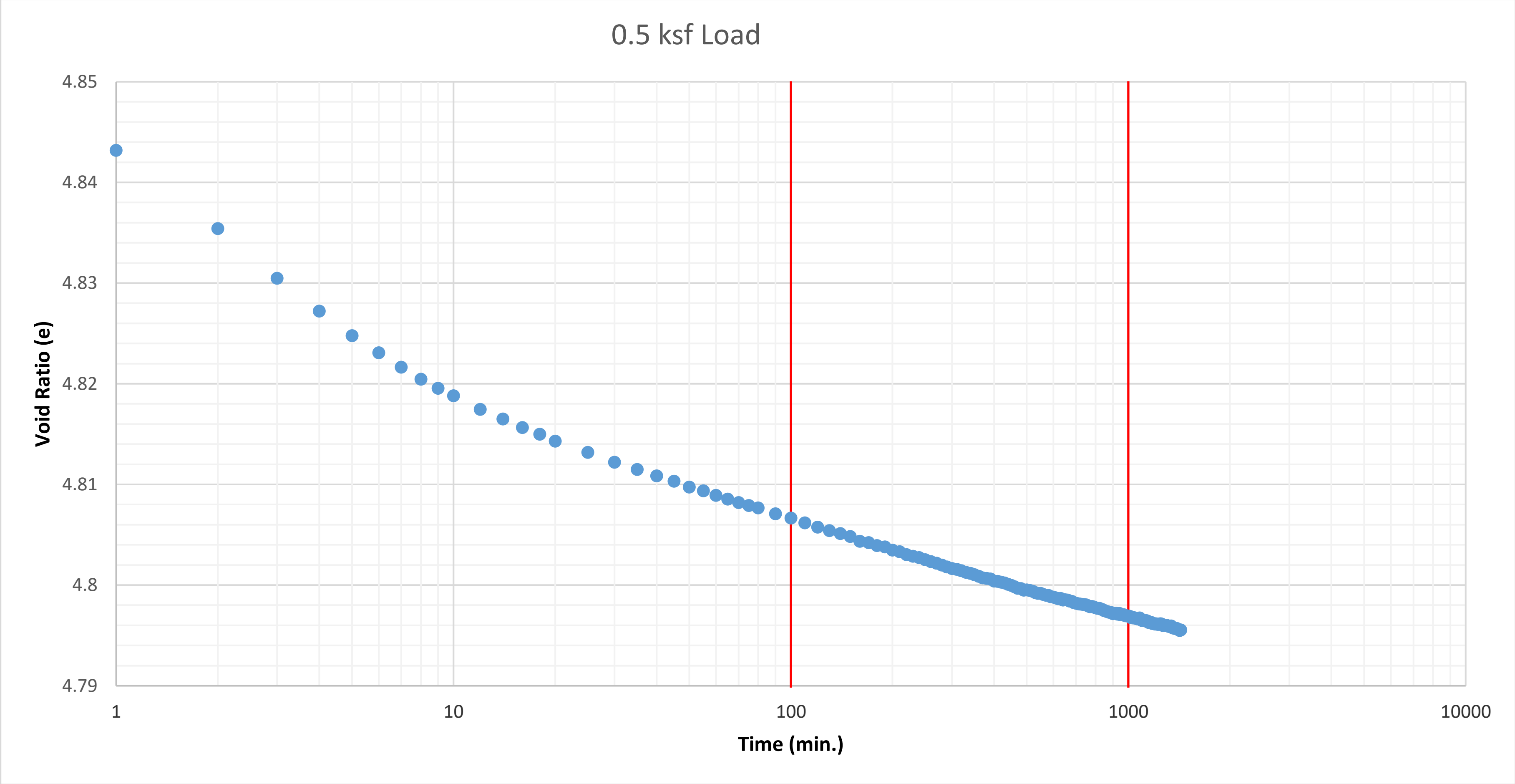
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf



C_α= **4.8718 - 4.8716 = 0.0003**

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf

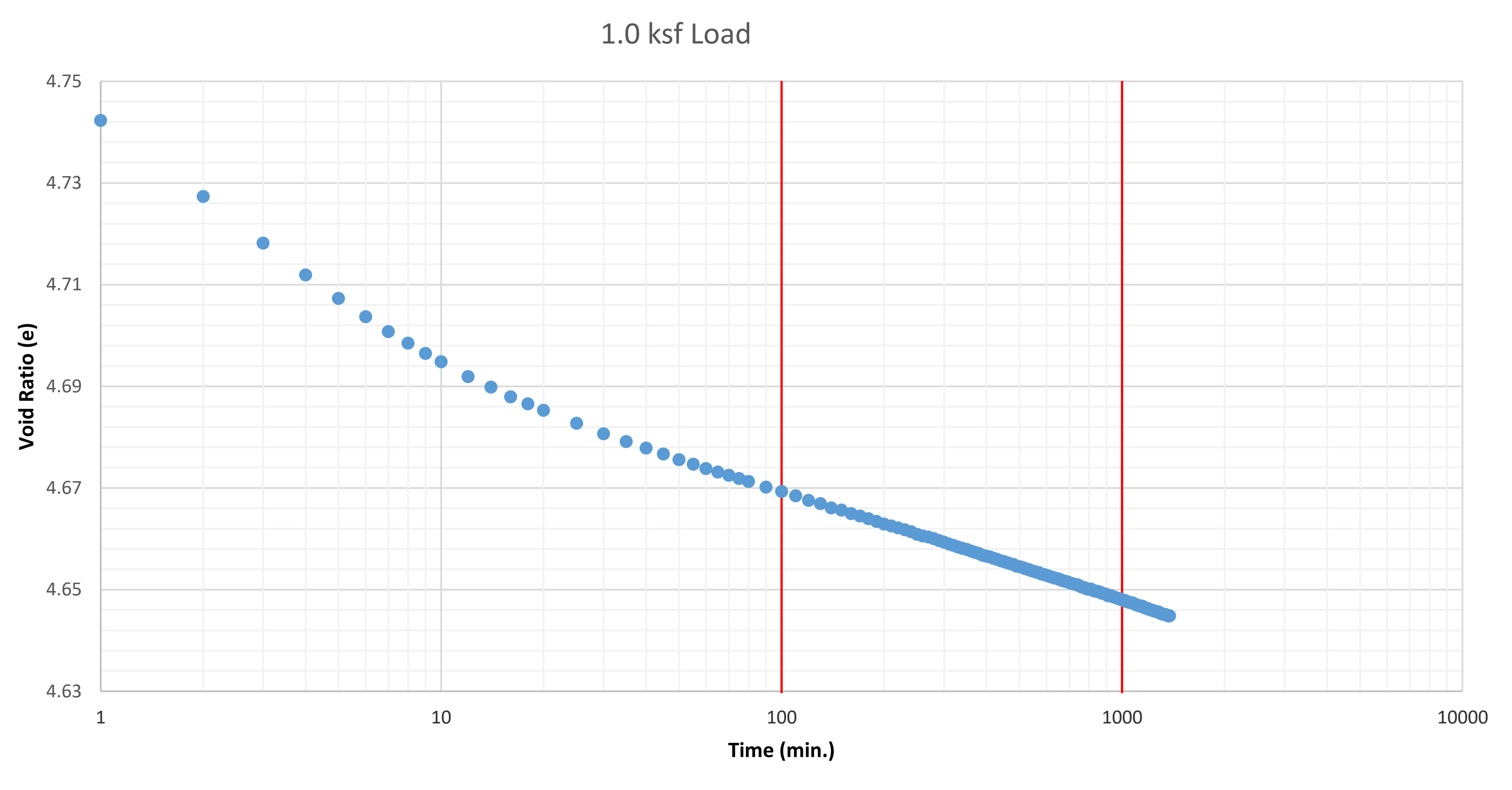


C_α= 4.8066 - 4.7969 = 0.0097

GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf

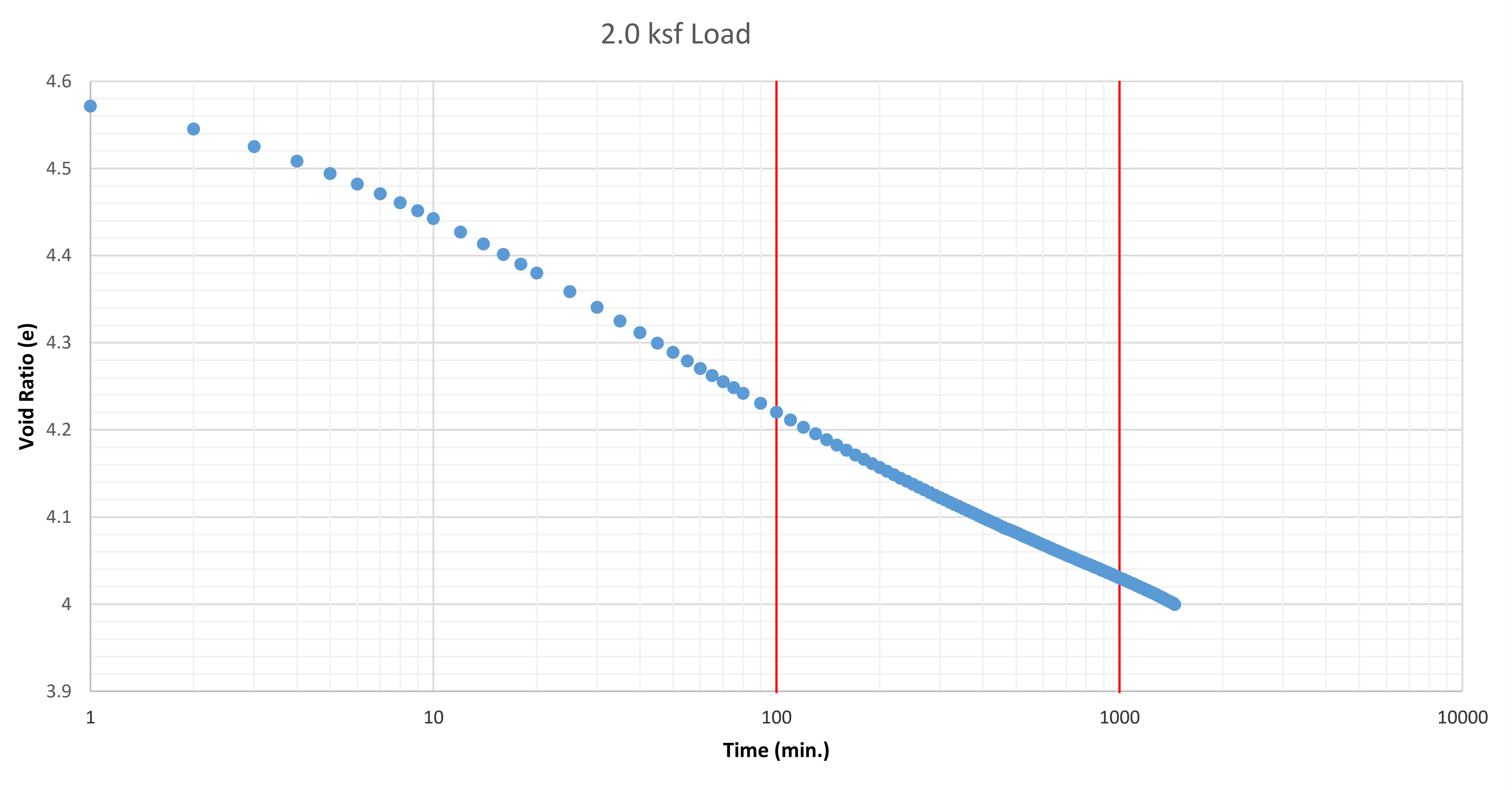


C_α= 4.6693 - 4.6480 = 0.0213

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

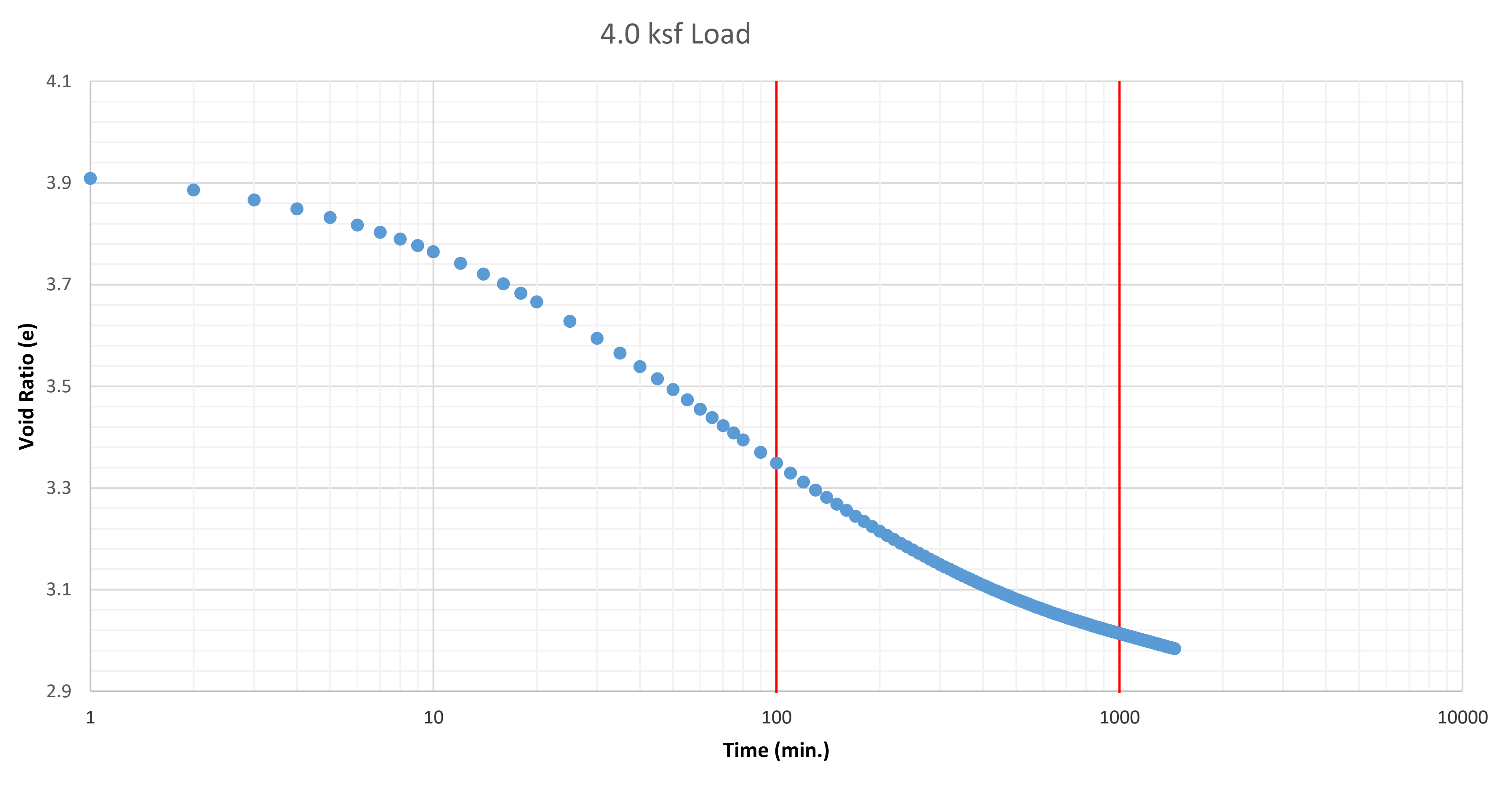
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf



C_α= 4.2203 - 4.0303 = 0.1900

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

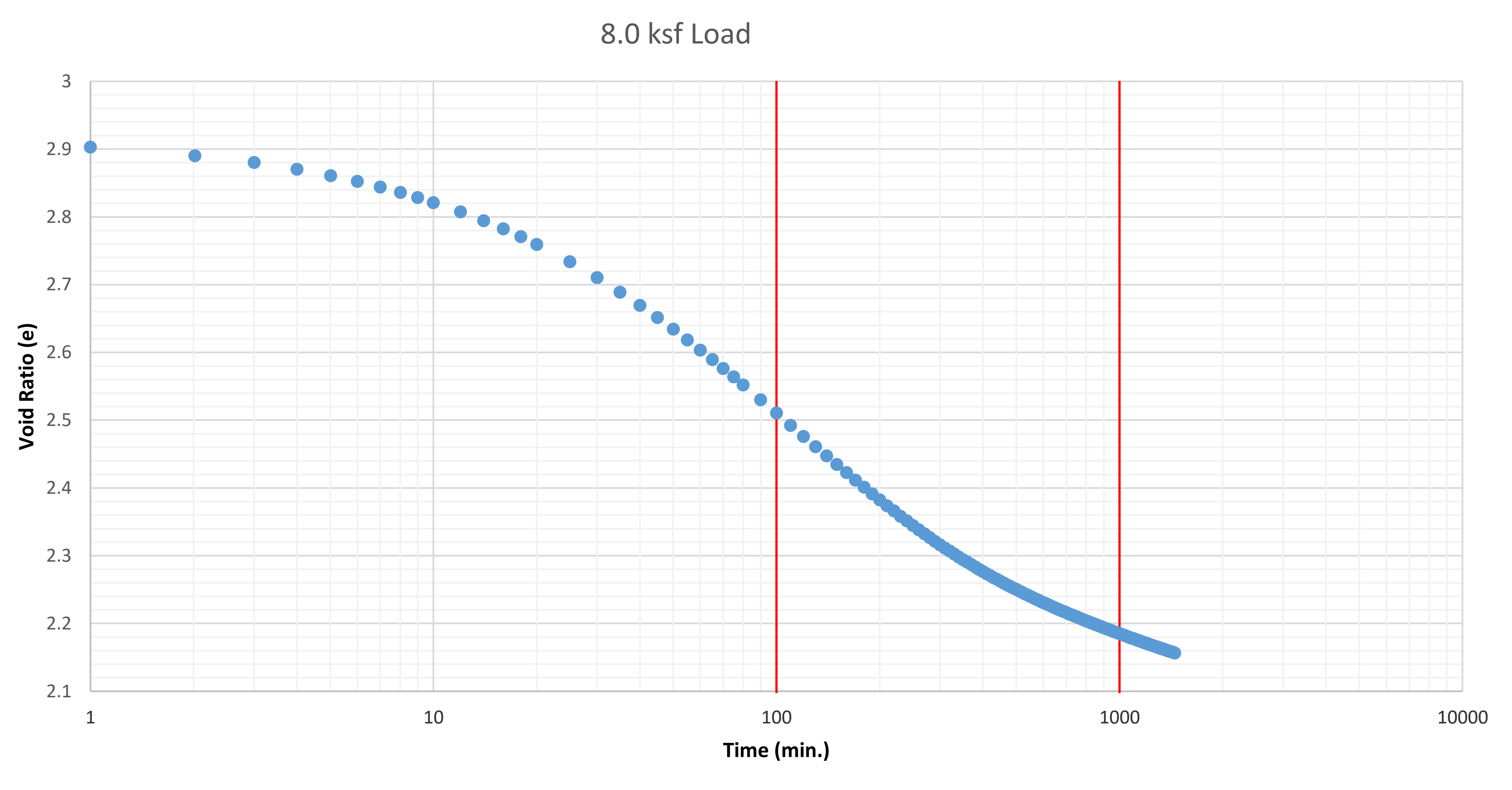
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf



C_α= 3.3484 - 3.0137 = 0.3348

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf

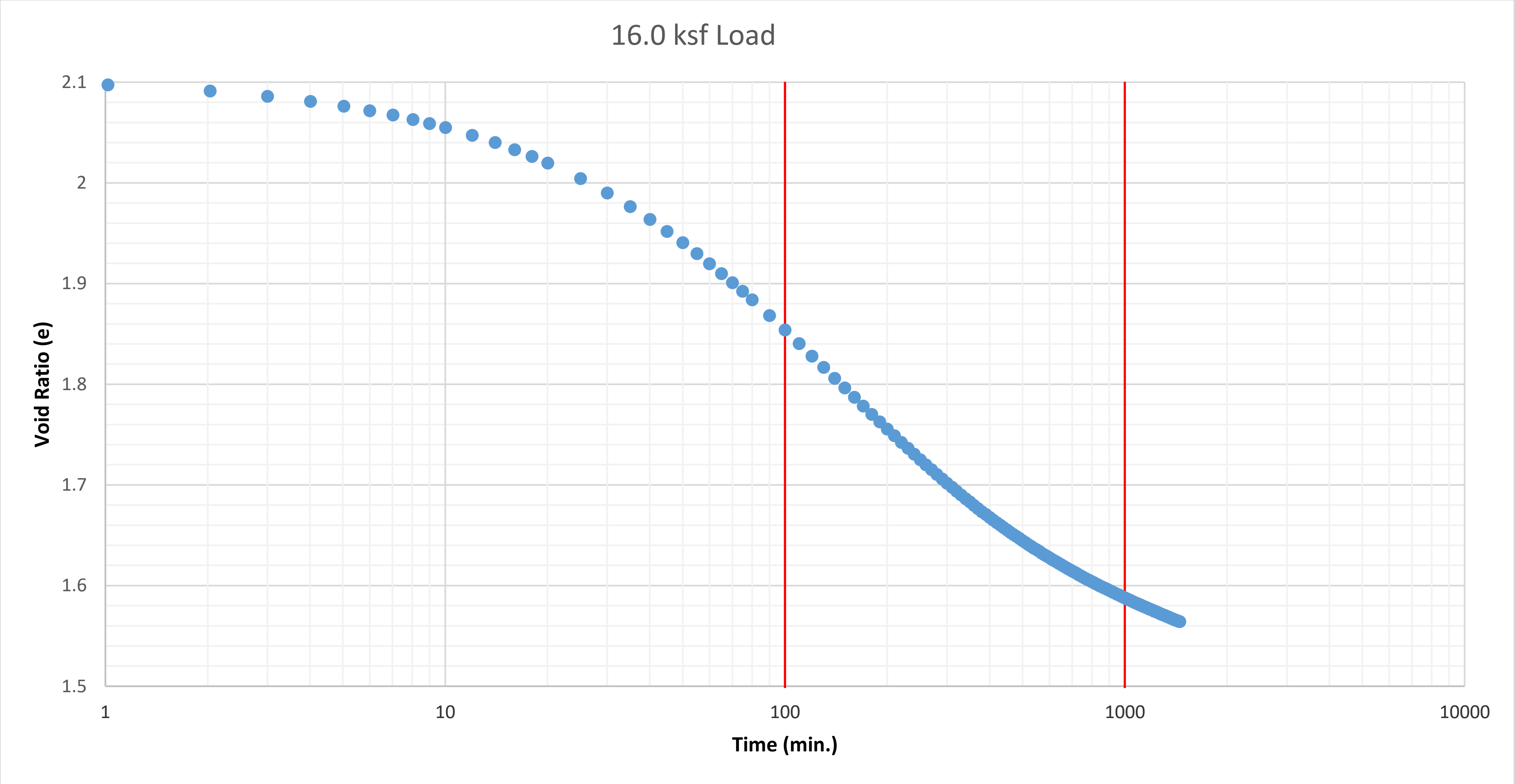


C_α= 2.5103 - 2.1850 = 0.3254

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

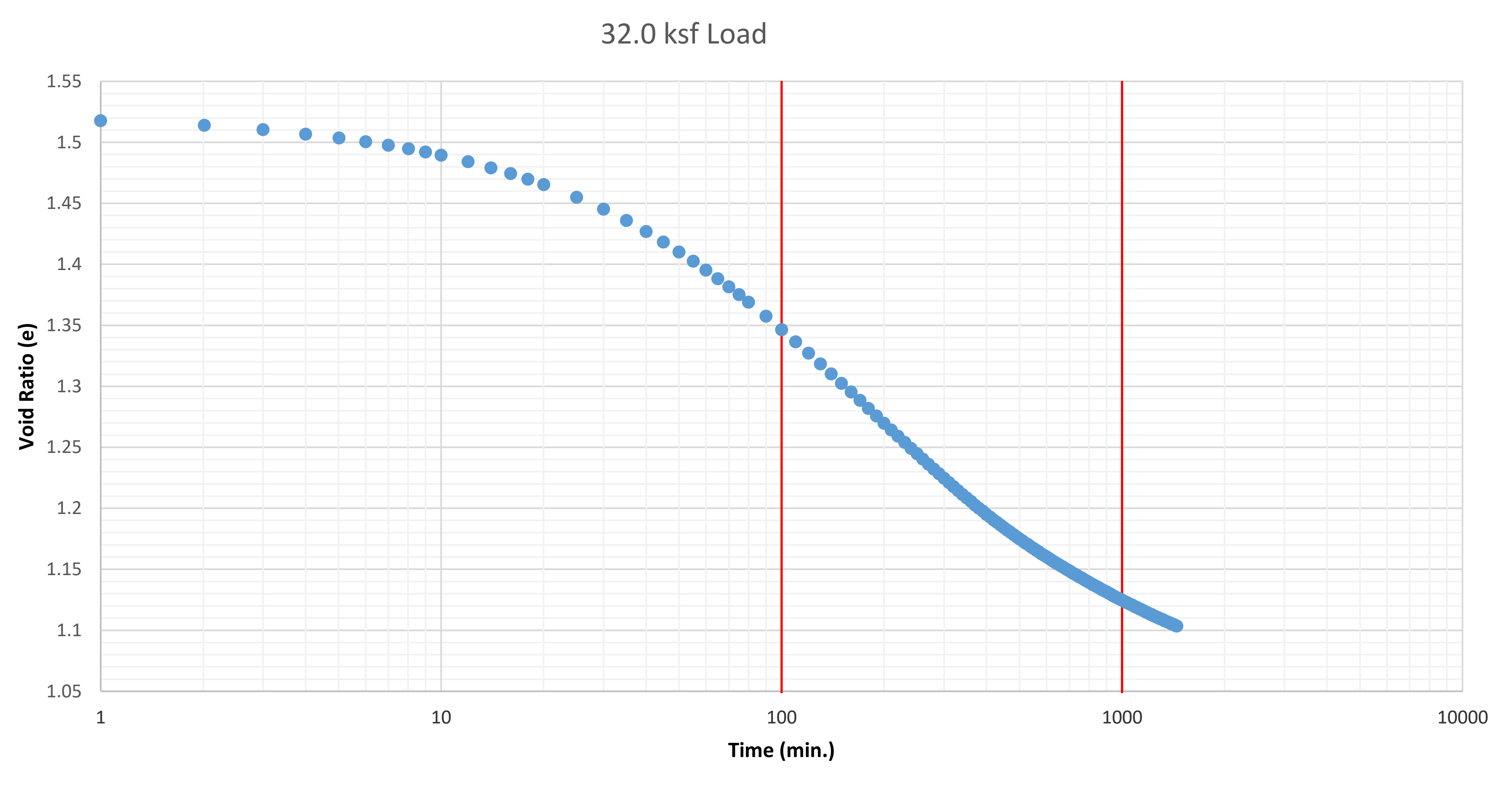
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf



C_α= 1.8537 - 1.5877 = 0.2660

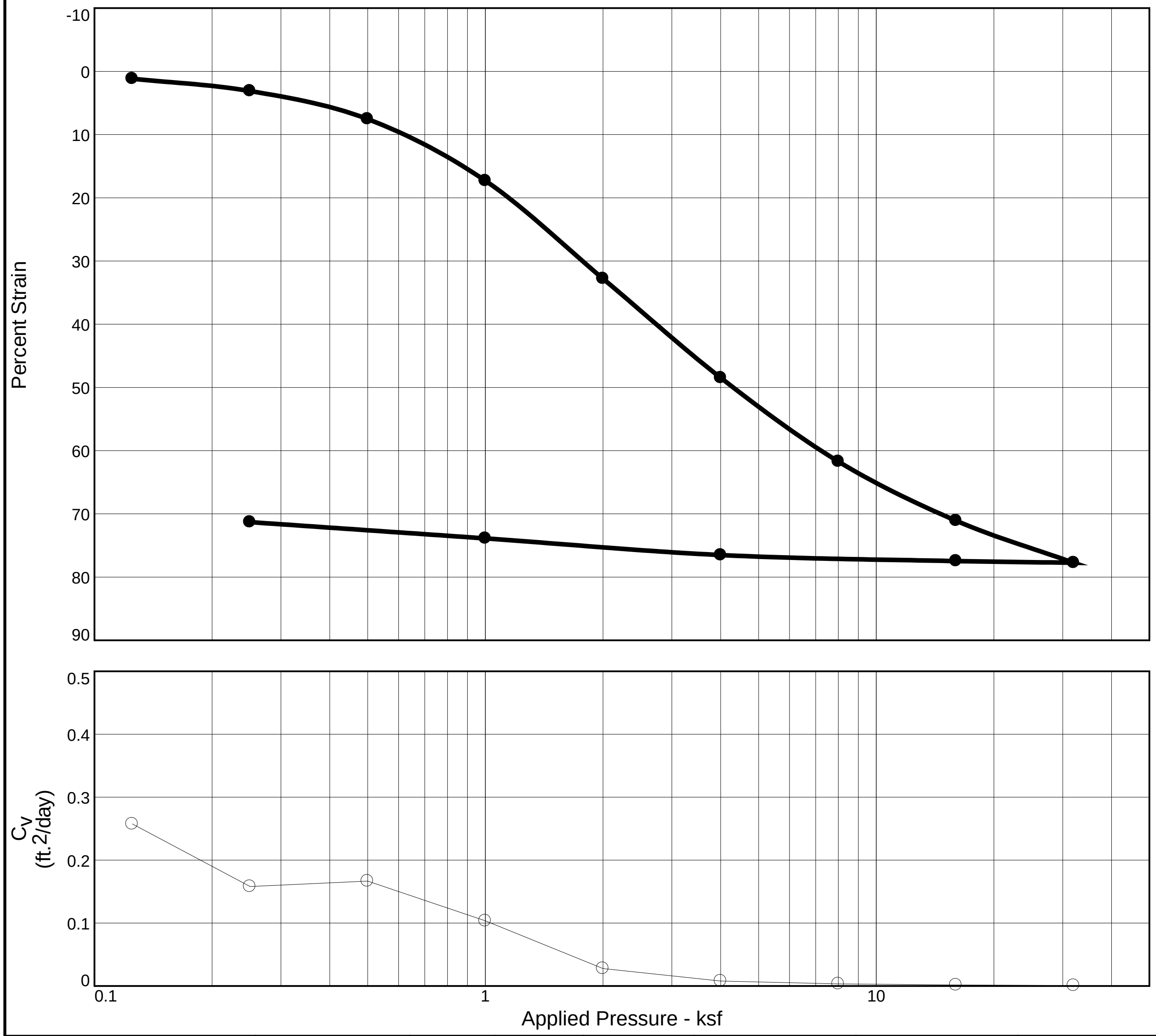
ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	324.9	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	99.1	%
Exploration Number:	BH-3	Soil Description	OL/OH	Dry Density	15.8	pcf



C_α= 1.3465 - 1.1246 = 0.2219

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
87.9 %	699.7 %	7.2			1.5	PT		11.941

MATERIAL DESCRIPTION

Very dark brown, PEAT

Project No. 2019-016 T8 **Client:**

Project: Sammamish On-Call 212 Avenue SE Failures

Source of Sample: BH-6 **Depth:** 10 **Sample Number:** S-2

HWA GEOSCIENCES INC.
DBE/MWBE

Remarks:
*Specific Gravity is Assumed

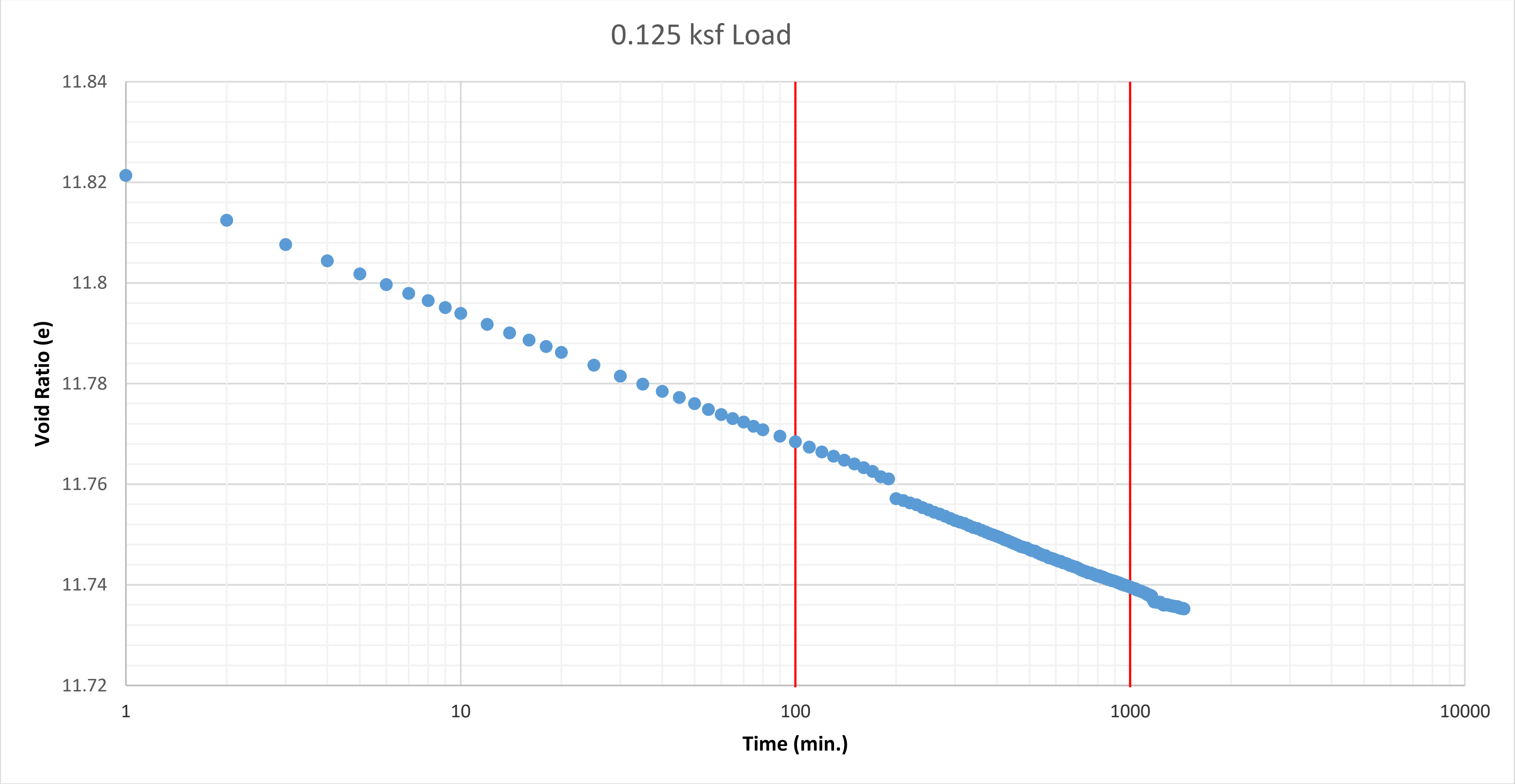
Figure B-8

Tested By: DW **Checked By:** SEG

GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf

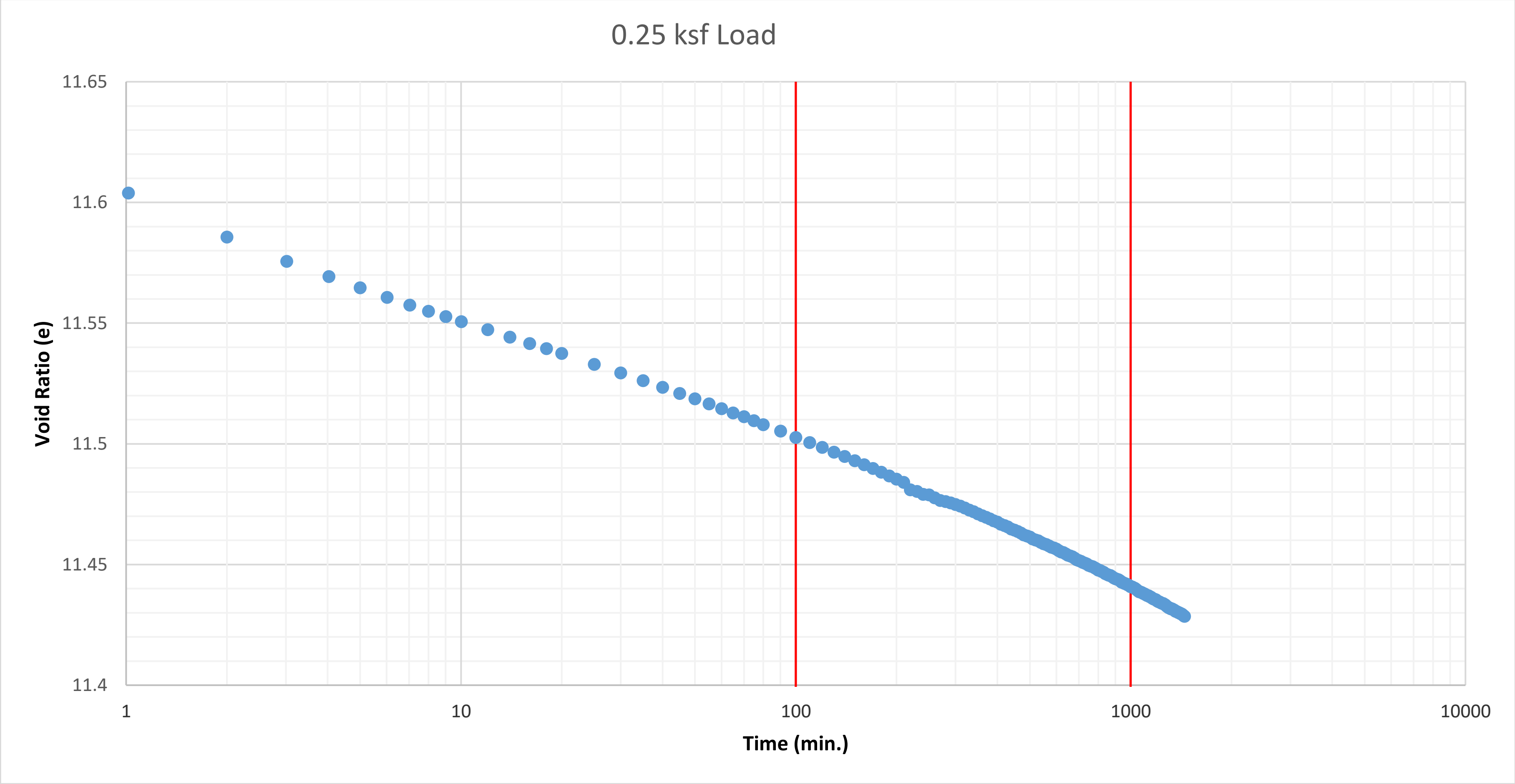


C_{α}= 11.7684 - 11.7396 = 0.0289

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

GEOSCIENCES INC.

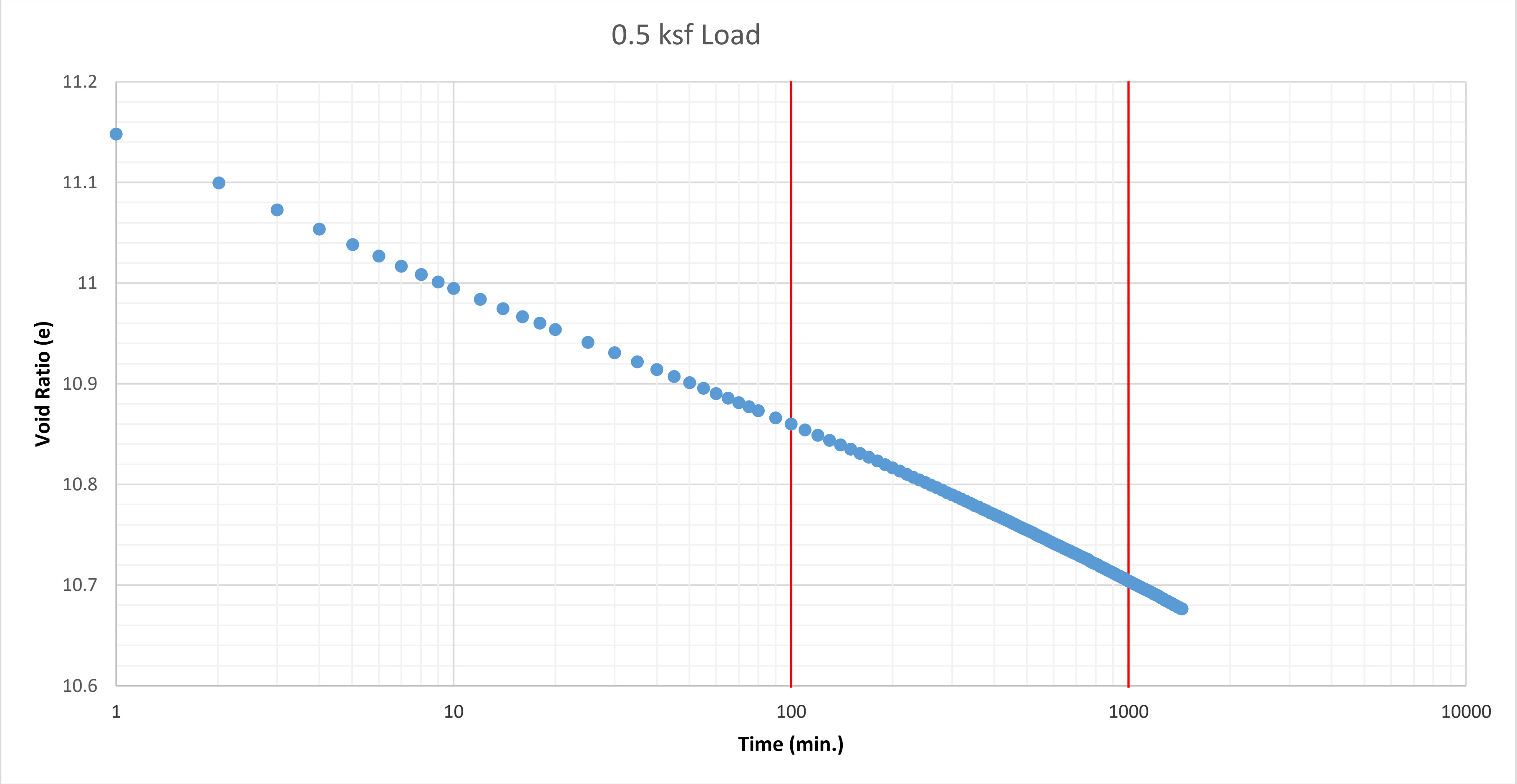
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf



C_α= 11.5027 - 11.4408 = 0.0618

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf



C_{α}= 10.8598 - 10.7040 = 0.1558

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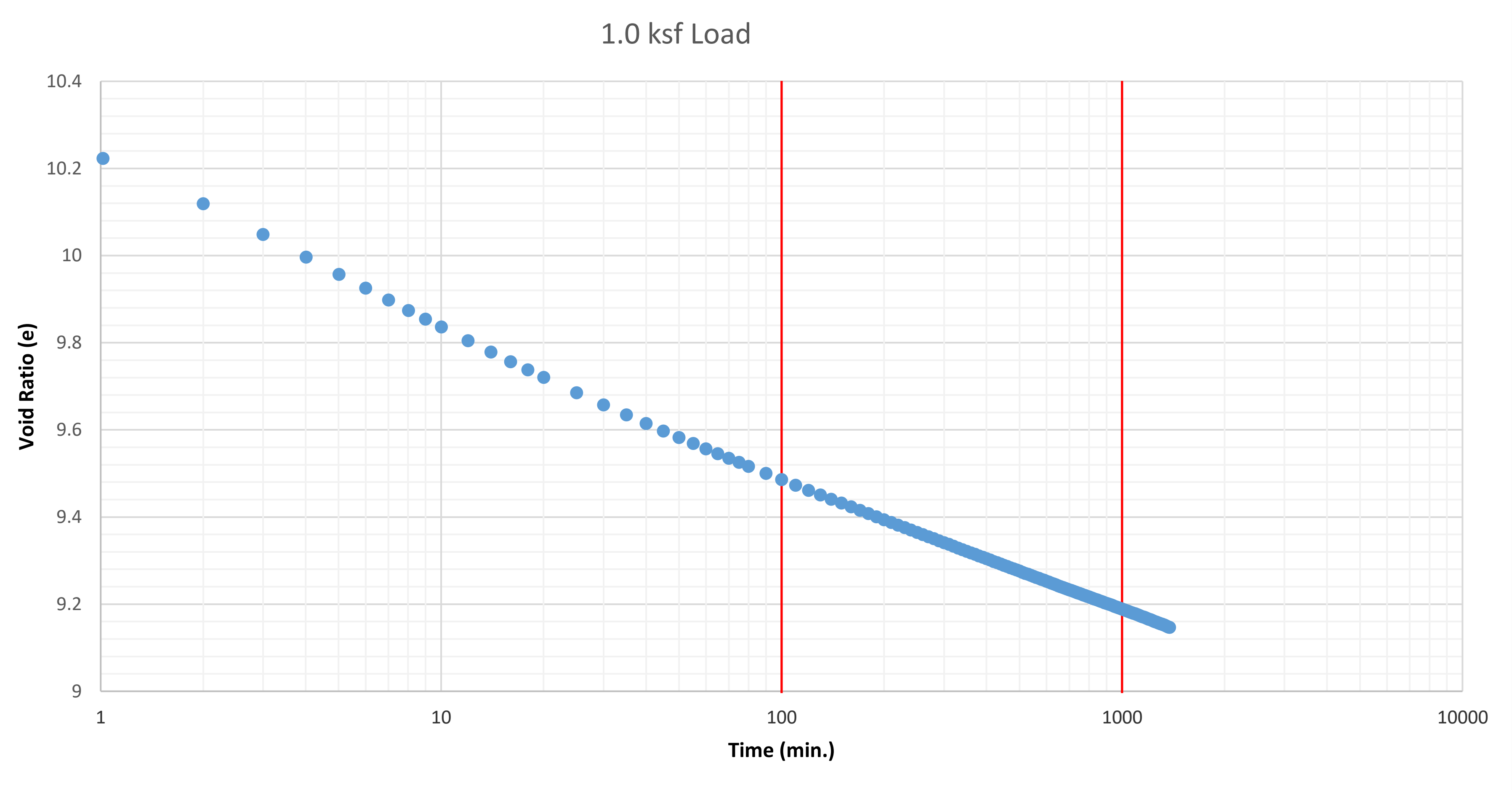
ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

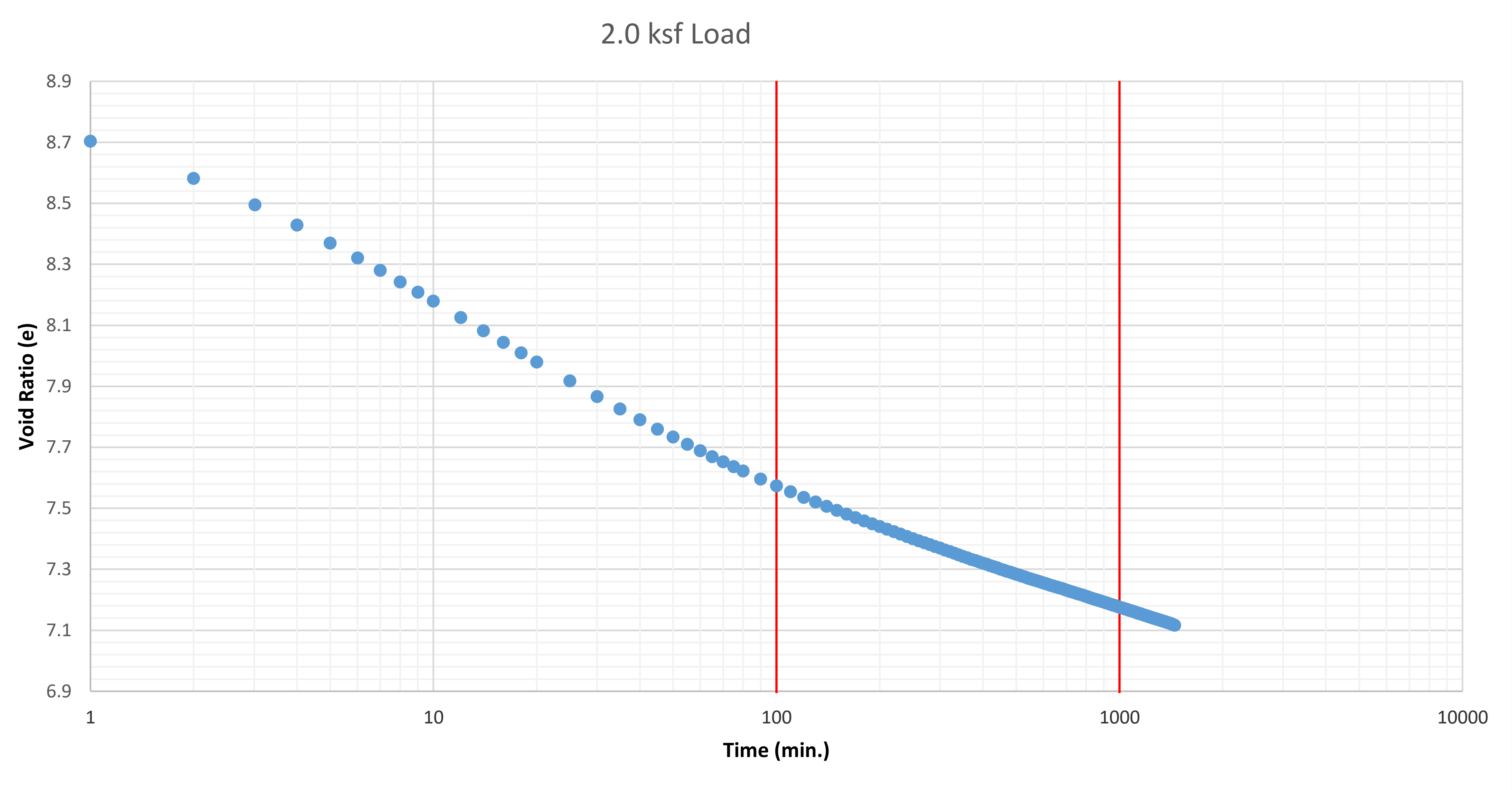
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf



C_α=	9.4857	-	9.1888	= 0.2968

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

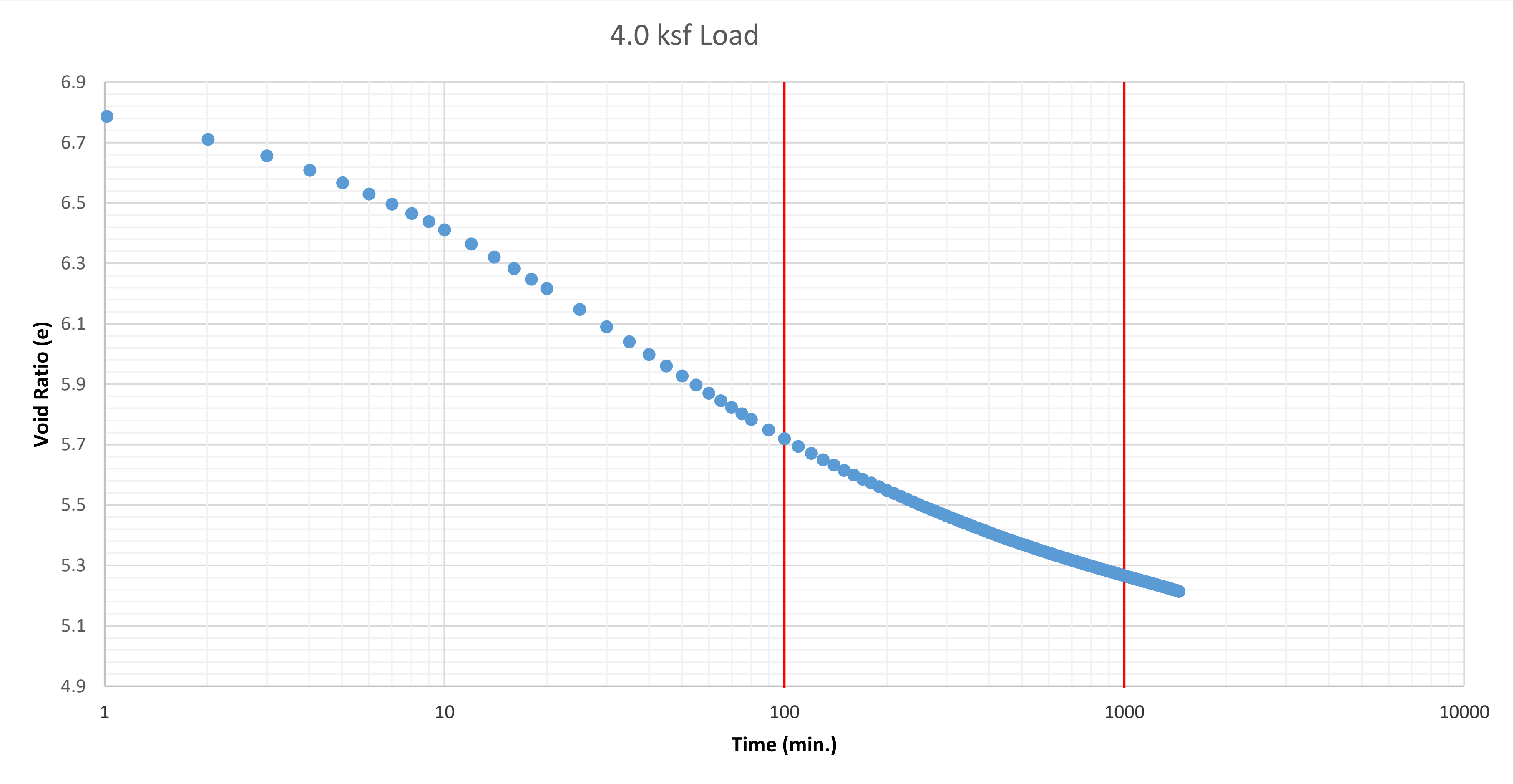
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf



C_α=	**7.5737**	**-**	**7.1760**	**=**	**0.3977**

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

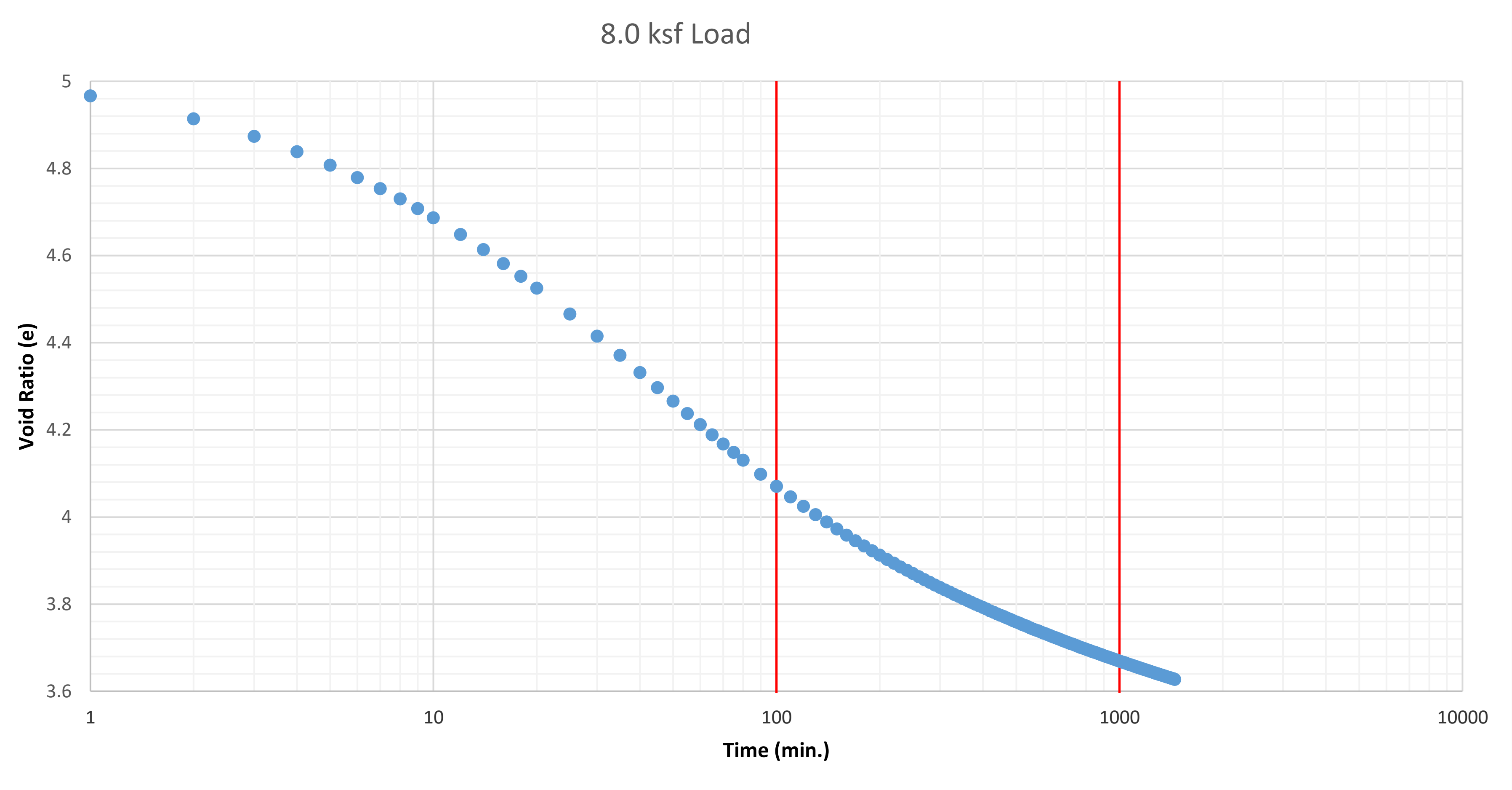
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf



C_α= **5.7194** - **5.2659** = **0.4534**

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

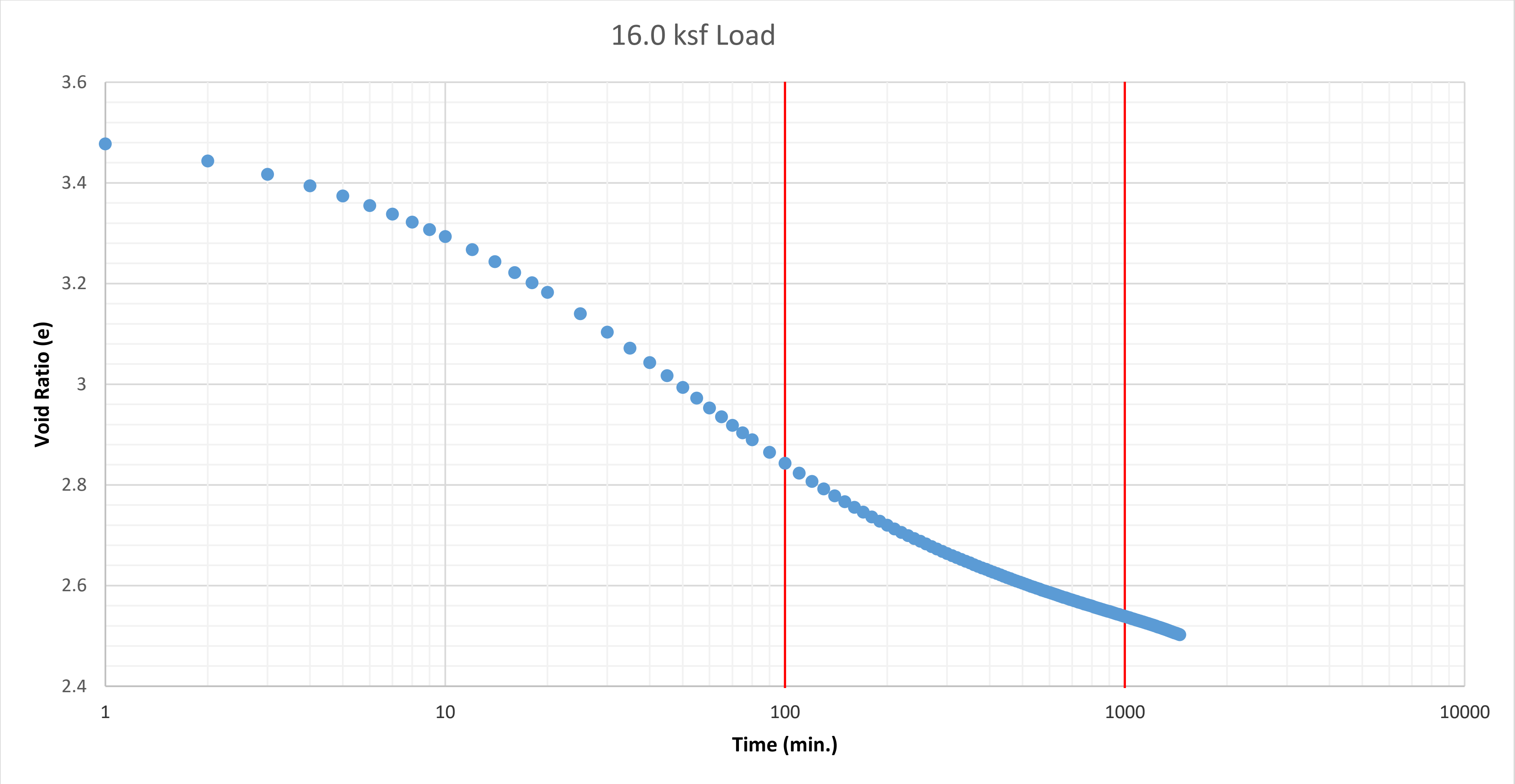
					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf



C_α= 4.0704 - 3.6692 = 0.4012

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf

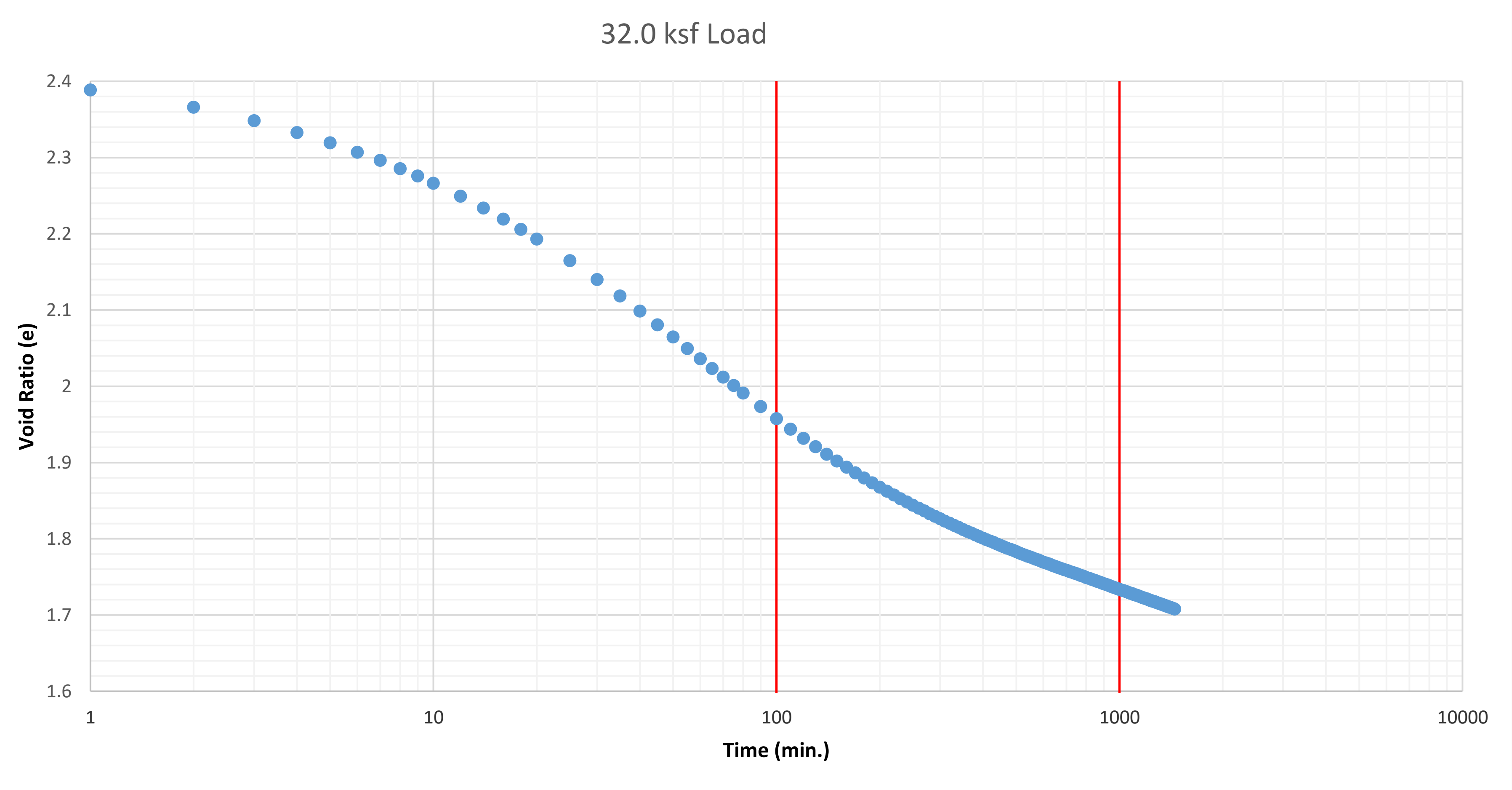


C_{α}= 2.8427 - 2.5387 = 0.3040

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	Sammamish On-Call	Sample Number	S-2	Moisture Content	699.7	%
Project Number:	2019-016 T8	Sample Depth	10-13 feet	Saturation	87.9	%
Exploration Number:	BH-6	Soil Description	PT	Dry Density	7.2	pcf



C_α=	1.9574	-	1.7338	=	0.2236