SUMMIT
GEOENGINEERING SERVICES

GEOTECHNICAL REPORT

New Apartment Building
665 Congress Street
Portland, Maine

Prepared for:

Redfern Properties
P.O. Box 8816
Portland, Maine 04104

Prepared by:

Summit Geoengineering Services
145 Lisbon St.
Lewiston, Maine

Project #15040
May 2015

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GEOENGINEERING SERVICES

May 1, 2015
SGS #15040

Jonathan Culley
Redfern Properties
P.O. Box 8816
Portland, Maine 04104

Reference: Geotechnical Report, New Apartment Building
665 Congress Street, Portland, Maine

Dear Jonathan;

Summit Geoengineering Services, Inc. (SGS) has completed a geotechnical investigation for the proposed apartment building at the site reference above. Our scope of services included the drilling of 13 borings and 9 probes and preparing this geotechnical report summarizing our findings and providing geotechnical recommendations.

1.0 Project Description

We understand that the project consists of the construction of an 8 story building at the site referenced above. The existing site contains Joe's Smoke Shop abutting Congress Street with a paved parking lot behind. The grade at the site slopes gently down towards the back of the parking lot. The site is bordered by Avon Street on the east and Vernon Street on the west. There used to be a church at the southern portion of the site which was demolished in 1965.

We understand that the newly proposed 8 story building is a steel framed structure which will consist of combined retail space and parking on the first floor and apartment living spaces in the top 7 floors. We also understand there is a proposed full basement for parking. We further understand that the proposed finish floor elevation of the first floor is near existing grade. There will be two elevator shafts on either end of the building (north and south).

We have been provided with preliminary structural loads which include the following:

Columns loads: 200 – 350 kip
Line loads: 2 – 15 k/lf
Uplift load: 100 kips

2.0 Exploration

2.1 Exploration

Summit Geoengineering Services (SGS) observed the subsurface conditions at the site with the drilling of 5 borings and six probes (B-1 through B-5 and P-1 through P-6) on March 31, 2015. All of the borings and probes were drilled to refusal, ranging in depth from 0.8 to 15.8 feet below ground surface. Borings and probes were advanced using 2-1/2" hollow stem augers. During the borings, split spoon sampling was conducted in general accordance with ASTM D1586 to collect blow counts and soil samples. Probes were advanced to refusal in order to document the bedrock topography throughout the site. Auger cuttings (if present) and relative drilling resistance were used to estimate the soil types in absence of soil sampling.

SGS performed a second investigation on April 15, 2015 with the drilling of 8 borings and 3 probes (B-101 through B-108 and P-101 through P-103). The drilling was conducted by Great Works Test Boring of Berwick, Maine under the supervision of SGS. All of the borings and probes were drilled to refusal using a Mobile B-53 tracked rig and 4" hollow stem augers. Borings B-105 and B-106 were pre-augered and then cased washed to refusal where rock core samples were collected. Split spoon sampling was conducted in general accordance with ASTM D1586 to collected blow counts and soil samples. Probes were advanced to refusal in order to further document the bedrock topography throughout the site. Auger cuttings (if present) and relative drilling resistance were used to estimate the soil types in absence of soil sampling.

Locations of the borings and probes were marked by SGS prior to drilling by measuring from the existing building and surrounding landmarks. These locations can be seen in the SGS Exploration Plan in Appendix A. The boring and probe logs can be found in Exploration Logs in Appendix B.

3.0 Subsurface Conditions

3.1 Soil

The soil at the site generally consists of ***pavement*** overlying ***fill*** overlying ***glacial till*** overlying ***weathered bedrock*** overlying ***bedrock***.

The ***pavement*** at the site was present at the location of all drilled borings and probes. It ranged from 2.5" to 4.0" in thickness.

The ***fill*** layer was encountered in all borings directly below the pavement and ranged from 4.3 feet to 8.8 feet in thickness, generally increasing in thickness towards the end of the site containing Joe's Smoke Shop. The ***fill*** is described as dark brown gravelly sand to brown and black sandy silt with varying amounts of ash and brick fragments. It is very loose to compact and humid to frozen. The ***fill*** located at the southern end of the site nearer to Joe's Smoke Shop

contained large voids and frequent rubble apparent from inspection of the open bore hole and difficult drilling conditions. The ***fill*** classifies as ML, SP, GP, SM, or SP-SM, in accordance with the Unified Soil Classification System.

The ***glacial till*** was encountered in borings B-1, B-2, B-3, B-101, B-103, B-104, B-107, and probe P-3 and P-101. ***Glacial till*** may also be present at the locations of other probes but the cuttings from the layer did not make it to the ground surface for visual inspection. The ***glacial till*** is described as olive green silt with trace to little clay, sand, and gravel. It is humid to damp, compact to dense, and ranges in thickness from 1.2 feet to 6.8 feet. Standard Penetration Test (SPT-N) blow counts in this layer ranged from 18 to 44 with an average of 28. Pocket penetrometer measurements (a rough estimate of unconfined compressive strength) ranged from 4,000 psf to greater than 9,000 psf. It classifies as ML in accordance with the Unified Soil Classification System.

The ***weathered bedrock*** was encountered in borings B-4, B-104, B-105, and B-107 and probes P-1, P-2, and P-3. It ranged in thickness from 1.0 feet to 2.9 feet.

Soil profile cross sections of the site can be found in Appendix A titled “Interpretive Soil Profiles”.

3.2 Groundwater

Groundwater was not encountered in any of the borings or probes. The glacial till recovered in borings B-1, B-2, B-101, B-104, and B-107 from depth 5 feet to 15 feet was slightly to heavily mottled, indicating that groundwater may be confined in this layer during wet periods.

3.3 Bedrock

Bedrock was encountered at the site ranging from 4.8 feet to 15.8 feet below existing ground surface. The bedrock elevation ranges from 99.8 feet to 107.3 feet. The table below summarizes the depth to bedrock encountered in the borings and probes and the approximate elevation at each location. Bedrock mapping by the Maine Geologic Survey classifies the bedrock at the site as the Precambrian Z Spring Point Formation consisting of green schist and amphibolites facies ranging from and mafic to felsic volcanic rock.

BEDROCK DEPTH & ELEVATION		
Boring/Probe	**Depth (ft)**	**Elevation (ft)**
B-1	15.8	100.1
B-2	11.6	102.4
B-3	6.2	106.7
B-4	7.2	105.3
B-5	4.8	107.7
B-101	11.9	106.6
B-102	-	-
B-103	14.5	100.5
B-104	9.5	103.6

*B-105	10.0	103.8
*B-106	10.0	102.0
B-107	10.5	102.4
B-108	8.5	101.7
P-1	10.0	104.9
P-2	10.0	103.9
P-3	9.9	102.9
P-4	-	-
P-5	-	-
P-6	5.0	107.3
P-101	10.8	105.6
P-102	12.1	99.8
P-103	9.6	102.7

* = Core samples obtained

Three rock core samples were obtained, one from B-105 and two from B-106. The recovered samples are classified as moderately weathered, very thinly spaced joints/fractures, medium to light gray schist. Rock Quality Designation (RQD) of the samples ranged from 0% (very poor) to 80% (good), increasing in quality as the sample depth increased. A majority of the joints and fractures were 45^{o} to vertical. A photograph log of the collected sample can be found in Appendix C.

4.0 Evaluation

The key geotechnical issues at the site include the following:

- Potential for differential settlement of the building supported partially by bedrock and partially by native soil (glacial till)
- Presence of rubble fill in the southern portion of the site presenting excavation difficulty and poor foundation and slab support
- Large uplift loads requiring the use of grouted rock anchors

Based on the preliminary design loads and the proposed building layout, we believe that the new building can be adequately supported by a conventional frost wall on continuous spread footing foundation. The interior columns can be supported by isolated column footings. Based on the finish floor elevations, interior and exterior footings will likely be supported by a combination of glacial till and bedrock. There is also a chance that existing rubble fill will be present at the bottom of footing elevation (near the southern portion of the building). It will be critical to remove all rubble fill from below the footings to ensure that tolerable settlements are not exceeded.

Uplift loading on the new building appears to be significant. We anticipate that rock anchors will be necessary to support the uplift loading on the foundation.

5.0 Foundation Recommendations

5.1. Allowable Bearing Pressure

We recommend that footings be proportioned using an allowable bearing pressure of 10,000 psf for foundations constructed on bedrock and an allowable bearing pressure of 4,000 psf for footings constructed on glacial till and Structural Fill (SF, see Section 5.2). Total settlement is expected to be less than 1.0" for footings constructed on glacial till and SF. Total settlement will be negligible for footings constructed on bedrock. Differential settlement is not anticipated to exceed 1.0" between footings on bedrock and footings on the native glacial till soil. The allowable bearing pressures above are based on the following conditions:

- All rubble and debris is removed from beneath the footings
- Footings are constructed on glacial till, placed Structural Fill (SF, see Section 5.2), or bedrock. If existing fill is exposed at the bottom of the footing excavation, it should be removed in its entirety down to the glacial till layer and laterally equal to a distance of the footing width on each side of the footing.
- All placed fill within the building footprint consist of SF placed in a maximum of 12" lifts and compacted to 95% of its optimum dry density in accordance with ASTM D1557.
- For footings supported on bedrock, any loose or weathered bedrock is removed to expose hard bedrock.
- Transition zones for footings spanning bedrock to native soil/placed fill be constructed in accordance with the Transition Zone Construction Detail provided in Appendix D.
- Exposed native soil is proofrolled with a minimum of 2 passes in each of two perpendicular directions with a 5 ton minimum (operating weight) vibratory roller or a large vibratory plate compactor. Any soft or unsuitable soil is removed and replaced with ¾" crushed stone or SF.

5.2 Slabs-on-grade

Based on a finish floor elevation of 108 feet for the basement level parking, the slab-on-grade will be supported by a combination of existing rubble fill, glacial till (native), and existing sandy silt fill. Although unlikely, the bedrock surface may rise up to this elevation in some isolated locations. To avoid differential settlement of the slab, we recommend a minimum of 12" of Structural Fill (SF, see table below) be placed under the slab for the entire building footprint to act as a cushion between the slab and underlying soil/bedrock.

Any exposed native soil should be proofrolled with a minimum of 2 passes in each of two perpendicular directions with a 5 ton minimum (operating weight) vibratory roller. Any exposed rubble, debris, or other non-soil materials should be removed and replaced with SF. Any loose or weathered bedrock should be removed to expose a hard bedrock surface.

The slab subgrade soil should be observed by SGS after proofrolling and prior to the placement of SF. A layer of geotextile or other subgrade improvement method may be necessary.

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	38 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 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.

For the conditions described above, the slab can be designed using a subgrade modulus value of 150 pci.

We anticipate that the existing rubble fill in the southern portion of the site will be difficult to compact and place fill on. Our experience from the geotechnical investigation indicates that there are frequent large voids and large rubble pieces throughout the layer. Flowable fill and/or ¾" crushed stone can be used to fill the voids and create a flat surface on which to place the SF for the building slab if needed.

5.3 Frost Protection and Foundation Backfill

Based on a 10-year design air freezing index of 1,200 degree F days for the Portland, Maine region, all foundation walls exposed to freezing temperatures should be constructed at a minimum depth of 4 feet below finish basement floor grade. However, in locations where the footing is supported by bedrock, footings may be constructed at a minimum depth of 2 feet below finish basement floor grade. We recommend that these elements be backfilled with Foundation Backfill (FB). The portion of FB passing the 3" sieve size should meet the following gradation requirements:

FOUNDATION BACKFILL (FB)	
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

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.

5.4 Seismic Site Class and Design Criteria

Based on the blow counts collected during split spoon sampling and the fractured/jointed condition of the bedrock surface, the site classifies as Site Class C "very dense soil and soft rock" for footings constructed on glacial till and Site Class B "rock" in accordance with the 2009 International Building Code. The site can be conservatively classified entirely as site class C if desired. The following seismic site coefficients should be used:

SEISMIC DESIGN COEFFICIENTS		
Seismic Coefficient	**Site Class B**	**Site Class C**
Short period spectral response (S_S)	0.315	0.315
1 second spectral response (S_1)	0.077	0.077
Maximum factored spectral response (S_{MS})	0.315	0.378
1 second factored spectral response (S_{M1})	0.077	0.131
Design short period spectral response (S_{DS})	0.210	0.252
Design 1 second spectral response (S_{D1})	0.051	0.087

No liquefiable soils were encountered in the investigation.

5.4 Groundwater Considerations

Groundwater was not encountered in the borings. However, apparent from the mottling of the native glacial till, groundwater is anticipated to fluctuate within the glacial till layer on a seasonal basis. Based on this, we recommend that perimeter underdrains be installed along the entire perimeter of exterior foundations. We recommend that underdrains consist of 4-inch diameter, perforated PVC pipe surrounded by a minimum of 6 inches of crushed stone wrapped in filter fabric. The underdrains should be placed at the base of the foundation and outlet to a free draining location or pumped if necessary. An underdrain or sump pump is highly recommended for the elevator shaft foundation.

5.5 Foundation Uplift and Sliding Capacity

Uplift capacity of the foundation includes the dead weight of the foundation, skin friction of the mobilized soil, and weight of soil above the footings. Sliding resistance of the foundation includes the 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. We recommend that the following coefficients be used in the uplift and sliding capacity of the foundation.

PARAMETER	FOUNDATION BACKFILL	BEDROCK	GLACIAL TILL (NATIVE)
Total Natural (moist) Unit Weight (γ_t)	130 pcf [1]	150 pcf	135 pcf
Saturated (buoyant) Unit Weight (γ_s)	68 pcf [1]	-	73 pcf
Friction Coefficient (f)	0.55	0.65	0.45
Active Earth Pressure Coefficient (K_a)	0.28	-	0.25
Passive Earth Pressure Coefficient (K_p)	3.57	-	4.0
At Rest Earth Pressure Coefficient (K_o)	0.47	-	0.41
Uplift Earth Pressure Coefficient (K_u)	0.92	-	0.94
Friction Angle (ϕ_c)	34^0 [1]	37^0	36^0
Cohesion (c)	0	1000 psi [2]	5.2 psi (750 psf)

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

[2] For near surface localized shear (i.e., bearing capacity, uplift, and sliding), the rock should be assumed to be cohesionless.

5.5.1 Rock Anchors

If additional foundation uplift capacity is needed, rock anchors can be used. 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.

Due to the potential presence of joints in the rock, we recommend that grouting be conducted in two stages. The first stage would comprise pressure grouting in the bond zone to fill in open joints and fractures. Final grouting of the bond zone would occur when pressure grouting had been shown to seal off the bond zone. All installed anchors should be proof tested to a minimum of 120% 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.

6.0 Construction Consideration

Based on proposed basement floor elevations, we anticipate that shoring will be necessary to excavate for footings and the basement slab. Due to the presence of shallow bedrock, we believe that installed sheeting will need to be braced with either a tie-back system or raker. Steel H-piles socketed into bedrock with timber lagging is also an option. The design of the temporary shoring system should be performed by the shoring contractor.

Based on the groundwater levels observed from our explorations, we do not anticipate that groundwater will be encountered within the building excavations. Diversion and control of surface water should be performed to prevent water flow from adjacent wet areas or from rain or snowmelt from entering the excavations.

All exposed native soil which will be load bearing should be proofrolled with a minimum of 2 passes in each of two perpendicular directions with a 5-ton (operating weight) vibratory roller. All exposed load bearing bedrock surface should be cleared of loose and weathered rock to expose hard, competent bedrock.

All exposed rubble fill below footings should be removed in its entirety down to the native glacial till soil and outwards equal to a distance of the footing width on each side of the footing. Exposed rubble fill below the basement slab should be removed a minimum of 12" below the finished slab elevation. Voids in the rubble fill can be filled with ¾" crushed stone or flowable fill.

All installed rock anchors will need to be proof tested to 120% of the design uplift load. The procedure for the proof testing is outlined in the Post Tensioning Institute 2014 recommendations.

If controlled blasting is required to construct the building foundations, we recommend that blasting be performed in accordance with the General Blasting Criteria included in Appendix F.

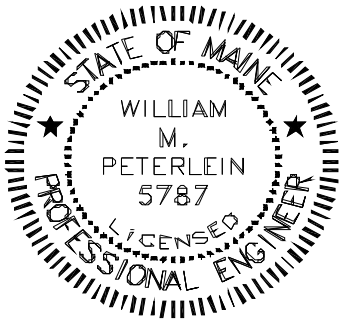
7.0 Closure

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

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.

Mathew Hardison, EI
Geotechnical Engineer



William M. Peterlein, PE
Principal Geotechnical Engineer

APPENDIX A

EXPLORATION PLAN

APPENDIX B

EXPLORATION LOGS

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EXPLORATION COVER SHEET

The exploration logs are prepared by the geotechnical engineer from both field and laboratory data. Soil descriptions are based upon the Unified Soil Classification System (USCS) per ASTM D2487 and/or ASTM D2488 as applicable. Supplemental descriptive terms for estimated particle percentage, color, density, moisture condition, and bedrock may also be included to further describe conditions.

Drilling and Sampling Symbols:

SS = Split Spoon Sample
UT = Thin Wall Shelby Tube
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RW = Rotary Wash
SV = Shear Vane
PP = Pocket Penetrometer
RC = Rock Core Sample
Hyd = Hydraulic Advancement of Drilling Rods
Push = Direct Push of Drilling Rods
WOH = Weight of Hammer
WOR = Weight of Rod
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. Groundwater monitoring wells may be required to record accurate depths and fluctuation.

Gradation Description and Terminology:

Boulders:	Over 12 inches	Trace:	Less than 5%
Cobbles:	12 inches to 3 inches	Little:	5% to 15%
Gravel:	3 inches to No.4 sieve	Some:	15% to 30%
Sand:	No.4 to No. 200 sieve	Silty, Sandy, etc.:	Greater than 30%
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 4	Very Loose
2 to 4	Soft	5 to 10	Loose
5 to 8	Firm	11 to 30	Compact
9 to 15	Stiff	31 to 50	Dense
16 to 30	Very Stiff	>50	Very Dense
>30	Hard		

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SOIL BORING LOG

Project:	Proposed Apartment Building	Boring #:	B-1
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	115.9'
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						2" to 2.5" of Pavement		PAVEMENT
1								0.2'
	S-1	24/4	1 to 3	6		Dark tan Gravelly SAND, little Silt, compact, humid,		FILL
2				11		SP-SM		
				*		* Spoon sampler skewed horizontally, unable to collect		2.0'
3				*		blow counts. Likely due to encountered rubble		
4						Auger advancement produced no cuttings, likely rubble		
						fill with large voids		
5								
	S-2	24/3	5 to 7	WH		Light gray Sandy GRAVEL, cobble pieces, little white Ash		
6				1		trace Silt, very loose, humid, GP		
				3				
7				1				
8								
9								
								9.0'
10								GLACIAL TILL
	S-3	24/20	10 to 12	6		Olive green SILT, little Clay and Sand, trace Gravel,		
11				8		compact, humid, ML	PP = 8,000 to	
				9			9,000 psf	
12				12				
13								
14								
15								
	S-4	24/9	15 to 17	6		Same as above, slightly mottled		
16				50/3"				
						End of Exploration at 15.8', Auger and Spoon refusal		15.8'
17								BEDROCK
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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%

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SOIL BORING LOG

Project:	Proposed Apartment Building	Boring #:	B-2
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	114 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						2" to 2.5" of Pavement		PAVEMENT
1	S-1	24/20	1 to 3	3		Dark brown Gravelly SAND, little Silt and black/white Ash,		0.2' FILL
2				6		loose to compact, frozen, SP-SM		
				5				
3				3				
4								
5	S-2	24/22	5 to 7	10		Same as above		
6				13		Olive green slightly mottled SILT, little Sand, trace Clay		5.2' GLACIAL TILL
				13		and Gravel, compact, damp, ML		
7				14				
8								
9								
10	S-3	24/16	10 to 12	8		Same as above, heavily mottled seam at 10.8', dense	PP = 4,000 to 7,000 psf	
11				12				
				32				
12				50/1"		End of Exploration at 11.6', Spoon refusal		11.6' BEDROCK
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-3
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	112.9 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						3" to 3.5" of Pavement		PAVEMENT
1								0.3'
	S-1	24/12	1 to 3	4		Dark brown SILT, large brick fragment in spoon, small		FILL
2				11*		brick fragment in spoon tip, loose, humid, ML		
				4				
3				2		* blow count due to brick fragment		
4								
5								
	S-2	24/12	5 to 7	12		Olive green SILT, little Sand, trace Clay and Gravel,		5' +/-
6				18		compact, humid, ML	PP = 5,000 psf	GLACIAL TILL
				50/3"				
7						End of Exploration at 6.2', Spoon and Auger refusal		6.2'
								BEDROCK
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-4
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	112.5 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						2.5" of Pavement		PAVEMENT
1								0.2'
	S-1	24/10	1 to 3	2		Brown Sandy SILT, little fine Gravel and black Ash, loose, humid, ML		FILL
2				2				
				3				
3				2				
						Auger cuttings show increasing ash content with depth and some brick fragments		
4								
	S-2	24/2	4.5 to 6.5	50/5"		Weathered rock fragments in spoon tip		
5								4.5'
						Augered through weathered rock to competent refusal		WEATHERED ROCK
6								
7								
						End of Exploration at 7.2', Auger refusal		7.2'
8								BEDROCK
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-5
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	112.5 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						2.5" of Pavement		PAVEMENT
1								0.2'
	S-1	24/8	1 to 3	15		Dark brown to black Sandy SILT, little Gravel and black		FILL
2				16		and white Ash, ML		
				6				
3				2				
4								
						Dense drilling at 4.8'		
5	S-2	24/1	4.8 to 6.8	50/3"		Rock in spoon tip		
						End of Exploration at 4.8', Spoon and Auger refusal		4.8'
6								BEDROCK
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-101
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	118.5 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	Mobile B-53	Diameter:	2"OD/1.5"ID
Method:	4" Solid Stem Auger	Hammer:	140 lb
Hammer Style:	R&C	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						3" Pavement		PAVEMENT
1	S-1	24/4	0.5 to 2.5	4		Brown Silty SAND, loose, humid, SM		0.25' FILL
				3				
2				3				
				3				
3								
4						Possible rubble encountered at 4' during drilling		
5								
	S-2	24/4	5 to 7	7		Brown Silty SAND, trace Gravel, compact humid, SM		
6				7				
				7				
7				7				
8								
9								
10								
	S-3	24/12	10 to 12	4		Dark olive green SILT, little Sand and Gravel, trace Clay,		10.0' +/-
11				8		dense/very stiff, slightly mottled, humid, ML	PP = *1,000 to *3,000 psf	GLACIAL TILL
				30				
12				50/5		* = Specimen failed via tension crack, low clay content		
						End of Exploration at 11.9', Auger and Spoon refusal		11.9' BEDROCK
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-102
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	118.7 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	Mobile B-53	Diameter:	2"OD/1.5"ID
Method:	4" Solid Stem Auger	Hammer:	140 lb
Hammer Style:	R&C	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						3" Pavement		PAVEMENT
1	S-1	24/4	0.5 to 2.5	4		Dark brown Silty SAND, little Gravel, Gravel pieces in spoon tip, loose, dry, SM		0.25' FILL
				5				
2				5				
				3				
3						Rubble fill, large voids apparent from open hole inpection		
4						Auger encountered refusal at 4.9' during drilling. Moved over 1' and attempted to drill past, refusal encountered in second hole at 3.2'		
5								
						End of Exploration at 4.9', Auger refusal on rubble		4.9'
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-103
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	115.0 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	Mobile B-53	Diameter:	2"OD/1.5"ID
Method:	4" Solid Stem Auger	Hammer:	140 lb
Hammer Style:	R&C	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						3" Pavement		PAVEMENT
1	S-1	24/8	0.5 to 2.5	4		Brown to dark brown SAND, trace silt, large brick fragment		0.25'
				6		in top 4" of sample, brick fragment in spoon tip, loose,		FILL
2				7		humid, SP		
				9				
3								
4								
5								
	S-2	24/6	5 to 7	5		same as above, no brick fragment, some white Ash		
6				7				
				15				
7				15				
8								
9								
								9.0' +/-
10								GLACIAL TILL
	S-3	24/20	10 to 12	14		Olive green SILT, little Gravel, Sand, and Clay, cobble	PP = 6,000 to	
11				24		pieces fro 10.5 to 11.0', humid, dense/hard, ML	> 9,000 psf	
				20				
12				20				
13								
14								
15						End of Exploration at 14.5', Auger refusal		14.5'
								BEDROCK
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	**B-104**
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	113.1 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	Mobile B-53	Diameter:	2"OD/1.5"ID
Method:	4" Solid Stem Auger	Hammer:	140 lb
Hammer Style:	R&C	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						4" Pavement		PAVEMENT
1						Augered to 5', relatively easy drillling (no rubble)		0.3' FILL
2								
3								
4								
5								
	S-1	24/18	5 to 7	7		Olive green SILT, little Gravel, Sand, and Clay, mottled,	PP = 5,000 to	5.0' +/-
6				7		damp, compact/very stiff, cobble pieces at 6.5', ML	7,000 psf	GLACIAL TILL
				17				
7				23				
8								
9								8.5' WEATHERED ROCK
10						End of Exploration at 9.5', Auger refusal		9.5' BEDROCK
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-105
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	113.8 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: 24" SS
Model: Mobile B-53	Diameter: 2"OD/1.5"ID
Method: 4" Cased Wash	Hammer: 140 lb
Hammer Style: R&C	Method: ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						3" Pavement		PAVEMENT
1						Augered to refusal for Rock Core		0.25'
2								
3								
4								
5								
6								
7								
8								
9								
10	ROCK CORE DATA							9.1' +/- WEATHERED ROCK
	RUN	DEPTH	RUN	RECOVERY	RQD			10.0'
11	C-1a	10 to 13.3	40"	70%	0%	Moderately weathered, very thinly spaced vertical joints, very hard, light to medium gray SCHIST		BEDROCK
12								
13								
	C-1b	13.3 to 15	20"	100%	80%	Same as above, moderately spaced joints		
14								
15								
						End of Exploration at 15.0', rock core terminated		15.0'
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-106
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	112.0 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: 24" SS
Model: Mobile B-53	Diameter: 2"OD/1.5"ID
Method: 4" Cased Wash	Hammer: 140 lb
Hammer Style: R&C	Method: ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						3" Pavement		PAVEMENT
1						Augered to refusal for Rock Core		0.25'
2								
3								
4						Dense drilling from approximately 2' to 8', frequent rubble or cobble		
5								
6								
7								
8								
9								
10	ROCK CORE DATA							
	RUN	DEPTH	RUN	RECOVERY	RQD			10.0'
11	C-2	10 to 15	60"	66%	33%	Moderately weathered, very thinly spaced joints, very hard light gray to blue SCHIST		BEDROCK
12						most fractures range from 45° to vertical		
13								
14								
15								
	C-3	15 to 19	48"	96%	65%	Same as above, most joints and fractures are vertical		
16								
17								
18								
19								
20						End of Exploration at 19.0', rock core terminated		19.0'
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-107
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	112.9 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	Mobile B-53	Diameter:	2"OD/1.5"ID
Method:	4" Solid Stem Auger	Hammer:	140 lb
Hammer Style:	R&C	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						4" Pavement		PAVEMENT
1	S-1	24/6	0.5 to 2.5	3		Dark brown Sandy SILT, trace Ash and Brick fragments, loose, dry, ML		0.3' FILL
				4				
2				4				
				3				
3								
4								
5								
	S-2	24/24	5 to 7	7		Olive green SILT, slight mottling, litte fine Sand, trace Gravel and Clay, compact/very stiff, humid, ML		5.0' +/- GLACIAL TILL
6				10				
				14				
7				14				
8								
9								
10						Soft rock encountered during augering, drilled 1.5' into rock to hard refusal		9.0' +/- WEATHERED ROCK
11						End of Exploration at 10.5', Auger refusal		10.5' BEDROCK
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 Apartment Building	Boring #:	B-108
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	110.2 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	Mobile B-53	Diameter:	2"OD/1.5"ID
Method:	4" Solid Stem Auger	Hammer:	140 lb
Hammer Style:	R&C	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						4" Pavement		PAVEMENT
1	S-1	24/10		8		Tan fine to coarse SAND, little silt, compacy, humid, SW-SM		0.3'
				9				
2				8		large Brick fragment and white ASH		1.1' +/-
				3				
3								FILL
4								
5								
	S-2	24/4		*50/6"		Light brown Gravelly SAND, cobble piece in spoon tip, humid, SP		
6						* high blow count due to cobble in fill		
7								
8								
9						End of Exploration at 8.5', Auger refusal		8.5' BEDROCK
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 PROBE LOG

Project:	Proposed Apartment Building	Boring #:	P-1
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	114.9 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: N/A
Model: AMS Power Probe	Diameter: N/A
Method: 2-1/2" H.S.A.	Hammer: N/A
Hammer Style: Auto	Method: N/A

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015			

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		2.5" of Pavement		PAVEMENT
1								0.2' FILL
2								
3						Dense drilling at 3', likely rubble		
4						Auger advancement produced no cuttings, large voids apparent from hole inspection, likely rubble fill		
5								
6								
7								
8								
9								
10								9.0' +/- WEATHERED ROCK
11						End of Probe at 10.0', Auger Refusal		10.0' BEDROCK
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 PROBE LOG

Project:	Proposed Apartment Building	Boring #:	P-2
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	113.9 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: N/A
Model: AMS Power Probe	Diameter: N/A
Method: 2-1/2" H.S.A.	Hammer: N/A
Hammer Style: Auto	Method: N/A

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015			

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		2.5" of Pavement		PAVEMENT
1								0.2' FILL
2						Auger cuttings: tan Sandy SILT, some brick fragments,		
3								
4								
5								
6								
7								
8								
9								
10								9.0' +/- WEATHERED ROCK
11						End of Probe at 10.0', Auger refusal		10.0' BEDROCK
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 PROBE LOG

Project:	Proposed Apartment Building	Boring #:	P-3
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	112.8 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: N/A
Model: AMS Power Probe	Diameter: N/A
Method: 2-1/2" H.S.A.	Hammer: N/A
Hammer Style: Auto	Method: N/A

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015			

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		3.5" of Pavement		PAVEMENT
1						Dense drilling at 8", moved over and started new hole		0.3' FILL
2						Auger cuttings: Dark tan SAND, little Silt and Gravel		
3								
4								
5								
6						Auger cuttings: similar to above, little Clay		5.0' +/- GLACIAL TILL
7								
8						Auger cuttings: light tan fine SAND (rock dust)		7.0' +/- WEATHERED ROCK
9								
10				↓				
11						End of Probe at 9.9', Auger refusal		9.9' BEDROCK
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 PROBE LOG

Project:	Proposed Apartment Building	Boring #:	**P-4**
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	112.9 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: N/A
Model: AMS Power Probe	Diameter: N/A
Method: 2-1/2" H.S.A.	Hammer: N/A
Hammer Style: Auto	Method: N/A

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015			

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		3.5" of Pavement		PAVEMENT
1								0.3'
						Auger refusal at 2', moved over and started new hole		FILL
2								
						Encountered dense drilling at 2' again in second hole,		
3						drilled past it. Dense driilling ecountered again at 4'.		
						Likely rubble		
4								
						End of Probe at 4.0', Auger refusal		4.0'
5								RUBBLE
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 PROBE LOG

Project:	Proposed Apartment Building	Boring #:	P-5
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	112.3 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: N/A
Model: AMS Power Probe	Diameter: N/A
Method: 2-1/2" H.S.A.	Hammer: N/A
Hammer Style: Auto	Method: N/A

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015			

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		3" of Pavement		PAVEMENT
1				↓		Auger refusal at 9"', moved over and started new hole, encounered same refusal. Likely cobble		0.3'
2						End of Probe at 0.8', Auger refusal		0.8' COBBLE
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 PROBE LOG

Project:	Proposed Apartment Building	Boring #:	P-6
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	112.3 ft
Driller:	C. Coolidge, P.E.	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 3/31/2015	Date Completed: 3/31/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: N/A
Model: AMS Power Probe	Diameter: N/A
Method: 2-1/2" H.S.A.	Hammer: N/A
Hammer Style: Auto	Method: N/A

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/31/2015			

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		2.5" of Pavement		PAVEMENT
1								0.2' FILL
2						Auger cuttings: Black Sandy SILT, frequent brick fragments, little Clay and black Ash		
3								
4								
5								
6						End of Probe at 5.0', Auger refusal		5.0' BEDROCK
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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 PROBE LOG

Project:	Proposed Apartment Building	Boring #:	**P-101**
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	116.4 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: N/A
Model: Mobile B-53	Diameter: N/A
Method 4" Solid Stem Auger	Hammer: N/A
Hammer Style: R&C	Method: N/A

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		3" Pavement		PAVEMENT
1						Very difficult drilling, frequent rubbe encountered, refusal encountered in first hole at 4.5', moved over 1' to start new hole		0.25' +/- FILL
2								
3								
4								
5								
6								
7								
8								
9								
10						Smoother drilling started around 9', assumed transizion zone into native till		9' +/- GLACIAL TILL
11						End of Probe at 10.8', Auger refusal		10.8' BEDROCK
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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
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SOIL PROBE LOG

Project:	Proposed Apartment Building	Boring #:	P-102
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	111.9 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	Mobile B-53	Diameter:	2"OD/1.5"ID
Method	4" Solid Stem Auger	Hammer:	140 lb
Hammer Style:	R&C	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		3" Pavement		PAVEMENT
1								
2						Smooth drilling throughout fill layer (no rubble/cobbles)		
3								
4								
5						Increased resistance at 4.8, potential till or soft rock		
6								
7								
8								
9								
10								
11								
12						End of Probe at 12.1', Auger refusal		12.1' BEDROCK
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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%

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GEOENGINEERING SERVICES

SOIL PROBE LOG

Project:	Proposed Apartment Building	Boring #:	P-103
Location:	665 Congress St.	Project #:	15040
City, State:	Portland, ME	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Great Works Test Boring	Boring Elevation:	112.3 ft
Driller:	Jeff Lee	Reference:	Site Survey by Titcomb Associates
Summit Staff:	M. Hardison, E.I.	Date started: 4/15/2015	Date Completed: 4/15/2015

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: 24" SS
Model: Mobile B-53	Diameter: 2"OD/1.5"ID
Method 4" Solid Stem Auger	Hammer: 140 lb
Hammer Style: R&C	Method: ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/15/2015	-		None observed

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		4" Pavement		PAVEMENT
1								0.3'
2								
3						Relatively easy drilling, no rubbe/cobbles encountered		
4								
5								
6								
7								
8								
9								
10						End of Probe at 9.6', Auger refusal		9.6' BEDROCK
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

Bedrock Joints
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%

APPENDIX C

ROCK CORE PHOTOS

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PHOTOGRAPHIC LOG

Project:	**Project No.**
Proposed Apartment Building – 665 Congress St., Portland ME	15040

Photo No. 1

Date: 4-16-2015

Site Location:

665 Congress Street
Portland, Maine

Description:

Rock Core C-1 in Boring B-105 from depth 10 feet to 15 feet

Elevation 103.8 feet to Elevation 98.8 feet

Description:

Schist

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PHOTOGRAPHIC LOG

Project:	**Project No.**
Proposed Apartment Building – 665 Congress St., Portland ME	15040

Photo No. 1

Date: 4-16-2015

Site Location:

665 Congress Street
Portland, Maine

Description:

Rock Core C-2 in Boring B-106 from depth 10 feet to 15 feet

Elevation 102 feet to Elevation 97 feet

Description:

Schist

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PHOTOGRAPHIC LOG

Project:	**Project No.**
Proposed Apartment Building – 665 Congress St., Portland ME	15040

Photo No. 1

Date: 4-16-2015

Site Location:

665 Congress Street
Portland, Maine

Description:

Rock Core C-3 in Boring B-106 from depth 15 feet to 19 feet

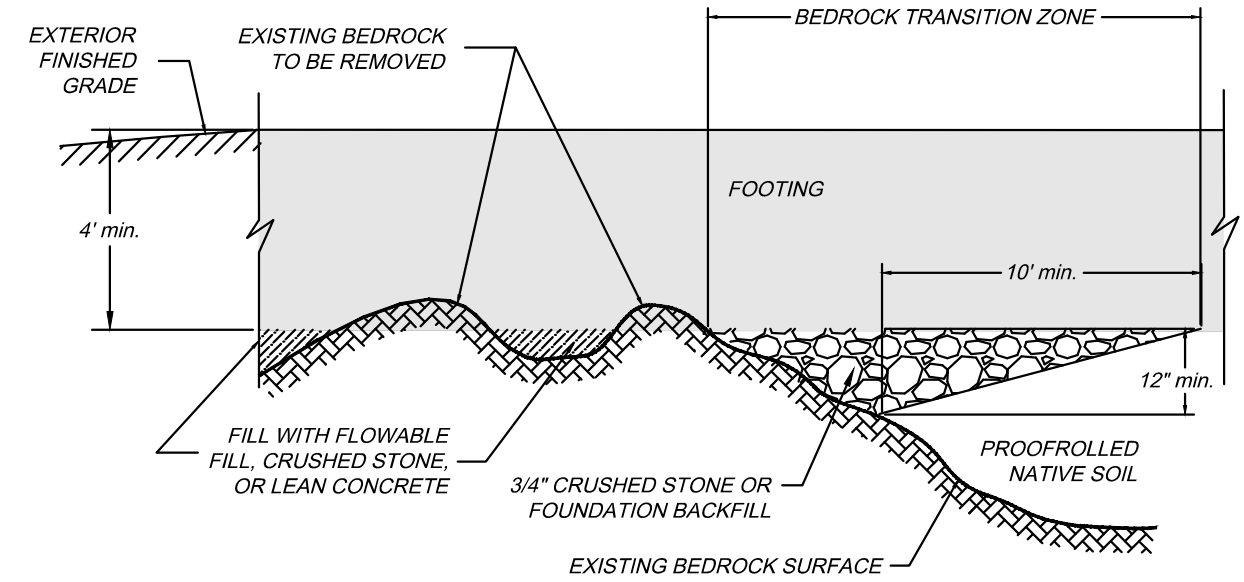
Elevation 97 feet to Elevation 93 feet

Description:

Schist

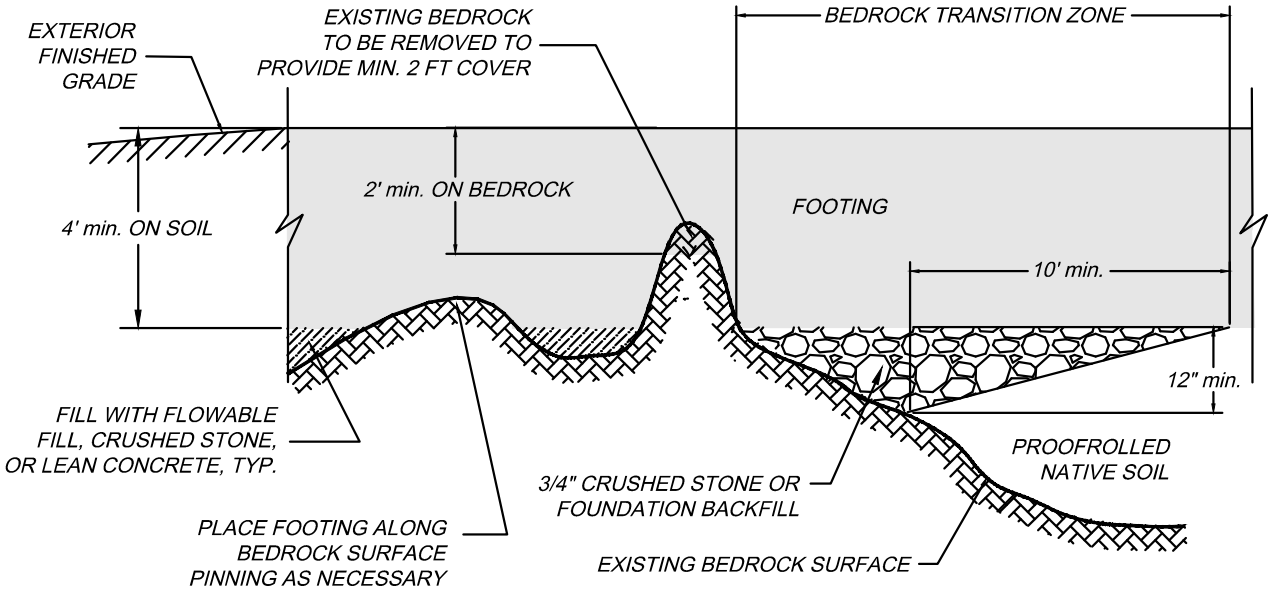
APPENDIX D

TRANSITION ZONE CONSTRUCTION DETAIL



FOOTING SUBGRADE OPTION #1 - FULL FROST PROTECTION

(not to scale)



FOOTING SUBGRADE OPTION #2 - MINIMUM FROST PROTECTION

(not to scale)

BEDROCK TO SOIL TRANSITION DETAIL

PROPOSED BUILDING SITE

665 CONGRESS STREET - PORTLAND, MAINE

PREPARED FOR

REDFERN PROPERTIES

DATE: 5-1-2015	DRAWN BY: KRF	CHECKED BY: WMP
JOB: 15040	NOT TO SCALE	FILE: 15040 BED

145 LISBON ST. - SUITE 601
LEWISTON, ME 04240
Tel.: (207) 576-3313

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

SUMMIT
GEOENGINEERING SERVICES
www.summitgeoeng.com

APPENDIX E

GENERAL BLASTING CRITERIA

GENERAL BLASTING RECOMMENDATIONS

Introduction

Blasting operations will be performed in general accordance with the applicable Maine Revised Statute Title 125 and Title 38, U.S. Department of the Interior Rules, the recommendations provided below, and a normal standard of care.

Blast Design

The blasting contractor shall submit a blasting plan to the Owner for approval prior to blasting operations. The blasting plan shall include a schedule, sketches of the drill patterns (hole spacing and depth), type and amount of explosives, number and sequence of delays, methods for minimizing flyrock, and any other information pertinent to demonstrating compliance with the applicable U.S. Department of the Interior Rules and the requirements of the applicable Statute requirements of 38 MRSA.

Notification

Oral notification to the abutters within one-half mile of the blast area shall be provided prior to blasting. Warning and all clear signals of different character or pattern that are audible within one-half mile from the point of the blast shall be given. The meaning of the signals shall be conveyed to the abutters at the time they are notified.

Pre-blast Surveys

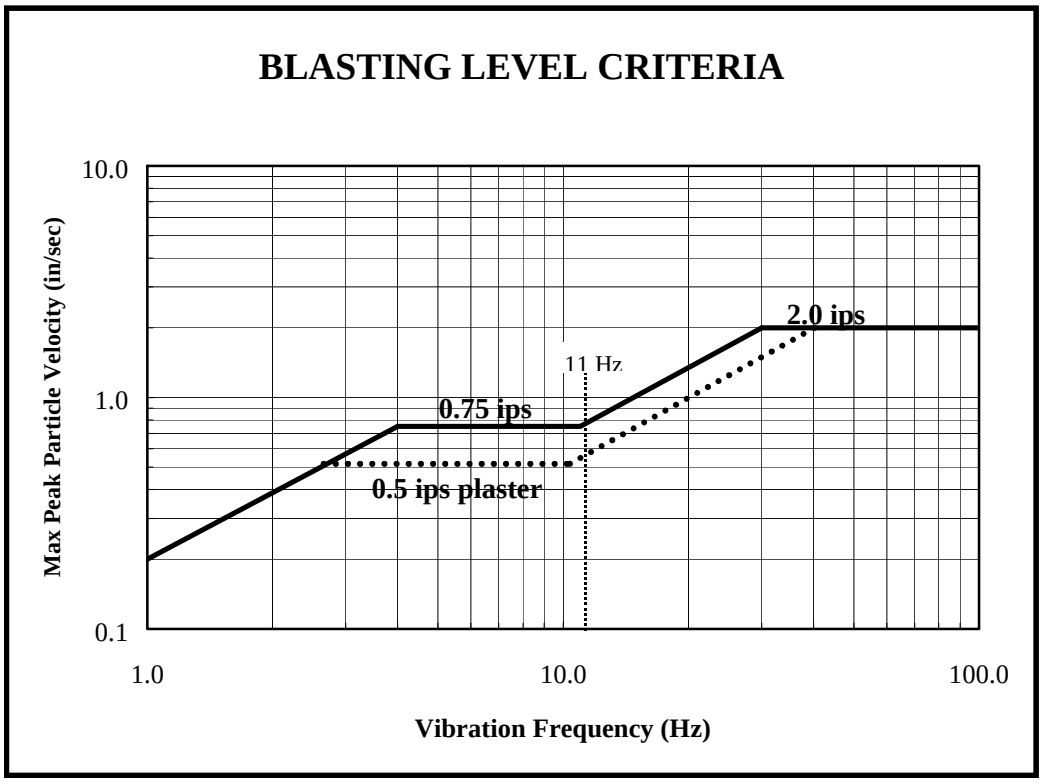
All blasting operations are the direct responsibility of the Blasting Contractor. Reports of damage to structures caused by blasting operations are the sole responsibility of the Blasting Contractor. Therefore, it is incumbent upon the Blasting Contractor to perform pre-blast surveys as they deem necessary.

Airblast Limits

Airblast overpressure shall not exceed the limits stipulated in 38 MRSA 490-Z(14)(H) at the nearest structure. This currently requires sound from blasting to not exceed 129 decibels peak at inhabited structures and 140 decibels peak at uninhabited structures.

Ground Vibration Limits

The maximum ground vibration at any structure shall not exceed the limits presented in the following chart:



REFERENCE: OSM alternative blasting criteria (Modified from figure B-1, Bureau of Mines, RI 8507)

The Blasting Contractor shall provide a seismographic record to the Owner for each blast event at the nearest off-site structure. The record shall include the date and time of the blast, peak and resultant particle velocities and associated frequencies, and the airblast overpressure.

Flyrock

Sufficient stemming, matting, or natural protective cover shall be provided to prevent flyrock from leaving property owned or under control of the operator or from entering protected natural resources or natural buffer strips.

Records

Records of blasts shall be recorded in accordance with Maine Statute 38 MRSA 490-Z(14)(L). The current requirements are as follows.

- Name of blasting company or blasting contractor
- Location, date and time of blast
- Name, signature and social security number of blaster
- Type of material blasted
- Number and spacing of holes and depth of burden or stemming
- Diameter and depth of holes
- Type of explosives used
- Total amount of explosives used
- Maximum amount of explosives used per delay period of 8 milliseconds or greater
- Maximum number of holes per delay period of 8 milliseconds or greater
- Method of firing and type of circuit
- Direction and distance in feet to the nearest dwelling, public building, school, church or commercial or institutional building neither owned nor controlled by the developer
- Weather conditions, including factors such as wind direction and cloud cover
- Height or length of stemming
- Amount of mats or other protection used
- Type of detonators used and delay periods used
- The exact location of each seismograph and the distance of each seismograph from the blast
- Seismographic readings
- Name and signature of the person operating each seismograph
- Names of the person and the firm analyzing the seismographic data

MAXIMUM PARTICLE VELOCITY/DISTANCE CRITERIA
FOR BLASTING NEAR UNCURED CONCRETE

Time From Batching (hr)	Non-Structural Concrete	Structural Concrete
0 – 4	4D	2D
4 – 24	1D	0.25D
24 – 72	1.5D	1D
72 – 168	3D	2D
168 – 240	8D	5D
Over 240	15D	10D

Distance (ft)	D (in/sec)
0 to 50	1.0
50 to 150	0.8
150 to 250	0.7
Over 250	0.6

NOTE: Allowable vibration levels are reduced with increasing distance since concrete can withstand higher vibration levels at higher frequencies. Vibration frequencies decrease as the distance from the blast increases because there is an attenuation of frequency with distance.

Reference: Wyllie, Duncan C. Foundations on Rock, 1st Ed, Chapman & Hall, London, 1992