Soil Metrics LLC Geotechnical Engineering

12 Farms Edge Road
Cape Elizabeth, Maine 04107
Telephone: 207.767.2192
Facsimile: 207.221.6568

January 26, 2011
File No. 144-01

Morse Construction
Attn: Mr. Glenn Morse
P.O. Box 1466
Scarborough, ME 04070

Re: 218 Washington Avenue Slope Stability
Portland, Maine

Dear Glenn

Soil Metrics LLC is pleased to present the results of a stability analysis for a proposed steep riprap slope at your 218 Washington Avenue residence in Portland, Maine. The project involves adding a parking lot to the left side of an existing residence (looking down slope). The lot will be approximately 70 feet long and approximately 40 feet deep, and constructed out of imported fill with a side slope away from Washington Avenue of 1H:1V. A plan showing the approximate dimensions of the parking lot in relation to the existing house is shown on the attached Figure 1, from Blais Civil Engineers. The plan currently calls for the 1H:1V slope to be covered with riprap. This report presents the results of a stability analysis performed to evaluate the global stability of the proposed new slope, and to assess if reinforcing might be necessary to enhance the stability.

Subsurface Conditions and Assumed Soil Properties: Six borings were drilled at the site at locations shown on Figure 1 in 2006 by Sebago Technics for a previous project at the site. The logs, included in Appendix A, indicate the subsurface conditions consist of the following from the ground surface:

> *Topsoil*: Consisting of very loose to loose brown silty sand (SM) with roots. The thickness was 0.3 foot.
> *Fill*: Consisting of very loose to medium dense, brown well graded sand with silt (SW-SM) to silty sand (SM), to poorly graded sand with silt (SP/SM) with various amounts of gravel, wood, bricks, bituminous and cinders. The thickness varied from 3.7 to 9.7 feet.
> *Marine Fan (Sand)*: Consisting of medium dense, brown to light brown well-graded sand with Gravel (SW). Up to 9 feet of this stratum was encountered.
> *Marine Sand*: Consisting of loose to medium dense brown poorly graded sand with silt (SP/SM); to silty sand (SM). The thickness varied from 6 to 11 feet.
> *Marine Clay*: Consisting of medium stiff, gray brown lean clay (CL). One boring near the bottom of the slope may have penetrated the clay deposit, indicating a thickness of 5.8 feet. The other borings were terminated in the stiff clay.

The borings were not extended to refusal and were terminated in a medium stiff clay except at B5 indicated above. Figure 2 is an interpretive subsurface profile through the center line of the proposed embankment fill. Borings B-2 (top of slope) and B4 (bottom of slope), were used to develop a subsurface profile of foundation conditions beneath the proposed embankment fill and forms the basis of the stability analysis.

The stiff clay stratum is interpreted as about 5-feet thick. Below the stiff clay, two additional strata of clay are assumed, with a slightly lower undrained shear strength.

There were no laboratory tests performed on the samples recovered from the borings. Engineering properties for the slope stability analysis were assumed based on the Standard Penetration Test (SPT) N-values and experience with similar materials. The assumed soil parameters used in the analysis are listed below in Table 1.

Table 1
Summary of Engineering Properties used in Stability Analyses

Soil Type	Unit Weight (pcf)		Strength Parameters	
	Moist	Saturated	Effective Internal Angle of Friction (degrees)	Cohesion (psf)
New Fill for embankment	135	135	35	0
Existing fill	135	120	30	0
Marine sand	115	115	30	0
Stiff Clay	115	115	0	1,500
Lower assumed clay strata	110	110	0	1,000

Stability Analysis Results:

Global stability analyses were conducted to assess the impact of the fill placement on the stability of the foundation soils, and the internal stability of the steep 1H:1V final slope configuration. The analyses were conducted using the computer program Slope/W (2007). A series of analyses a were conducted and are summarized below.

Case 1 Figure 3, Existing Conditions: The existing factor of safety was calculated as about 1.5 to 1.6 for surfaces passing through the loose fill and marine sands.

Case 2 Figure 4: New Embankment - No reinforcing: The minimum failure surfaces pass through the new embankment fill and loose marine. The minimum calculated factor was about 0.9 for surfaces passing through the end of the steep slope. Surfaces extending further into the fill and loose sand had factors of safety in the range of 1.1.

Case 3 Figures 5 through 7: New Embankment - Geogrid Reinforcement: The calculated minimum factor of safety is about 1.4 for slip surfaces that pass behind the reinforcing. The presence of the grid forces the minimum circles beyond the grid. Hypothetical slip surfaces that pass through the grid are on the order of 1.5 as indicated on Figure 6. The minimum calculated FS of 1.39 as indicated on Figure 5 assumes a water table surface at the base of the fill soils at a depth of 11 feet in Boring B2, and at about 6 feet below ground at Boring B-4. The borings were drilled in July 2006 and indicated dry conditions in both borings which were drilled to depths of 17 feet each. A water table was included in the stability analysis because water surfaces can increase seasonally. The surface depicted on the stability analysis profile is considered to be a reasonably conservative assumption, although the exact water table location is not known. The same analysis was re-run without a water table and the factor of safety was 1.6 as indicated on Figure 7. The actual factor of safety under most conditions is likely somewhere between 1.4 and 1.6. The above analyses were limited to depths explored by the borings, down to the stiff clay stratum with an undrained shear strength of 1,500 psf. As noted on the profile, a lower strength clay stratum was modeled to explore the impact that lower unknown/unexplored softer clay would have on the overall stability. Figure 8 shows the minimum calculated factor of safety of about 1.4 using an undrained shear strength of

1,000 psf. This seems like a reasonable assumption, however the only way to confirm deeper conditions would be to drill deeper borings.

Geogrid reinforcement will be necessary in order to improve the factor of safety in the embankment fill and shallow existing fill and marine sands. Details of the recommended grid elevations and lengths are provided on Figure 9. In order get the grid back far enough in the slope beneath the new fill, the existing slope will have to be cut back at a 1.5H to 1V angle to remove the existing fill. The bottom grid length is 27 feet at elevation 79 feet and extends from the back of the cut face to the end of the granular fill soil. The grid does not extend into the riprap. Ten layers of geogrid are necessary, spaced every 2 feet in elevation. The lengths increase by one foot up the slope to the upper layer (layer 10) at elevation 97 with a length of 36 feet.

The ends of the granular fill adjacent to the riprap will require wrapping in a geotextile to contain the fill and prevent it from unraveling and filtering into the riprap facing on the slope. The slope wrapping is shown on Detail A, Figure 9. Specifications for the geogrid, geotextile and granular backfill are indicated on Figure 9.

After the cut slope has been made, the existing subgrade on which the first layer of grid will be placed should be compacted with intense surface compaction. This can be accomplished using a vibratory roller or at least 30,000 pounds operating at a frequency of 30 cycles per second (Hz) and a minimum of 10 passes. Following the vibratory rolling, the surface should be compacted with at least 2 passes without vibration, to densify the near surface soils. New fill within the embankment should be placed in loose lift thicknesses of no more than 1-foot, and be compacted to 95 percent of ASTM D-1557.

The proposed construction includes a cast-in-place retaining wall to be built on the right side, perpendicular to the slope between the parking lot and the house. You may want to consider a segmental block, mechanically stabilized earth wall for this structure as it might be a cheaper alternative. Some of the geogrid for the slope reinforcement might be able to be utilized for the wall.

Thank you for the opportunity to provide geotechnical engineering services on this project. If you have any questions about this report, please do not hesitate to contact me.

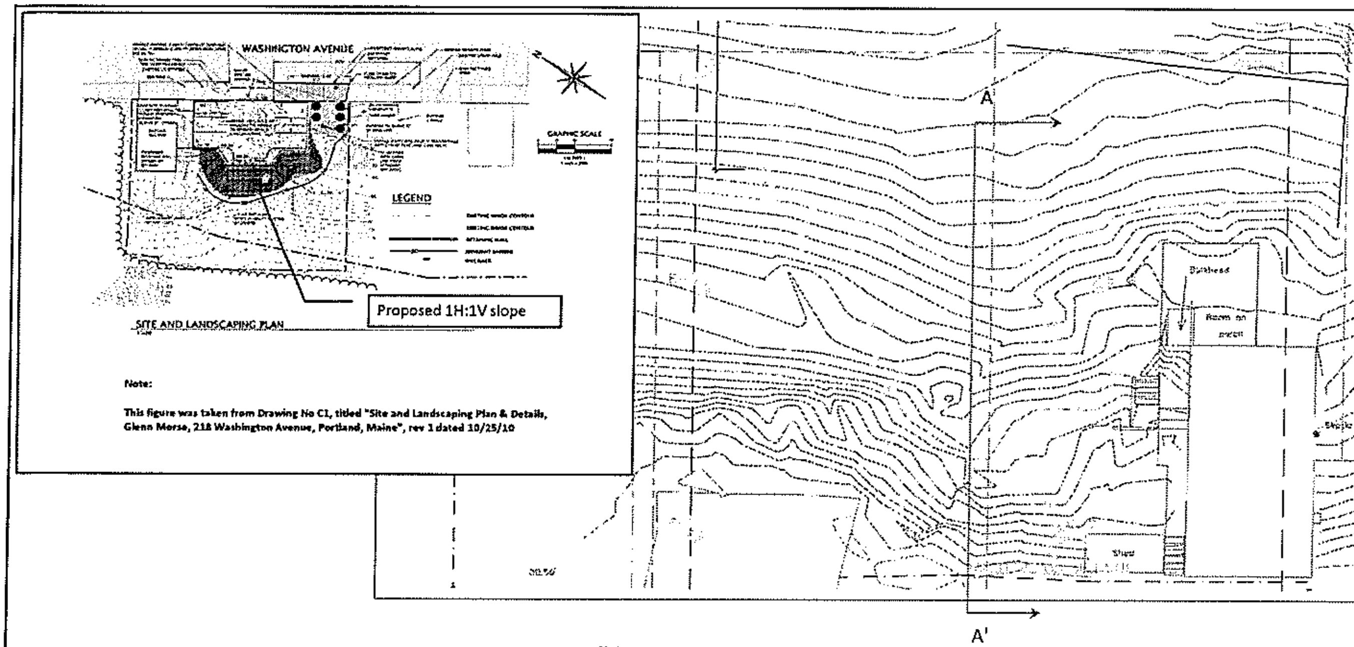
Very truly yours,

SOIL METRICS LLC

Stephen J. Rabasca, P.E.

Enclosures:

Figure 1: Site and Boring Location Plan
Figure 2: Interpretive Subsurface Profile
Figure 3: Stability Analysis Results - Existing Conditions
Figure 4: Stability Analysis Results - Embankment - No Reinforcement
Figure 5: Stability Analysis Results - Embankment Reinforcement - Surfaces beyond Grid
Figure 6: Stability Analysis Results - Embankment Reinforcement - Surfaces through Grid
Figure 7: Stability Analysis Results - No Groundwater Table
Figure 8: Stability Analysis Results - Deep softer Clay
Figure 9: Slope Reinforcement Details
Appendix A - Sebago Technics Boring Logs



Note:

This figure was taken from Drawing No C1, titled "Site and Landscaping Plan & Details, Glenn Morse, 218 Washington Avenue, Portland, Maine", rev 1 dated 10/25/10

Note:

This figure was taken from Sebago Technics Drawing titled "Boring Plan, 218 Washington Avenue", dated August 15, 2006, by Sebago Technics.

Soil Metrics LLC Geotechnical Engineering

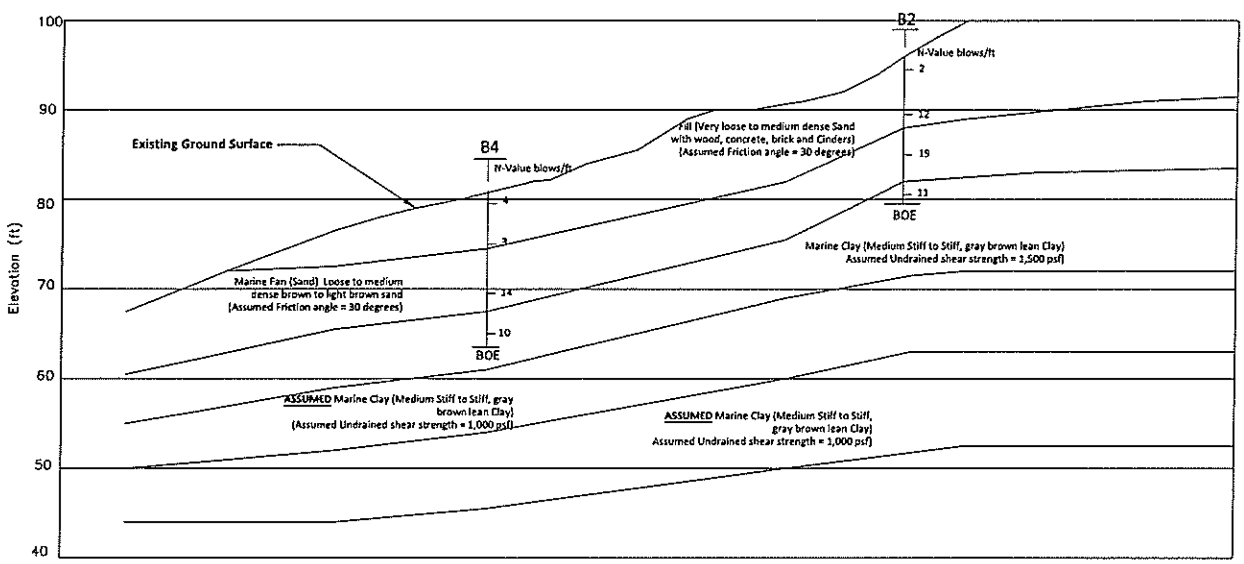
By: SJR
Checked: sjr
Date: 1/26/11
Scale: NTS

Site and Boring Location Plan

218 Washington Avenue
Morse Construction

Project No. 144-01

Figure No. 1



Notes:

1. The existing slope topography based on Plan titled "Boring Plan, 218 Washington Avenue", dated August 15, 2006, by Sebago Technics.
2. Refer to Figure 1 for profile location.
3. The borings were terminated before a refucal surface was encountered. The assumed conditions below the bottom of the boring are indicated on the profile as stiff clay with an undrained shear strength of 1,000 psf.

Interpretive Subsurface Profile A-A'
218 Washington Avenue Slope
Portland, Maine

SCALE: 1"=10'

Soil Metrics LLC
Geotechnical Engineering
12 Farms Edge Road, Cape Elizabeth, Maine 04107

Project: 218 Washington Avenue Slope
Morse Construction

Subject: Interpretive Subsurface Profile

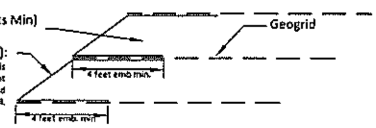
Project No: 144-01
Date: January 26, 2011
By: SJR

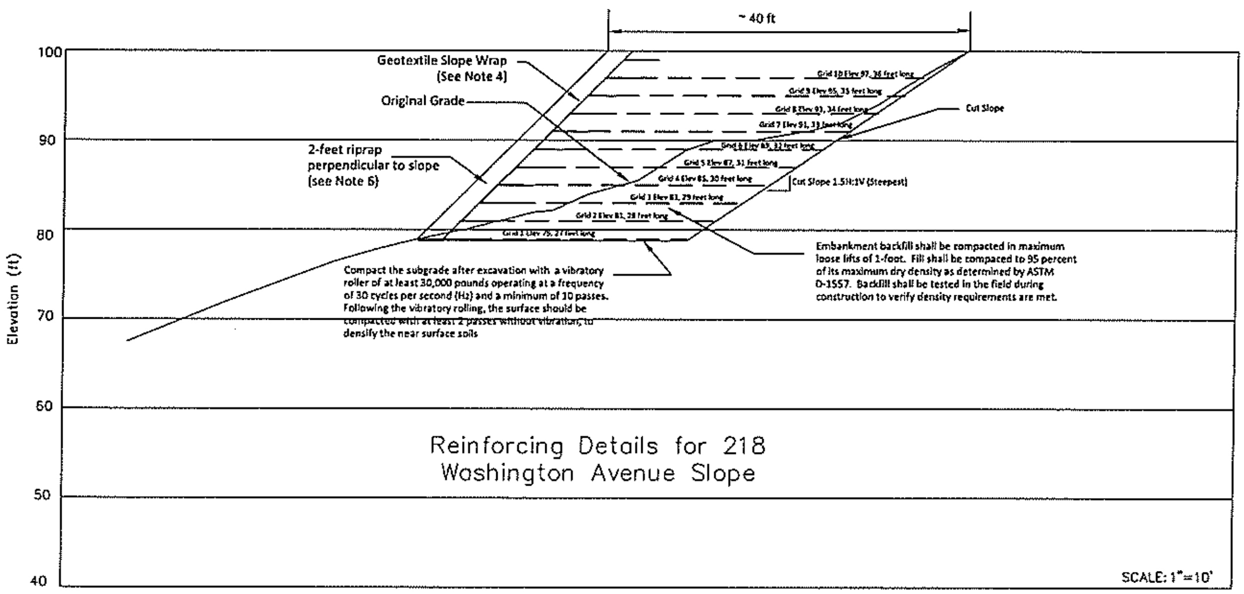
Figure No: 2

Notes:

1. The existing slope topography based on Plan titled "Boring Plan, 218 Washington Avenue", by Sebago Technics, dated August 15, 2006.
2. Refer to Figure 1 for profile location.
3. Geogrid shall meet the requirements of StrataGird SG200 or equal, with a long term design strength of at least 1,900 lbs/ft after appropriate reduction factors.
4. The geotextile for slope wrapping shall meet the reqiuirements of Mirafi 180N or equal.
5. The embankment backfill shall meet the requirements of MDOT 703-06 b, Type D.
6. The rip rap shall have a D50 of 12 inches, and be angular rock. Rounded or subrounded stone is not acceptable.

Detail A
Slope Wrapping





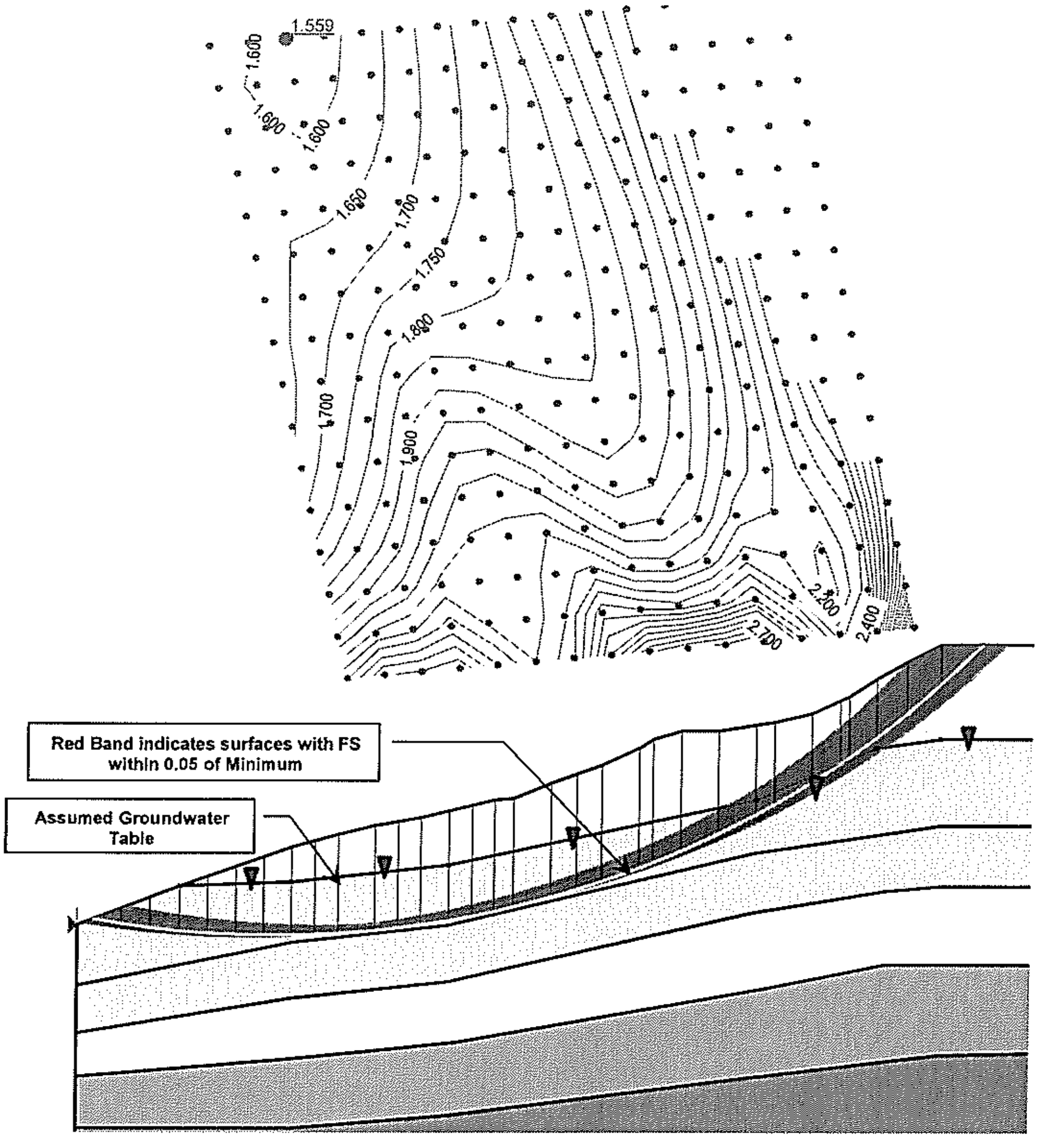
SoilMetrics L.L.C. Geotechnical Engineering
12 Farms Edge Road, Cape Elizabeth, Maine 04107

Project: 218 Washington Avenue Slope
Morse Construction

Subject: Reinforcing Details for Slope

Project No: 144-01
Date: January 26, 2011
By: SJR

Figure No: 9



Existing Factor of Safety = 1.5 to 1.6

SoilMetrics LLC
Geotechnical Engineering

By: SJR
Checked: sjr
Date: 1/26/11
Scale: NTS

Stability Analysis Results - Existing

218 Washington Avenue
Morse Construction

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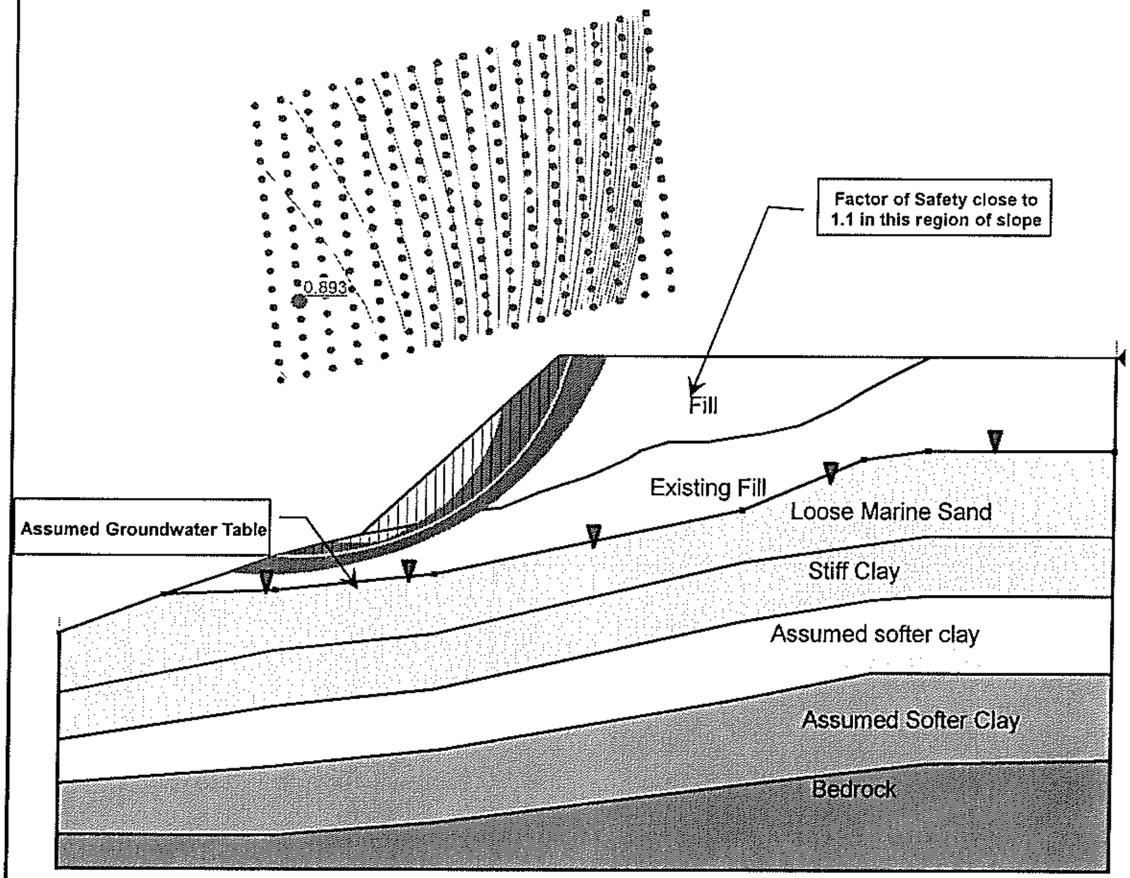
144-01

Figure No.
3



Embankment - No Reinforcement FS = 0.9 to 1.1

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Checked: sjr
Date: 1/26/11
Scale: NTS

Stability Analysis Results
Embankment - No Reinforcement

218 Washington Avenue
Morse Construction

Project No.
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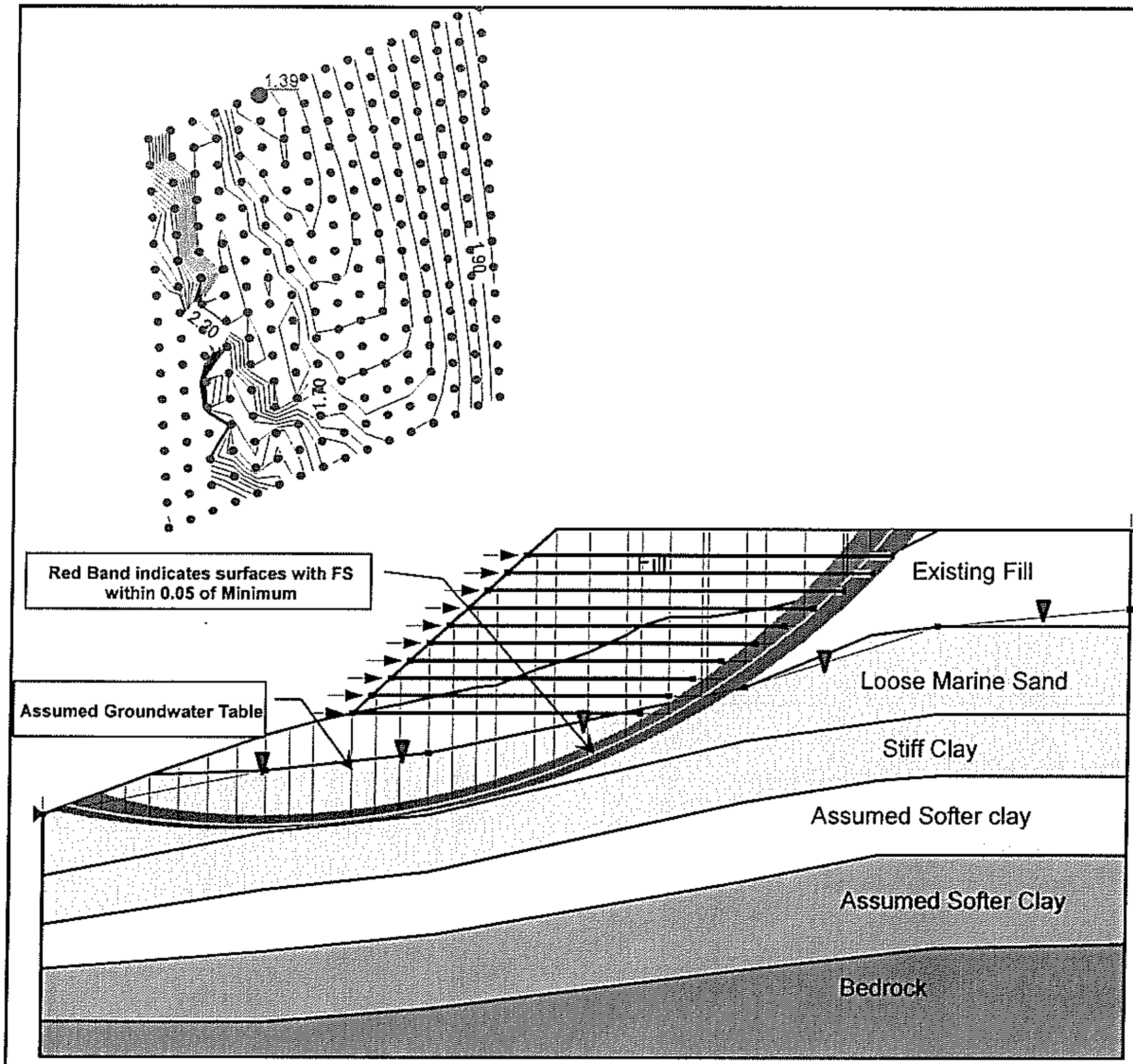
Figure No.
4



Embankment Reinforcement
Surfaces Beyond Grid FS = 1.4

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By: SJR	Checked: sjr
Date: 1/26/11	Scale: NTS

Stability Analysis Results
Embankment Reinforcement - Surfaces Beyond Grid

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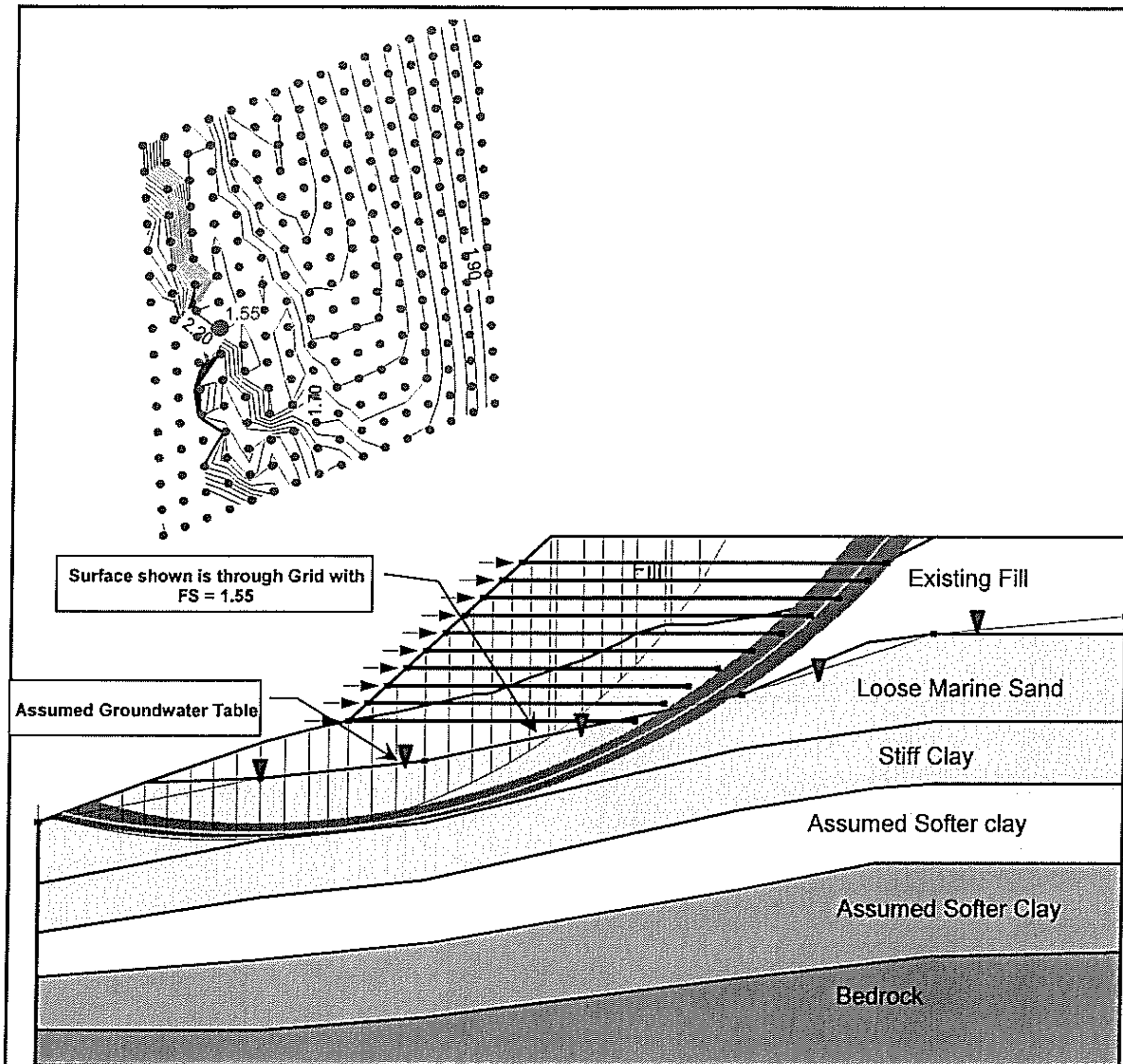
Project No.
144-01

Figure No.
5



Embankment Reinforcement
Surfaces Through Grid FS = 1.55

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By : SJR
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Scale: NTS

Stability Analysis Results
Embankment Reinforcement - Surfaces Through Grid

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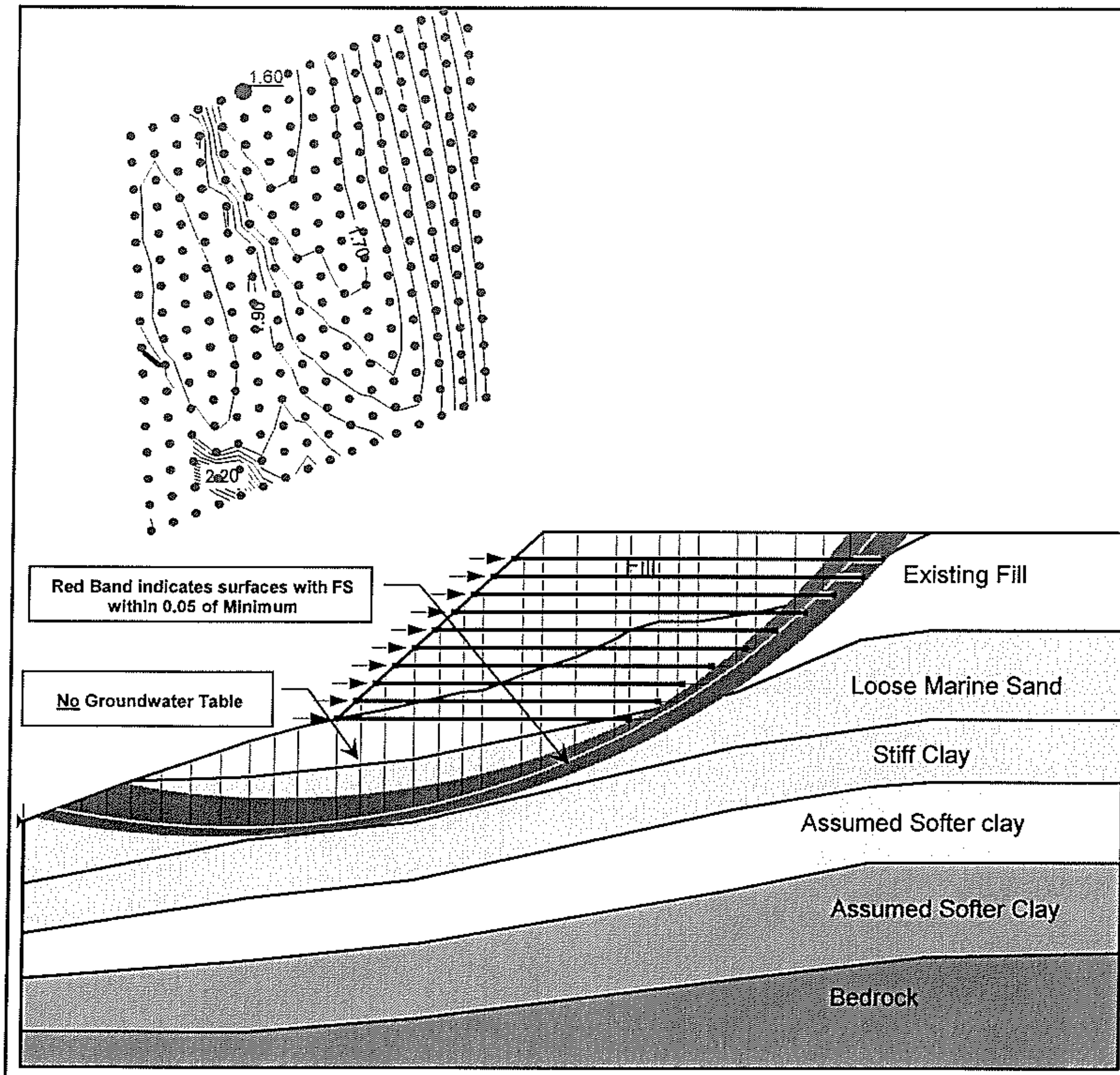
Project No.
144-01

Figure No.
6



Embankment Reinforcement
No Groundwater Table FS = 1.60

SoilMetrics LLC Geotechnical Engineering

By : SJR
Checked: sjr
Date: 1/26/11
Scale: NTS

Stability Analysis Results
Embankment Reinforcement - No Groundwater Table

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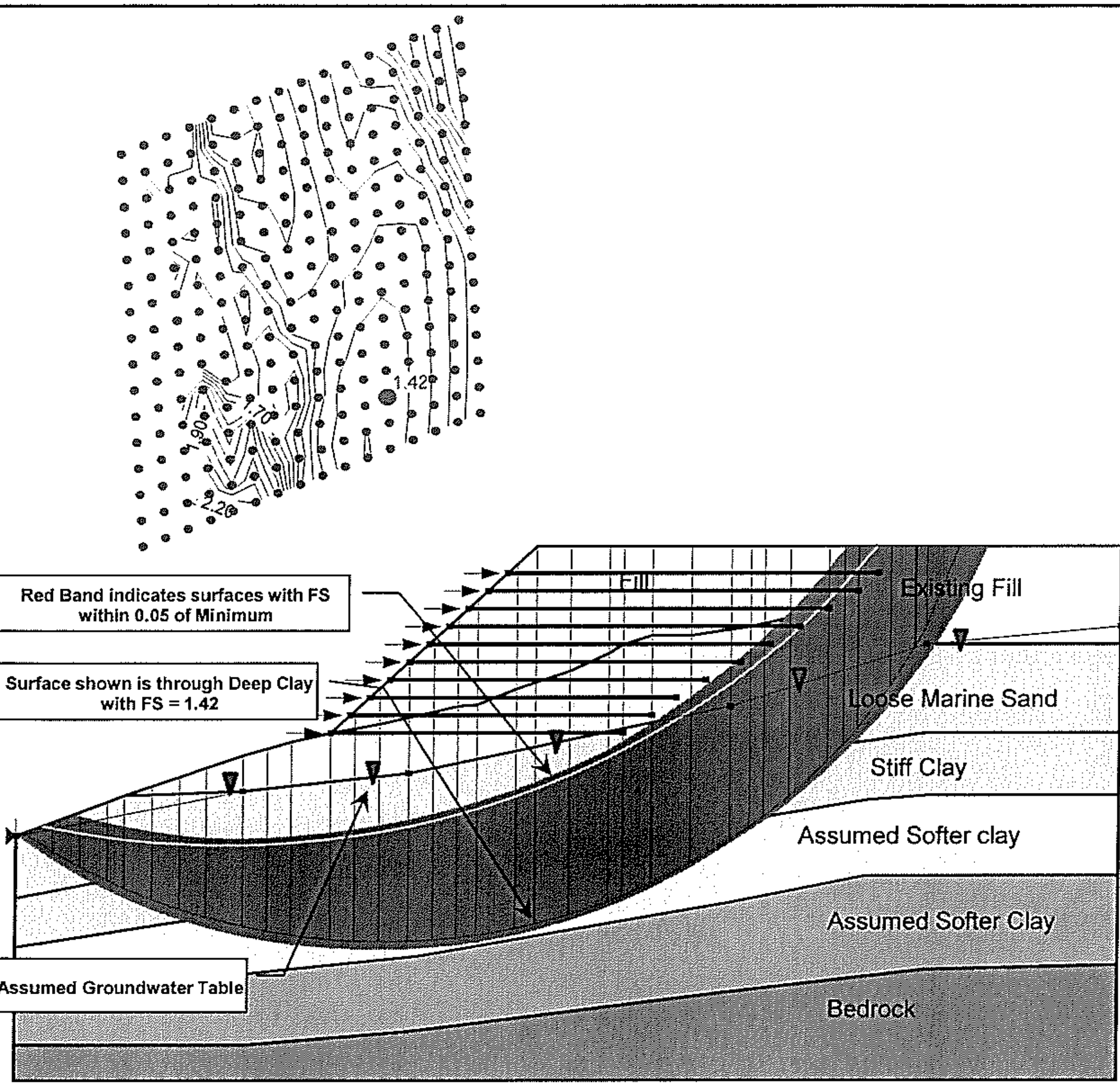
Project No.
144-01

Figure No.
7



Embankment Reinforcement
Assumed Deeper Clay - FS = 1.42

SoilMetrics LLC
Geotechnical Engineering

By: SJR
Checked: sjr
Date: 1/26/11
Scale: NTS

Stability Analysis Results
Embankment Reinforcement - Assumed Deeper Clay

218 Washington Avenue
Morse Construction

Project No.
144-01

Figure No.
8

APPENDIX A

BORING LOGS

SEBAGO TECHNICS, INC.	TEST BORING REPORT	BORING NO. B1
		Page 1 of 1

PROJECT	PROPOSED APARTMENT BUILDING	STI JOB NO.	06172
LOCATION	218 WASHINGTON AVENUE, PORTLAND, MAINE	PROJECT MGR.	S. FRANK
CLIENT	MORSE CONSTRUCTION	FIELD REP.	K. B. STEPHENSON
CONTRACTOR	MAINE TEST BORINGS, INC.	DATE STARTED	7/28/2006
DRILLER	D. McKEEN	DATE FINISHED	7/28/2006

Elevation ft. Datum | Boring Location: See Plan

Item	Casing	Sampler	Core Barrel	Rig Make & Model: B47/53		Hammer Type	Drilling Mud	Casing Advance
Type	HSA	SS	--	☐ Truck ☐ Tripod	☐ Cat-Head	☑ Safety	☐ Bentonite	Type Method Depth
Inside Diameter (in.)	2.5	1.375	--	☐ ATV ☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer	HSA/Spin/15.0
Hammer Weight (lb.)				☑ Track ☐ Air Track	☐ Roller Bit	☐ Automatic	☑ None	
Hammer Fall (in.)				☐ Skid ☐	☑ Cutting Head	Drilling Notes:		

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0																	
	1	S1	0.0		0.2		-BITUMINOUS CONCRETE-										
	7					SW-SM	Medium dense, brown well-graded SAND with silt and gravel (SW-SM),	10	10	30	20	20	10				
	9						mps = 1.1 in., wood at 1.8 ft., dry										
	10/.4	8	1.9														
							-FILL-										
							Note: wood, gravel, metal spike in cuttings from 1.9-5.0 ft.										
5	3	S2	5.0			SM	Loose, dark brown silty SAND with gravel (SM), wood, mps = 0.75 in.,	10	5	30	20	20	15				
	3						dry										
	3																
	2	3	7.0				-FILL-										
					8.0												
10	7	S3	10.0			SW	Medium dense, brown well-graded SAND with gravel (SW), mps = 1.3 in.,	10	10	30	35	10	5				
	10						damp										
	10																
	10	14	12.0														
							-MARINE FAN DEPOSITS-										
					14.5												
15	11	S4	15.0			SW	Medium dense, light brown well-graded SAND with gravel (SW), mps =	15	10	35	30	10					
	14						1.2 in., damp										
	16						-MARINE FAN DEPOSITS-										
	37	14	17.0														
							Bottom of exploration at 17.0 ft. below ground surface										
							No refusal										
20																	
25																	
30																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
7/28/06	0824		--	13.0	Dry

Sample ID

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

Well Diagram

- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (Linear ft.)	17.0
Rock Cored (Linear ft.)	--
Number of Samples	4S
BORING NO.	B1

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

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.

TEST BORING REPORT

SEBAGO TECHNICS, INC.

BORING NO. B2 — Page 1 of 1

PROJECT	PROPOSED APARTMENT BUILDING	STI JOB NO.	06172
LOCATION	218 WASHINGTON AVENUE, PORTLAND, MAINE	PROJECT MGR.	S. FRANK
CLIENT	MORSE CONSTRUCTION	FIELD REP.	K. B. STEPHENSON
CONTRACTOR	MAINE TEST BORINGS, INC.	DATE STARTED	7/28/2006
DRILLER	D. McKEEN	DATE FINISHED	7/28/2006

Elevation ft. | Datum | Boring Location: See Plan

Item	Casing	Sampler	Core Barrel
Type	HSA	SS	--
Inside Diameter (in.)	2.5	1.375	--
Hammer Weight (lb.)			
Hammer Fall (in.)			

Rig Make & Model: B47/53

- ☐ Truck ☐ Tripod ☐ Cat-Head
- ☐ ATV ☐ Geoprobe ☑ Winch
- ☑ Track ☐ Air Track ☐ Roller Bit
- ☐ Skid ☐ ______ ☑ Cutting Head

Hammer Type: ☑ Safety ☐ Doughnut ☐ Automatic

Drilling Mud: ☐ Bentonite ☐ Polymer ☑ None

Casing Advance — Type Method Depth: HSA/Spin/15.0

Drilling Notes:

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	1/12"	S1	0.0			SM	Very loose, brown silty SAND with gravel (SM), traces concrete, mps = 1.3 in., dry to damp	5	10	20	20	30	15				
	1																
	2	4	2.0		2.0		-FILL-										
5	3	S2	5.0		5.4	SM	Medium dense, dark brown silty SAND (SM), brick, trace ash, mps = 0.2 in., dry -FILL-			20	30	30	20				
	5																
	7					SP-SM	Medium dense, brown poorly-graded SAND with silt (SP-SM), mps = 0.1 in., dry -FILL-				20	70	10				
	9	18	7.0		7.0												
					8.0		Note: plastic, dark brown silty sand with gravel in cuttings from 7.0 to 8.0 ft. -FILL-										
10	7	S3	10.0			SP	Medium dense, brown poorly-graded SAND (SP), occasional mottles, mps = 0.1 in., damp				5	90	5				
	9																
	10																
	11	18	12.0				-MARINE DEPOSITS-										
					14.0												
15	4	S4	15.0			CL	Stiff, gray-brown mottled lean CLAY (CL), frequent sand partings to seams mps = 0.02 in., damp -MARINE DEPOSITS-					10	90	N	M	M	
	5																
	6																
	8	24	17.0														
							Bottom of exploration at 17.0 ft. below ground surface No refusal										
20																	
25																	
30																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
7/28/06	0742		--	13.5	Dry

Sample ID

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

Well Diagram

- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (Linear ft.)	17.0
Rock Cored (Linear ft.)	--
Number of Samples	4S
BORING NO.	B2

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

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.

SEBAGO TECHNICS, INC.

TEST BORING REPORT

BORING NO. **B3**

Page 1 of 1

PROJECT	PROPOSED APARTMENT BUILDING	STI JOB NO.	06172
LOCATION	218 WASHINGTON AVENUE, PORTLAND, MAINE	PROJECT MGR.	S. FRANK
CLIENT	MORSE CONSTRUCTION	FIELD REP.	K. B. STEPHENSON
CONTRACTOR	MAINE TEST BORINGS, INC.	DATE STARTED	7/27/2006
DRILLER	D. McKEEN	DATE FINISHED	7/27/2006

Elevation ft. | Datum | Boring Location: See Plan

Item	Casing	Sampler	Core Barrel	Rig Make & Model: B47/53		Hammer Type	Drilling Mud	Casing Advance
Type	HSA	SS	--	☐ Truck ☐ Tripod	☐ Cat-Head	☑ Safety	☐ Bentonite	Type Method Depth
Inside Diameter (in.)	2.5	1.375	--	☐ ATV ☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer	HSA/Spin/15.0
Hammer Weight (lb.)				☑ Track ☐ Air Track	☐ Roller Bit	☐ Automatic	☑ None	
Hammer Fall (in.)				☐ Skid ☐ ______	☑ Cutting Head	Drilling Notes:		

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	3	S1	0.0		0.3	SM	Loose, brown silty SAND (SM), grass roots, mps = 0.1 in., dry -TOPSOIL-				10	75	15				
	5					SM	Loose, brown silty SAND with gravel (SM), wood, bituminous concrete, mps = 0.5 in., dry	5	10	20	20	30	15				
	5																
	4	14	2.0														
							-FILL-										
5	2	S2	5.0			SM	Loose, brown silty SAND (SM), traces brick and cinder, mps = 0.2 in., dry			15	30	40	15				
	2																
	2																
	1	8	7.0				-FILL-										
					10.0												
10	5	S3	10.0			SW	Medium dense, light brown well-graded SAND with gravel (SW), mps = 0.75 in., dry	5	10	30	50	5					
	6																
	5																
	6	16	12.0														
							-MARINE FAN DEPOSITS-										
					14.5												
15	2	S4	15.0			SW	Loose, light brown well-graded SAND with gravel (SW), mps = 1.0 in., 1.2 in., dry	10	5	40	40	5					
	4						-MARINE FAN DEPOSITS-										
	5																
	5	14	17.0														
							Bottom of exploration at 17.0 ft. below ground surface										
							No refusal										
20																	
25																	
30																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
7/27/06	1530		--	14.0	Dry

Sample ID

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

Well Diagram

- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (Linear ft.)	17.0
Rock Cored (Linear ft.)	--
Number of Samples	45
BORING NO.	B3

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

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.

SEBAGO TECHNICS, INC.	TEST BORING REPORT	BORING NO. B4
		Page 1 of 1

PROJECT	PROPOSED APARTMENT BUILDING	STI JOB NO.	06172
LOCATION	218 WASHINGTON AVENUE, PORTLAND, MAINE	PROJECT MGR.	S. FRANK
CLIENT	MORSE CONSTRUCTION	FIELD REP.	K. B. STEPHENSON
CONTRACTOR	MAINE TEST BORINGS, INC.	DATE STARTED	7/27/2006
DRILLER	D. McKEEN	DATE FINISHED	7/27/2006

Elevation ft. Datum | Boring Location: See Plan

Item	Casing	Sampler	Core Barrel	Rig Make & Model: B47/53			Hammer Type	Drilling Mud	Casing Advance
Type	HSA	SS	--	☐ Truck	☐ Tripod	☐ Cat-Head	☑ Safety	☐ Bentonite	Type Method Depth
Inside Diameter (in.)	2.5	1.375	--	☐ ATV	☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer	HSA/Spin/15.0
Hammer Weight (lb.)				☑ Track	☐ Air Track	☐ Roller Bit	☐ Automatic	☑ None	
Hammer Fall (in.)				☐ Skid	☐	☑ Cutting Head	Drilling Notes:		

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2	S1	0.0			SM	Very loose, light brown silty SAND with gravel (SM), traces concrete,	5	10	10	30	25	20				
	2						mps = 1.0 in., dry										
	2				1.5		-FILL-										
	2	6	2.0			SM	Very loose, brown silty SAND with gravel (SM), traces brick, mps = 1.0 in.,	5	10	30	20	20	15				
							damp										
5	2	S2	5.0			SM	Very loose, brown silty SAND with gravel (SM), traces paint, mps = 1.0 in.,	10	5	30	20	20	15				
	1				6.0		damp -FILL-										
	2					SP-SM	Very loose, brown poorly-graded SAND with silt (SP-SM), mps = 0.02					90	10				
	2	12	7.0				in., damp										
							-MARINE DEPOSITS-										
					9.0												
10	5	S3	10.0			SP	Medium dense, light brown poorly-graded SAND (SP),					100					
	6						occasional mottles, mps = 0.2 in., damp										
	8																
	12	18	12.0														
							-MARINE DEPOSITS-										
					13.0												
15	3	S4	15.0			CL	Medium stiff, gray-brown mottled lean CLAY (CL), frequent sand seams,					30	70	N	M	M	
	5						mps = 0.02 in., damp										
	5						-MARINE DEPOSITS-										
	8	24	17.0														
							Bottom of exploration at 17.0 ft. below ground surface										
							No refusal										
20																	
25																	
30																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
7/27/2006	1635		--	14.0	Dry

Sample ID

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (Linear ft.) 17.0
Rock Cored (Linear ft.) --
Number of Samples 4S

BORING NO. B4

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

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.

SEBAGO TECHNICS, INC.	TEST BORING REPORT	BORING NO. B5
		Page 1 of 1

PROJECT	PROPOSED APARTMENT BUILDING	STI JOB NO.	06172
LOCATION	218 WASHINGTON AVENUE, PORTLAND, MAINE	PROJECT MGR.	S. FRANK
CLIENT	MORSE CONSTRUCTION	FIELD REP.	K. B. STEPHENSON
CONTRACTOR	MAINE TEST BORINGS, INC.	DATE STARTED	7/27/2006
DRILLER	D. McKEEN	DATE FINISHED	7/27/2006

Elevation ft. Datum — Boring Location: See Plan

Item	Casing	Sampler	Core Barrel	Rig Make & Model: B47/53			Hammer Type	Drilling Mud	Casing Advance
Type	HSA	SS	–	☐ Truck	☐ Tripod	☐ Cat-Head	☑ Safety	☐ Bentonite	Type Method Depth
Inside Diameter (in.)	2.5	1.375	–	☐ ATV	☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer	HSA/Spin/20.0
Hammer Weight (lb.)				☑ Track	☐ Air Track	☐ Roller Bit	☐ Automatic	☑ None	
Hammer Fall (in.)				☐ Skid	☐	☑ Cutting Head	Drilling Notes:		

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	2	S1	0.0			SM	Loose, brown silty SAND (SM), traces bituminous concrete, one 0.5 in.			20	30	30	20				
	3						gravel piece, grass roots to 0.1 in., dry										
	4						-FILL-										
	2	8	2.0				Note: 1.0 to 2.0 in. gravel in cuttings from 2.0 to 4.0 ft.										
					4.0												
5	5	S2	5.0			SM	Loose, gray-brown mottled silty SAND (SM), mps = 0.02 in., occasional					80	20				
	5						clay lenses, damp										
	4																
	4	24	7.0														
							-MARINE DEPOSITS-										
					9.0												
10	10	S3	10.0			SP	Medium dense, brown poorly-graded SAND with silt (SP), mps = 1.2 in.,	5	5		40	40	10				
	11						damp										
	10																
	10	15	12.0				-MARINE DEPOSITS-										
					15.0												
15	2	S4	15.0			CL	Medium stiff, gray-brown mottled lean CLAY with sand (CL), occasional					25	75	N	M	M	
	2						sand seams, mps = 0.02 in., wet										
	3																
	6	24	17.0														
							-MARINE DEPOSITS-										
20	2	S5	20.0			CL	Stiff gray-brown mottled CLAY with sand (CL), occasional sand seams,					25	75	N	M	M	
	6				20.8		mps = 0.02 in., wet -MARINE DEPOSITS-										
	5					SM	Medium dense, brown silty SAND (SM), occasional clay seams, mps =				5	75	20				
	9	24	22.0				0.1 in., wet -MARINE DEPOSITS-										
							Bottom of exploration at 22.0 ft. below ground surface										
							No refusal										
25																	
30																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
7/27/06	1340		20.0	22.0	19.0
7/27/06	1355		–	19.0	18.0

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

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

Summary

Overburden (Linear ft.)	22.0
Rock Cored (Linear ft.)	–
Number of Samples	5S
BORING NO.	B5

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

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.

SEBAGO TECHNICS, INC.

TEST BORING REPORT

BORING NO. **B6**

PROJECT	PROPOSED APARTMENT BUILDING	STI JOB NO.	06372
LOCATION	218 WASHINGTON AVENUE, PORTLAND, MAINE	PROJECT MGR.	S. FRANK
CLIENT	MORSE CONSTRUCTION	FIELD REP.	K. B. STEPHENSON
CONTRACTOR	MAINE TEST BORINGS, INC.	DATE STARTED	7/27/2006
DRILLER	D. McKEEN	DATE FINISHED	7/27/2006

Elevation ft. Datum | Boring Location See Plan

Item	Casing	Sampler	Core Barrel	Rig Make & Model		B47/53		Hammer Type	Drilling Mud	Casing Advance
Type	HSA	SS	--	☐ Truck	☐ Tripod	☐ Cat-Head		☑ Safety	☐ Bentonite	Type Method Depth
Inside Diameter (in.)	2.5	1.375	--	☐ ATV	☐ Geoprobe	☑ Winch		☐ Doughnut	☐ Polymer	HSA/Spin/10.0
Hammer Weight (lb.)				☑ Track	☐ Air Track	☐ Roller Bit		☐ Automatic	☑ None	
Hammer Fall (in.)				☐ Skid	☐	☑ Cutting Head		Drilling Notes:		

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Toughness	Plasticity	Strength
0																	
	2	S1	0.0		0.3	SM	Very loose, brown silty SAND (SM), roots, mps = 0.1 in., dry -TOPSOIL-				10	75	15				
	1					SM	Very loose, brown silty SAND (SM), brick, traces ash and roots, mps =			20	30	35	15				
	2						0.2 in., dry										
	2	8	2.0														
							-FILL-										
					4.0												
5	8	S2	5.0			SM	Medium dense, brown mottled silty SAND (SM), mps = 0.02 in., damp					85	15				
	10																
	9																
	7	20	7.0				-MARINE DEPOSITS-										
					8.5												
10	8	S3	10.0			SP-SM	Medium dense, brown poorly-graded SAND with silt (SP-SM), mps =				5	85	10				
	8						0.1 in., damp										
	8						-MARINE DEPOSITS-										
	8	20	12.0														
							Bottom of exploration at 12.0 ft. below ground surface										
							No refusal										
15																	
20																	
25																	
30																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
7/27/06	1445		--	9.0	Dry

Sample ID

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

Well Diagram

- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (Linear ft.)	12.0
Rock Cored (Linear ft.)	--
Number of Samples	3S
BORING NO.	B6

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

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.