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Geotechnical Report

Proposed Residential/Retail Building

20 Thames Street, Portland, Maine

Client
Essexnorth Portland, LLC
PO Box 394
Topsfield, MA 01983

Project #: 16300
Date: 7/13/17

SUMMIT
GEOENGINEERING SERVICES

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com

July 13, 2017
Summit #16300

Ara Aftandilian
Essexnorth Portland, LLC
PO Box 394
Topsfield, MA 01983

Reference: Geotechnical Engineering Report – Proposed Retail/Residential Building
20 Thames Street, Portland, Maine

Dear Ara;

Summit Geoengineering Services, Inc. (SGS) has completed a geotechnical investigation for the proposed mixed use building at the site referenced above. Our scope of services included the interpretation of geotechnical borings performed by Haley and Aldrich (H&A), the drilling of 18 probes within the proposed development area to supplement geotechnical borings performed H&A, 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.

The recommendations provided within this geotechnical report are based partially upon the previous explorations performed by H&A at the site and are contingent upon a site visit during construction to observe the subgrade conditions.

1.0 Project and Site Description

We understand that the project consists of the construction of a new 6 story building at 20 Thames Street in Portland, Maine. We further understand that the new building will have a footprint of 8,706 square feet, will be a steel-framed structure, and will be a mixture of retail space and residential units. Based on building concepts provided by you, we understand that the first floor will be at-grade parking in the northern portion of the building and retail space in the southern portion. The upper 5 floors will consist of residential units.

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Based on the Site Grading Plan prepared by Ransom Consulting Engineers, the existing grade within the site is relatively flat, ranging from approximately elevation 15 feet to 16 feet. During our explorations at the site, there was a new hotel being constructed at the neighboring lot to the east, and the proposed building site at 20 Thames Street was being used to stockpile soil and store equipment. Existing grades at the site may vary slightly from those shown on the grading plan due to this site activity.

Anticipated structural loads were provided to us by Veitas & Veitas Engineers, Inc. (V&V) for the proposed building. Based on these loads and a preliminary foundation plan prepared by V&V, we understand that isolated footing widths are anticipated to range from 3.5 feet to 11.5 feet, and strip footings will have a width of approximately 24 inches.

2.0 Subsurface Explorations and Laboratory Testing

2.1 Subsurface Explorations – Haley and Aldrich (2005 and 2007)

SGS was provided a geotechnical report, containing boring and rock core logs, prepared by Haley and Aldrich (H&A) entitled "Report on Subsurface Explorations and Geotechnical Engineering Recommendations – The Watermark, Portland, Maine" dated May 16, 2007. Based on the information contained within this report, H&A performed a total of 6 borings within and surrounding the proposed development area in September/October of 2005 and March of 2007. These borings included the following (bedrock depths are provided next to the boring title):

HA05-16 – Bedrock @ 11.6 ft.
HA05-18 – Bedrock @ 6.6 ft.
HA05-19 – Bedrock @ 5.0 ft. to 7.6 ft.
HA05-21 – Bedrock @ 16.7 ft.
HA05-22 – Bedrock @ 10.3 ft.
HA07-101 – Bedrock @ 10.0 ft.

Note that all borings listed above were advanced to refusal and rock cores were collected. Based on the information provided within the H&A logs, the borings were performed using 3" to 4" steel casing with roller bit or with 2.5" inside diameter hollow steam augers. Split spoon sampling was performed continuously for the borings, except for HA05-22 and HA07-101, where no samples were collected.

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2.2 Subsurface Explorations – Summit Geoengineering Services (2017)

SGS observed the subsurface conditions at the site with the drilling of 18 probes on June 9, 2017. All explorations were performed by Summit Geoengineering Services (SGS), using a rubber track mounted Power Probe 9500 VTR. The probes were advanced using 2½-inch solid stem augers to a depth of refusal, encountered at 5.5 to 15.7 feet.

The probes were located by SGS prior to drilling by taping/pacing from existing features. The probe locations were based on proposed critical footing locations from the foundation plan prepared by V&V. These locations can be seen in the SGS Exploration Plan in Appendix A. The H&A logs can be found in Appendix B.

2.3 Laboratory Testing

Laboratory testing, consisting of two Grain Size Analyses (*ASTM D422*), was performed by H&A on fill soil specimens collected from split spoon samples obtained during Boring HA05-19 and HA05-21 at depths 0.5' to 4.5' and 2.0' to 6.0', respectively. A summary of the results are presented below. Detailed results can be found in Appendix C.

Table 1: Laboratory Test Results

GRAIN SIZE ANALYSIS RESULTS – FILL						
Boring	**Sample**	**Depth (ft.)**	**Composition**			**USCS**
			Gravel	Sand	Silt/Clay	
HA05-19	S-1 & S-2	0.5 to 4.5	15.0%	76.0%	9.0%	SW-SM
HA05-21	S-2 & S-3	2.0 to 6.0	16.0%	72.0%	12.0%	SP-SM

USCS = Unified Soil Classification System, SM-SC = Silty Sand/Clayey Sand

3.0 Subsurface Conditions

3.1 Soil

The soil conditions within the proposed building area consist of fill overlying bedrock. Bedrock ranges in depth from 5.5 to 15.7 feet below existing ground surface.

Fill. In general, the fill soil consists of a mixture of sand, silt, and gravel with occasional brick, cement, wood, and glass pieces throughout the layer. Brick pieces were encountered during the probe explorations performed by SGS. Standard Penetration Number (SPT-N) of the fill ranges from 5 to 53 with an average of 21 blows per foot (bpf). The fill is loose to dense, dry to wet

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(generally increasing moisture with depth) and classifies as SW-SM or SP-SM in accordance with the Unified Soil Classification System. Based on grain sizes performed on collected samples, the gravel content of the fill ranges from 15% to 16%, the sand content ranges from 72% to 76%, and the silt content ranges from 9% to 12%.

A fill stockpile, which was stored on site, was examined by SGS in December of 2016 (See Photo 1). Additionally, fill exposed in various excavations for construction of the nearby hotel were also observed by SGS (See Photo 2). In general, the fill was observed to consist entirely of mineral soil and small-sized inorganic demolition debris (bricks, etc.).

Photo 1: Stockpile within proposed building footprint, December 2016

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Photo 2: Foundation excavation for hotel directly east of the proposed building footprint

3.2 Bedrock

Bedrock was encountered within the proposed building footprint ranging from 5.5 feet to 15.7 feet below existing ground surface (elevation -0.6 feet to 10.4 feet). In general, the bedrock surface appears to be sloping downward in a northeast direction towards the AC Hotel building neighboring the property.

Rock cores were performed in all 6 of the H&A borings at the refusal depths encountered during drilling. Rock core depths ranged from 2.9 feet to 26.4 feet below the bedrock surface. Rock Quality Designation (RQD) of the collected rock core samples, measured as the percentage of recovered rock in lengths greater than or equal to 4 inches, ranged from 0 to 100 with an average of 66. In general, the deeper the recovered core sample was, the higher the resulting RQD. H&A classified the rock as the following: "…hard to moderately hard, fresh to slightly weathered SCHIST."

The following table presents the bedrock depths and corresponding elevations encountered in the SGS probes and the H&A borings. It should be noted that the ground surface elevations for the probes were surveyed on the day of the probes using a DMH-3 rim elevation of 14.49 feet as shown on the Ransom Grading Plan. All ground surface elevations and bedrock depths for the H&A borings were obtained from the H&A report and boring logs.

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Table 2: Bedrock Depth and Elevation Summary

Bedrock Depths and Elevations			
[1]Exploration	[2]Ground Surface Elevation (ft.)	Depth to Bedrock (ft.)	Bedrock Elevation (ft.)
P-1	15.1’	7.3’	7.8’
P-2	15.1’	15.7’	-0.6’
P-3	15.3’	9.2’	6.1’
P-4	15.0’	10.3’	4.7’
P-5	14.9’	9.0’	5.9’
P-6	15.3’	12.5’	2.8’
P-7	15.6’	7.4’	8.2’
P-8	15.4’	10.5’	4.9’
P-9	15.4’	12.7’	2.7’
P-10	15.9’	6.2’	9.7’
P-11	15.9’	5.5’	10.4’
P-12	15.5’	6.3’	9.2’
P-13	15.7’	6.4’	9.3’
P-14	16.3’	6.5’	9.8’
P-15	16.4’	6.8’	9.6’
P-16	15.9’	6.9’	9.0’
P-17	16.9’	7.9’	9.0’
P-18	16.3’	8.7’	7.6’
[3]HA05-16	*18.0’ +/-*	*11.6’*	*6.4’ +/-*
[3]HA05-18	*16.5’ +/-*	*6.6’*	*9.9’ +/-*
HA05-19	15.4’ +/-	5.0’ to 7.6’	10.4’ to 7.8’ +/-
[3]HA05-21	*16.5’ +/-*	*16.7’*	*-0.2’ +/-*
HA05-22	15.0’ +/-	10.3’	4.7’ +/-
[3]HA07-101	*15.5’ +/-*	*10.0’*	*5.5’ +/-*

[1]Note: Probes performed by SGS in 2017, Borings performed by H&A in 2005/2007. All data shown from borings was taken from the H&A report and logs.
[2]Note: Ground surface elevation for the probes was surveyed on the day of the exploration using a DMH-3 rim elevation on Thames Street of 14.49’, as shown on the Ransom grading plan.
[3]Note: Boring performed outside of the proposed building footprint.

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3.3 Groundwater

H&A installed 3 monitoring wells during their explorations at the site in areas nearby the proposed building location. Groundwater was found to vary between elevations 4.3 feet to 7.2 feet, close to or slightly below the bedrock surface elevation.

4.0 Geotechnical Evaluation

Based on the geotechnical information collected at the site and the structural loads and footing depth/locations provided to us by V&V, we believe that the new building foundation can be constructed using conventional spread footings on frost wall with a slab-on-grade. The subgrade beneath the footings and slabs should be prepared in accordance with the recommendations provided in Section 5.

We have identified the following geotechnical considerations in regard to the construction of the proposed foundation:

- Need for rock anchors due to the large uplift loads on the foundation.
- Potential for differential settlements between adjacent footings constructed on soil and footings constructed with rock anchors (eliminating vertical deflection).
- Potential for bedrock at or above the proposed bottom of footing elevation.

Based on the description of the fill samples recovered in the H&A borings, observations by SGS of a stockpile and excavations near the site, and the auger spoils during our probe explorations, we anticipate that some man-made material (brick, ash, coal) may be present within the existing fill. While this material does not pose an issue in small amounts, a significant presence of these soils beneath footings may pose a settlement risk due to its compressibility or degradation potential. We recommend that significant amounts of these materials, if encountered, be removed from beneath proposed footings, as outlined in Section 5. We also recommend that SGS be retained to perform footing subgrade inspections in order to verify that the subgrade is suitable for footing support.

Based on discussions with Veitas and Veitas Engineers (V&V), we understand that uplift loads on some of the isolated footings will exceed the dead weight on the footings and the overburden soil weight for practical footing depths. We anticipate that rock anchors will be required to resist these uplift loads. We have provided geotechnical recommendations for rock anchors in Section 5.

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Footings which are constructed with conventional rock anchors will have limited or no vertical deflection due to the restraint of the rock anchor bar. Footings which are constructed on existing fill are anticipated to have a maximum 1.0" vertical deflection based on the total dead and live load. To eliminate the potential for excessive differential settlement between these two types of footings, we recommend footings which include uplift anchors are constructed in accordance with the recommendations provided in Section 5.5.2.

Borings performed by H&A and probes performed by us indicate that bedrock depth ranges from 5.5 feet to 15.7 feet below existing ground surface. Based on the footing depths provided by V&V, we anticipate that all of footings will be at or above bedrock elevation. If bedrock is encountered in the footing excavation above the bottom of footing elevation, we anticipate that it will be a minimal amount that requires removal and that standard breaker/hoe ram equipment will be adequate to remove the bedrock.

5.0 Geotechnical Recommendations

5.1 Foundation Bearing Pressure

Based on the proposed footing depths, we anticipate that existing fill soil will be exposed beneath footings for the building. Assuming that the recommendations below are followed, we recommend an allowable bearing pressure of 3,000 psf be used to proportion the footings for the new building. If the recommendations provided below are followed, we anticipate that post construction total settlement will be less than 1 inch and differential settlement within the building will be less than 0.5 inches between adjacent column footings:

- Prior to footing excavations, the entire building footprint should be proofrolled with a minimum of 12 passes (6 north/south and 6 east/west) with a 10 ton minimum operating weight vibratory roller.
- All footings exposed to freezing temperatures are constructed at the recommended frost protection depth of 3.5 feet below exterior finish grade, constructed on a minimum of 6" of ¾" crushed stone (for a total frost-protected depth of 4.0 feet). Interior footings should be constructed at a minimum depth of 1.5 feet below FFE and constructed on a minimum of 6" of ¾" crushed stone.
- If soft or unsuitable fill is encountered at the bottom of the excavation, it should be removed and replaced with ¾" crushed stone prior to proofrolling. If a significant amount of soft/unsuitable soils are encountered, SGS should be notified. Unsuitable soils should be removed from beneath footings at a 2V:1H taper beyond all edges of the footing.

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- Exposed soil at the bottom of footing trenches is proofrolled with a minimum of 6 passes with a large (minimum 10 tons) vibratory roller. Proofrolling should be performed on dry, unfrozen soils. Any loose or soft areas identified during the proofrolling process should be removed and replaced with ¾" crushed stone.
- If bedrock is exposed in the footing excavation, any loose or weathered rock is removed from beneath the footing area to expose a hard, competent bedrock surface. Any large gaps or voids created by removing loose pieces of bedrock are filled with ¾" crushed stone, flowable fill, or lean concrete.
- All placed fill within the building footprint consists of Structural Fill (SF, see Section 5.6 for gradation and compaction requirement) or ¾" crushed stone.

Summit Geoengineering Services (SGS) should be retained to perform a subgrade inspection of the exposed footing subgrade soil for the reinforced retaining wall footings prior to placing the 12" of crushed stone on top of the subgrade.

5.2 Uplift and Sliding Capacity

Assuming that the recommendations presented in this report are followed, Foundation Backfill (FB, see Section 5.3) can be assumed to be the soil on the exterior of the foundation walls, Structural Fill (SF, see section 5.6) can be assumed to be on the interior of foundation walls and as backfill for interior footings, and ¾" crushed stone can be assumed to be at the base of footings.

PARAMETER	[1]Foundation Backfill	[1]Structural Fill	¾" Crushed Stone
Total Natural (moist) Unit Weight (γ_t)	125 pcf	130 pcf	140 pcf
Saturated (buoyant) Unit Weight (γ_s)	63 pcf	58 pcf	78 pcf
Friction Coefficient (f)	0.40	0.45	0.60
Passive Earth Pressure Coefficient (K_p)	3.0	3.0	8.0
At Rest Earth Pressure Coefficient (K_o)	0.47	0.44	0.36
Active Earth Pressure Coefficient (K_a)	0.30	0.33	0.20
Effective Friction Angle (ϕ')	32^0	34^0	40^0
Undrained Shear Strength (S_u)	0	0	0 psf

[1]Based on 95% compaction of by ASTM D1557, Modified Proctor Test Method.

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Uplift capacity of the foundation includes the dead weight of the foundation, friction of the mobilized soil along the soil-to-soil shear plane, and weight of soil above the footings. Sliding resistance of the foundation includes passive resistance of the soil against the side of the foundation wall and the friction between the bottom of the footing and the underlying soil/bedrock. If additional sliding or uplift capacity is required, bedrock doweling or rock anchors should be considered.

5.2.1 Rock Anchors

Based on discussions with V&V, we understand that rock anchors will be required for some of the proposed footings to withstand uplift loads. Based on the recovered rock core samples at the site, we recommend an ultimate rock-grout bond stress of 120 psi be used in the design of the rock anchors. We recommend that the bonded zone start at a minimum length of 10 feet below the bedrock surface to allow for a free stressing zone. We further recommend that the rock anchors be installed with a Class 1 corrosion protection system. A minimum factor of safety of 2.5 should be used in bond stress calculations. If a 6" diameter hole is used for an anchor, this provides approximately 16 kips of uplift resistance per foot of bonded length.

To ensure adequate rock breakout capacity, we recommend that bond length of the anchors be a minimum of 5 feet. The calculation of the rock breakout was based on a failure cone projected 45^{o} from the midpoint of the bonded zone, using a rock unit weight of 150 pcf and a factor of safety of 1.0 on the rock weight resistance. Based on this, we recommend a minimum rock anchor spacing of 5 feet. We recommend a maximum of two rock anchors per footing. In total, the rock anchor tendons should extend a minimum of 15 feet below bedrock surface (free stress zone + bond zone). Centralizers should be used for all installed anchors.

All installed anchors should be proof tested to a minimum of 133% of the design load, not to exceed 60% of the tensile strength of the steel. We recommend that the proof testing of all of the anchors be performed in accordance with the Post Tensioning Institute 2014 recommendations.

To reduce post-construction differential settlement, we recommend that rock anchors be constructed through the footings using a bond-breaker system between the cast-in-place concrete and the rock anchor bar. This will allow the footing to compress vertically under the dead load of the building framing system during construction. Once construction is nearly complete and the dead load has been applied to the footings, the rock anchor bar and plate system can be tightened and/or grouted if necessary.

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5.3 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 4.0 feet of frost protection should be provided for the exterior footings and interior footings exposed to freezing temperatures. Interior footings constructed in continuously heated areas can be constructed at a depth of 2.0 feet below interior grade. Since the footings will be constructed on a minimum of 6 inches of drained crushed stone, the bottom of exterior and interior footings may be constructed at a minimum depth of 3.5 feet and 1.5 feet, respectively.

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:

Table 3: Foundation Backfill - Soil Gradation

FOUNDATION BACKFILL	
Sieve Size	**Percent Finer**
3 inch	100
¼ inch	25 to 100
No. 40	0 to 50
No. 200	0 to 6*

Reference: MDOT Specification 703.06, Type E (2014)
*Reduced from 7% to 6% from Type E Standard

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.

5.4 Seismic Design

Based on the summary of field results we recommend Site Class C be used in accordance with the 2006 or 2009 International Building Code. The following seismic site coefficients should be used:

Table 4: Seismic Design Coefficients

SUBGRADE SITE SEISMIC DESIGN COEFFICIENTS - IBC	
Seismic Coefficient	**Site Class C**
Short period spectral response (S_S)	0.313
1 second spectral response (S_1)	0.077
Maximum short period spectral response (S_{MS})	0.376
Maximum 1 second spectral response (S_{M1})	0.130
Design short period spectral response (S_{DS})	0.251
Design 1 second spectral response (S_{D1})	0.087

Subgrade conditions are not considered susceptible to liquefaction during seismic events.

5.5 Groundwater Control

Based on observed groundwater levels, groundwater is anticipated to be below the bottom of footing elevation for the proposed exterior and interior footings. However, due to the potential for seasonal groundwater fluctuations and to mitigate the flow of surface water towards the building, we recommend perimeter underdrains be installed along the entire exterior foundation walls for the buildings. Perimeter underdrains should consist of 6 inch rigid perforated PVC placed adjacent to the exterior footings and surrounded by a minimum of 12 inches of crushed stone wrapped in filter fabric to prevent clogging from the migration of the fine soil particles in the foundation backfill soils. The underdrain pipe should outlet to a location where it will be free flowing. Where exposed at the ground surface, the ends of pipes should be screened or otherwise protected from entry and nesting of wildlife, which could cause clogging.

5.6 Ground Floor Slab-on-Grade and/or Pavement

This section provides recommendations for a concrete slab-on-grade or pavement surface in the event that both types of surface are used for the ground floor area. Additionally, this section will provide recommendations for both heated and unheated conditions. We anticipate that existing fill will be exposed in the slab excavation.

5.6.1 Concrete Slab-on-Grade

We recommend that the slab for the new building be constructed on a minimum of 12” of Structural Fill (SF, see table below) or ¾” crushed stone. All exposed soil should be proofrolled with a minimum of 2 passes in each of two perpendicular directions with a 10 ton minimum

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(operating weight) vibratory roller. Any exposed rubble, debris, or other non-soil materials should be removed and replaced with SF or ¾" crushed stone. If the slab area is unheated, the slab subgrade thickness should be increased to 24" and the slab should be constructed on 2" of rigid insulation. Alternatively, the subgrade soil thickness could be increased to 48" (including the slab) if rigid insulation is not used.

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

Table 5: Structural Fill - Soil Gradation

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 SF particle size should be limited to 6 inches. Structural Fill should be placed in 6 to 12 inch lifts and should be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557. If ¾" crushed stone is used, it should be placed in 12" lifts and be compacted with a minimum of 4 passes in each of two perpendicular directions with a vibratory roller. For the conditions described above, the slab can be designed using a subgrade modulus value of 175 pci.

5.6.2 Pavement

The mean annual freezing index for the Portland area is estimated at 900 degree days. Based on the subgrade and mean annual freezing index, the anticipated mean annual frost penetration depth is 36 inches.

We recommend a minimum total section thickness of 18 inches for pavement in unheated areas. The Subbase soil thickness can be reduced to 6" if the area is continuously heated. We further recommend that the pavement section consist of the following materials:

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Table 6: Pavement Section Thicknesses

MATERIAL	THICKNESS (in)	SPECIFICATION
Asphalt Surface Course	1	MDOT 703.09 Type 9.5 mm or Type 12.5 mm
Asphalt Binder Course	2	MDOT 703.09 Type 19 mm
Base Soil	3	MDOT 703.06 Type A
Subbase Soil	12	MDOT 703.06 Type D

For portions of the pavement subjected to light traffic loads of cars and light trucks we recommend MDOT Type 9.5mm surface course. The following specifications are for MDOT base and subbase gravel:

Table 7: Pavement Base and Subbase Gradations

SIEVE SIZE	Percent Passing a 3-inch Sieve	
	MDOT Type A (Base)	MDOT Type D (Subbase)
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

Reference: MDOT Specification 703.06, Aggregate for Base and Subbase (2014)

The recommendations above can be used for exterior pavement areas.

6.0 Earthwork Considerations

The table below summarizes the OSHA general excavation guidelines for occupied excavations for the soils encountered in our geotechnical explorations. All permissible slopes below apply to soil above groundwater table:

Table 8: OSHA Permissible Slopes

OSHA Excavation Slopes		
Soil	**OSHA Classification**	**Permissible Slope**
Existing Fill	Type C	1.5H:1V

The proofrolling recommendations provided in Section 5.1 and 5.6 are critical for the successful performance of the new foundation. All proofrolling should be performed with a vibratory roller with a minimum operating weight of 10 tons, and should be conducted in accordance with the minimum number of passes described in the sections above. Any soft or unsuitable soil is identified during the proofrolling, it should be removed and replaced with ¾" crushed stone.

We do not anticipate that bedrock will be encountered in the footing excavations. However, if bedrock is encountered in the footing excavation, we anticipate that it will be a minimal amount that requires removal and that standard breaker/hoe ram equipment will be adequate to remove the bedrock.

It is possible that the existing soil may meet the gradation requirements for Foundation Backfill (FB) or Structural Fill (SF) if blended with ¾" or 1 ½" crushed stone. We recommend that if this blending occurs that a representative sample of the blend is tested for its accordance with the FB and SF requirements.

Surface water should be redirected from excavation areas. Where softened, we recommend the subgrade at the base of the excavation be over-excavated and replaced with a minimum of 12 inches of Crushed Stone. Crushed Stone should be should be tamped to lock the stone structure together. Crushed Stone should meet the following gradation specification:

Table 9: 3/4" Crushed Stone Gradation

CRUSHED STONE ¾ INCH	
Sieve Size	**Percent finer**
1 inch	100
¾ inch	90 to 100
½ inch	20 to 55
⅜ inch	0 to 15
No. 4	0 to 5

Reference: MDOT Specification 703.13, Crushed Stone ¾-Inch (2014)

In general, we anticipate that groundwater will enter the excavations. Dewatering may consist of shallow sumps at the base of the excavation. Diversion and control of surface water should be performed to prevent water flow from rain or snowmelt from entering the excavations.

We recommend that a qualified geotechnical consultant be retained to monitor and test soil materials used during construction and confirm that soil conditions and construction methods are consistent with this report.

7.0 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 or the proposed development differ from those described in this report, SGS should be notified so that we can re-evaluate our recommendations.

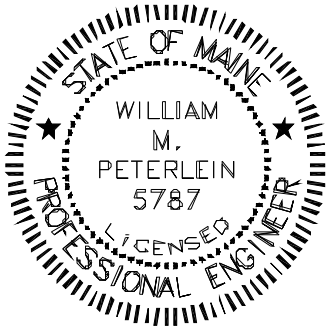
It is important that SGS be consulted during construction of the foundation in order to provide guidance on the suitability of exposed soil and to select the appropriate subgrade improvement measures.

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.

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 yours,

Mathew Hardison, EI
Geotechnical Engineer

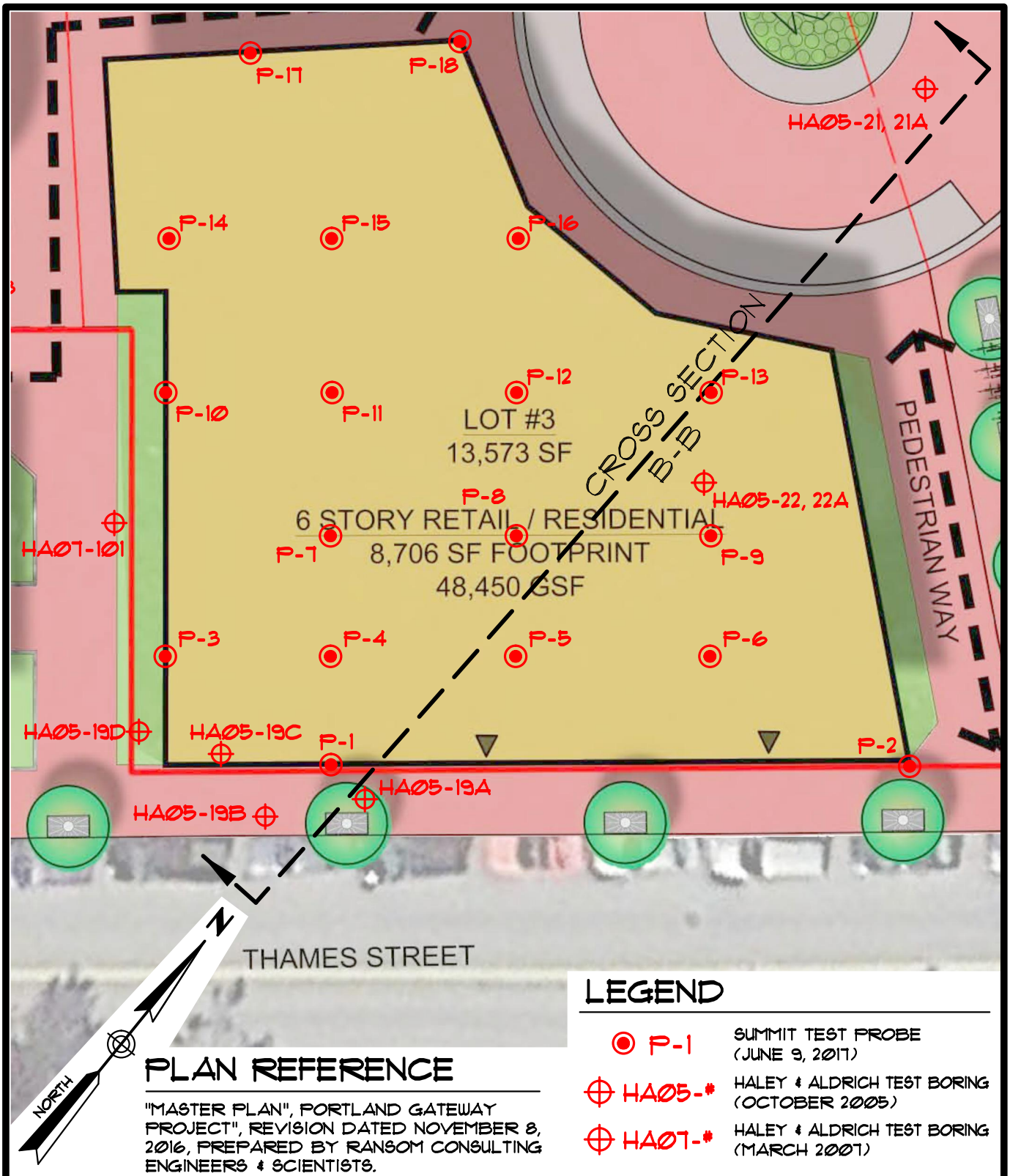


William M. Peterlein, PE
President & Principal Engineer

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com

APPENDIX A

EXPLORATION LOCATION PLAN



LEGEND

P-1	SUMMIT TEST PROBE (JUNE 9, 2017)
HA05-*	HALEY & ALDRICH TEST BORING (OCTOBER 2005)
HA07-*	HALEY & ALDRICH TEST BORING (MARCH 2007)

PLAN REFERENCE

"MASTER PLAN", PORTLAND GATEWAY PROJECT", REVISION DATED NOVEMBER 8, 2016, PREPARED BY RANSOM CONSULTING ENGINEERS & SCIENTISTS.

EXPLORATION LOCATION PLAN
PORTLAND GATEWAY - LOT 3

THAMES STREET - PORTLAND, MAINE

PREPARED FOR

ESSEXNORTH PORTLAND, LLC

DATE: 7-12-2017	DRAWN BY: KRF	CHECKED BY: WMP
JOB: 16300	SCALE: 1" = 20'	FILE: 16300 SKT

145 LISBON ST. - SUITE 701
LEWISTON, ME 04240
Tel.: (207) 576-3313

173 PLEASANT STREET
ROCKLAND, ME 04841
Tel.: (207) 318-7761

SUMMIT
GEOENGINEERING SERVICES
www.summitgeoeng.com

APPENDIX B

HALEY & ALDRICH BORING LOGS

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA05-16

Project THE WATERMARK Portland, ME
Client Riverwalk, LLC.
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 1
Start 4 October 2005
Finish 4 October 2005
Driller B. Enos
H&A Rep. K. Stone
Elevation 18.0+/-
Datum Portland City
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	SS	NQ	Rig Make & Model: Mobile Drill B-53 Truck
Inside Diameter (in.)	3.0	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: Driven
				Hoist/Hammer: Winch/ Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	9 8 6 3	S1 3	0.0 2.0	NO WELL INSTALLED		SW	Medium dense, dark-brown, well graded SAND with gravel (SW), mps 1.0 in., no odor, dry. -FILL-	40	5	15	20	20					
	3 4 8 22	S2 5	2.0 4.0			SP	Medium dense, dark-gray, poorly graded SAND with gravel (SP), mps 1.5 in., no odor, dry, pieces of brick fragments.	25	5	10	20	35	5				
5	13 32 21 18	S3 16	4.0 6.0			SM	Very dense, dark brownish-gray to brown, silty SAND with gravel (SM), mps 1 in., no odor, moist, cement pieces and shell fragments present.	10	15	5	20	35	15				
	9 8 8 12	S4 19	6.0 8.0			SP ML	Medium dense, brown to grayish-brown, poorly graded SAND with gravel (SP), mps 0.75 in., no odor, moist. Medium dense, gray-brown, sandy SILT (ML), mps 1 mm., no odor, moist, mottled, slightly blocky.		5	20	50 10	25 30	60				
	11 23 14 19	S5 21	8.0 10.0			SM	Dense, gray to brown, silty SAND (SM), mps 10 mm., no odor, moist, brick pieces.		5		10	65	20				
10	4 11 12 50(1 in.)	S6 19	10.0 11.6			SM	Medium dense, brownish-gray, silty SAND with gravel (SM), mps 1 in., no odor, moist to wet. -FILL-	5	10	5	20	40	20				
					11.6		NOTE: Split-spoon and casing refusal at 11.6 ft. Advanced roller bit to 12.3 ft. Begin NQ rock core at 12.3 ft. See Core Boring Report HA05-16 for details.										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water

Sample Identification	
O	Open End Rod
T	Thin Wall Tube
U	Undisturbed Sample
S	Split Spoon
G	Geoprobe

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary	
Overburden (lin. ft.)	12.3
Rock Cored (lin. ft.)	7.2
Samples	6S, 2C

Boring No. HA05-16

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA05-16
File No. 30322-000
Sheet No. 1 of 1

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
10							NO WELL INSTALLED		NOTE: Encountered bedrock at 11.6 ft. Advanced roller bit to 12.3 ft. Begin NQ rock core at 12.3 ft.
		C1	12.3 15.4	37/25	100/68			12.3	Hard, fresh, gray, aphanitic to fine grained SCHIST. Primary joints dipping at moderate to high angles, very close to close, planar to stepped, smooth, tight to partly open. Secondary joints dipping at low angles. Joints fresh to slightly weathered with some calcite coatings.
15		C2	15.4 19.5	49/20	100/41				Hard, fresh to slightly weathered, gray, aphanitic to fine grained SCHIST. Primary joints dipping at high to near vertical angles, planar to undulating, smooth, tight to partly open, very close to moderate. Secondary joints dipping at horizontal to low angles. Discoloration on some joint surfaces.
								19.5	-BOTTOM OF EXPLORATION-

TEST BORING REPORT

Boring No. HA05-18

Project THE WATERMARK Portland, ME
Client Riverwalk, LLC.
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 1
Start 4 October 2005
Finish 4 October 2005
Driller B. Enos
H&A Rep. K. Stone
Elevation 16.5+/-
Datum Portland City
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	SS	NQ	Rig Make & Model: Mobile Drill B-53 Truck
Inside Diameter (in.)	4.0	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: Driven
				Hoist/Hammer: Winch/ Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	18 11 10 12	S1 15	0.0 2.0	NO WELL INSTALLED		SM	Medium dense, dark-brown, silty SAND (SM), mps 0.43 mm., black staining present, no odor, dry. -FILL-					60	40				
5	9 75(0.4ft)	S2	5.0 5.9		5.9	GM	Very dense, dark-brown, silty GRAVEL with sand (GM), mps 1.0 in., no odor, dry. -FILL-	50	10			50	35				
							NOTE: Split spoon refusal at 5.9 ft. Advance roller bit to 6.6 ft. Begin NQ rock core at 6.6 ft. See Core Boring Report HA05-18 for details.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
10-4-05	12:55	0.25	-	13.2	5.0

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 6.6
Rock Cored (lin. ft.) 9
Samples 2S, 2C

Boring No. HA05-18

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA05-18
File No. 30322-000
Sheet No. 1 of 1

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
0									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
									NOTE: Bedrock encountered at 5.9 ft. Advanced roller bit to 6.6 ft. Begin NQ rock core at 6.6 ft.
5								5.9	
		C1	6.6 11.0	48/23	91/47				Hard, fresh, gray, aphanitic to fine grained SCHIST. Primary joints dipping at moderate to high angles, very close to close, planar, smooth, tight to partly open, occasional calcite veins.
10							NO WELL INSTALLED		
		C2	11.0 15.6	57/30	100/52				Hard, fresh, gray, aphanitic to fine grained SCHIST. Primary joints dipping at moderate to high angles, close to moderate, planar, smooth, tight to partly open, occasional calcite veins.
15								15.6	-BOTTOM OF EXPLORATION-

TEST BORING REPORT

Boring No. HA05-19A

Project THE WATERMARK Portland, ME
Client Riverwalk, LLC.
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 1
Start 3 October 2005
Finish 4 October 2005
Driller R. Idano
H&A Rep. K. Stone
Elevation 15.4+/-
Datum Portland City
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	NQ	Rig Make & Model: Mobile Drill B-53 Trailer
Inside Diameter (in.)	2.5	1 3/8	-	Bit Type: Cutting Head
Hammer Weight (lb.)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: -
				Hoist/Hammer: Winch/ Doughnut Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-BITUMINOUS CONCRETE-										
	11 12 12 11	S1 13	0.5 2.5		0.1	SM	Medium dense, brown to dark gray, silty SAND with gravel, (SM), mps 1.0 in., contains some ash material, no odor, dry to moist.	5	20	10	20	30	15				
							-FILL-										
	5 5 9 20	S2 12	2.5 4.5			SP	Medium dense, dark brown to gray, poorly graded SAND (SP), mps 1.0 in., no odor, dry to moist.		10	5	20	60	5				
							-FILL-										
5	3 2 3 4	S3 12	4.5 6.5			SP	Loose dark brown to gray, poorly graded SAND with gravel (SP), mps 1.0 in., no odor, moist.	5	15	5	30	40	5				
	2 15 50(0.1 ft)	S4 4	6.5 7.6			SP	Very dense, dark brown, poorly graded SAND with gravel (SP), mps 1.0 in., no odor, wet.	10	20	5	30	30	5				
					7.6	BR	-FILL-										
				NO WELL INSTALLED	8.4		-BOTTOM OF EXPLORATION-										
10							HA05-19A: Auger refusal at 7.6 ft. - BOE at 8.4 ft. (using roller bit) HA05-19B: Auger refusal at 6.8 ft. - BOE at 7.0 ft (using roller bit) HA05-19C: Auger refusal at 5.0 ft. - BOE at 5.5 ft. (using roller bit) HA05-19D: Auger refusal at 6.5 ft. Advanced roller bit to 6.9 ft. Begin NQ rock core at 6.9 ft. See Core Boring Report HA05-19D.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 11.6
Rock Cored (lin. ft.) -
Samples 4S

Boring No. HA05-19A

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA05-19D
File No. 30322-000
Sheet No. 1 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS (FOR HA05-19A)
5									NOTE: Bedrock encountered at 6.5 ft. Advanced roller bit to 6.9 ft. Begin NQ rock core at 6.9 ft.
		C1	6.9 7.5	6/4.5	85/66			6.9	Hard, fresh, gray, aphanitic to fine grained SCHIST. Joints dipping at low to moderate angles, close to wide, planar to stepped, smooth to rough, partly open, calcite veins present.
		C2	7.5 10.3	33/31	100/94				
10		C3	10.3 14.3	48/40.5	100/84				Hard, fresh, gray, aphanitic to fine grained SCHIST. Joints dipping at low to moderate angles, close to moderate, planar to undulating, smooth to rough, tight to partly open, occasional calcite veins.
15		C4	14.3 18.9	55/40	100/72		NO WELL INSTALLED		Hard, fresh, gray, aphanitic to fine grained SCHIST. Joints dipping at moderate to high angles, close to moderate, planar to undulating, smooth to rough, tight to partly open, occasional calcite veins.
		C5	18.9 23.9	60/53.5	100/89				Hard, fresh, gray, aphanitic to fine grained SCHIST. Joints dipping at moderate to high angles, close to moderate, planar to undulating, smooth to rough, tight to partly open, occasional calcite veins.
20									
		C6	23.9 28.9	60/57	100/95				Hard, fresh, gray, aphanitic to fine grained SCHIST. Joints dipping at moderate to high angles, close to moderate, planar to stepped, smooth to rough, tight to partly open. Frequent calcite veins parallel to foliation.
25									

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA05-19D
File No. 30322-000
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
30		C7	28.9 33.9	60/46	100/76		NO WELL INSTALLED		Hard, fresh, gray, aphanitic to fine grained SCHIST. Joints dipping at low to high angles, very close to close, planar to undulating, smooth to rough, tight to partly open. Quartz intrusions throughout core stem, occasional calcite stringers.
								33.9	-BOTTOM OF EXPLORATION-

TEST BORING REPORT

Boring No. HA05-21

Project THE WATERMARK Portland, ME
Client Riverwalk, LLC.
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 1
Start 30 September 2005
Finish 30 September 2005
Driller R. Idano
H&A Rep. K. Stone
Elevation 16.5+/-
Datum Portland City
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: Mobile Drill B-53 Trailer
Inside Diameter (in.)	2.5	1 3/8	-	Bit Type: Cutting Head
Hammer Weight (lb.)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Spun
				Hoist/Hammer: Winch/ Doughnut Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	7 11 9 15	S1 14	0.0 2.0			SP	Medium dense, brown, poorly graded SAND with gravel (SP), mps 1.0 in., black staining present, no odor, dry. -FILL-	5	10	5	5	75					
	14 17 17 17	S2 13	2.0 4.0			SP	Dense, brown, poorly graded SAND with gravel (SP), mps 1.0 in., black staining present, brick fragments present, no odor, dry.	5	10	5	5	75					
5	10 11 11 9	S3 12	4.0 6.0			SP	Medium dense, brown, poorly graded SAND with gravel (SP), mps 1.0 in., black staining from 4.5-4.7ft., no odor, dry.	5	10	5	5	75					
	3 6 8 9	S4 12	6.0 8.0			SP	Medium dense, brown, poorly graded SAND with gravel (SP), mps 1.0 in., brick fragments present, no odor, dry.	5	10	5	5	75					
	10 30 18 9	S5 9	8.0 10.0			SP	Medium dense, brown, poorly graded SAND with gravel (SP), mps 1.0 in., some silt and clay from 8.3-8.5 ft., no odor, dry. -FILL-	5	10	5	5	75					
10	2 11 14 24	S6 10	10.0 12.0	NO WELL INSTALLED	10.2	SC GP	Medium dense, olive-brown, clayey SAND (SC), mps 0.43 mm., no odor, moist.	50	50			65	35				
	14 14 17 100(0.3 ft)	S7 10	12.0 14.0		10.4	GP	Dense, brown, poorly graded GRAVEL (GP), mps 1.25 in.,appears to be weathered rock fragments, no odor, wet. Dense, brown, poorly graded GRAVEL with sand (GP), mps 1.25 in., no odor, wet. -FILL-	35	35	10	10	10					
	24 50(0.4 ft)	S8 6	14.0 14.9		13.8		Piece of wood in split spoon, wood fragments. -WOOD-										
15	22 27 27 27	S9 14	15.0 17.0		15.5	SP	Very dense, gray to black, poorly graded SAND with gravel (SP), mps 1.25 in., no odor, wet. -GLACIAL TILL-	10	10	15	15	50					
	44 50(0.1 ft)	S10 8	17.0 17.6		17.6	SP	Very dense, gray, poorly graded SAND with gravel (SP). mps 1.0 in., no odor, wet. -GLACIAL TILL- -BOTTOM OF EXPLORATION-	10	10	15	15	50					

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 17.6
Rock Cored (lin. ft.) -
Samples 10S

Boring No. HA05-21

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

Boring No. HA05-21A

Project THE WATERMARK Portland, ME
Client Riverwalk, LLC.
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 1
Start 5 October 2005
Finish 5 October 2005
Driller B. Enos
H&A Rep. B. Steinert
Elevation 16.5+/-
Datum Portland City
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	SS	NQ	Rig Make & Model: Mobile Drill B-53 Truck
Inside Diameter (in.)	3.0	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: Driven
				Hoist/Hammer: Winch/ Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							NOTE: See Test Boring Report HA05-21 for overburden details from 0-10 ft.										
10	6 9 9 10	S1 6	10.0 12.0	NO WELL INSTALLED		SW	Medium dense, brown to olive-brown, well graded SAND with gravel (SW), mps 1.0 in., no odor, wet, brick and porcelain fragments present, rock fragments in tip of spoon. -FILL-	5	15	30	30	10	10				
	10 12 12 75(0.4 ft)	S2 8	12.0 14.0			SW	Medium dense, brown to olive-brown, well graded SAND with gravel (SW), mps 1.0 in., no odor, wet, brick and porcelain fragments present. -FILL- NOTE: Wood and rock fragments observed in drill cuttings from 14.4-15.2 ft.	5	15	30	30	10	10				
15	3 10 75(0.3 ft)	S3 12	15.2 17.2		16.4	SW	Very dense, gray, well graded SAND (SW), mps 1.0 in., no odor, wet, very small brick and porcelain fragments present, wood fibers in top of spoon. -FILL- NOTE: Split spoon refusal at 16.4 ft. Advanced roller bit to 16.7 ft. Begin NQ rock core at 16.7 ft. See Core Boring Report HA05-21A for details.	5	15	30	30	10	10				

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water

Sample Identification	
O	Open End Rod
T	Thin Wall Tube
U	Undisturbed Sample
S	Split Spoon
G	Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 16.7
Rock Cored (lin. ft.) 2.9
Samples 3S, 1C

Boring No. HA05-21A

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

USCS_TB4 USCSLIB4.GLB USCSTB+CORE4.GDT G:\PROJECTS\30322\00\30322-000.GPJ 16 May 07

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA05-21A
File No. 30322-000
Sheet No. 1 of 1

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weath-ering	Well Dia-gram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
15							NO WELL INSTALLED		
									NOTE: Bedrock encountered at 16.4 ft. Advanced roller bit to 16.7 ft.
								16.4	Begin NQ rock core at 16.7 ft.
	2	C1	16.7	35/31	100/89				Moderately hard to hard, moderately to slightly weathered, gray to green, aphanitic to fine grained SCHIST. Quartz vein dipping at 20-60 degrees near bottom of run. Primary joint sets dipping at moderate to high angles, close, undulating to rough, discolored, tight to moderately wide.
	5		19.6						
	4								
								19.6	-BOTTOM OF EXPLORATION-

TEST BORING REPORT

Boring No. HA05-22

Project THE WATERMARK Portland, ME
Client Riverwalk, LLC.
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 1
Start 5 October 2005
Finish 5 October 2005
Driller B. Enos
H&A Rep. B. Steinert
Elevation 15.0+/-
Datum Portland City
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: Mobile Drill B-53 Truck
Inside Diameter (in.)	2.5	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Driven
				Hoist/Hammer: Winch/ Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				NO WELL INSTALLED			-BITUMINOUS CONCRETE-										
	6 6 4 5	S1 11	0.4 2.4		0.4	SM	Loose, dark-brown to black, silty SAND (SM), mps 0.1 in., no structure, no odor, damp, rust stains present. -FILL-			10	50	20	20				
	6 8 6 5	S2 2	2.4 4.4				Brick fragments, no odor. -FILL-										
5	3 3 4 2	S3 0	4.4 6.4				NOTE: No recovery, brick fragments present at tip of spoon.										
	5 4 7 16	S4 2	6.4 8.4			SM	Medium dense, brown, silty SAND (SM), mps 0.1 in., no structure, no odor, damp. -FILL-			10	35	35	20				
10	13 50(3 in.)	S5 4	8.4 10.4			SM	Very dense, brown, silty SAND (SM), mps 0.1 in., no odor, damp. -FILL-			10	35	35	20				
					10.3		-BOTTOM OF EXPLORATION- NOTE: Auger refusal at 10.3 ft. Move hole and advance to confirm bedrock. See HA05-22A for details.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 10.3
Rock Cored (lin. ft.) -
Samples 5S

Boring No. HA05-22

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

USCS_TB4 USCSLIB4.GLB USCSTB+CORE4.GDT G:\PROJECTS\30322\000\30322-000.GPJ 16 May 07

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA05-22A

Project THE WATERMARK Portland, ME
Client Riverwalk, LLC.
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 1
Start 5 October 2005
Finish 5 October 2005
Driller B. Enos
H&A Rep. B. Steinert
Elevation 15+/-
Datum Portland City
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	-	NQ	Rig Make & Model: Mobile Drill B-53 Truck
Inside Diameter (in.)	3.0	-	2.0	Bit Type: Roller Bit
Hammer Weight (lb.)	300	-	-	Drill Mud: None
Hammer Fall (in.)	30	-	-	Casing: Driven
				Hoist/Hammer: Winch/ Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							NOTE: No samples taken. See Test Boring Report HA05-22 for over burden details.										
5																	
10				NO WELL INSTALLED	9.7		NOTE: Casing refusal at 9.7 ft. Advanced roller bit to 10.0 ft. Begin NQ rock core at 10.0 ft. See Core Boring Report HA05-22A for details.										

Water Level Data						Sample Identification	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water	O Open End Rod T Thin Wall Tube U Undisturbed Sample S Split Spoon G Geoprobe	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (lin. ft.) 10 Rock Cored (lin. ft.) 3.2 Samples - **Boring No. HA05-22A**

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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CORE BORING REPORT

Boring No. HA05-22A
File No. 30322-000
Sheet No. 1 of 1

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
5									
									NOTE: Bedrock encountered at 9.7 ft. Advanced roller bit to 10 ft. Begin NQ rock core at 10.0 ft.
10	3	C1	10.0 12.0	24/0	100/0		NO WELL INSTALLED	9.7	Moderately hard, fresh to slightly weathered, gray to green, aphanitic to fine grained SCHIST. Primary joint set dipping at vertical angles, extremely close to very close, undulating, fresh, open to wide.
	3	C2	12.0 13.2	14/0	100/0				
								13.2	-BOTTOM OF EXPLORATION-

TEST BORING REPORT

Boring No. HA07-101

Project THE WATERMARK Portland, Maine
Client Riverwalk, LLC
Contractor Maine Test Borings, Inc.

File No. 30322-000
Sheet No. 1 of 2
Start 7 March 2007
Finish 7 March 2007
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 15.5 +/-
Datum Portland City
Location See plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	-	NQ	Rig Make & Model: Mobile Drill B-53 Bombardier
Inside Diameter (in.)	3.0	-	2.0	Bit Type: Roller Bit
Hammer Weight (lb.)	300	-	-	Drill Mud: None
Hammer Fall (in.)	30	-	-	Casing: NW Drive 10.8 ft
				Hoist/Hammer: Winch Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							NOTE: No samples taken.										
10				NO WELL INSTALLED	10.0		NOTE: Casing refusal on probable bedrock at 10.0 ft. Advance roller bit to 10.8 ft. Begin NQ rock core at 10.8 ft. See Core Boring Report for details.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 10.0
Rock Cored (lin. ft.) 8.8
Samples 2C

Boring No. HA07-101

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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CORE BORING REPORT

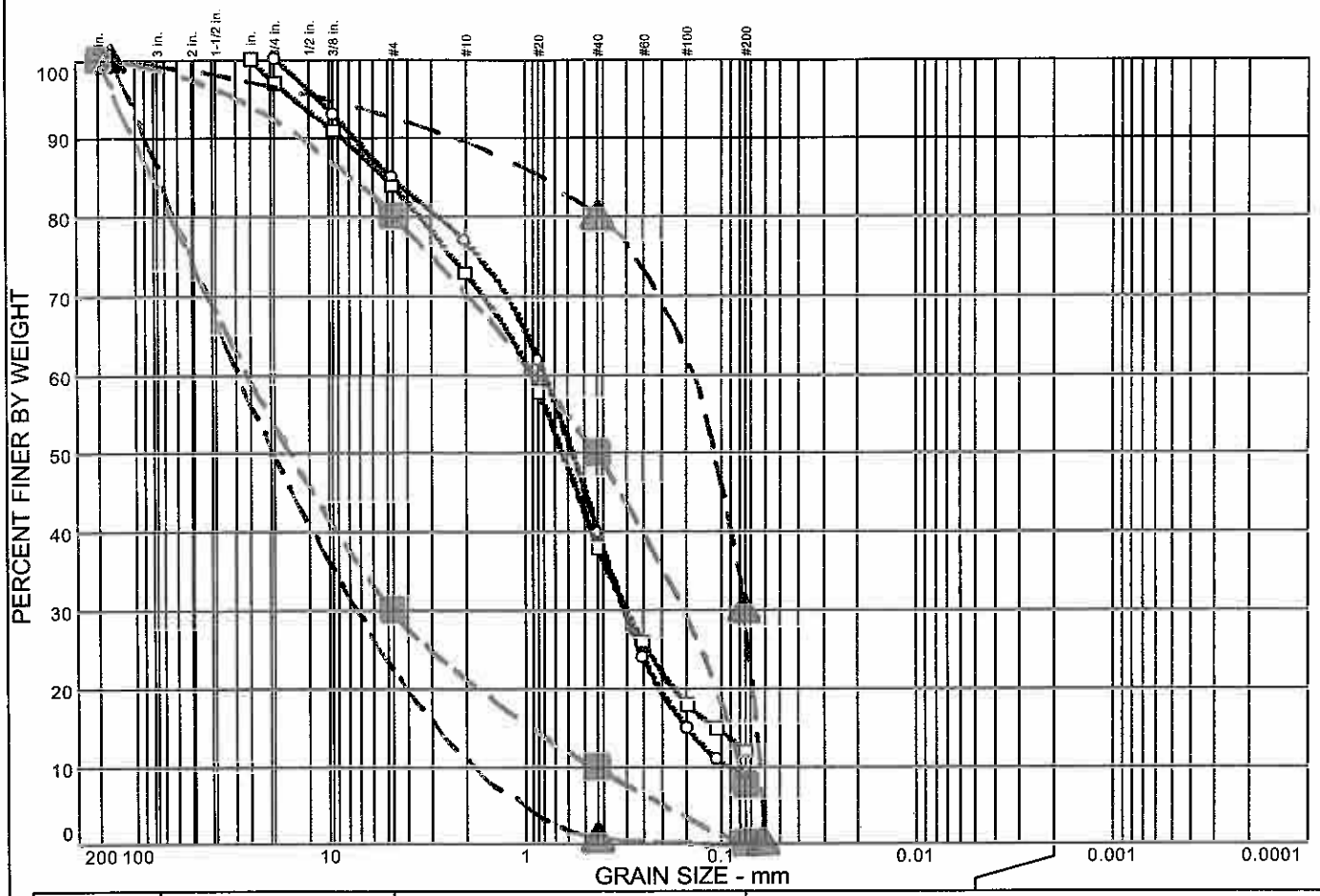
Boring No. HA07-101
File No. 30322-000
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
									Note: Bedrock encountered at 10.0 ft. Advanced roller bit to 10.8 ft. Begin NQ rock core at 10.8 ft.
10								10.0	
	3	C1	10.8 14.8	48/44	100/92	Fresh			Hard, fresh, gray, fine grained to aphanitic SCHIST. Joints are low angle to moderately dipping, close to wide, planar, stepped and undulating, smooth to rough, calcite veins present throughout, multiple healed joints.
	3								
	2								
	3								
15	2	C2	14.8 18.8	36/48	75/100	Fresh		14.8	Hard, fresh, gray, fine grained to aphanitic SCHIST. Joints are low angle to moderately dipping, close to moderately spaced, planar and undulating, smooth to rough, calcite veins present thoughout, multiple healed joints.
	2								
	2								
	3								
							NO WELL INSTALLED	18.8	-BOTTOM OF EXPLORATION-

APPENDIX C

HALEY & ALDRICH LABORATORY TEST RESULTS

U.S. STANDARD SIEVE SIZE



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	15.0	8.0	37.0	31.0	9.0	
□	0.0	3.0	13.0	11.0	35.0	26.0	12.0	

	Expl. No.	Sample No.	Depth (ft)	Atterberg Limits %			Water Content (%)	C_u	C_c	USCS
				W_L	W_P	I_P				
○	HA05-19	C01	0.5-4.5				6.8	8.59	1.34	SW-SM
□	HA05-21	C01	2.0-6.0				6.5			SP-SM

	Sample Description
○	Gray Well-graded sand with silt and gravel
□	Gray brown Poorly graded sand with silt and gravel

Remarks:

○ Composite sample of S01 & S02

□ Composite sample of S02 & S03

▒ maximum and minimum limits for the percentage of soil particles finer than sieve size noted per CGF recommendation

▲ maximum and minimum limits for the percentage of soil particles finer than sieve size noted per Common Fill recommendation

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

The Watermark
Portland, Maine

GRAIN SIZE DISTRIBUTION

DATE: 4/11/2007

FILE NO: 30322-000