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Geotechnical Report

Proposed Office Building

1945 Congress Street, Portland, Maine

Client

Northland Enterprises
17 South Street, Unit 3
Portland, ME 04101

SUMMIT
GEOENGINEERING SERVICES

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Project #: 14226
Date: August 2016

August 24, 2016
Summit #14226

Northland Enterprises
Attn: Brad Fries
17 South Street, Unit 3
Portland, ME 04101

Reference: Geotechnical Engineering Services, Clark Insurance Office Building
1945 Congress St, Portland, Maine

Dear Brad;

Summit Geoengineering Services, Inc. (SGS) has completed a geotechnical investigation for the proposed office building at the site referenced above. Our scope of services included the drilling of six test borings in and around the proposed building footprint, the excavation of five test pits around the proposed building footprint, and preparing this geotechnical report summarizing our findings and providing geotechnical recommendations.

Our scope of services for this project did not include an environmental site assessment or further investigation for the presence or absence of hazardous or toxic material on, below, or around the site. Any statements in this report, or on the soil boring logs, regarding odors or unusual and suspicious conditions observed are for informational purposes and are not intended to constitute an environmental assessment.

1.0 Project and Site Description

We understand that the project consists of the construction of a new building at the site. The building will have a footprint of approximately 25,000 square feet and will consist of a single story wood framed structure. Several concepts have been investigated. At the time of this writing the concept is to construct the building as a slab-on-grade at elevation 69 feet. This is the basis for the recommendations contained in this report. The project will also include the construction of new parking lots and driveways and storm water treatment areas.

The existing site contains a paved parking area for the Portland Elks Club. The club's building lies on the eastern side of the parking lot. The lot is bordered to the west and north by areas of tall grass and woodlands. The driveway for Unum Life Insurance borders the site to the south and Congress Street borders to the east. Existing grade within the proposed building footprint generally ranges in elevation from 63 to 66 feet. A ditch with a bottom elevation of 61 feet is present in the south corner of the building. A gully with a bottom elevation of 58 feet is located at the west corner of the building.

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Information on interior and exterior column loads and locations was not available at the time of this writing. We understand that the single story wood frame building will be relatively light.

2.0 Subsurface Exploration and Laboratory Testing

Summit Geoengineering Services (SGS) observed the subsurface conditions with the drilling of 6 test borings and the excavation of 5 test pits on June 22, 2016. The test borings were performed by using a track mounted AMS Power Probe 9500 VTR rig. The borings were performed in and around the proposed building footprint at the locations shown on the Boring Location Plan in Appendix A. B-1 and B-2 were completed using 2.25-inch hollow stem augers and spoon sampling conducted at 5-foot depth intervals. B-3, B-4, B-5, and B-6 were completed using 3-inch casings and spoon sampling conducted at 5-foot depth intervals.

Five test pits were excavated by use of a LinkBelt 80X3 Mini excavator by Eastern Excavation, Inc. on June 22, 2016. The test pits were terminated in the glacial marine deposit or fill at depths between 6 and 8 feet.

All soil samples were visually classified (ASTM D2488). Test borings used SPT split spoon sampling (ASTM D1586). The test boring and test pit locations are shown on the Boring Location Plan in Appendix A. Boring and test pit logs are provided in Appendix B.

A sample of the silty clay at a depth of 20 feet was tested for natural moisture in accordance with ASTM D2216. The resulting moisture content of the sample was 44.8%.

3.0 Subsurface Conditions

The subsurface conditions presented herein are based on the findings from the test borings and test pits performed by SGS on June 22, 2016. These conditions are summarized in Table 1 in Appendix B.

3.1 Soil

The following subsurface layers and thicknesses were encountered in our geotechnical investigation, starting from the ground surface:

- ***Pavement,*** 5 inches (B-5) or ***Topsoil,*** 8 inches to 1 foot
- ***Fill,*** 1.0 foot to 7.5 feet
- ***Glacial Marine,*** 9.5 feet to greater than 20 feet
- ***Bedrock,*** 52.6 feet at B-2

The ***Pavement*** was encountered at the B-1, B-5, and B-6 locations and is 5 inches thick at all locations. The pavement is in good to fair condition.

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The ***Topsoil*** layer was encountered in the test pits and ranges in total thickness from 8 inches to 1 foot. The soil in this layer is described as a dark brown sandy silt with roots and rootlets, and classifies as ML in accordance with the Unified Soil Classification System (USCS). This layer is generally humid to damp.

The ***Fill*** was encountered at all the boring and test pit locations ranging in total thickness from 1 foot to roughly 7.5 feet. The fill consisted of an upper layer of brown medium sand overlying a reworked silty clay. At the TP-2 location, a 8" thick pavement layer was encountered at a depth of 2 feet. The upper layer was encountered in all borings and is described as a medium brown sand with little silt and classifies as SM in accordance with the USCS. Spoon penetration tests (SPT N-values) for the upper layer range from 2 blows per foot (bpf) to 26 bpf and average 13 bpf. This sub-layer is generally dry.

The soil below the sand layer is described as a reworked gray silty clay with rootlets throughout, classified as CL in accordance with USCS. This sub-layer was encountered at the B-2 and B-3 locations. SPT N-values for the layer range from 2 blows per foot (bpf) to 8 bpf and average 4 bpf. This sub-layer is generally moist.

The ***Glacial Marine*** deposit was encountered in all the boring and test pit locations and ranges in thickness from 9.5 feet to greater than 20 feet. This deposit consists of a silty clay upper sub-layer and either a soft clay or fine sand bottom sub-layer. The soil in the top sub-layer is described as an olive brown silty clay and classifies as CL in accordance with the USCS. SPT N-values for this sub-layer range from 2 to 32 bpf and average 13 bpf. This sub layer was encountered in all borings.

The fine sand bottom sub-layer was encountered in B-1 and B-3. The fine sand has a little silt and classified as SM in accordance with the USCS. SPT N-values for this sub-layer ranges from 4 bpf to 16 bpf and averages at 11 bpf. This sub-layer was wet in both locations.

The soft silty clay bottom sub-layer was encountered in B-2 and B-4. The sub-layer is described as a gray or olive gray silty clay and classifies as CL in accordance with the USCS. SPT N-values for this sub-layer range from 0 bpf (weight of hammer) to 6 bpf and average 2 bpf. The silty clay had a natural moisture content of 44.8% at a depth of 20 feet at the B-2 location.

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3.2 Bedrock

Bedrock was encountered at the B-2 location at a depth of 52.6 feet. Mapping by the Maine Geological Survey indicates the bedrock at the site is of the Precambrian Z Spring Point Formation consisting of green schist and amphibolites facies ranging from mafic to felsic volcanic rock.

3.3 Groundwater

Groundwater was encountered in B-1 and B-3 at depths of 11.5 feet and 15.6 feet respectively. Groundwater was estimated to be at a depth of 19 feet in B-2 based on the presence of soft clays. Slight mottling was observed at a depth of 5 feet at the B-2 location. Mottling can indicate a temporary rise in the groundwater level during periods of heavy rainfall.

4.0 Geotechnical Evaluation

The most significant geotechnical concern at this site is the presence of the soft silty clay layer at a depth of 18.5 feet at the B-2 location, the potential for soft silty clay at the B-3 location and their potential settlement from up to 13 feet of fill. Total settlement from the weight of the fill is estimated to range from 1 to 2.5 inches at these locations.

To allow construction of the building foundations on a conventional slab-on-grade and spread footing foundation, preloading of the softy silty clay soil will be required. Specific recommendations for preloading the site are presented below.

5.0 Foundation Recommendations

The following recommendations are based on adequately preparing the subgrade soils so that potentially significant settlement is avoided. This will require preloading the building footprint prior to constructing footings. We understand that this is an acceptable approach. Based on this the following recommendations are based on constructing the building on a conventional slab-on-grade and spread footing foundation after the preload period has been completed.

5.1 Allowable Bearing Pressure

Based on a successful preloading of the proposed building area, we recommend a maximum contact pressure of 3000 psf be used for the design of all footings. The maximum anticipated long term settlement (including both dead and live loads) associated with this contact pressure after completion of the preload will be less than 1 inch. This is within the allowable settlement for a building of this size. Differential settlement will be within tolerable limits.

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This bearing pressure and associated settlement are based on the following conditions:

- The entire building footprint is filled to the bottom of the floor slab and allowed to preload the site for the required period, estimated to be 1 to 3 months.
- All fill within the building footprint up to 12 inches below the bottom of the slab consists of Gravel Borrow, meeting the requirements of MDOT 703.20 (See Section 5.5), compacted to 95% of its maximum dry density (ASTM D1557).
- The settlement induced by the preload is monitored during the preload period.
- Exterior footings and interior footings in unheated areas are constructed at a minimum frost protection depth of 4 feet below finish exterior grade (Section 5.2). Interior footings in continuously heated areas are constructed at a minimum of 2 feet below FFE.
- All footings are constructed on the existing proof rolled fill, glacial marine deposit, or on imported Structural Fill (SF, see Section 5.5.1 for gradation requirements) overlying the existing fill or glacial marine deposit.
- Exposed glacial marine soil that becomes soft and wet due to rainwater or groundwater, is removed and ¾" crushed stone and/or geotextile to create a suitable base for the footing or placement of fill.

5.2 Frost Protection

The design air freezing index for the Portland area is approximately 1,200 degree F days (10 year, 90% probability). Based on this, a total of 4 feet of frost protection should be provided for the exterior footings and interior footings exposed to freezing temperatures. We recommend that the exterior of all foundation elements exposed to freezing temperatures be backfilled with Foundation Backfill (FB). The portion of FB passing the 3" sieve size should meet the following gradation requirements:

FOUNDATION BACKFILL	
Sieve Size	**Percent Finer**
3 inch	100
¼ inch	25 to 100
No. 40	0 to 50
No. 200	0 to 7

Reference: MDOT Specification 703.06, Type E (2014)

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The maximum particle size should be limited to 6 inches. Foundation backfill should be placed in 6 to 12 inch lifts and compacted to 95% of its optimum dry density determined in accordance with ASTM D1557. The compaction requirement can be reduced to 90% beneath landscaped areas.

5.3 Seismic Design

Based on the information obtained from our subsurface investigation, the site classifies as Site Class E "Soft Clay Soil" in accordance with the 2012 International Building Code. The following seismic site coefficients should be used:

SEISMIC DESIGN COEFFICIENTS – 2012 IBC	
Seismic Coefficient	**Site Class E**
Short period spectral response (S_S)	0.245
1 second spectral response (S_1)	0.079
Maximum factored spectral response (S_{MS})	0.611
1 second factored spectral response (S_{M1})	0.276
Design short period spectral response (S_{DS})	0.408
Design 1 second spectral response (S_{D1})	0.184

Soil exhibiting liquefaction characteristics were not observed in the explorations at the site.

5.4 Groundwater Control

On the day of the explorations, groundwater was encountered at the B-1 and B-3 locations at depths of 11.5 and 15.6 feet, respectively. Slight mottling was observed at the B-2 location. Based on this, groundwater is expected to be below the bottom of the proposed footings. Assuming that a slab-on-grade will be constructed on fill placed above the existing ground surface, foundation underdrains will not be necessary.

5.5 Slabs-on-Grade

We recommend that interior slabs-on-grade in heated areas be constructed on a minimum of 12" of Structural Fill (SF).

The portion of SF passing the 3" sieve shall meet the following gradation requirements:

STRUCTURAL FILL (SF)	
Sieve Size	**Percent finer**
3 inch	100
½ inch	35 to 80
¼ inch	25 to 65
No. 40	0 to 30
No. 200	0 to 7

Reference: MDOT Specification 703.06, Type D

The maximum particle size should be limited to 6 inches. Structural Fill should be placed in a maximum of 12 inch lifts and should be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557.

We recommend that exterior slabs exposed to freezing temperatures be constructed on a minimum of 30 inches of SF. Alternatively, exterior slabs can be constructed on 2 inches of insulation over 12 inches of structural fill. In this case the insulation should extend a minimum of 2 feet outside the edge of the slab.

We recommend that all fill beneath the SF within the building footprint consist of Gravel Borrow (GB). All topsoil and pavement should be removed within the building footprint prior to placing the GB. The exposed soil should be proof rolled with a minimum of 4 passes in each of two perpendicular directions with a 10 ton minimum (operating weight) vibratory roller prior to placing GB. Any soft, wet and disturbed areas should be removed and replaced with ¾" crushed stone and/or geotextile. GB should meet the following grain size requirements.

GRANULAR BORROW	
Sieve Size	**Percent Finer**
6 inch	100
¼ inch	0 to 70
No. 200	0 to 10

Reference: MDOT Specification 703.20, Gravel Borrow

GB shall be placed in a maximum of 12 inch lifts and compacted to 95% of its maximum dry density in accordance with ASTM D1557.

For the conditions described above, the slab can be designed using a subgrade modulus value of 200 pci.

6.0 Preload Recommendations

We recommend preloading the site by filling all areas within the building footprint and to a minimum width of 20 feet outside the building footprint. The preload should be placed up to the bottom of the slab elevation within the building footprint. The preload outside the building footprint should be placed to the proposed finished grade. We recommend all preload fill consist of GB as specified in Section 5.5. The exceptions are beneath the slab where the final 12 inch layer shall consist of SF (Section 5.5) and beneath pavement areas, where the upper layers should consist of the base and subbase soil recommended in Section 7 below.

The intent of the preload is to allow the weight of the fill to consolidate underlying soft soil with the intent to limit the total settlement after foundations are constructed to tolerable levels. Based on our analysis (based on computed and assumed physical properties of the soil within the building footprint) we anticipate settlement form the preload will be sufficiently completed within 2 to 3 months. The actual time may be less, depending on soil and stratigraphic characteristics which cannot be definitively established.

To determine when sufficient settlement has occurred to allow safe construction of the new foundations, we recommend that the settlement induced by the preload be monitored. SGS will fabricate, install, and take periodic readings on a total of three settlement plates, set at key locations, to be determined by us.

SGS will perform sufficient readings as required to minimize the preload time. Monitoring of the settlement plates would be performed at the following settlement schedule until the predicted settlement is achieved and/or when the rate of consolidation slows to an acceptable pace, as deemed appropriate by the geotechnical engineer.

- 2 x per day during filling
- 3 x per week for the first two weeks after placing fill
- 2 x per week for the second two weeks after placing fill
- 1 x per week thereafter.

It is critical that the settlement plates are installed after grubbing and prior to placing preload fill. SGS should be notified at this point during site work, so that the settlement monitoring plates can be installed at the appropriate time.

7.0 Pavement Section Recommendations

Based on the proposed finished grades, the pavement section will be constructed on the existing sand fill soil. The existing fill soil is considered moderately to highly frost susceptible. The mean annual freezing index for the Portland area is estimated at 900 degree days. Based on

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the subgrade soil and mean annual freezing index, the anticipated mean annual frost penetration depth is 36 inches.

Based on the above, we recommend a minimum total pavement section thickness of 50% of the mean annual frost penetration or approximately 18 inches. We further recommend that the pavement section consist of the following materials.

PAVEMENT SECTION MATERIALS AND THICKNESSES		
Material	**Thickness (in)**	**Specification**
Asphalt Surface Course	1	MDOT Type, 9.5 mm
Asphalt Binder Course	2	MDOT Type, 19 mm
Base Soil	3	MDOT 703.06 Type A
Subbase Soil	12	MDOT 703.06 Type D

We recommend the following gradation requirements be used for Base and Sub-base Soil:

MATERIAL SPECIFICATIONS		
Sieve Designation	**Percent Passing a 3-inch Sieve**	
	MDOT Type A (Base)	**MDOT Type D (Sub-base)**
3 Inch	100	100
2 Inch	100	--
½ Inch	45 – 70	35 - 80
¼ Inch	30 – 55	25 – 65
No. 40	0 – 20	0 – 30
No. 200	0 – 6	0 - 7

The material specifications are referenced to the Maine Department of Transportation Standard Specifications, 2014 Edition.

8.0 Storm Water Treatment Design

Information on the specific stormwater treatment techniques were not available for this report. In general the soil encountered at the test pit locations, excavated at or near the proposed stormwater treatment areas, generally consists of 8 to 12 inches of topsoil over sandy silt or re-worked clayey silt, over native olive-brown clayey silt. A layer of pavement was encountered at a depth of 2 feet at the TP-2 location. Large pieces of asphalt intermixed with brown silt and sand were encountered from a depth of 2 to 4 feet at the TP-3 location.

Groundwater was not observed in any of the test pits, excavated to depths ranging from 6.1 to 8 feet below the existing ground surface (limit of test pit excavation approximately elevation 60 feet to 58.5 feet).

For specific information at each proposed stormwater treatment area refer to the test pit logs in Appendix B.

9.0 Earthwork Considerations

Excavation for the construction of the foundations should be relatively easily accomplished in the fill and native soil at this site. The existing fill soils (sand and reworked silty clay fill) are classified as OSHA Type C soil. The native stiff silty clay glacial marine soil is classified as OSHA Type A soil.

Groundwater is not anticipated in shallow excavations. We recommend that temporary grades be sloped away from excavations to preclude water from filling trenches. We recommend that all concrete be placed on a subgrade soil free from standing water.

All exposed subgrade soil should be proofrolled prior to placing GB. Proofrolling should be performed by making a minimum of 4 passes in each of two perpendicular directions with a 10 ton minimum (operating weight) vibratory roller.

8.0 Closure

Our recommendations are based on professional judgment and generally accepted principles of geotechnical engineering and project information provided by others. Some changes in subsurface conditions from those presented in this report may occur. Should these conditions differ materially from those described in this report, SGS should be notified so that we can re-evaluate our recommendations.

Information on the magnitude, locations, and types of loads were not available for this report. SGS should review the structural loads once they have been determined to confirm that they do not exceed our assumptions.

It is recommended that this report be made available in its entirety to contractors for informational purposes and be incorporated in the construction Contract Documents. We recommend that SGS be retained to review final construction documents relevant to the recommendations in this report.

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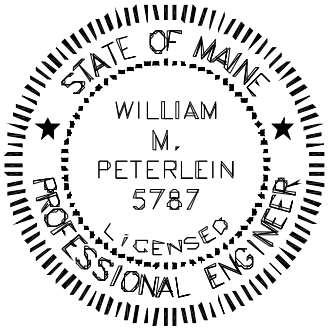
We appreciate the opportunity to serve you during this phase of your project. If there are any questions or additional information is required, please do not hesitate to call.

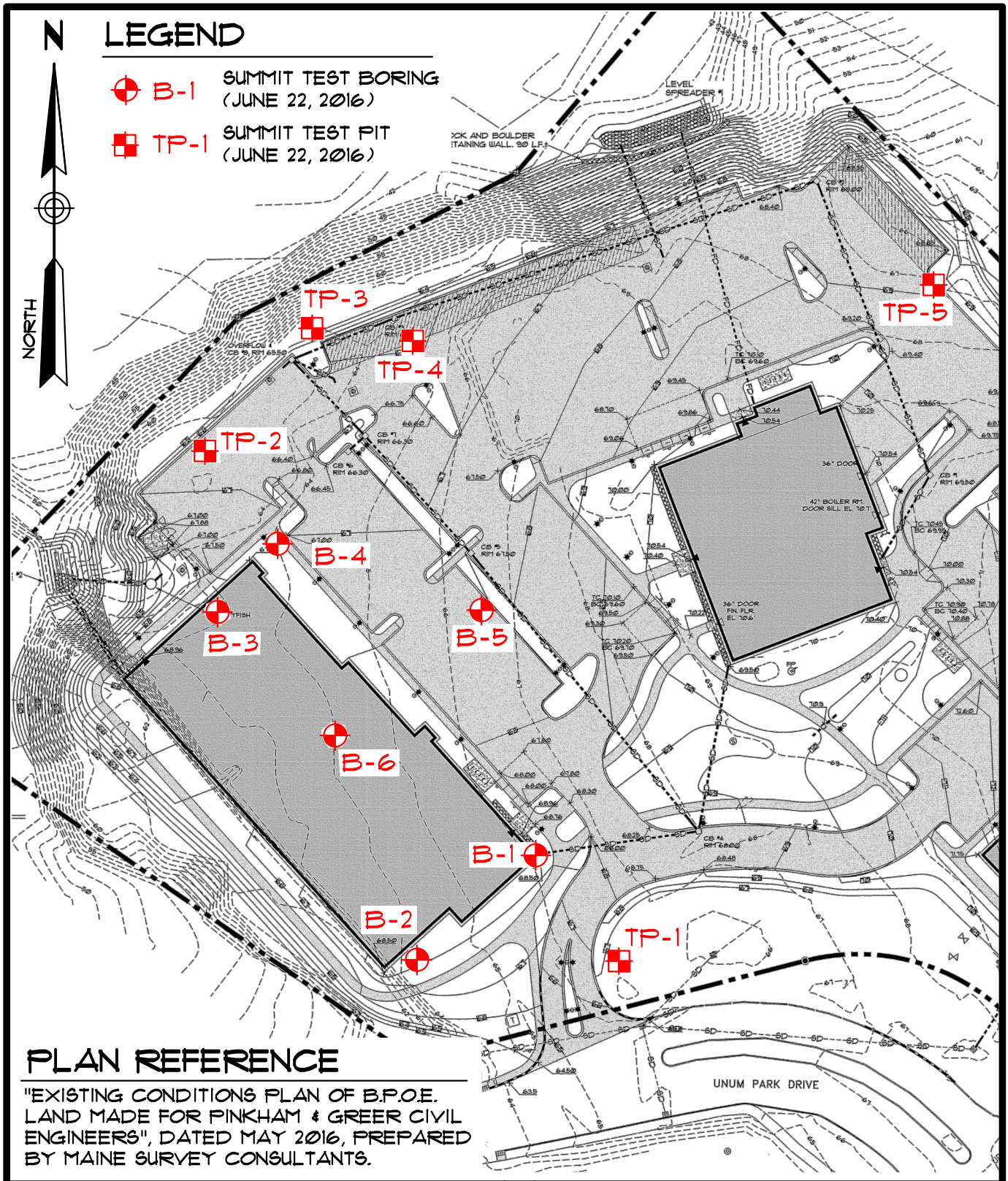
Sincerely,
Summit Geoengineering Services, Inc.

William M. Perterlein, PE
President and Principal Engineer



APPENDIX A

EXPLORATION LOCATION PLAN



PLAN REFERENCE

"EXISTING CONDITIONS PLAN OF B.P.O.E. LAND MADE FOR PINKHAM & GREER CIVIL ENGINEERS", DATED MAY 2016, PREPARED BY MAINE SURVEY CONSULTANTS.

TEST BORING LOCATION PLAN
PROPOSED BUILDINGS

1945 CONGRESS STREET - PORTLAND, MAINE

PREPARED FOR

NORTHLAND ENTERPRISES

DATE: 8-4-2016	DRAWN BY: KRF	CHECKED BY: WMP
JOB: 14226	SCALE: 1" = 80'	FILE: 14226 BOR

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APPENDIX B

EXPLORATION LOGS

EXPLORATION REPORT COVER SHEET

The exploration report has been prepared by the geotechnical engineer from both field and laboratory data. Differences between field logs and exploration reports may exist.

It is common practice in the soil and foundation engineering profession that field logs and laboratory data sheets not be included in engineering reports, because they do no represent the engineer's final opinion as to appropriate descriptions for conditions encountered in the exploration and testing work. The field logs will be retained in our office for review. Results of laboratory tests are generally shown on the borings logs or are described in the text of the report as appropriate.

Drilling and Sampling Symbols:

SS = Split Spoon
ST = Shelby Tube – 2" OD, disturbed
UT = Shelby Tube – 3" OD, undisturbed
HSA = Hollow Stem Auger
CS = Casing – size as noted
Sv = Vane Shear
PP = Pocket Penetrometer
RX = Rock Core – size as noted
Hyd = Hydraulic advance of probes
WOH = Weight of Hammer
WOR = Weight of Rod
GS = Grain Size Data
PI = Plasticity Index
LL = Liquid Limit
w = Natural Water Content
USCS = unified Soil Classification System

Water Level Measurements:

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations via observation or monitoring wells must be sought.

Gradation Description and Terminology:

Boulders:	Over 8 inches	Trace:	Less than 5%
Cobbles:	8 inches to 3 inches	Little:	5% to 15%
Gravel:	3 inches to No.4 sieve	Some:	15% to 25%
Sand:	No.4 to No. 200 sieve	Silty, Sandy, etc.:	Greater than 25%
Silt:	No. 200 sieve to 0.005 mm		
Clay:	less than 0.005 mm		

Density of Granular Soils and Consistency of Cohesive Soils:

CONSISTENCY OF COHESIVE SOILS		DENSITY OF GRANULAR SOILS	
SPT N-value blows/ft	**Consistency**	**SPT N-value blows/ft**	**Relative Density**
0 to 2	Very Soft	0 to 3	Very Loose
3 to 4	Soft	4 to 9	Loose
5 to 8	Firm	10 to 29	Compact
9 to 16	Stiff	30 to 49	Dense
17 to 32	Very Stiff	50 to 80	Very Dense
>32	Hard		

SUMMIT
GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-1**

Project:	Proposed Office Building
Location:	1945 Congress Street
City, State:	Portland, Maine
Project #:	14226
Sheet:	1 of 1
Chkd by:	

Drilling Co:	Summit
Driller:	C.Coolidge, P.E.
Summit Staff:	P. Spicer, M. Hardison
Boring Elevation:	66' +/-
Reference:	Topographic Plan by Pinkham & Greer Civil Engineers
Date started:	6/22/2016 Date Completed: 6/22/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	Hollow Stem Auger	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/22/2016	11.5'	54.5'	Measured in auger

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	PS-1		0 to 1.5	PUSH	65.5	5" of pavement		ASPHALT
1				PUSH		Brown medium SAND, little Gravel and Silt, humid,		
				PUSH		loose, SM		
2	S-1	24/18	1.5 to 3.5	7				FILL
				4				
3				6	63			
				5		Gray Clayey SILT, little Sand, humid, firm, ML		
4								
5								GLACIAL MARINE
	S-2	24/18	5 to 7	4		Olive gray Silty CLAY, little Sand, humid, very stiff,		
6				7		CL		
				10				
7				11				
8								
9								
10								
	S-3	24/24	10 to 12	4		Olive gray Silty CLAY, moist, stiff, CL		
11				5				
				6				
12				6				
13								
14								
15								
	S-4	24/12	15 to 17	4		Light brown medium to fine SAND, wet, compact,		
16				5		SP		
				6				
17				5				
18								
19								
20								
	S-5	24/12	20 to 22	8		Light brown medium to fine SAND, little Silt and		
21				8		Clay, wet, compact, SP		
				8				
22				8	44			
						End of boring at 22', no refusal		

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Project:	Proposed Office Building	Boring #:	**B-2**
Location:	1945 Congress Street	Project #:	14226
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit	Boring Elevation:	63' +/-
Driller:	C.Coolidge, P.E.	Reference:	Topographic Plan by Pinkham & Greer Civil Engineers
Summit Staff:	P. Spicer, M. Hardison	Date started: 6/22/2016	Date Completed: 6/22/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	Hollow Stem Auger	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/22/2016	19' +/-	44' +/-	Beginning of soft clays

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/12	0 to 2	1		Brown medium SAND with organics, dry, compact,		
1				3		SP		
				9				
2				9				FILL
3								
4								
5								
	S-2	24/24	5 to 7	1		Dark gray Silty CLAY, rootlets throughout, moist,	PP= 0.75 tsf	
6				2		blocky, slightly mottled, soft, CL	Reworked	
				2				
7				4				
					55.5			
8								
9								
								GLACIAL MARINE
10								
	S-3	24/24	10 to 12	4		Olive gray Silty CLAY, humid to moist, stiff, CL	PP= 2.5 to 3.0 tsf	
11				6				
				7				
12				8				
13								
14								
15								
	S-4	24/24	15 to 17	3		Olive gray Silty CLAY, moist, firm, CL	PP= 1.25 tsf	
16				3				
				3				
17				4				
18								
19								
20								
	S-5	24/24	20 to 22	WOH		Gray Silty CLAY, wet, soft, CL	PP= <0.5 tsf	
21				WOH				
				1			MC = 44.8%	
22				1				
							Dense drilling @ 45'	
					10.4	Probe refusal at 52.6', end of boring		

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Project:	Proposed Office Building	Boring #:	**B-3**
Location:	1945 Congress Street	Project #:	14226
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit	Boring Elevation:	63' +/-
Driller:	C.Coolidge, P.E.	Reference:	Topographic Plan by Pinkham & Greer Civil Engineers
Summit Staff:	P. Spicer, M. Hardison	Date started: 6/22/2016	Date Completed: 6/22/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/22/2016	15.6'	47.4'	Measured in casings

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/20	0 to 2	7		Light brown Sandy SILT with Cobble and organics,		
1				8		dry, stiff, ML		
				7				FILL
2				10				
3								
4								
5								
	S-2	24/20	5 to 7	1		Gray Silty CLAY, some Sand, rootlets throughout,	PP= 1.0 to 3.0 tsf	
6				2		moist, very loose, CL		
				1				
7				2	56			
8								
9								GLACIAL MARINE
10								
	S-3	24/24	10 to 12	6		Olive gray Silty CLAY, moist, very stiff, CL	PP= 3.5 to 4.0 tsf	
11				8				
				9				
12				12				
13								
14								
15								
	S-4	24/24	15 to 17	3		Olive gray Silty CLAY, moist, firm, CL	PP= 2.0 to 2.25 tsf	
16				3				
				4				
17				5				
18								
19								
20								
	S-5	24/24	20 to 22	4		Same as S-4		
21				3		Silty fine SAND, wet, loose, SM		
				2				
22				6	41			
						End of boring at 22', no refusal		

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT
GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-4**

Project: Proposed Office Building
Location: 1945 Congress Street
City, State: Portland, Maine

Project #: 14226
Sheet: 1 of 1
Chkd by:

Drilling Co: Summit
Driller: C.Coolidge, P.E.
Summit Staff: P. Spicer, M. Hardison

Boring Elevation: 64' +/-
Reference: Topographic Plan by Pinkham & Greer Civil Engineers
Date started: 6/22/2016 Date Completed: 6/22/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/22/2016	dry		

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/18	0 to 2	3		Light brown Silty SAND, some Clay, organics, and		
1				11		brick, dry, compact, SM		
				12				
2				13				FILL
3								
4								
5								
	S-2	24/18	5 to 7	4	58.5	Gray fine SAND with brown gravelly bits, SP		
6				3		Olive gray Silty CLAY, little Sand, humid, firm, CL		
				3				
7				4				
								GLACIAL MARINE
8								
9								
10								
	S-3	24/20	10 to 12	1		Dark gray Silty CLAY, some Sand, rootlets	PP= 0.25 to 2.5 tsf	
11				3		throughout, moist, stiff, CL		
				5				
12				6				
13								
14								
15								
	S-4	24/24	15 to 17	7		Olive gray Silty CLAY, moist, very stiff, CL	PP= 4.0 tsf	
16				9				
				10				
17				11				
18								
19								
20								
	S-5	24/24	20 to 22	1		Olive gray Silty CLAY, wet, soft, CL	PP= 1.0 to 1.25 tsf	
21				2				
				1				
22				3	42			
						End of boring at 22', no refusal		

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-5**

Project:	Proposed Office Building	Project #:	14226
Location:	1945 Congress Street	Sheet:	1 of 1
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit	Boring Elevation:	67' +/-
Driller:	C.Coolidge, P.E.	Reference:	Topographic Plan by Pinkham & Greer Civil Engineers
Summit Staff:	P. Spicer, M. Hardison	Date started: 6/22/2016	Date Completed: 6/22/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/22/2016	dry		

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
					66.5	5" of pavement		ASPHALT
1								
2	S-1	24/18	1.5 to 3.5	7		Brown medium SAND, little Silt, some mottling,		FILL
				5		humid, loose, SP		
3				5				
				5				
4					63			
5								
	S-2	24/24	5 to 7	4		Brown Silty CLAY, moist, stiff, CL	PP= 4.5 tsf	
6				5				GLACIAL MARINE
				8				
7				9				
	S-3	24/20	7 to 9	8		Brown Silty CLAY, some Sand, moist, stiff, CL		
8				12				
				11				
9				10	58			
						End of boring at 9', no refusal		
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-6**

Project: Proposed Office Building
Location: 1945 Congress Street
City, State: Portland, Maine

Project #: 14226
Sheet: 1 of 1
Chkd by:

Drilling Co: Summit
Driller: C.Coolidge, P.E.
Summit Staff: P. Spicer, M. Hardison

Boring Elevation: 64' +/-
Reference: Topographic Plan by Pinkham & Greer Civil Engineers
Date started: 6/22/2016 Date Completed: 6/22/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/22/2016	dry		

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
					63.5	5" of pavement		ASPHALT
1								
	S-1	24/18	1.5 to 3.5	6		Light brown medium to fine SAND, trace Silt,		
2				6		humid, compact, SP		FILL
				6				
3				6				
					60.5			
4								
5								
	S-2	24/24	5 to 7	6		Olive gray Silty CLAY, some Sand, moist, very stiff,	PP= 2.0 to 2.25 tsf	GLACIAL MARINE
6				8		CL		
				9				
7				16				
8								
9								
10								
	S-3	24/12	10 to 12	5		Brown Clayey SAND, some Silt, moist, compact,		
11				8		SM		
				6				
12				8				
13					50.5			
						Refusal at 13.5', likely cobble, end of boring		
14								
15								
16								
17								
18								
19								
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES	TEST PIT LOG	Test Pit # TP-1
	Project: Proposed Office Building 1945 Congress Street Portland, ME	Project #: 14226 Groundwater: None Observed
Contractor: Eastern Excavation, Inc.	Ground Surface Elevation: 66 ft. +/-	
Equipment: Link Belt 80x3 Mini	Reference: Site / Grading Plan by Pinkham and Greer	
Summit Staff: M. Hardison, E.I.	Date: 6/22/2016	Weather: 70°, Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
	8" Dark brown Sandy SILT, roots and rootlets, humid, ML	TOPSOIL
1	Dark brown - tan Sandy SILT, Gravel and Cobbles, trace rootlets, ML	0.66' FILL
2		
3	Intermixed SILT from below	
	Olive brown Clayey SILT, little Sand, humid, slightly blocky, ML	2.8' Mottling starting @ 3.1' GLACIAL MARINE DEPOSIT
4		Increased mottling @ 4.0'
5	Reddish brown Clayey SILT, trace fine Sand and Gravel, humid, blocky, ML	4.5'
6		
	End of Test Pit @ 6.1', no refusal	6.1'
7		
8		

SUMMIT GEOENGINEERING SERVICES	TEST PIT LOG	Test Pit # TP-2
	Project: Proposed Office Building 1945 Congress Street Portland, ME	Project #: 14226 Groundwater: None Observed
Contractor: Eastern Excavation, Inc.	Ground Surface Elevation: 64 ft. +/-	
Equipment: Link Belt 80x3 Mini Excavator	Reference: Site / Grading Plan by Pinkham and Greer	
Summit Staff: M. Hardison, E.I.	Date: 6/22/2016	Weather: 70°, Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	10" dark brown Sandy SILT, lots of roots and rootlets, ML	TOPSOIL
2	Light brown Sandy SILT, little Gravel, trace Clay, humid, ML	0.8' FILL
		2.0' OLD PAVEMENT
3	Olive brown Clayey SILT, little Sand, damp, ML	2.2' GLACIAL MARINE DEPOSIT
4		Mottling starting @ 3.5'
5	Same as above, moist	Pocket Penetrometer = 5,000 psf medium digging, softer with depth
6		
7		
8	End of Test Pit @ 7.2', no refusal	7.2'

SUMMIT GEOENGINEERING SERVICES	TEST PIT LOG	Test Pit # TP-3
	Project: Proposed Office Building 1945 Congress Street Portland, ME	Project #: 14226 Groundwater: None Observed
Contractor: Eastern Excavation, Inc.	Ground Surface Elevation: 64 ft. +/-	
Equipment: Link Belt 80x3 Mini	Reference: Site / Grading Plan by Pinkham and Greer	
Summit Staff: M. Hardison, E.I.	Date: 6/22/2016	Weather: 70°, Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	GEOLOGIC/GENERAL
1	11" dark brown Sandy SILT, lots of roots and rootlets, damp, ML	TOPSOIL
2	Olive brown Clayey SILT, little intermixed fine Sand and Gravel, Cobble pieces, humid, ML	0.9' FILL Pocket Penetrometer = > 9000 psf
3	Large pieces of asphalt, intermixed brown Silt and Sand, trace Clay and Gravel, moist	Pile of asphalt starting @ 2' Very hard digging
4		
5	Olive brown Clayey SILT, little intermixed fine Sand, little Gravel, and cobble pieces, moist, ML	4.0' GLACIAL MARINE DEPOSIT
6		Medium - hard digging
7		
8	End of Test Pit @ 7', no refusal	7'

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # **TP-4**

Project: Proposed Office Building
1945 Congress Street
Portland, ME

Project #: 14226

Groundwater: None Observed

Contractor: Eastern Excavation, Inc.	Ground Surface Elevation: 65 ft. +/-
Equipment: Link Belt 80x3 Mini	Reference: Site / Grading Plan by Pinkham and Greer
Summit Staff: M. Hardison, E.I.	Date: 6/22/2016 — Weather: 70°, Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	12" dark brown Sandy SILT, lots of roots and rootlets, ML	TOPSOIL
2	Brown - orange, medium to coarse SAND, some Gravel, brick fragments, SP	1.0' FILL Medium digging
3	Gravel and Cobble pieces (angular), intermixed Sand and Silt, glass and metal fragments, rubble pieces, dry	2.0' Hard digging Maximum particle size = 22"
4		
5		
6	Same as above, metal fragments	
7	End of Test Pit @ 6.5', no refusal	6.5'
8		

SUMMIT GEOENGINEERING SERVICES	TEST PIT LOG	Test Pit # TP-5
	Project: Proposed Office Building 1945 Congress Street Portland, ME	Project #: 14226 Groundwater: None Observed
Contractor: Eastern Excavation, Inc.	Ground Surface Elevation: 67 ft. +/-	
Equipment: Link Belt 80x3 Mini	Reference: Site / Grading Plan by Pinkham and Greer	
Summit Staff: M. Hardison, E.I.	Date: 6/22/2016	Weather: 70°, Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	Light brown Sandy GRAVEL, little to some Silt, slightly mottled at bottom, humid, GW	FILL
2	Dark gray Silty CLAY, intermixed Sand, organic odor, moist, CL	1.5' GLACIAL MARINE DEPOSIT Large roots @ 20"
3		Easy digging
4		Pocket Pentrometer = 3,000psf
5		
6	Same as above, decreasing amount of Sand with depth, slightly blocky	
7		
8		
	End of Test Pit at 8', no refusal	8'

APPENDIX C

LABORATORY TEST REPORTS

SUMMIT
GEOENGINEERING SERVICES

Laboratory Determination of Water (Moisture) Content of Soil ASTM D2216 / D4643

PROJECT NAME:	Proposed Office Building	PROJECT #:	14226
PROJECT LOCATION:	1945 Congress St, Portland, ME	DRYING METHOD:	Oven Dried
CLIENT:	Northland Enterprises, Inc.	DESCRIPTION:	Glacial Marine Clay
SOURCE:	Boring B-2	TECHNICIAN:	Erika Stewart, E.I.
COLLECTION DATE:	6/22/2016	TESTING DATE:	06/23/16

Location	Sample No.	Depth	Moisture Content	Remarks
B-2	S-5	20' - 22'	44.8%	Gray Clay

REMARKS: