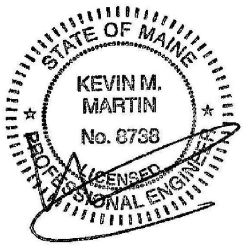
KEVIN M. MARTIN, P.E.
KMM GEOTECHNICAL CONSULTANTS, LLC
7 Marshall Road
Hampstead, NH 03841
603-489-5556 (p)/ 603-489-5558 (f)/781-718-4084(m)
kevinmartinpe@aol.com

MEMORANDUM

TO: Evolution Rock +Fitness, LLC
10 Langdon Avenue
Concord, NH

FROM: Kevin M. Martin, P.E.
Geotechnical Engineer



DATE: November 4, 2013

RE: **GEOTECHNICAL SUMMARY REPORT**
PROPOSED BUILDING - EVOLUTION ROCK
65 WARREN AVENUE
PORTLAND, MAINE

This memorandum report serves as a geotechnical summary report for the referenced project. The contents of this memorandum are subject to the attached ***Limitations***.

SITE & PROJECT DESCRIPTION

The project site is located on a vacant parcel. Present development includes paved parking to the front with woodlands to the rear. Based on review of the *Site Plan* (Sebago Technics - July 2013), grades in the parking lot are relatively level being near elevation ≈103 ft. The site is embanked (elevated) about ≈3 ft above Warren Avenue. Grades then slope downward to near elevation ≈99-100 ft towards the rear of the site. Wetlands are delineated towards the rear of the site. There is also a detention pond in this area (elevation ≈98 ft). KMM has no knowledge of past construction, use and/or development of the property.

The project includes a new recreational building. The building will include a single-story, metal building about ≈13,000 ft² in footprint area. It is intended to support the building on a conventional spread footing foundation with a concrete floor slab-on-grade. The building will have as stepped floor grade. Specifically, the front of the building will be elevation 105.0 ft with the Climbing Gym at elevation 103.0 ft. Some shallow fill (≈1-2 ft) will be necessary for final grading.

The purpose of this study is to review the subgrade conditions and provide a geotechnical evaluation related to foundation design and construction as required by the *State Building Code*. This report does not include an environmental assessment relative to oil, gasoline, solid waste and/or other hazardous materials. The environmental conditions of the property should be addressed by others as necessary. This study also does not include review of site design or construction issues such as infiltration systems, dry wells, retaining walls, underground utilities or other site and/or temporary design unless specifically addressed herein.

SUBSURFACE EXPLORATION PROGRAM

Test Borings

The exploration program for the project included four (4) test borings throughout the building pad. The test borings (B1 to B4) were advanced to depths of ≈9-34 ft utilizing 4¼ inch continuous flight hollow stem augers and/or NW casing. Soil samples were typically retrieved at no greater than 5 ft intervals with a 2 inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 (*Standard Method for Penetration Test and Split-Barrel Sampling of Soils*). Field descriptions and penetration resistance of the soils encountered, observed depth to groundwater, depth to apparent bedrock refusal and other pertinent data are contained on the attached *Test Boring Logs*. The attached *Sketch* shows the test bore locations.

Vane Shear Testing

Vane shear tests were performed on the cohesive soils to evaluate undrained shear strength. Vane shear testing was performed in accordance with ASTM D2573 (Vane Shear Tests in Cohesive Soils). The test results are shown on the *Test Bore Logs*.

SUBSURFACE CONDITIONS

The subsurface conditions below undocumented Fill and discontinuous buried Organic Silt include a Stiff Silt & Clay. Softer Clay was present at B1. At depth, there is a consolidated Glacial Till then apparent Bedrock refusal. The subgrade conditions are variable for the small site. A *Subsurface Profile* depicting the soil and groundwater conditions is attached for review.

Fill/ Organics

Fill was encountered at most locations to depths of ≈5-9 ft. In the parking lot, there is about ≈5 ft of Granular Fill as identified at B1 & B2. Organic laden Fill and/or Organic Silt were identified in the other holes at grade or below the Granular Fill. The parent surface organic soils (Forest Mat & Subsoil) were present at B4 (located in the undeveloped woodlands). Organic laden Fill (dark brown, loose, loamy, silty Sand with trace wood, roots and organic matter) were identified at B2 & B3. A buried Organic Silt was identified at B3. The collective depth of the Fill and Organic laden soils is about ≈5-9 ft.

Stiff Silt & Clay
A Stiff Silt & Clay was identified at all the test bores below the Fill and/or Organic laden soils. The layer includes a grey to olive to brown, Silt & Clay with little to trace sand. The relative consistency of the deposit is generally Stiff based on the SPTs. The Stiff Silt & Clay is considered a competent bearing stratum for support of a spread footing foundation. This is shown on the attached *Profile Section* in relation to the expected foundation. The fine-grained composition of the Silt & Clay renders the soil highly moisture sensitive, poor-draining and frost susceptible.

Soft Clay
Soft silty Clay (Penobscot Clay) was encountered at B1 being about ≈ 14 ft in thickness. Vane shear tests at B3 indicate a Stiffer Clay.

Glacial
At depth, there is a silty Sand, little gravel, little clay. These soils are a mixture of Sand, Silt & Gravel with varying clay. These soils are stable and compact.

Groundwater
Groundwater was encountered in the test holes at depths of ≈5-9 ft below grade. This corresponds to an elevation ≈94-95 ft. Seasonally perched conditions are also expected given the restrictive Silt & Clay. It should be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature and other factors differing from the time of the measurements. This study was completed at a time of seasonally low groundwater.

FOUNDATION SUBGRADE RECOMMENDATIONS

The subgrade conditions are favorable for supporting the proposed building on a conventional spread footing foundation with a concrete floor slab. The undocumented fill, organic laden soils, intersecting utilities and other questionable materials are **not** rendered suitable for structural support given questionable strength and compressibility characteristics. As such, these soils shall be fully removed from the building pad including the *Footing Zone of Influence* (*FZOI*) to expose the Stiff Clay. The *FZOI* is defined as that area extending laterally one foot from the edge of footing then outward and downward at a 1H:1V splay. Some over-excavation (below BOF) will be necessary for the proposed foundation. This is shown on the attached *Profile*. Structural Fill necessary to achieve foundation grade should conform to the *Specifications* (Table 1).

The parent subgrade soils (Stiff Clay) should be exposed in the foundation areas prior to casting the footings or placing structural fill. Final excavations to expose the Stiff Clay shall be completed with smooth bladed equipment to mitigate disturbance. It is also recommended that the Stiff Clay be *immediately* protected with Structural Fill and/or ¾ inch minus crushed stone. A minimum ≈ 10 inch stone base (encased in a geotextile fabric Mirafi 140N or equal) shall be used if the Stiff Clay is

exposed at BOF grade. Structural Fill may be used if the BOF is greater than ≈2 ft above the Stiff Clay. The purpose of the stone or gravel base is to protect the sensitive clay from disturbance when exposed to construction activities and wet conditions. The contractor should exercise extra precaution to minimize subgrade disturbance given the sensitive subgrade. The groundwater table or ponded storm water should be continuously maintained at least one foot below construction grade until the backfilling is complete. A base of ¾-inch minus crushed stone should be placed atop the earthen subgrade if wet conditions are present. The stone should be *immediately* placed atop the undisturbed subgrade then tamped with a plate compactor exhibiting stable conditions. The purpose of the stone base is to protect the wet subgrade, facilitate necessary dewatering and provide a dry/stable base upon which to progress foundation construction. Proper groundwater control and storm water management are also necessary to maintain site stability. Groundwater may be an issue if construction occurs during the wetter winter or spring season. The drier summer months are more favorable for groundwater control.

Consolidation settlement of the Soft Clay may be an issue if there is site filling greater than ≈1-2 ft. Maximum site fill within the building pad is about ≈2 ft. Preliminary estimates indicate about ≈0.3 inches of settlement for every ≈1 ft increase in site grade. For this reason, we recommend filling the pad as soon as practicable to initiate compression of the soft clay. The fill may be elevated (surcharged) in the general area B1 to further compress the Soft Clay. A Sand Fill (unit weight less than ≈115 pcf) may be used for general backfill within and around the foundation (Table 1). Lowing the FFE would also mitigate concern with consolidation settlement.

The subgrade should ultimately be stable, dewatered, compact and protected from frost throughout construction. Bearing subgrades that become weakened or disturbed due to wet conditions will be rendered unsuitable for structural support. An Engineer from KMM should be scheduled to review the foundation subgrade conditions and preparation during construction.

FOUNDATION DESIGN RECOMMENDATIONS

The footings are expected to gain bearing support atop the Stiff Clay and/or compacted Structural Fill (Table 1). Footings may be designed using an allowable bearing capacity of 4 ksf (FS=3). The allowable bearing capacity may be increased a third (⅓) when considering transient loads such as wind or seismic. The bearing capacity is contingent upon the perimeter strip footings and isolated column footings being no less than 2 ft and 3 ft in width respectively. For footings less than 3 ft in lateral dimension, the allowable bearing capacity should be reduced to one-third and multiplied by the least lateral footing dimension in feet. Foundation settlement should be less than 1 inch with differential settlement less than ½ inch. Foundation settlement is in addition to consolidation settlement associated with site fills as previously addressed. Exterior footings shall be provided with at least 4½ ft of frost protection. Proper frost protection should be necessary during winter construction.

The subsurface conditions were reviewed with respect to seismic criteria set forth in the *International Building Code (2012)*. Based on the relative density of the site soils, the site does not appear susceptible to liquefaction (complete loss of shear resistance) in the event of an earthquake. Based on interpretation of the *Building Code* together with the project and site conditions, the *Site Classification* is "D" (Stable Soil Profile).

It is recommended that a minimum 6-inch base of *Clean Granular Fill* (Table 1) be placed below the concrete floor slab for moisture and frost control. The gravel base shall be increased to no less than 12 inches for exterior concrete slabs exposed to frost. A subgrade modulus of 150 pci may be used for design of the floor slab. The subgrade modulus may be increased 25 pci for every 3 inch in additional gravel base thickness (200 pci @ 12 inch gravel base). A vapor retarder should be used below the floor slab dependent upon the floor treatment. A vapor barrier should be specified by others per ACI Standards. Structural fill necessary within and below the foundation should also conform to the attached *Specifications* (Table 1). As prior mentioned, a *Clean Sand Fill* (Table 1) is recommended for general fill to limit ground stress. The existing Granular Fill may be re-used on the project. The organic laden soils as well as the silt/clay soils are **not** suitable for re-use within or around the building. These soils should be segregated and used in non-structural areas away from the building.

CONSTRUCTION CONCERNS

The contractor should be required to maintain a stable-dewatered subgrade for the building foundation and other concerned areas during construction. Subgrade disturbance may be influenced by excavation methods, moisture, precipitation, groundwater control and construction activities. The silt and clay soils are considered inherently vulnerable to disturbance when exposed to wet conditions and construction activities. The moisture sensitivity of these soils is associated with the high percentage of fine-grained material (silt/clay) which acts to retain moisture. The presence of a perched water or groundwater (ie: wet conditions) will further impact the subgrade stability. The contractor should be aware of the moisture concerns and take precautions to reduce subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling footings as soon as practicable, and maintaining an effective dewatering program. Soils exhibiting weaving or instability should be over-excavated to a competent bearing soil and replaced with a crushed stone or gravel. The moisture concerns are typically more problematic if construction takes place during the winter to spring season or other periods of inclement weather. The Silt & Clay subgrade shall be protected with a minimum ≈10 inch base of ¾ inch minus crushed stone encased in a geotextile fabric (Mirafi 140N or equal) or a minimum ≈24 inches of Structural Fill (ie: Gravel). The stone shall be tamped with a plate compactor and exhibit stable conditions. The purpose of the stone base is to protect the sensitive clay soils from disturbance when exposed to construction activities and wet conditions. The Clay shall also be excavated with a smooth blade and be protected immediately upon exposure. Bearing subgrades that become weakened or disturbed due to wet conditions will be rendered unsuitable for structural support. An Engineer from KMM should inspect bearing subgrades during construction.

Adequate dewatering and storm water management are also necessary for maintaining the competency of the site soils. Groundwater or ponded storm water should be continuously maintained at least one foot below construction grade. The groundwater is expected to be controlled with conventional filtered sumps and pumps together with a base of crushed stone. A ≈10 inch lift of ¾-inch minus crushed stone (protected with geotextile fabric) should be placed atop the wet subgrade to protect its competency and facilitate dewatering. The footing trenches should have a positive clay slope towards the sumps. The sumps shall extend at least ≈2 ft below construction grade and be protected with filter stone.

Soils which become softened and/or disturbed during construction will be rendered unsuitable for structural bearing support. The foundation subgrades should ultimately be stable, dewatered, protected from frost and compact throughout construction. An Engineer from KMM should be scheduled to review the subgrade conditions and preparation.

CONSTRUCTION MONITORING

It is recommended that a qualified engineer or representative be retained to review earthwork activities such as the preparation of the foundation bearing subgrade and the placement/compaction of Structural Fill. It is recommended that KMM be retained to provide construction monitoring services. This is to observe compliance with the design concepts presented herein.

We trust the contents of this memorandum report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.

kmm50/PortlandEvolutionRock.wpd

LIMITATIONS

Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by KMM Geotechnical Consultants, LLC.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of Evolution Rock + Fitness, LLC in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by KMM Geotechnical Consultants, LLC. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to preliminary geotechnical design considerations only.

TABLE 1

Evolution Rock + Fitness
65 Warren Avenue
Portland, Maine

Recommended Soil Gradation & Compaction Specifications

Clean Granular Fill
(Select GRAVEL borrow)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3 inch	100
3/4 inch	60-90
No. 4	30-70
No. 200	2-8

NOTES: For minimum 6 inch base below Concrete Floor Slab-on-Grade;
For 12 inch base below exterior concrete slabs exposed to frost
Compact to 95% relative compaction per ASTM D1557

Structural Fill
(Gravelly SAND)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5 inch	100
3/4 inch	60-100
No. 4	20-80
No. 200	0-10

NOTES: For use below building foundations for structural bearing support
A ¾-inch crushed stone may be used for Structural Fill in wet conditions
For use as backfill behind unbalanced foundation walls
Compact to 95% relative compaction per ASTM D1557

TABLE 1

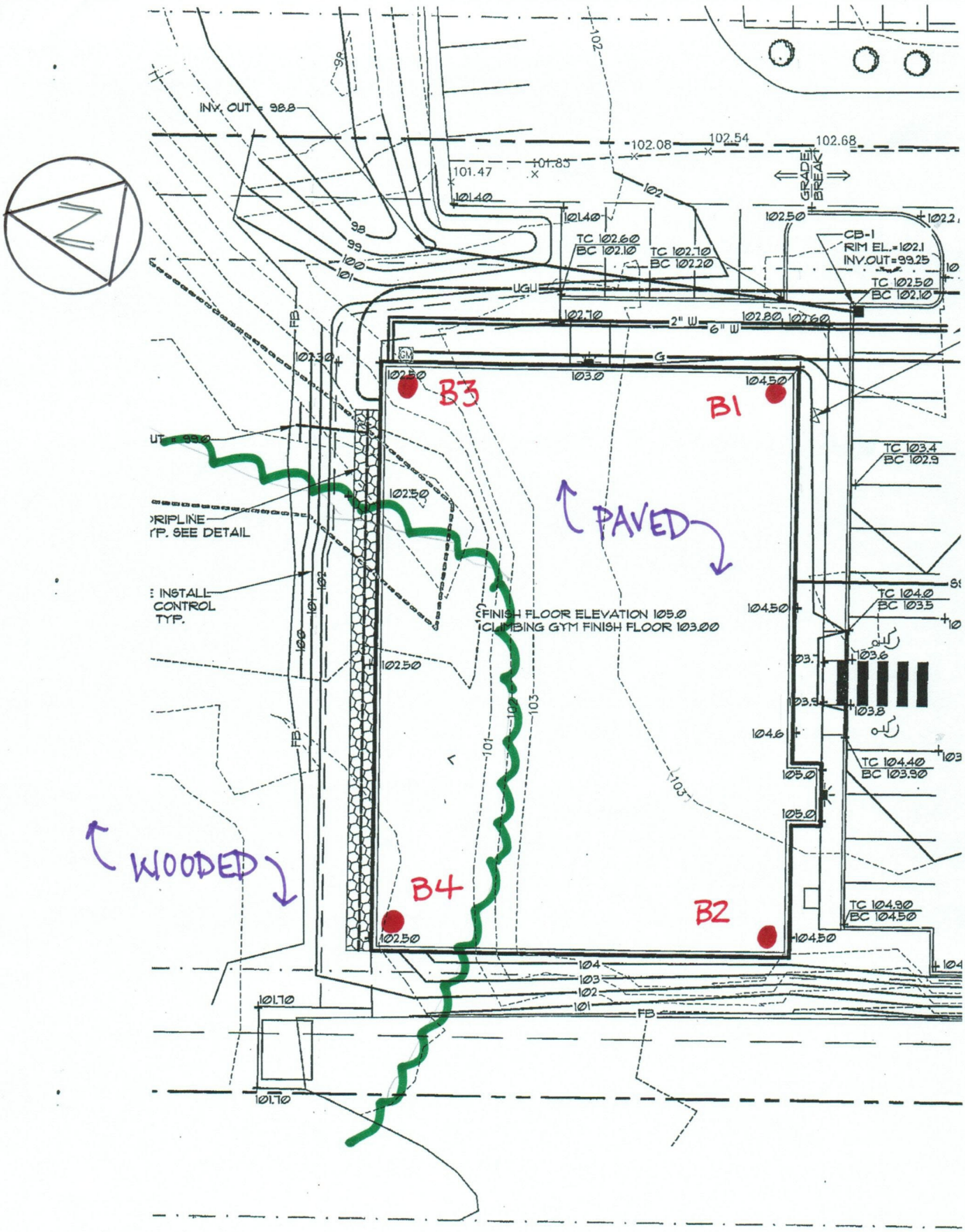
Evolution Rock + Fitness
65 Warren Avenue
Portland, Maine

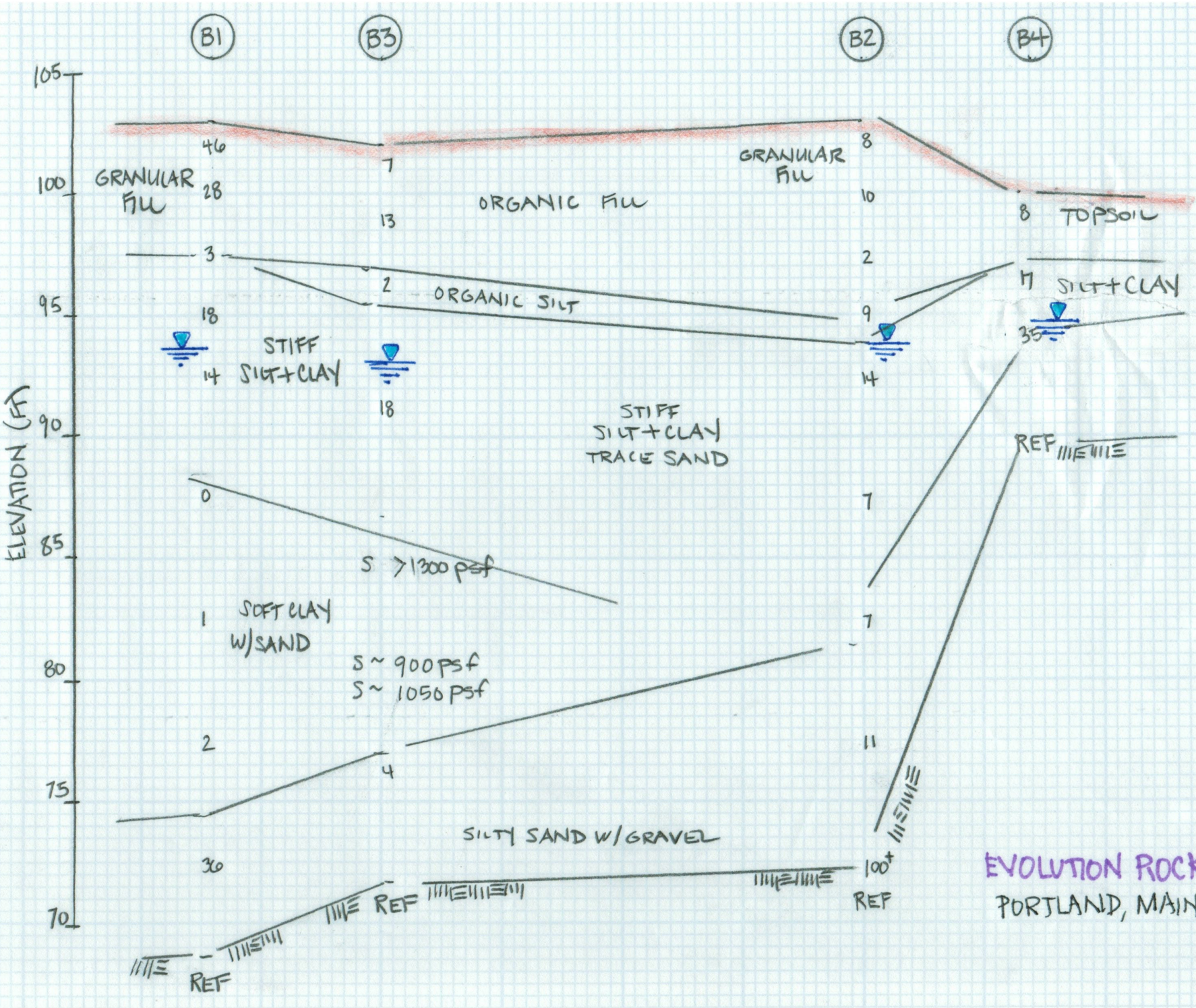
Sand Fill
(SAND)

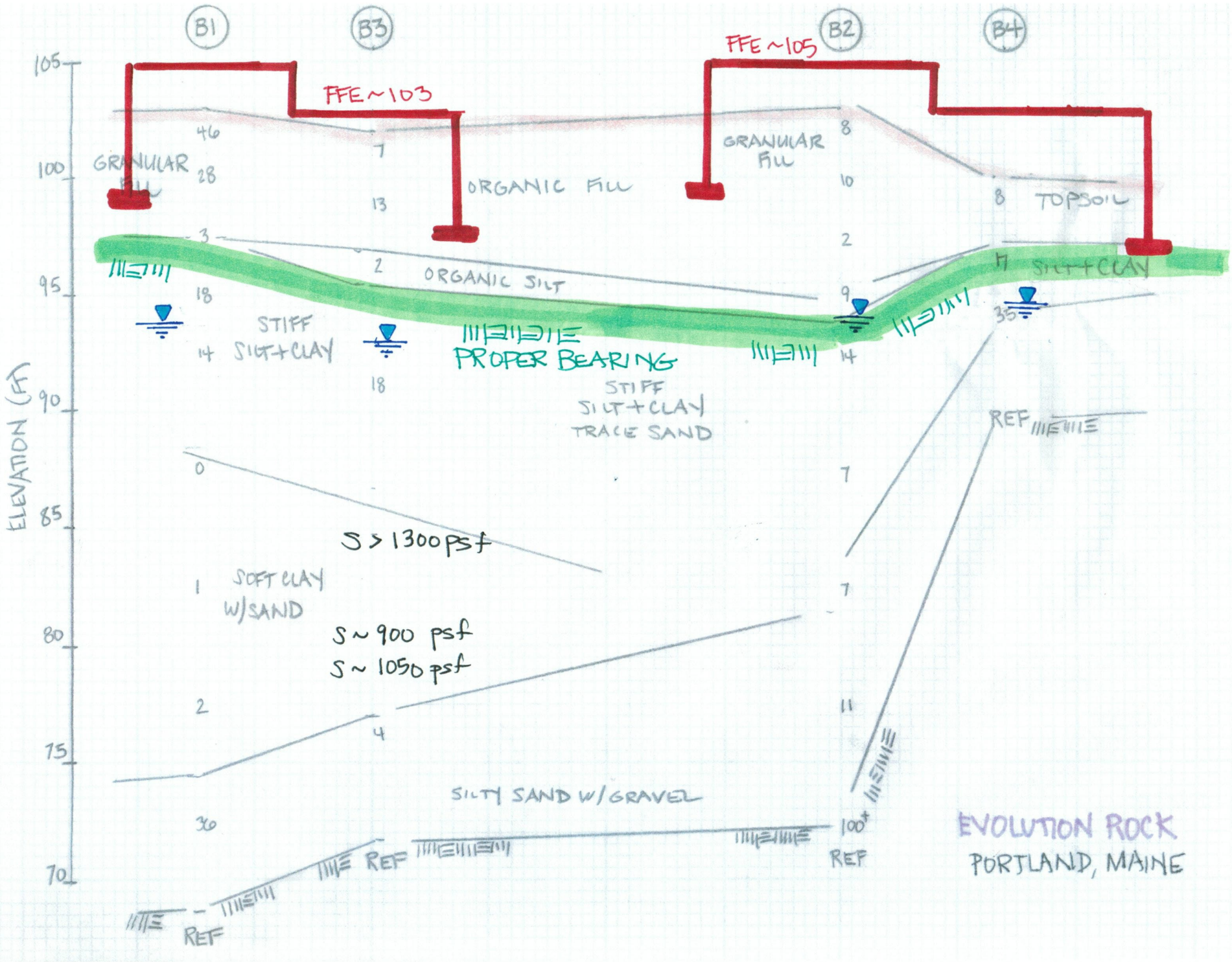
SIEVE SIZE	PERCENT PASSING BY WEIGHT
1 inch	100
3/4 inch	90-100
No. 4	85-100
No. 40	10-70
No. 200	0-8

NOTES: For use as general building backfill
Not to be used as Structural Fill below footings
Not to be use as the Gravel Base below the floor slab
Dry unit weight less than 115 pcf
Compact to 95% relative compaction per ASTM D1557

Structural Fill placed beneath the foundation should include the *Footing Zone of Influence* which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1H:1V splay. Structural Fill should be placed in loose lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors. All the fill on the project should be compacted to at least 95 percent of maximum dry density as determined by the Modified Proctor Test (ASTM-D1557). The fill shall be compacted within ±2 of the optimum moisture content. The adequacy of the compaction efforts should be verified by field density testing which is also a requirement of the *State Building Code*.


INV. OUT = 98.8
102.08
102.54
102.68
GRADE BREAK
101.47
101.83
101.40
102.50
CB-1
RIM EL.=102.1
INV.OUT=99.25
TC 102.60
BC 102.10
TC 102.70
BC 102.20
TC 102.50
BC 102.10
UGU
2" W
6" W
102.80
102.60
103.0
B3
B1
104.50
TC 103.4
BC 102.9
PAVED
DRIPLINE
TYP. SEE DETAIL
INSTALL
CONTROL
TYP.
FINISH FLOOR ELEVATION 105.0
CLIMBING GYM FINISH FLOOR 103.00
TC 104.0
BC 103.5
103.6
103.8
104.6
TC 104.40
BC 103.90
105.0
WOODED
B4
B2
TC 104.90
BC 104.50
104.50
101.70
FB
GRAPHIC SCALE
20 0 10 20 40


B1
B3
B2
B4
105
100
95
90
85
80
75
70
ELEVATION (FT)
GRANULAR FILL
46
28
3
18
14
ORGANIC FILL
7
13
2
ORGANIC SILT
18
STIFF SILT+CLAY
GRANULAR FILL
8
10
2
9
14
8 TOPSOIL
17 SILT+CLAY
35
STIFF SILT+CLAY TRACE SAND
REF
0
S >1300 psf
7
1
SOFT CLAY W/SAND
S ~ 900 psf
S ~ 1050 psf
7
2
4
11
SILTY SAND W/GRAVEL
30
100+
REF
REF
REF
EVOLUTION ROCK
PORTLAND, MAINE


B1
B3
B2
B4
FFE~103
FFE~105
GRANULAR FILL
ORGANIC FILL
GRANULAR FILL
TOPSOIL
ORGANIC SILT
SILT+CLAY
STIFF SILT+CLAY
PROPER BEARING
STIFF SILT+CLAY TRACE SAND
REF
S>1300psf
SOFT CLAY W/SAND
S~900 psf
S~1050 psf
SILTY SAND W/GRAVEL
REF
REF
ELEVATION (FT)
105
100
95
90
85
80
75
70
EVOLUTION ROCK
PORTLAND, MAINE

CONTRACTOR: Great Works Test Bores
Rollingsford, NH

FOREMAN: Pete Michaud

RIG: CME 850C

KMM Geotechnical Consultants, LLC

7 Marshall Road
Hampstead, NH 03841

TEST BORING LOG

PROJECT: EVOLUTION ROCK
LOCATION: 65 WARREN AVENUE
PORTLAND, MAINE

BORING NO: B-1

SHEET: 1 OF 2
DATE: START: Oct 23, 2013
FINISH:
PREPARED BY: Kevin Martin, P.E.
CHECKED BY:

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HSA	NW	SS	
SIZE ID (IN)	4¼	4	2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	10/23			
DEPTH (FT)	9 ft			
CASING AT (FT)	n/a			
TIME (HR)	0.1			

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ _____

LOCATION OF BORING: See Sketch GROUND SURFACE ELEV.:

FT	NO.	DEPTH	REC. (IN)	BLOWS/ 6 IN.	SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	STRATUM CHANGE	NOTES
					Pavement		
	S1	1-3	16	13-20	Brn, f-m SAND, some Gravel, trace Silt, dry (FILL)		
				26-23			
	S2	3-5	14	16-15	Brn, f-c SAND & GRAVEL, trace silt, brick, dry (FILL)		
				13-13		5'	
5	S3	5-7	20	1-1	Grey-Brn, mottled, SILT & CLAY, trace fine sand		
				2-3			
	S4	7-9	24	6-8	Same		
				10-10			
10	S5	10-12	24	4-6	Grey, silty Clay, wet		
				8-10			
						14'	
15	S6	15-17	24	WOH/24	Grey, silty Clay w/ sand layers		
20	S7	20-22	18	WOH/18	Same		
				1			
25	S8	25-27	24	1-1	Grey, silty Clay		
				1-1			

RELATIVE DENSITY

GRANULAR SOILS (Blows/ft)	
0 to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

NOTES:

BORING NO. B-1

RELATIVE CONSISTENCY

COHESIVE SOILS (Blows/ft)	
0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6" taken with an 24" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless noted.
S = Split-Spoon Sample; C = Rock Core Sample; U = Undisturbed Shelby Tube Sample

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%) and (35-50%)

CONTRACTOR: Great Works Test Bores
Rollingsford, NH

FOREMAN: Pete Michaud

RIG: CME 850C

KMM Geotechnical Consultants, LLC

7 Marshall Road
Hampstead, NH 03841

TEST BORING LOG

PROJECT: EVOLUTION ROCK
LOCATION: 65 WARREN AVENUE
PORTLAND, MAINE

BORING NO: B-1

SHEET: 2 OF 2
DATE: START: Oct 23, 2013
FINISH:
PREPARED BY: Kevin Martin, P.E.
CHECKED BY:

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HSA	NW	SS	
SIZE ID (IN)	4¼	4	2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	10/23			
DEPTH (FT)	9 ft			
CASING AT (FT)	n/a			
TIME (HR)	0.1			

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ _____

LOCATION OF BORING: See Sketch GROUND SURFACE ELEV.:

FT	SAMPLE DATA NO.	DEPTH	REC. (IN)	BLOWS/ 6 IN.	*SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)*	STRATUM CHANGE	NOTES
						28'	
30	S9	30-32	6	17-18	Brown, silty Sand & Gravel		
				18-18			
35						34.5'	
					Refusal		
40							
45							
50							

RELATIVE DENSITY

GRANULAR SOILS (Blows/ft)	
O to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

NOTES:

BORING NO. B-1

RELATIVE CONSISTENCY

COHESIVE SOILS (Blows/ft)	
0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6" taken with an 24" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless noted.
S = Split-Spoon Sample; C = Rock Core Sample; U = Undisturbed Shelby Tube Sample

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%) and (35-50%)

CONTRACTOR: Great Works Test Bores
Rollingsford, NH

FOREMAN: Pete Michaud

RIG: CME 850C

KMM Geotechnical Consultants, LLC
7 Marshall Road
Hampstead, NH 03841

TEST BORING LOG
PROJECT: EVOLUTION ROCK
LOCATION: 65 WARREN AVENUE
PORTLAND, MAINE

BORING NO: B-2

SHEET: 1 OF 2
DATE: START: Oct 23, 2013
FINISH:
PREPARED BY: Kevin Martin, P.E.
CHECKED BY:

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HSA	NW	SS	
SIZE ID (IN)	4¼	4	2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	10/23			
DEPTH (FT)	9 ft			
CASING AT (FT)	n/a			
TIME (HR)	0.1			

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ _____

LOCATION OF BORING: See Sketch GROUND SURFACE ELEV.:

FT	NO.	DEPTH	REC. (IN)	BLOWS/6 IN.	SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	STRATUM CHANGE	NOTES
	S1	0-2	12	4-4	Brn, f-m SAND, some Gravel, trace Silt, dry (FILL)		
				4-4			
	S2	2-4	3	4-5	Same (FILL)		
				5-5			
5	S3	5-7	6	2-1	Dark Brn, f-m SAND, little Gravel, little Silt, trace organic, dry		
				1-2			
	S4	7-9	6	3-3	Same, trace wood, organic (ORGANIC FILL)		
				6-7		9'	
10	S5	10-12	24	5-6	Olive Brown, SILT & CLAY, little sand, wet		
				8-10			
15	S6	15-17	24	1-1	Grey, silty Clay w/ sand layers, wet		
				6-3			
						20'	
20	S7	20-22	24	2-3	Grey, silty Sand, little gravel, little clay, wet		
				4-4			
25	S8	25-27	14	5-5	Same		
				6-6			

RELATIVE DENSITY

GRANULAR SOILS (Blows/ft)	
0 to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

NOTES:

BORING NO. B-2

RELATIVE CONSISTENCY

COHESIVE SOILS (Blows/ft)	
0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6" taken with an 24" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless noted.
S = Split-Spoon Sample; C = Rock Core Sample; U = Undisturbed Shelby Tube Sample

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%) and (35-50%)

CONTRACTOR: Great Works Test Bores
Rollingsford, NH

FOREMAN: Pete Michaud

RIG: CME 850C

KMM Geotechnical Consultants, LLC
7 Marshall Road
Hampstead, NH 03841

TEST BORING LOG
PROJECT: EVOLUTION ROCK
LOCATION: 65 WARREN AVENUE
PORTLAND, MAINE

BORING NO: B-2

SHEET: 2 OF 2
DATE: START: Oct 23, 2013
FINISH:
PREPARED BY: Kevin Martin, P.E.
CHECKED BY:

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HSA	NW	SS	
SIZE ID (IN)	4¼	4	2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	10/23			
DEPTH (FT)	10 ft			
CASING AT (FT)	n/a			
TIME (HR)	0.1			

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ _____

LOCATION OF BORING: See Sketch GROUND SURFACE ELEV.:

FT	SAMPLE DATA NO.	DEPTH	REC. (IN)	BLOWS/ 6 IN.	*SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)*	STRATUM CHANGE	NOTES
30	S9	30-32	6	20-22	Grey, fine to medium Sand & Gravel, some silt, fractured rock	29'	
				50/5"		31.5'	
35							
40							
45							
50							

RELATIVE DENSITY
GRANULAR SOILS (Blows/ft)

0 to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

NOTES:

BORING NO. B-2

RELATIVE CONSISTENCY
COHESIVE SOILS (Blows/ft)

0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6" taken with an 24" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless noted.
S = Split-Spoon Sample; C = Rock Core Sample; U = Undisturbed Shelby Tube Sample

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%) and (35-50%)

CONTRACTOR: Great Works Test Bores
Rollingsford, NH

FOREMAN: Pete Michaud

RIG: CME 850C

KMM Geotechnical Consultants, LLC

7 Marshall Road
Hampstead, NH 03841

TEST BORING LOG

PROJECT: EVOLUTION ROCK
LOCATION: 65 WARREN AVENUE
PORTLAND, MAINE

BORING NO: B-3

SHEET: 1 OF 2
DATE: START: Oct 23, 2013
FINISH:
PREPARED BY: Kevin Martin, P.E.
CHECKED BY:

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HSA	NW	SS	
SIZE ID (IN)	4¼	4	2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	10/23			
DEPTH (FT)	9 ft			
CASING AT (FT)	n/a			
TIME (HR)	0.1			

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ _____

LOCATION OF BORING: See Sketch

GROUND SURFACE ELEV.:

FT	NO.	DEPTH	REC. (IN)	BLOWS/ 6 IN.	SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	STRATUM CHANGE	NOTES
	S1	0-2	14	3-3	Dark Brn, loamy, silty SAND, little Gravel, trace organic (FILL)		
				4-6			
	S2	2-4	10	6-7	Dark Brown, Organic Clay & Silt, trace wood (FILL)		
				6-8			
						5'	
5	S3	5-6	10	1-1	Black Organic Silt w/ roots (ORGANIC)		
		6-7	10	4-4		6'	
	S4	7-9	24	4-6	Olive Brown, SILT & CLAY, little fine sand		
				7-9			
10	S5	10-12	24	5-7	Olive Brown, SILT & CLAY, trace sand, wet		
				11-13			
15	U1	15-17	24	SHELBY	Grey, silty Clay w/ sand layers, wet - STIFF CLAY		
				TUBE			
	V1	17-18		VANE	S > 1,300 psf		
20	V2	20-21		VANE	S = 900 psf		
	V3	21-22		VANE	S = 1,050 psf		
						25'	
25	S8	25-27	14	9-3	Grey, Silt & Clay, some Sand, trace gravel, wet		
				1-1			

RELATIVE DENSITY

GRANULAR SOILS (Blows/ft)	
0 to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

NOTES:

BORING NO. B-2

RELATIVE CONSISTENCY

COHESIVE SOILS (Blows/ft)	
0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6" taken with an 24" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless noted.
S = Split-Spoon Sample; C = Rock Core Sample; U = Undisturbed Shelby Tube Sample

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%) and (35-50%)

CONTRACTOR: Great Works Test Bores
Rollingsford, NH

FOREMAN: Pete Michaud

RIG: CME 850C

KMM Geotechnical Consultants, LLC

7 Marshall Road
Hampstead, NH 03841

TEST BORING LOG

PROJECT: EVOLUTION ROCK
LOCATION: 65 WARREN AVENUE
PORTLAND, MAINE

BORING NO: B-3

SHEET: 2 OF 2
DATE: START: Oct 23, 2013
FINISH:
PREPARED BY: Kevin Martin, P.E.
CHECKED BY:

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HSA	NW	SS	
SIZE ID (IN)	4¼	4	2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	10/23			
DEPTH (FT)	9 ft			
CASING AT (FT)	n/a			
TIME (HR)	0.1			

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ _____

LOCATION OF BORING: See Sketch

GROUND SURFACE ELEV.:

FT	SAMPLE DATA NO.	DEPTH	REC. (IN)	BLOWS/ 6 IN.	*SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)*	STRATUM CHANGE	NOTES
30					Refusal @ 29.5'	29.5'	
35							
40							
45							
50							

RELATIVE DENSITY

GRANULAR SOILS (Blows/ft)

0 to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

NOTES:

BORING NO. B-3

RELATIVE CONSISTENCY

COHESIVE SOILS (Blows/ft)

0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6" taken with an 24" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless noted.
S = Split-Spoon Sample; C = Rock Core Sample; U = Undisturbed Shelby Tube Sample

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%) and (35-50%)

CONTRACTOR: Great Works Test Bores
Rollingsford, NH

FOREMAN: Pete Michaud

RIG: CME 850C

KMM Geotechnical Consultants, LLC

7 Marshall Road
Hampstead, NH 03841

TEST BORING LOG

PROJECT: EVOLUTION ROCK
LOCATION: 65 WARREN AVENUE
PORTLAND, MAINE

BORING NO: B-4

SHEET: 1 OF 1
DATE: START: Oct 23, 2013
FINISH:
PREPARED BY: Kevin Martin, P.E.
CHECKED BY:

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HSA	NW	SS	
SIZE ID (IN)	4¼	4	2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	10/23			
DEPTH (FT)	5 ft			
CASING AT (FT)	n/a			
TIME (HR)	0.1			

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ _____

LOCATION OF BORING: See Sketch GROUND SURFACE ELEV.:

FT	NO.	DEPTH	REC. (IN)	BLOWS/ 6 IN.	*SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)*	STRATUM CHANGE	NOTES
	S1	0-2	14	3-4	Dark Brown, Organic Forest Mat (ORGANIC)		
				4-3	Rust Brown, silty Sand, trace loam, roots (SUBSOIL)		
	S2	2-4	10	6-7		2'6"	
				10-10	Brown, Silt + Clay + Sand, dry		
						5'	
5	S3	5-7	12	8-15	Brown, fine to coarse Sand, little gravel, little silt, wet		
				20-40			
						9'	
10					Auger Refusal @ 9 ft		
15							
20							
25							

RELATIVE DENSITY

GRANULAR SOILS (Blows/ft)	
0 to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

NOTES:

BORING NO. B-4

RELATIVE CONSISTENCY

COHESIVE SOILS (Blows/ft)	
0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6" taken with an 24" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless noted.
S = Split-Spoon Sample; C = Rock Core Sample; U = Undisturbed Shelby Tube Sample

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%) and (35-50%)