REPORT ON
SUBSURFACE INVESTIGATION
WESTBROOK RIVERFRONT
PRESUMPSCOT RIVER
WESTBROOK, MAINE

by

Haley & Aldrich, Inc.
South Portland, Maine

for

City of Westbrook
Westbrook, Maine

File No. 27481-000
May 2001

HALEY & ALDRICH

UNDERGROUND
ENGINEERING &
ENVIRONMENTAL
SOLUTIONS

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3 May 2001
File No. 27481-000

City of Westbrook
Westbrook City Hall
2 York Street
Westbrook, Maine 04092

Attention: Mr. Matthew Eddy

Subject: Westbrook Riverfront
Presumpscot River
Westbrook, Maine

Ladies and Gentlemen:

This report presents the results of subsurface explorations at the site of the proposed Westbrook Riverfront project in Westbrook, Maine. Our evaluation of subsurface conditions and foundation requirements will be provided when details for the pedestrian bridge and boardwalk are established.

INTRODUCTION

The Riverfront Project is located along the Presumpscot River in Westbrook, as shown on Figure 1, Project Locus. The project consists of a 16-ft. wide pedestrian bridge crossing the Presumpscot River and a boardwalk along the river near Bridge Street. The bridge will span the river approximately between High Street on the north and Park Drive on the south. The boardwalk will extend from a fountain to be constructed along the south side of the river near Ash Street, over the Bridge Street abutment to Saccarappa Park. Ground surface elevations along the river vary from approximately El. 40 at the river's edge to El. 56 at the top of the river bank.

SUBSURFACE EXPLORATIONS

Maine Test Borings, Inc. (MTB) of Brewer, Maine drilled 6 borings, B1 to B6, at locations shown on Figure 2, Site and Subsurface Exploration Plan during the period 12 to 17 April 2001. Borings were drilled to depths below ground surface varying from 14.4 ft. to 42.0 ft. Rod probes were driven below the bottom of borings B1, B2 and B3 to depths varying from 57 ft. to 96 ft.

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Borings were drilled using 2.5-in. diameter hollow stem augers. Soil samples were typically obtained at 5-ft. intervals in the borings. Standard Penetration Resistance (N) was measured at each sample interval in accordance with ASTM test designation D 1586. Rod probes consisted of AW drill rods driven with a 140-lb. hammer falling 30 in.

Haley & Aldrich determined the locations of borings by pacing from existing site features.

The boring logs and related information depict subsurface conditions and water levels only at their specific locations at the time indicated on the logs. Soil conditions at other locations may differ from conditions at these locations. Also, the passage of time may result in a change in groundwater conditions at exploration locations.

SUBSURFACE CONDITIONS

The borings encountered four principal soil units below topsoil at the site: topsoil, fill, marine deposit and glacial till. Encountered thickness and generalized descriptions of the soil units are presented below in order of increasing depth below ground surface.

Topsoil – The topsoil typically consists of dark brown, silty SAND (SM) to sandy SILT (ML), with roots. Encountered thickness varied from 0.3 ft. to 0.6 ft.

Fill – Fill consists of loose to medium dense, gray brown sandy SILT (ML); to silty SAND (SM); to poorly graded SAND (SP), with various amounts of ash, bricks and oversized particles. Encountered thickness varied from 7.1 ft. to 24.7 ft.

Marine Deposit – The marine deposit consists of sub-strata of loose to medium dense, silty SAND (SM), sandy SILT (ML) and lean CLAY (CL). The encountered thickness of sand varied from 1.9 ft. to 16.0 ft.; silt varied from 3.5 ft. to 18.0 ft.; and clay varied from 6.5 ft. to 80.0 ft.

Glacial Till – Glacial till consists of dense, gray brown poorly graded SAND (SP) with oversized particles. Borings penetrated up to 4.0 ft. into the glacial till.

The borings encountered water at depths below ground surface varying from 9.0 ft. to 23.2 ft. Observations of water were made over a relatively short period of time and may not represent the stabilized groundwater level. In addition, water levels will vary with season, temperature, precipitation, water level in the Presumpscot River and construction activity in the area. Therefore, water levels during and following construction will vary from those measured in the borings.

FOUNDATION CONSIDERATIONS

The borings disclosed up to 24.7 ft. of miscellaneous fill and thick deposits of compressible clay. Generally, supporting structures on existing uncontrolled fill is not acceptable. However, it may be possible to improve the fill condition by methods such as intensive surface compaction and thus make it acceptable for structure support. Structures founded above the compressible clay will be subject to settlement. The magnitude and duration of settlement will be a function of the structure loads and raises in site grade, that is, the greater the load, the greater the settlement. We can evaluate the feasibility of supporting structures above the clay stratum by conducting settlement analyses after the proposed structure loading and site grades have been established. Alternatively, structures could be supported on piles driven through the fill and compressible clay. Pile types and capacity can be evaluated when structure loading is available. Required pile lengths will likely vary from approximately 30 ft. to greater than 100 ft.

We appreciate the opportunity to provide services on this project. Please do not hesitate to contact us if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

Kenneth L. Recker, P.E.
Vice President

Enclosures:

Table I	- Summary of Borings
Figure 1	- Project Locus
Figure 2	- Site and Subsurface Exploration Plan
Appendix A	- Logs of Borings

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TABLE I
SUMMARY OF BORINGS
WESTBROOK RIVERFRONT
WESTBROOK , MAINE

BORING NUMNBER	DEPTH (FT)	DEPTH TO WATER (FT)	STRATA THICKNESS (FT)					
			TOPSOIL	FILL	MARINE SAND	MARINE SILT	MARINE CLAY	GLACIAL TILL
B1	87.0		0.6	--	1.9	3.5	80.0	1.0*
B2	96.0	19.7	0.6	--	16.0	5.2	72.0	2.0*
B3	57.0	NE	0.4	7.1	--	18.0	28.5	4.0*
B4	32.0	23.2	0.3	24.7	--	--	6.5	0.5*
B5	15.7	9.0	--	15.5	--	--	--	0.2*
B6	14.4	NE	--	14.4*	--	--	--	--

NOTES:
1. NE Indicates water not encountered within depth of boring.
2. -- Indicates stratum not encountered within depth of boring.
3. * Indicates depth of penetration into stratum.

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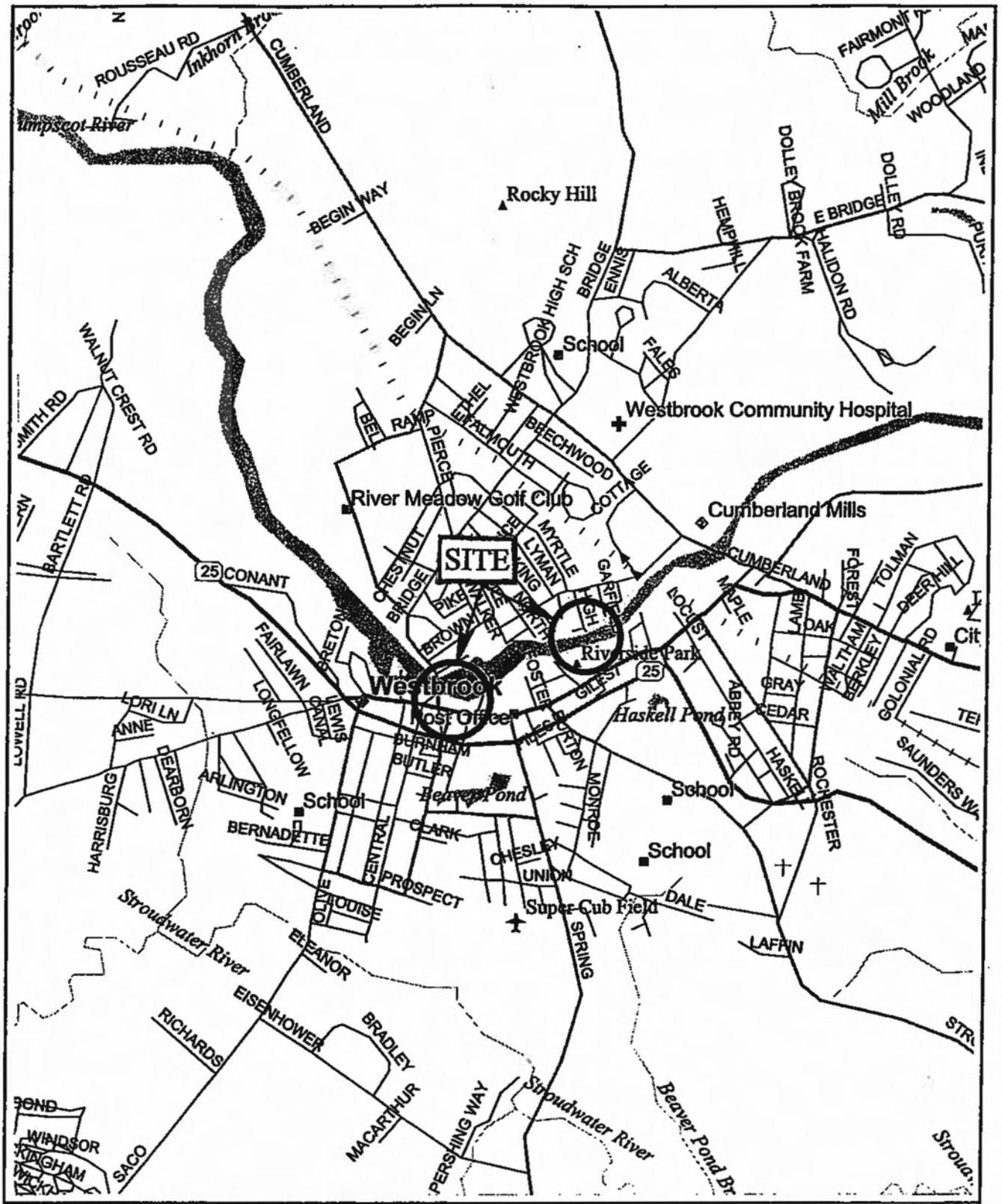

SITE COORDINATES: N43°40'38",W70°21'57"
N43°40'47",W70°21'32"

"MAP FROM DELORME'S STREET ATLAS USA, 2000
FREEPORT, MAINE"

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

WESTBROOK RIVERFRONT
WESTBROOK, MAINE

PROJECT LOCUS

APPROX. SCALE: 1:25,000

MAY 2001

FILE NO. 27481-000

FIGURE 1

APPENDIX A

Logs of Borings

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TEST BORING REPORT

Boring No. B1

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No. 27481-000
Sheet No. 1 of 4
Start 16 April 2001
Finish 16 April 2001
Driller M. Porter
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S		Rig Make & Model: Bombardier
Inside Diameter (in.)	2.5	1 3/8		Bit Type: Cutting Head
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Winch/ Automatic Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 7 8 13	S1 3	0.0 2.0	NO WELL INSTALLED		ML	Medium dense, brown sandy SILT (ML), mps 2mm, roots, moist -TOPSOIL-				10	30	60	R			
					0.6	SM	Medium dense, gray-brown silty SAND (SM), mps 4mm, moist			15	20	25	40	R			
					2.5	ML	Hard, brown gray mottled SILT (ML), mps 0.4mm, moist					5	95	R			
5	13 15 20 23	S2 24	5.0 7.0		6.0	CL	Hard, brown gray mottled lean CLAY (CL), mps 0.4mm, moist					5	95	N	M	M	
10	4 6 7 8	S3 24	10.0 12.0			CL	Stiff, mottled gray brown lean CLAY (CL), mps 0.4mm, moist -MARINE DEPOSIT-					5	95	N	M	M	
15	WOR 1 2 1	S4 24	15.0 17.0			CL	Medium stiff, gray lean CLAY (CL), mps 0.4mm, frequent silt partings, moist, wet					10	90	S	M	M	
20																	

Water Level Data

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

Sample Identification

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

Well Diagram

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

Summary

Overburden (lin. ft.) 87.0
Rock Cored (lin. ft.)
Samples 9S

Boring No. B1

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

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

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

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TEST BORING REPORT

Boring No. B1
File No. 27481-000
Sheet No. 2 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
20	3 2 3 5	S5 24	20.0 22.0			CL CL	Medium stiff, gray lean CLAY (CL), mps 0.4mm, occasional fine sand partings, wet					5	95	S	M	M	
25	WOH WOH 2 3	S6 24	25.0 27.0			CL	Soft, gray lean CLAY (CL), mps 0.4mm, occasional silty fine sand seams, wet					5	95	S	M	M	
30	WOH WOH 1 2	S7 24	30.0 32.0			ML	Soft, gray SILT (ML), mps 0.4mm, wet, frequent fine sand seams					15	85	R			
					30.5		Soft, gray sandy SILT (ML), mps 0.4mm, wet					40	60	R			
35	WOR WOR WOR WOH	S8 24	35.0 37.0				Soft, gray lean CLAY (CL), mps 0.5mm, wet						100	N	M	M	
40	WOH WOH WOH WOH	S9 24	40.0 42.0				Soft, gray lean CLAY (CL), mps 0.4mm, black streaks, wet, occasional fine sand partings						100	N	M	M	
							-MARINE DEPOSIT-										
							AW Rod Probe begins at 42.0 ft.										
							Depth 300lb. Hammer blows/ft.										
45							42.0 WOH 43.0 WOH 44.0 1 45.0 3 46.0 3 47.0 4 48.0 5 49.0 4 50.0 5 51.0 5 52.0 4 53.0 4										

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

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

Boring No. B1

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TEST BORING REPORT

Boring No. B1
File No. 27481-000
Sheet No. 3 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
50																	
							Depth 300lb. Hammer blows/ft.										
							54.0 5										
							55.0 6										
							56.0 5										
							57.0 6										
							58.0 5										
							59.0 6										
							60.0 6										
55							61.0 5										
							62.0 7										
							63.0 7										
							64.0 8										
							65.0 7										
							66.0 9										
							67.0 7										
							68.0 9										
							69.0 7										
							70.0 9										
							71.0 8										
							72.0 10										
60							73.0 10										
							74.0 9										
							75.0 11										
							76.0 11										
							77.0 11										
							78.0 11										
							79.0 11										
							80.0 11										
							81.0 12										
							82.0 13										
							83.0 13										
65							84.0 11										
							85.0 10										
							86.0 75										
							Bottom of AW Rod Probe at 87.0 ft.										
70																	
							-MARINE DEPOSIT-										
75																	

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

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

Boring No. B1

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TEST BORING REPORT

Boring No. B1
File No. 27481-000
Sheet No. 4 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
80							-MARINE DEPOSIT-										
85							Probable top of Glacial Till at 86.1 ft.										
					87.0		Bottom of Exploration at 87.0 ft.										

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

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

Boring No. B1

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TEST BORING REPORT

Boring No. B2

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No.	27481-000
Sheet No.	1 of 4
Start	13 April 2001
Finish	13 April 2001
Driller	M. Porter
H&A Rep.	B. Lawrence
Elevation	
Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S		Rig Make & Model: Bombardier
Inside Diameter (in.)	2.5	1 3/8		Bit Type: Cutting Head
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Winch/ Automatic Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 4 4 8	S1 18	0.0 2.0	NO WELL INSTALLED		SM	Loose, brown silty SAND (SM), mps 2mm, roots, moist				15	60	25	R			
					0.6	ML	-TOPSOIL- Loose, gray SILT with sand (ML), mps 0.4mm, moist, roots -MARINE DEPOSIT-					20	80	R			
5	2 4 6 4	S2 24	5.0 7.0			CL	Medium stiff, gray lean CLAY (CL), mps 0.4mm, moist					10	90	S	M	M	
					6.0	CL	Stiff, olive lean CLAY with sand, mps 0.4mm, frequent fine sand seams, moist					20	80	S	M	M	
10	2 2 3 3	S3 24	10.0 12.0			CL	Medium stiff, olive lean CLAY, mps 0.4mm, frequent fine sand partings, moist, wet -MARINE DEPOSIT-					10	90	S	M	M	
					14.0	SM	Medium dense, brown gray silty SAND (SM), mps 4mm, wet			10	40	35	15	R			
15	1 2 18 13	S4 20	15.0 17.0		15.5	SP-SM	Medium dense, brown poorly graded SAND with silt (SP-SM), mps 2mm, wet -MARINE DEPOSIT-				5	85	10	R			
20																	

Water Level Data

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

Sample Identification

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

Well Diagram

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

Summary

Overburden (lin. ft.)	96.0
Rock Cored (lin. ft.)	
Samples	9S
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

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

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

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TEST BORING REPORT

Boring No. B2
File No. 27481-000
Sheet No. 2 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
20	3 2 5 4	S5 24	20.0 22.0			SP-SM ML	Medium stiff, olive SILT with sand (ML), mps 0.4mm, wet					20	80	R			
					21.2	SM	Loose, olive silty SAND (SM), mps, 2mm, wet				10	70	20	R			
25	WOR 1 3 6	S6 10	25.5 27.5			SP	Very loose, gray poorly graded SAND (SP), wet, mps 3/4" -MARINE DEPOSIT-		10	5	50	30	5				
30	1 WOH 1 2	S7 24	30.0 32.0		30.0		Soft, gray lean CLAY (CL), mps 0.4mm, with black streaks, wet, occasional fine sand partings						100	N	M	M	
35	WOR WOR WOH 1	S8 24	35.0 37.0			CL	Soft, gray lean CLAY (CL), mps 0.4mm, wet -MARINE DEPOSIT-						100	S	M	M	
40	WOR WOH WOH WOH	S9 24	40.0 42.0			CL	Soft, gray lean CLAY (CL), mps 0.4mm, with black streaks, wet, occasional silt seams						100	S	M	M	
							Begin AW rod probe at 42.0 ft.										
							Depth — 300lb. Hammer blows/ft.										
45							42.0 — WOH										
							43.0 — 1										
							44.0 — 2										
							45.0 — 3										
							46.0 — 3										
							47.0 — 4										
							48.0 — 3										
							49.0 — 3										
							50.0 — 4										
							51.0 — 4										
							52.0 — 4										
							53.0 — 3										

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

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

Boring No. B2

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B2
File No. 27481-000
Sheet No. 3 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
50							Depth 300lb. Hammer blows/ft.										
							54.0 3										
							55.0 4										
							56.0 4										
							57.0 4										
							58.0 5										
							59.0 5										
							60.0 7										
							61.0 6										
55							62.0 7										
							63.0 6										
							64.0 7										
							65.0 9										
							66.0 9										
							67.0 7										
							68.0 7										
							69.0 6										
							70.0 7										
							71.0 8										
							72.0 6										
							73.0 8										
60							74.0 8										
							75.0 9										
							76.0 9										
							77.0 9										
							78.0 8										
							79.0 9										
							80.0 10										
							81.0 10										
							82.0 9										
							83.0 9										
							84.0 9										
65							85.0 12										
							86.0 11										
							87.0 11										
							88.0 11										
							89.0 11										
							90.0 10										
							91.0 12										
							92.0 10										
							93.0 13										
							94.0 23										
							95.0 165										
70							Bottom of AW Rod Probe at 96.0 ft.										
75							-MARINE DEPOSIT-										

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

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

Boring No. B2

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TEST BORING REPORT

Boring No. B2
File No. 27481-000
Sheet No. 4 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
80																	
85							-MARINE DEPOSIT-										
90																	
95					94.8		Probable Top of Glacial Till at 94.8 ft.										
					96.0		Bottom of Exploration at 96.0 ft.										

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

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

Boring No. B2

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B3

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No. 27481-000
Sheet No. 1 of 3
Start 12 April 2001
Finish 12 April 2001
Driller M. Porter
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S		Rig Make & Model: Bombardier
Inside Diameter (in.)	2.5	1 3/8		Bit Type: Cutting Head
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Winch/ Automatic Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 2 5 9	S1 6	0.0 2.0	NO WELL INSTALLED		ML	Medium stiff, brown SILT with sand (ML), mps 2mm, moist				10	10	80	R			
					0.4	ML	-TOPSOIL-				10	10	80	R			
							Medium stiff, brown SILT with sand (ML), mps 2mm, moist -FILL-										
5	3 3 3 2	S2 8	5.0 7.0			ML	Medium stiff, gray SILT with sand (ML), organics, roots, wet, brick fragment, mps 2mm.				10	20	70	R			
					7.5												
10	WOR WOH WOH WOH	S3 24	10.0 12.0			ML	Soft, gray SILT with sand (ML), mps 0.4mm, wet -MARINE DEPOSIT-					25	75	R			
15	WOR WOH 1 3	S4 18	15.0 17.0			ML	Soft, gray SILT with sand (ML), mps 0.4mm, wet					25	75	R			
20																	

Water Level Data

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

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 57.0
Rock Cored (lin. ft.)
Samples 7S

Boring No. B3

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

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

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

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TEST BORING REPORT

Boring No. B3
File No. 27481-000
Sheet No. 2 of 3

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
20	WOR WOH WOH 4	S5 18	20.0 22.0			ML	Soft, gray SILT with sand (ML), mps 0.4mm, wet, light brown sand seam at bottom -MARINE DEPOSIT-					25	75	R			
25	1 2 3 4	S6 24	25.0 27.0		25.5	ML CL	Soft, gray SILT with sand (ML), mps 0.4mm, wet Medium stiff, gray lean CLAY (CL), mps 0.4mm, wet -MARINE DEPOSIT-					25 5	75 95	R S	 M	 M	
30	WOR WOR WOR 3	S7 24	30.0 32.0				Soft, gray lean CLAY (CL), mps 0.05mm, black streaks						100	N	M	M	

Begin AW Rod Probe at 32.0 ft.

Depth	300lb. Hammer blows/ft.
32.0	3
33.0	5
34.0	6
35.0	7
36.0	9
37.0	8
38.0	8
39.0	10
40.0	10
41.0	11
42.0	11
43.0	11
44.0	12
45.0	13
46.0	14
47.0	13
48.0	16
49.0	16
50.0	19
51.0	19
52.0	21
53.0	30
54.0	48
55.0	55
56.0	47

Bottom of AW Rod Probe at 57.0 ft.

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

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

Boring No. B3

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B3
File No. 27481-000
Sheet No. 3 of 3

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
50						CL	-MARINE DEPOSIT-										
					53.0		Change in soil density at ~53.0 ft.										
							Probable -GLACIAL TILL DEPOSIT-										
55																	
					57.0		Bottom of Exploration at 57.0 ft.										

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

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

Boring No. B3

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TEST BORING REPORT

Boring No. B4

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No. 27481-000
Sheet No. 1 of 2
Start 13 April 2001
Finish 13 April 2001
Driller M. Porter
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S		Rig Make & Model: Bombardier
Inside Diameter (in.)	2.5	1 3/8		Bit Type: Cutting Head
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Winch/ Automatic Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 3 5 16	S1 16	0.0 2.0	NO WELL INSTALLED	0.3	ML	Medium stiff, dark brown SILT with sand (ML), moist, roots -TOPSOIL-					30	70				
						SP	Loose, light brown poorly graded SAND (SP), mps 1.25in., moist			10	10	50	30				
5	4 3 17 18	S2 6	5.0 7.0				Medium dense, dark brown to white 50% ash, 20% medium sand, 20% fine sand, 10% brick/miscellaneous, mps 3/4in., moist -FILL-										
							Note: Encountered cobbles from 8.0-10.0 ft. while augering.										
10	1 2 5 4	S3 12	10.0 12.0		10.5	SM	Loose, gray silty SAND (SM)		5	15	15	25	40				
							Loose, light brown silty SAND (SM), mps 4mm, wet, occasional brick fragments Note: Numerous obstructions to 15.0 ft.			10	30	35	25				
15	1 WOH 1 1	S4 24	15.0 17.0				Loose, gray-brown SAND, 10% brick/miscellaneous fill, 20% ash (black), wet -FILL-				20	50					
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
4/12/01	0745	0	30.0	32.0	23.2

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 32.0
Rock Cored (lin. ft.)
Samples 7S

Boring No. B4

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B4
File No. 27481-000
Sheet No. 2 of 2

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
20	4 2 4 5	S5 6	20.0 22.0			ML	Medium stiff, black SILT(organic)(ML), occasional brick particles, mps 1.25in. -FILL-				30	20	50				
25	WOR WOH WOH 2	S6 24	25.0 27.0		25.0	CL	Soft, gray lean CLAY (CL), mps 0.05mm, wet -MARINE DEPOSIT-						100	S	M	M	
30	WOR 1 2 10	S7 24	30.0 32.0			CL	Soft, gray lean CLAY (CL), mps 0.4mm, frequent silty fine sand seams					15	85	S	M	M	
					31.5	SP-SM	Loose, gray poorly graded SAND with silt (SP-SM), mps 0.4mm, wet					90	10				
					31.8	SP	Medium dense, gray poorly graded SAND (SP), 2 pieces of gravel in tip of spoon, mps 1.25in. -GLACIAL TILL-				10	60	30				
					32.0		Bottom of Exploration at 32.0 ft. No refusal										

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

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

Boring No. B4

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B5

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No. 27481-000
Sheet No. 1 of 1
Start 17 April 2001
Finish 17 April 2001
Driller M. Porter
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S		Rig Make & Model: Monkey/Tripod
Inside Diameter (in.)		1 3/8		Bit Type:
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Cat-Head/ Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 2 4 7	S1 4	0.0 2.0	NO WELL INSTALLED		SM	Loose, brown silty SAND with gravel (SM), moist, mps 1.25in.		25	10	40	10	15				
	5 7 65 17	S2 10	2.0 4.0			SP-SM	Very dense, gray brown poorly graded SAND (SP-SM), moist, mps 1 in. -FILL-		10	30	30	20	10				
5	14 20 10 9	S3 10	4.0 6.0			ML	Dense, gray brown sandy SILT (ML), moist, mps 1in. -FILL-		10	10	10	10	60				
	7 8 8 9	S4 16	6.0 8.0			ML	Stiff, gray brown SILT with sand (ML), mps 1/2", moist		10			20	70	R			
					6.5	SM	Medium dense, brown silty SAND (SM), moist, mps 2mm.				5	80	15				
	6 9 6 7	S5 2	8.0 10.0			SP	Medium dense, brown poorly graded SAND with gravel (SP), mps 1.25in., moist		50		25	25					
10	10 10 9 9	S6 6	10.0 12.0			SP	Medium dense, brown poorly graded SAND (SP), mps 15mm, wet -FILL-			30	35	30	5				
	25 12 20 13	S7 24	12.0 14.0			SP	S7A:Dense, gray-black poorly graded SAND (SP), wet, mps1in., chemical odor										
					13.7	SM	S7B: Dense, gray silty SAND (SM), wet, mps 2mm, root fibers					85	15				
15	15 15 33 50/.2	S8 3	14.0 16.0			ML	-FILL- Dense, gray silty SAND (ML), brick, glass fragments, wet, mps 1.25in.		15	10	15	40	20				
					15.5	SP-SM	Dense, gray brown poorly graded SAND with silt and gravel (SP-SM), mps 1.25in. -GLACIAL TILL-	10	20	20	20	20	10				
					15.7		Bottom of Exploration at 15.7 ft. Refusal										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
4/17/01	0920	0.25	-	13.0	9.0

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

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

Summary	
Overburden (lin. ft.)	15.7
Rock Cored (lin. ft.)	
Samples	8S
Boring No.	B5

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B6

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No.	27481-000
Sheet No.	1 of 1
Start	13 April 2001
Finish	13 April 2001
Driller	M. Porter
H&A Rep.	B. Lawrence
Elevation	
Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S		Rig Make & Model: Bombardier
Inside Diameter (in.)	2.5	1 3/8		Bit Type: Cutting Head
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Winch/ Automatic Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				NO WELL INSTALLED			Bituminous Concrete										
	3 6 7 7	S1 6	0.5 2.5		0.2	SW	Medium dense, light brown well graded SAND (SW), moist, mps 1.25in. -FILL-	5	20	25	25	20	5				
5	2 3 5 5	S2 6	5.0 7.0				Loose, brown gray silty SAND, 10% ash, 10% cinders, moist				20	25	25				
10	1 1 7 11	S3 12	10.0 12.0				Loose, gray to black SAND, 30% ash, 20% brick, 20% cinders/miscellaneous fill materials, wet -FILL-				15	15					
					14.4		Auger refusal at 14.4 ft. Bottom of Exploration at 14.4 ft.										

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

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

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

Summary	
Overburden (lin. ft.)	14.4
Rock Cored (lin. ft.)	
Samples	3S
Boring No.	**B6**

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

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

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

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REPORT ON
SUBSURFACE AND FOUNDATION INVESTIGATION
WESTBROOK RIVERFRONT
PRESUMPSCOT RIVER
WESTBROOK, MAINE

by

Haley & Aldrich, Inc.
South Portland, Maine

for

City of Westbrook
Westbrook, Maine

File No. 27481-001
July 2002

HALEY & ALDRICH

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www.HaleyAldrich.com

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23 July 2002
File No. 27481-001

City of Westbrook
Westbrook City Hall
2 York Street
Westbrook, Maine 04092

Attention: Mr. Matthew Eddy

Subject: Westbrook Riverfront
Presumpscot River
Westbrook, Maine

Ladies and Gentlemen:

This report presents the results of our subsurface and foundation investigation for the proposed Westbrook Riverfront project in Westbrook, Maine. This work was completed in accordance with our proposal dated 11 June 2002.

In summary, it is our opinion that the buildings, retaining wall and boardwalk structure can be supported on conventional spread footings bearing on a minimum of two feet of compacted structural fill placed after excavation of the existing fill. In addition, earth supported slabs-on-grade may be used for the ground floors. Specific recommendations for foundation design, slope protection and construction considerations are presented below.

INTRODUCTION

The Riverfront Project is located along the Presumpscot River in Westbrook, as shown on Figure 1, Project Locus. This portion of the project consists of a boardwalk along the river from approximately Bridge Street to Ash Street, riverbank protection and seasonal retail buildings. The existing riverbank slopes vary from approximately 1.5 horizontal to 1 vertical (1.5:1) to 2:1. The slopes are presently covered with various sizes of riprap, vegetation and other materials. The proposed area for retail buildings presently consists of bituminous paved parking and roadway. The boardwalk will consist of marine grade wood decking supported on a concrete retaining wall and individual footings. The retail buildings will consist of two-story wood-framed buildings with ground floors at approximately El. 56. Ground surface elevations along this portion of the river vary from approximately El. 40 at the river's edge to El. 56 at the top of the riverbank. Elevations in this report are in feet and referenced to National Geodetic Vertical Datum (NGVD).

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SUBSURFACE EXPLORATIONS

Recent Explorations

Maine Test Borings, Inc. (MTB) of Brewer, Maine drilled 8 borings, B101 to B108, at locations shown on Figure 2, Site and Subsurface Exploration Plan during 8 and 9 July 2002. MTB drilled the borings to depths below ground surface varying from 2.0 to 25.0 ft. Boring B107 was terminated at a depth of 2 ft. when an active electric cable was encountered. Haley & Aldrich monitored the borings and prepared the logs included in Appendix A. Table I summarizes the results of borings.

Borings were drilled using 2.5-in. diameter hollow stem augers. Soil samples were typically obtained at 5-ft. intervals in the borings. Standard Penetration Resistance (N) was measured at each sample interval in accordance with ASTM test designation D 1586.

Previous Explorations

During the period 13 to 17 April MTB drilled 2 borings, B4 and B5, at locations shown on Figure 2. MTB drilled the borings to depths below ground surface varying from 15.7 ft. to 32.0 ft. Haley & Aldrich monitored the borings and prepared the logs included in Appendix B. Results are summarized in Table I.

Boring B4 was drilled using 2.5-in. diameter hollow stem augers. Soil samples were typically obtained at 5-ft. intervals in the boring. Boring B5 was drilled using portable equipment and continuously driving a sampler in the open hole. Standard Penetration Resistance (N) was measured at each sample interval in accordance with ASTM test designation D 1586.

Haley & Aldrich determined the locations of borings by pacing from existing site features.

The boring logs and related information depict subsurface conditions and water levels only at their specific locations at the time indicated on the logs. Soil conditions at other locations may differ from conditions at these locations. Also, the passage of time may result in a change in groundwater conditions at exploration locations.

SUBSURFACE CONDITIONS

The borings encountered four principal soil units at the site: fill, alluvial deposit, marine deposit and glacial till. Encountered thickness and generalized descriptions of the soil units are presented below in order of increasing depth below ground surface.

Fill – Fill consists of loose to dense, gray to brown well-graded SAND (SW); to sandy SILT (ML); to silty SAND (SM); to poorly graded SAND (SP), with various amounts of ash,

bricks, cinders, wood and oversized particles. Encountered thickness varied from 8.5 ft. to 25.0 ft.

Alluvial Deposit – The alluvial deposit consists of soft to medium stiff, gray brown to olive gray, sandy SILT (ML) to elastic SILT (MH) with gravel and organics. Encountered thickness varied from 1.5 ft. to greater than 6.5 ft.

Marine Deposit – The marine deposit consists of sub-strata of loose to medium dense, silty SAND (SM), sandy SILT (ML) and lean CLAY (CL). The encountered thickness of marine deposit varied from 6.8 ft. to greater than 16.5 ft.

Glacial Till – Glacial till consists of dense, gray brown poorly graded SAND (SP) with oversized particles. Borings penetrated approximately 0.2 ft. into the glacial till.

The borings encountered water at depths below ground surface varying from 9.0 ft. to 25.0 ft. Observations of water were made over a relatively short period of time and may not represent the stabilized groundwater level. In addition, water levels will vary with season, temperature, precipitation, water level in the Presumpscot River and construction activity in the area. Therefore, water levels during and following construction will vary from those measured in the borings.

RECOMMENDATIONS FOR FOUNDATION DESIGN

Recommended Foundation Type

The fill encountered in the borings did not contain significant quantities of soft, compressible or organic materials. Based on the depth of fill and the nominal building and boardwalk loads, we anticipate that supporting the building and boardwalk foundations within the fill layer would be acceptable. However, due to the uncontrolled nature of the fill, unpredictable settlement may occur if the fill contains large quantities of organic or decomposable material or void producing objects. These conditions were not disclosed in the borings. Therefore, we recommend that the buildings and boardwalk structures be supported on spread or continuous footings bearing on a minimum of 2 ft. of compacted structural fill placed after removal of the existing fill.

Footings may be proportioned for an allowable bearing stress equal to 700 lbs. per sq. ft. multiplied by the least lateral dimension of the footing in ft. up to a maximum of 2,000 lbs. per sq. ft. All footings should be at least 2 ft. wide.

Exterior footings should be founded a minimum of 4.5 ft. below the lowest adjacent ground surface exposed to freezing. Interior footings may be founded a minimum of 1.5 ft. below the ground floor slab.

Compacted structural fill supporting footings should extend laterally from the footings to at least the limits defined by 1 horizontal to 1 vertical lines sloped outward and downward from the bottom edges of the footings.

The concrete retaining wall may be supported on a continuous footing bearing on a minimum of 2 ft. of compacted structural fill placed after removal of existing fill. The footing may be proportioned for an allowable bearing stress equal to 700 lbs. per sq. ft. multiplied by the least lateral dimension of the footing in ft. up to a maximum of 2,000 lbs. per sq. ft. The footing should be at least 2 ft. wide. The resultant of all forces should fall within the middle third of the footing and the maximum stress on any portion of the footing should not exceed 2,500 lbs. per sq. ft.

Ground Floor Slab

We recommend that the floor slabs be designed as earth-supported slabs-on-grade bearing on a minimum of 6 in. of compacted structural fill. Prior to placement of structural fill, any debris should be removed from the surface of the fill and the exposed subgrade should be systematically proofrolled using fully loaded ten-wheeled dump trucks or similar equipment. Any soft or unsuitable materials encountered should be excavated and replaced with compacted structural fill. All fill placed below the floor slab for raises-in-grade should consist of compacted structural fill. Normal dampproofing and vapor barriers should be provided below the slabs.

Lateral Foundation Loads

We recommend that lateral loads be resisted by bottom friction on footings and that a coefficient of friction equal to 0.4 be used for footings bearing on soil. If this does not provide sufficient lateral resistance, we will consider the problem in more detail, to take into account other factors.

Lateral Soil Pressure

We anticipate that the concrete retaining wall will be free to rotate at the top. We recommend that the retaining wall be designed to resist a lateral earth pressure calculated on the basis of an equivalent fluid unit weight of 40 lbs. per cu. ft. In addition, the wall may be subjected to surcharge due to pedestrians or other loads behind the wall. The wall should be designed for a uniform lateral pressure acting over the full height of wall, calculated on the basis of 0.5 times the surcharge pressure, in addition to the lateral earth pressure recommended above. The wall should be backfilled with free-draining structural fill to minimize build up of hydrostatic pressure on the back of the wall.

Backfill Materials

Structural fill used below foundations and floor slabs and for backfill adjacent to walls should consist of sandy gravel to gravelly sand. It should be free of organic material, loam, trash, snow, ice, frozen soil and other objectionable material, and should conform to the following gradation:

Sieve Size	Percent Finer by Weight
6 in.	100
No. 4	30 to 90
No. 40	10 to 50
No. 200	0 to 8

Compacted structural fill should be placed in layers not exceeding 8 in. in loose measure and compacted by self-propelled vibratory equipment at the approximate optimum moisture content to a dry density of at least 95 percent of the maximum dry density, as determined in accordance with ASTM Test Designation D1557. In confined areas, the maximum particle size should be reduced to 3 in. and the loose layer thickness should be reduced to 6 in. and compaction performed by hand-guided equipment.

Compacted structural fill on the outside of the foundation walls should extend laterally a minimum of 2 ft. from the wall. Backfill beyond this limit on the outside of the building may consist of common fill. The top 12-in. of fill on the exterior of the building should consist of low permeability material to minimize water infiltration next to the building. Grading should provide for runoff away from the building.

Common fill may consist of inorganic mineral soil that can be placed in layers not exceeding 12 in. in thickness and compacted with a minimum of four systematic passes of the equipment placing the fill.

Pavement Section

The recommended pavement section is as follows:

3 in. bituminous concrete, placed in two layers
3 in. screened or crushed gravel base course
12 in. sand or gravel subbase course

Existing fill materials may remain in place but all debris should be removed from the surface. The exposed subgrade should be proofrolled as described below. Base and subbase course materials should conform to the following gradations:

Screened or Crushed Gravel (Maine DOT Standard Specification, Highways and Bridges; Section 703.06a, Type A)

Sieve Size	Percent Finer by Weight
2 in.	100
½ in.	45 to 70
¼ in.	30 to 55
No. 40	0 to 20
No. 200	0 to 5

Sand or Gravel (Maine DOT, Section 703.06b, Type E)

Sieve Size	Percent Finer by Weight
6 in.	100
¼ in.	25 to 100
No. 40	0 to 50
No. 200	0 to 7

(Note: Compacted structural fill may be substituted for gravel subbase course)

Subbase course materials should be placed in maximum 8-in. thick loose lifts and compacted at approximately optimum moisture content to a dry density of at least 92 percent of maximum dry density, as determined in accordance with ASTM Test Designation D1557. Base course material should be placed in one lift and compacted with a minimum of two coverages with self-propelled vibratory compaction equipment.

It should be noted that the subgrade soils are considered frost-susceptible. Therefore, pavement roughness due to non-uniform frost movement may occur. To eliminate such non-uniform frost movement would require approximately 4.5 ft. of structural fill subbase. However, it is common practice to tolerate seasonal movement to avoid the high cost of the added thickness of subbase.

Slope Protection

We recommend that the riverbank slopes be constructed no steeper than 1.5 horizontal to 1 vertical and that the slopes be protected with a minimum thickness of 3-ft. of riprap as shown on the sketch in Appendix C. Riprap should conform to the requirements of Maine DOT Standard Specification, Highways and Bridges; Section 703.26, Plain Riprap. Stones should consist of sound, durable rock, which will not disintegrate by exposure to water or weather. Either field stone or rough, unhewn quarry stone may be used. Stones should be angular and as nearly rectangular as practicable. Rounded boulders or cobbles should not be permitted.

Stones should weigh from 10 lbs. to 200 lbs. except that when available, suitable stones weighing more than 200 lbs. may be used. Approximately 50 percent of the stones by volume should exceed a mass of 50 lbs. each.

CONSTRUCTION CONSIDERATIONS

General

The primary purpose of this section of the report is to comment on items related to excavation, earthwork, and related geotechnical aspects of proposed construction. It is written primarily for the engineer having responsibility for preparation of plans and specifications. Since it identifies potential construction problems related to foundations and earthwork, it will also aid personnel who monitor the construction activity. Prospective contractors for this project must evaluate the construction problems on the basis of their own knowledge and experience in the Westbrook, Maine area, and on the basis of similar projects in other localities, taking into account their proposed construction methods, procedures, equipment and personnel.

Excavation, Lateral Support and Control of Water

We anticipate that foundation excavation can be accomplished with sloped open excavation through the overburden soils provided safe side slopes can be maintained. Some sloughing and raveling should be anticipated in temporary slopes. Temporary excavations should be made in accordance with all OSHA and other applicable regulatory agency requirements.

We anticipate that groundwater may be encountered at proposed subgrade level. If encountered, open pumping from sumps can likely control groundwater. In general, the contractor should control groundwater and water from runoff and other sources by methods, which prevent disturbance of bearing surfaces or adjacent soils and allow construction in-the-dry.

Preparation of Slab and Paved Areas

All bituminous pavement and fill containing debris should be removed from the slab and paved areas subgrade. The exposed subgrade should be systematically proofrolled with a minimum of two coverages of a fully loaded ten-wheel dump truck or similar equipment. Any soft or yielding areas encountered should be excavated and replaced with compacted structural fill prior to raising the grade for construction.

Construction Monitoring

The foundation recommendations contained herein are based on the known and predictable behavior of a properly engineered and constructed foundation. Monitoring of the foundation

construction is required to enable the geotechnical engineer to keep in contact with procedures and techniques used in construction. Therefore, we recommend that a person qualified by training and experience be present to provide monitoring at the site during subgrade preparation and placement of compacted structural fill.

LIMITATIONS OF RECOMMENDATIONS

This report has been prepared for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. In the event that any changes in the nature, design or location of the building, boardwalk or retaining wall are planned, the conclusions and recommendations contained in this report should not be considered valid, unless the changes are reviewed and the conclusions of this report modified or verified in writing.

The recommendations presented herein are based in part upon the data obtained from the referenced test borings. The nature and extent of variations from that disclosed by the explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

We recommend that we be provided with the opportunity for a general review of final design and specifications in order to determine that our earthwork and foundation recommendations have been interpreted and implemented in the design and specifications as they were intended.

It has been a pleasure to work with you on this project. Please do not hesitate to contact us if you have any questions or require additional information.

Sincerely yours,
HALEY & ALDRICH, INC.

Kenneth L. Recker, P.E.
Vice President

STATE OF MAINE
KENNETH L RECKER #5435
REGISTERED PROFESSIONAL ENGINEER

Enclosures:

Table I	- Summary of Borings
Figure 1	- Project Locus
Figure 2	- Site sand Subsurface Exploration Plan
Appendix A	- Logs of Recent Borings
Appendix B	- Logs of Previous Borings
Appendix C	- Slope Protection Sketch

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TABLE I
SUMMARY OF BORINGS
WESTBROOK RIVERFRONT
WESTBROOK, MAINE

BORING NUMBER	DEPTH (FT)	DEPTH TO WATER (FT)	STRATA THICKNESS (FT)			
			FILL	ALLUVIAL DEPOSIT	MARINE DEPOSIT	GLACIAL TILL
B101	15.0	NE	11.0	1.5	2.5*	--
B102	15.0	NE	9.0	--	6.0*	--
B103	15.0	NE	8.5	6.5*	--	--
B104	15.0	NE	13.0	1.5	0.5*	--
B105	17.0	NE	13.0	4.0*	--	--
B106	14.0	NE	14.0*	--	--	--
B107	2.0	NE	2.0*	--	--	--
B108	25.0	12.5	8.5	--	16.5*	--
B4	32.0	23.2	25.0	--	6.8	0.2*
B5	15.7	9.0	15.5	--	--	0.2*

NOTES:
1. NE INDICATES WATER NOT ENCOUNTERED WITHIN DEPTH OF BORING.
2. -- INDICATES STRATUM NOT ENCOUNTERED WITHIN DEPTH OF BORING.
3. * INDICATES DEPTH OF PENETRATION INTO STRATUM.

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APPENDIX A

Logs of Recent Borings

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TEST BORING REPORT

Boring No. B101

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 1
Start July 8, 2002
Finish July 8, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-BITUMINOUS CONCRETE-										
	8 14 22 14	S1 14	0.5 2.5		0.1	SW	Dense gray to brown well-graded SAND (SW) with gravel, mps=1 1/4 ", dry	15	10	20	20	30	5				
					4.0												
5	4 4 5 7	S2 20	5.0 7.0			SM	Loose light brown silty SAND (SM), occasional silt lenses,damp -FILL-					80	20				
10	8 8 3 2	S3 20	10.0 12.0				Medium dense light brown silty SAND, damp					80	20				
					11.0	ML	Medium stiff gray-brown SILT with sand, organics, damp -ALLUVIAL DEPOSITS-					15	85		L	L	
	1 1 1 2	S4 20	13.0 15.0	NO WELL INSTALLED	12.5	SM	Very loose gray silty SAND, damp -MARINE DEPOSITS-					80	20				
15					15.0		Bottom of Exploration No refusal										

Water Level Data

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

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 15.0
Rock Cored (lin. ft.) -
Samples 4S

Boring No. B101

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

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

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

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TEST BORING REPORT

Boring No. B102

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 1
Start July 8, 2002
Finish July 8, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-BITUMINOUS CONCRETE-										
	9 13 17 17	S1 4	0.5 2.5		0.2	SW	Medium dense light brown well-graded SAND (SW) with gravel, dry, mps=3/4"	15	15	20	45	5					
					2.3	SM	Medium dense gray silty SAND (SM), dry				10	70	20				
					3.5												
5	2 3 5 6	S2 20	5.0 7.0			CL	Medium stiff gray-brown CLAY (CL), organics, trace brick, medium to fine sand -FILL-				5	10	85		M	M	
					9.0												
10	2 2 4 3	S3 20	10.0 12.0	NO WELL INSTALLED		CL	Medium stiff olive CLAY, frequent fine sand partings, damp -MARINE DEPOSITS-					15	85		M	M	
	1 2 3 2	S4 22	13.0 15.0		13.3	CL CL	Medium stiff olive CLAY Medium stiff olive-gray CLAY						100		M	M	
15					14.5	CL	Medium stiff gray lean CLAY with sand					25	75		M	M	
					15.0		Bottom of Exploration No refusal										

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

Sample Identification

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

Well Diagram

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

Summary

Overburden (lin. ft.)	15.0
Rock Cored (lin. ft.)	-
Samples	4S

Boring No. B102

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

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

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

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TEST BORING REPORT

Boring No. B103

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 1
Start July 8, 2002
Finish July 8, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-BITUMINOUS CONCRETE-										
	8 12 13 10	S1 14	0.5 2.5	NO WELL INSTALLED	0.2	SW	Medium dense light brown well-graded SAND (SW) with gravel, mps=3/4", dry		15	20	15	45	5				
5	3 5 7 7	S2 20	5.0 7.0		4.5	SM	Medium dense gray silty SAND (SM) with trace gravel, cinders, wood, mps=1 1/4", dry -FILL-										
10	1 1 2 2	S3 8	10.0 12.0		8.5	ML	Soft olive-gray sandy SILT, trace fine gravel and organics					40	60				
	1 5 2 3	S4 12	13.0 15.0				Medium stiff gray sandy SILT, trace gravel, organics mps=1 1/4" -ALLUVIAL DEPOSITS-										
15					15.0		Bottom of Exploration No refusal										

Water Level Data

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

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 15.0
Rock Cored (lin. ft.) -
Samples 4S

Boring No. B103

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B104

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 1
Start July 9, 2002
Finish July 9, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-BITUMINOUS CONCRETE-										
	10 16 22 16	S1 13	0.5 2.5		0.2	SW	Dense gray-brown to light brown well-graded SAND (SW) with gravel, mps=1 1/4", dry	15	10	10	20	40	5				
					3.5												
5	3 3 13 13	S2 20	5.0 7.0			ML	Very stiff gray-brown sandy SILT (ML), ash, trace brick, mps=1 1/2", damp Note: most ash below 6.5 ft.	10				30	60				
10	1 1 2 11	S3 15	10.0 12.0	NO WELL INSTALLED		ML	Soft gray-brown sandy SILT (ML), ash, mps=1", damp -FILL-		10			25	65				
	1 1 2 3	S4 20	13.0 15.0		13.0	MH	Soft gray elastic SILT with sand, damp -ALLUVIAL DEPOSITS-					25	75			M	
15					14.5	CL	Soft gray CLAY, damp -MARINE DEPOSITS-					10	90		M	M	
					15.0		Bottom of Exploration No refusal										

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

Sample Identification

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

Well Diagram

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

Summary

Overburden (lin. ft.)	15.0
Rock Cored (lin. ft.)	-
Samples	4S

Boring No. B104

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

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

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

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TEST BORING REPORT

Boring No. B105

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 1
Start July 9, 2002
Finish July 9, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-BITUMINOUS CONCRETE-										
	12 15 15 10	S1 14	0.5 2.5	NO WELL INSTALLED	0.2		Medium dense gray silty SAND, mps=1 1/2", dry	10		20	15	40	15				
					1.0	SW	Medium dense light brown well-graded SAND (SW), dry			35	30	30	5				
					3.0												
5	2 4 4 2	S2 15	5.0 7.0			ML	Medium stiff gray-brown SILT (ML) with sand, wood, ash, cinders, trace gravel, dry										
10	1 1 1 1	S3 2	10.0 12.0				Very loose gray to red-brown ASH, dry -FILL-										
					13.0												
15	2 3 5 5	S4 16	15.0 17.0			MH	Medium stiff gray elastic SILT, frequent brown fine sand seams, wood, organics, moist -ALLUVIAL DEPOSITS-					15	85			M	
					17.0		Bottom of Exploration No refusal										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
7/9/02	0755		15.0	17.0	16.6

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

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

Summary	
Overburden (lin. ft.)	17.0
Rock Cored (lin. ft.)	-
Samples	4S

Boring No. B105

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B106

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 1
Start July 9, 2002
Finish July 9, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-BITUMINOUS CONCRETE-										
	6 10 9 8	S1 13	0.5 2.5		0.3	SW	Medium dense light brown well-graded SAND (SW) with gravel, dry	15	10	15	30	25	5				
					2.3	ML	Medium stiff gray-brown SILT (ML) with sand, ash, damp					15	85				
5	4 5 7 6	S2 20	5.0 7.0			SM	Loose gray-brown silty SAND (SM) with ash, damp		10	15	20	35	20				
					6.0	SP	Medium dense light brown poorly-graded SAND (SP), mps=1", dry -FILL-	5			40	50	5				
10	2 1 3 4	S3 19	10.0 12.0	NO WELL INSTALLED	9.0	SM	Very loose gray-brown silty SAND (SM), frequent clay seams, ash, damp Note: obstruction at 14.0 ft. Auger refusal at 14.0 ft.-probable granite block Auger crooked-unable to drive split spoon			10	15	55	20				
					14.0		Bottom of Exploration Refusal on obstruction										

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

Sample Identification

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

Well Diagram

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

Summary

Overburden (lin. ft.)	14.0
Rock Cored (lin. ft.)	-
Samples	3S

Boring No. B106

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

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

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

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B107

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 1
Start July 9, 2002
Finish July 9, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 7 10 9	S1 14	0.0 2.0	NO WELL INSTALLED	0.1	SM	-TOPSOIL- Medium dense brown silty SAND (SM) with gravel, mps=1 1/4", dry -FILL-	10	10	15	15	30	20				
					2.0		Note: boring terminated at 2.0 ft. augered through electrical line. Bottom of Exploration										

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

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

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

Summary

Overburden (lin. ft.)	2.0
Rock Cored (lin. ft.)	-
Samples	1S

Boring No. B107

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

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

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

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B108

Project	WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client	CITY OF WESTBROOK
Contractor	MAINE TEST BORINGS, INC.

File No. 27481-001
Sheet No. 1 of 2
Start July 8, 2002
Finish July 8, 2002
Driller M.Coffin
H&A Rep. K.Stephenson
Elevation
Datum
Location See Plan

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

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 4 5 5	S1 13	0.0 2.0	NO WELL INSTALLED	0.1	SW	Very loose brown SAND with grass roots -TOPSOIL-				10	75	15				
							Loose brown well-graded SAND (SW) with silt and gravel, mps=1", dry	20		10	15	35	20				
					1.8	SM	Loose brown silty SAND (SM), dry -FILL-			15	15	50	20				
5	4 4 5 9	S2 16	4.5 6.5				Loose brown SAND with ash, cinders, occasional silt seam, rusty at 6.0 ft., dry										
					6.0	ML	Stiff gray-brown SILT (ML) with sand, trace ash, glass					15	85		L	L	
					8.5												
10	4 7 7 8	S3 20	10.0 12.0			CL	Stiff gray-brown CLAY, frequent fine sand partings, dry -MARINE DEPOSITS-					85	15		M	M	
15	WOH 3 2 2	S4 18	15.0 17.0		15.0	ML	Soft gray SILT with sand, moist					25	75				
					16.0	SP	Loose gray poorly-graded SAND, wet				60	35	5				
					16.2	OL/OH	Soft brown to gray-brown SILT with organics, fine sand, wet					30	70				
20	3 2 3 4	S5 24	20.0 22.0			SW-SM	Loose gray well-graded SAND with silt, wet			20	30	40	10				
					20.5	CL	Medium stiff gray CLAY, trace fine sand								M	M	
					21.6	SW-SM	Loose gray well-graded SAND with silt, wet -MARINE DEPOSITS-			20	20	50	10				
	WOR WOR 1 1	S6 20	23.0 25.0		23.0	CL	Very soft gray CLAY, wet						100		M	M	
25																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
7/8/02	1315	-	23.0	25.0	19.3
7/8/02	1335	-	-	14.9	12.5

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 25.0
Rock Cored (lin. ft.) -
Samples 6S

Boring No. B108

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B108
File No. 27481-001
Sheet No. 2 of 2

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
25					25.0		Bottom of Exploration No refusal										

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

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

Boring No. B108

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APPENDIX B

Logs of Previous Borings

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TEST BORING REPORT

Boring No. B4

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No.	27481-000
Sheet No.	1 of 2
Start	13 April 2001
Finish	13 April 2001
Driller	M. Porter
H&A Rep.	B. Lawrence
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S		Rig Make & Model: Bombardier
Inside Diameter (in.)	2.5	1 3/8		Bit Type: Cutting Head
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Winch/ Automatic Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 3 5 16	S1 16	0.0 2.0	NO WELL INSTALLED	0.3	ML SP	Medium stiff, dark brown SILT with sand (ML), moist, roots -TOPSOIL- Loose, light brown poorly graded SAND (SP), mps 1.25in., moist			10	10	30 50	70 30				
5	4 3 17 18	S2 6	5.0 7.0				Medium dense, dark brown to white 50% ash, 20% medium sand, 20% fine sand,10% brick/miscellaneous, mps 3/4in., moist -FILL- Note: Encountered cobbles from 8.0-10.0 ft. while augering.										
10	1 2 5 4	S3 12	10.0 12.0		10.5	SM	Loose, gray silty SAND (SM) Loose, light brown silty SAND (SM), mps 4mm, wet, occasional brick fragments Note: Numerous obstructions to 15.0 ft.		5	15 10	15 30	25 35	40 25				
15	1 WOH 1 1	S4 24	15.0 17.0				Loose, gray-brown SAND, 10% brick/miscellaneous fill, 20% ash (black), wet -FILL-				20	50					
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
4/12/01	0745	0	30.0	32.0	23.2

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.)	32.0
Rock Cored (lin. ft.)	
Samples	7S

Boring No. B4

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B4
File No. 27481-000
Sheet No. 2 of 2

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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
20	4 2 4 5	S5 6	20.0 22.0			ML	Medium stiff, black SILT(organic)(ML), occasional brick particles, mps 1.25in. -FILL-				30	20	50				
25	WOR WOH WOH 2	S6 24	25.0 27.0		25.0	CL	Soft, gray lean CLAY (CL), mps 0.05mm, wet -MARINE DEPOSIT-						100	S	M	M	
30	WOR 1 2 10	S7 24	30.0 32.0			CL	Soft, gray lean CLAY (CL), mps 0.4mm, frequent silty fine sand seams					15	85	S	M	M	
					31.5	SP-SM	Loose, gray poorly graded SAND with silt (SP-SM), mps 0.4mm, wet					90	10				
					31.8	SP	Medium dense, gray poorly graded SAND (SP), 2 pieces of gravel in tip of spoon, mps 1.25in. -GLACIAL TILL-				10	60	30				
					32.0		Bottom of Exploration at 32.0 ft. No refusal										

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

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

Boring No. B4

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B5

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No. 27481-000
Sheet No. 1 of 1
Start 17 April 2001
Finish 17 April 2001
Driller M. Porter
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S		Rig Make & Model: Monkey/Tripod
Inside Diameter (in.)		1 3/8		Bit Type:
Hammer Weight (lb.)		140	-	Drill Mud:
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Cat-Head/ Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, 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 2 4 7	S1 4	0.0 2.0	NO WELL INSTALLED		SM	Loose, brown silty SAND with gravel (SM), moist, mps 1.25in.		25	10	40	10	15				
	5 7 65 17	S2 10	2.0 4.0			SP-SM	Very dense, gray brown poorly graded SAND (SP-SM), moist, mps 1 in. -FILL-		10	30	30	20	10				
5	14 20 10 9	S3 10	4.0 6.0			ML	Dense, gray brown sandy SILT (ML), moist, mps 1in. -FILL-		10	10	10	10	60				
	7 8 8 9	S4 16	6.0 8.0			ML	Stiff, gray brown SILT with sand (ML), mps 1/2", moist		10			20	70	R			
					6.5	SM	Medium dense, brown silty SAND (SM), moist, mps 2mm.				5	80	15				
	6 9 6 7	S5 2	8.0 10.0			SP	Medium dense, brown poorly graded SAND with gravel (SP), mps 1.25in., moist		50		25	25					
10	10 10 9 9	S6 6	10.0 12.0			SP	Medium dense, brown poorly graded SAND (SP), mps 15mm, wet -FILL-			30	35	30	5				
	25 12 20 13	S7 24	12.0 14.0			SP	S7A: Dense, gray-black poorly graded SAND (SP), wet, mps1in., chemical odor										
					13.7	SM	S7B: Dense, gray silty SAND (SM), wet, mps 2mm, root fibers					85	15				
15	15 15 33 50/.2	S8 3	14.0 16.0			ML	-FILL- Dense, gray silty SAND (ML), brick, glass fragments, wet, mps 1.25in.		15	10	15	40	20				
					15.5	SP-SM	Dense, gray brown poorly graded SAND with silt and gravel (SP-SM), mps 1.25in. -GLACIAL TILL-	10	20	20	20	20	10				
					15.7		Bottom of Exploration at 15.7 ft. Refusal										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
4/17/01	0920	0.25	-	13.0	9.0

Sample Identification

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

Well Diagram

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

Summary

Overburden (lin. ft.) 15.7
Rock Cored (lin. ft.)
Samples 8S

Boring No. B5

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

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

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

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APPENDIX C

Slope Protection Sketch

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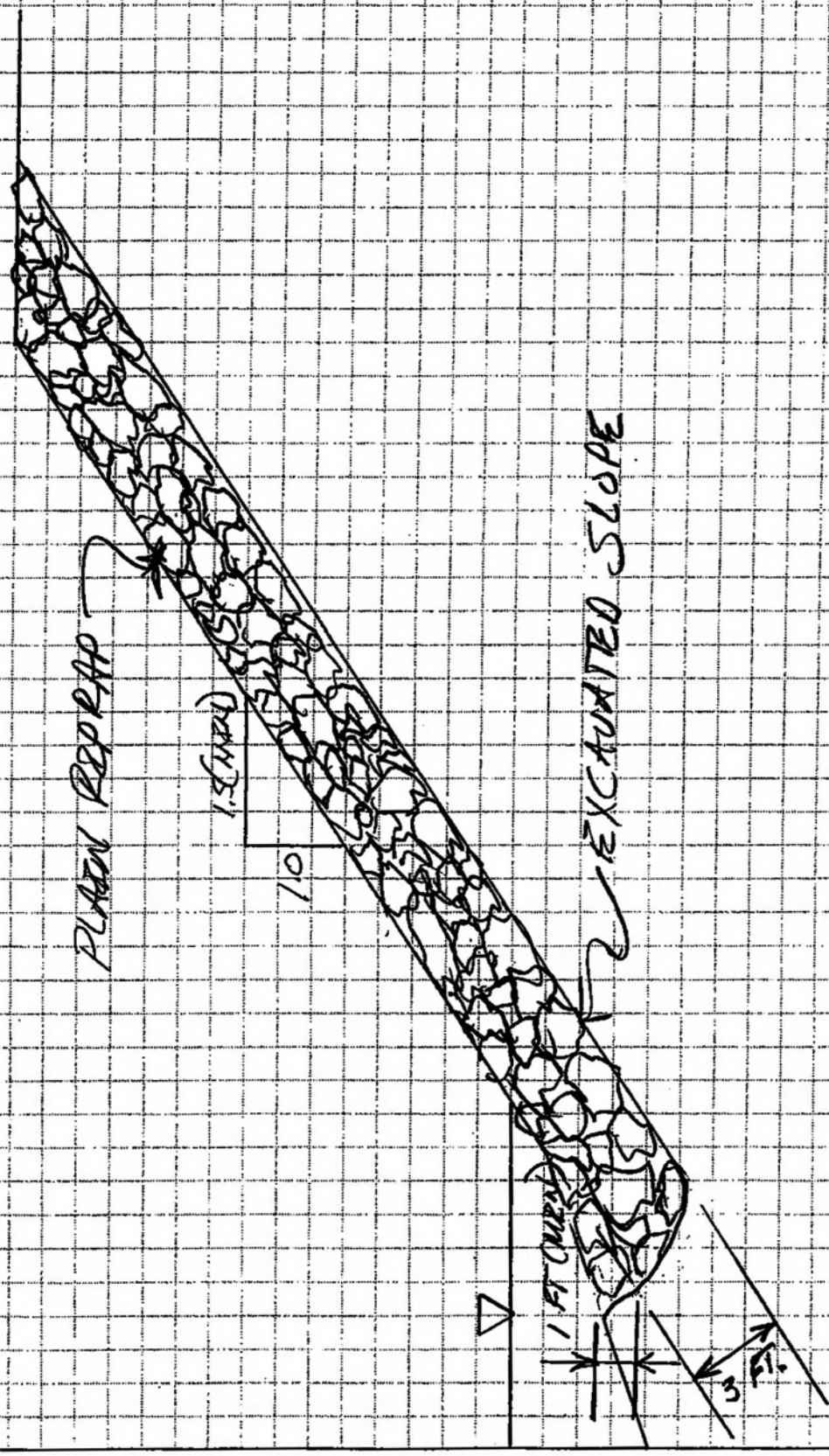
CALCULATIONS

Client	CITY OF WESTBROOK	File No.	27481-001
Project	WESTBROOK RIVERFRONT	Sheet	1 of 1
Subject	SLOPE PROTECTION	Date	7/22/02
		Computed By	RECKER
		Checked By	



PLAIN RIPRAP RIVERBANK SLOPE

NOT TO SCALE

CAL02AFH.FRP 20 November 1997

REPORT ON
SUBSURFACE INVESTIGATION
ADDITIONAL EVALUATION
WESTBROOK RIVERFRONT
PRESUMPSCOT RIVER
WESTBROOK, MAINE

by

Haley & Aldrich, Inc.
South Portland, Maine

for

Orcutt Associates
Yarmouth, Maine

File No. 27481-002
December 2002

HALEY & ALDRICH

ENGINEERING &
ENVIRONMENTAL
SOLUTIONS

Haley & Aldrich, Inc.
500 SouthBorough Drive
Suite 10
South Portland, ME 04106-6935
Tel: 207.772.5439
Fax: 207.871.5999
www.HaleyAldrich.com

HALEY & ALDRICH

11 December 2002
File No. 27481-002

Orcutt Associates
81 Bridge Street
Yarmouth, Maine 04096

Attention: Ms. Shelley Brunelle

Subject: Additional Evaluation
Westbrook Riverfront
Presumpscot River
Westbrook, Maine

Ladies and Gentlemen:

This report presents the results of our additional subsurface investigation for the proposed Westbrook Riverfront project in Westbrook, Maine. Our evaluation of foundation requirements will be provided when the site development and building configurations are established.

INTRODUCTION

The Riverfront Project is located along the Presumpscot River in Westbrook, as shown on Figure 1, Project Locus. This portion of the project consists of development west of Bridge Street including realignment of parking, additional parking, new building parcels and design of boardwalk, walkways and lighting. The existing riverbank slopes vary from approximately 1.5 horizontal to 1 vertical (1.5:1) to 2:1. The slopes are presently covered with various sizes of riprap. The proposed areas for buildings and additional parking presently consist of concrete slabs, bituminous walkways and park landscaping.

SUBSURFACE EXPLORATIONS

Recent Explorations

Maine Test Borings, Inc. (MTB) of Brewer, Maine drilled 3 borings, B201 to B203, at locations shown on Figure 2, Site and Subsurface Exploration Plan, on 11 November 2002. MTB drilled the borings to depths below ground surface varying from 17.0 to 21.1 ft. Haley & Aldrich monitored the borings and prepared the logs included in Appendix A.

OFFICES
Boston
Massachusetts
Cleveland
Ohio
Dayton
Ohio
Denver
Colorado
Detroit
Michigan
Hartford
Connecticut
Los Angeles
California
Manchester
New Hampshire
Newark
New Jersey
Rochester
New York
San Diego
California
Tucson
Arizona
Washington
District of Columbia

Printed on recycled paper

Borings were drilled using 2.5-in. diameter hollow stem augers. Soil samples were typically obtained at 5-ft. intervals in the borings. Standard Penetration Resistance (N) was measured at each sample interval in accordance with ASTM test designation D 1586.

Previous Explorations

On 13 April 2001 MTB drilled 1 boring, B6, at the location shown on Figure 2. MTB drilled the boring to a depth below ground surface of 14.4 ft. Haley & Aldrich monitored the boring and prepared the log included in Appendix B.

Haley & Aldrich determined the locations of borings by pacing from existing site features.

The boring logs and related information depict subsurface conditions and water levels only at their specific locations at the time indicated on the logs. Soil conditions at other locations may differ from conditions at these locations. Also, the passage of time may result in a change in groundwater conditions at exploration locations.

SUBSURFACE CONDITIONS

The borings encountered three principal soil units at the site: topsoil, fill, and marine deposit. Encountered thickness and generalized descriptions of the soil units are presented below in order of increasing depth below ground surface.

Topsoil – Topsoil consists of very loose, brown, silty SAND with grass and roots; to stiff, brown, sandy SILT with grass and roots. Encountered thickness varied from 0.5 ft. to 1.0 ft. A 0.4-ft. thickness of wood chips/mulch was encountered in B201.

Fill – Fill consists of very loose to dense, gray to brown to black, well-graded SAND (SW); to silty SAND (SM); to mottled lean CLAY (CL) with various amounts of ash, cinders, bricks, glass, wood and organics. Encountered thickness varied from 14.4 ft. to 20.0 ft.

Marine Deposit – The marine deposit consists of loose, gray, poorly-graded SAND (SP); to soft, gray, lean CLAY (CL). The encountered thickness of marine deposit varied from 1.4 ft. to greater than 2.0 ft.

Borings encountered refusal on what was judged to be bedrock at depths below ground surface varying from 14.4 ft. to 21.1 ft.

The borings encountered water at depths below ground surface on the order of 14.6 ft. Observations of water were made over a relatively short period of time and may not represent the stabilized groundwater level. In addition, water levels will vary with season, temperature, precipitation, water level in the Presumpscot River and construction activity in the area.

Therefore, water levels during and following construction will vary from those measured in the borings.

PRELIMINARY FOUNDATION CONSIDERATIONS

The topsoil and fill are not considered suitable for support of buildings and other structures due to their variable density and the presence of organics and other miscellaneous materials. The loose condition and decomposition of organic materials could lead to potential unacceptable movement with time.

We anticipate that buildings and other load bearing structures will require support on foundations such as treated timber piles that will penetrate through the fill materials into the underlying glacial till or bedrock.

Sincerely yours,
HALEY & ALDRICH, INC.

Kenneth L. Recker, P.E.
Vice President

Enclosures:

Figure 1	- Project Locus
Figure 2	- Site sand Subsurface Exploration Plan
Appendix A	- Logs of Recent Borings
Appendix B	- Logs of Previous Borings

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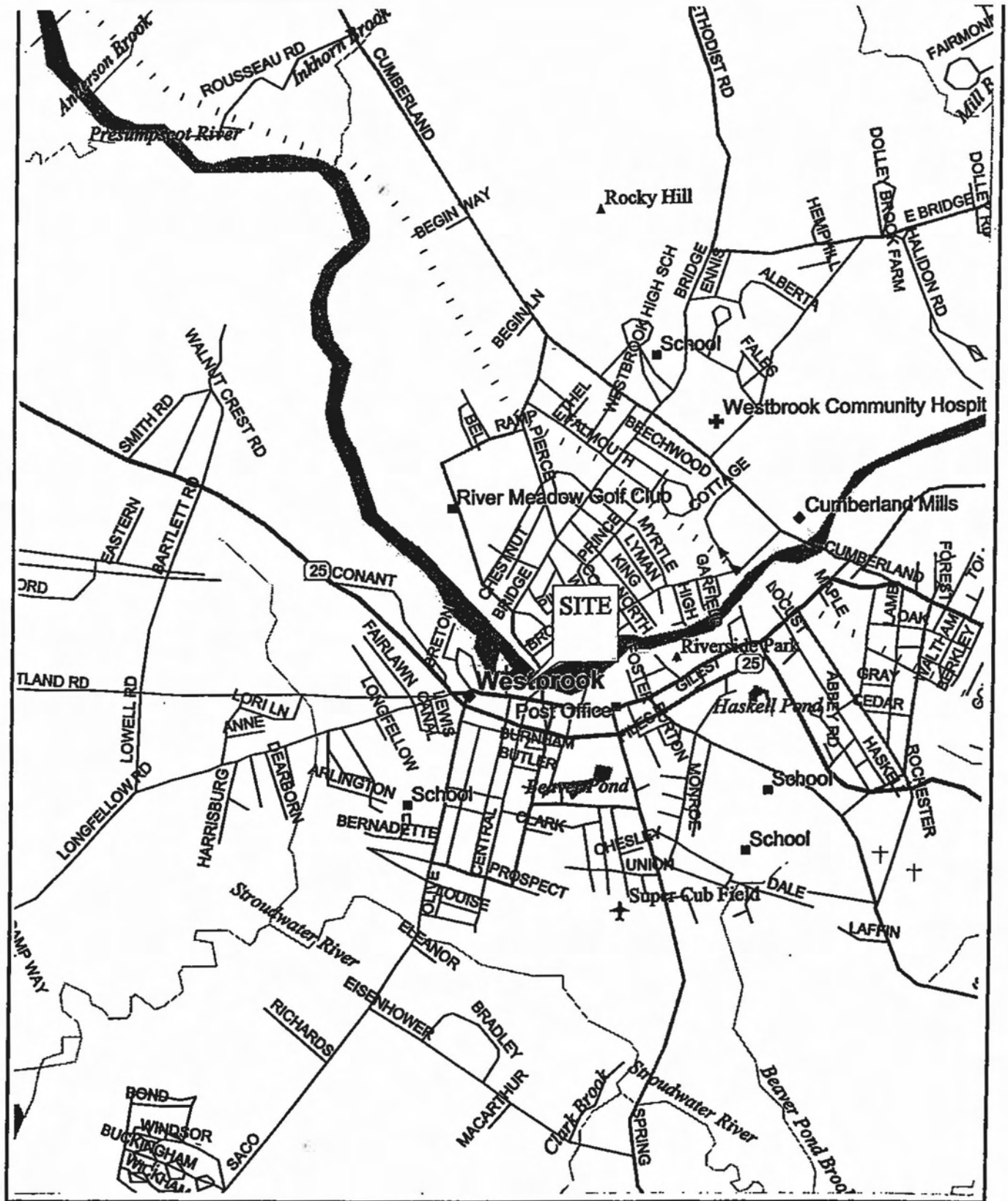

SITE COORDINATES: N43°40'37", W70°21'57"

N

MAP FROM DELORME, YARMOUTH, ME.
STREET ATLAS USA, V8.0, 2000

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

ADDITIONAL EVALUATION
PROPOSED WESTBROOK RIVERFRONT
PRESUMPSCOTT RIVER
WESTBROOK, MAINE

PROJECT LOCUS

APPROX. SCALE: 1 in.= 2000 ft.

DECEMBER 2002

FILE NO. 27481-002

FIGURE 1

APPENDIX A

Logs of Recent Borings

HALEY & ALDRICH

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B201

Project WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client ORCUTT ASSOCIATES
Contractor MAINE TEST BORINGS, INC.

File No. 27481-002
Sheet No. 1 of 2
Start 11 November 2002
Finish 11 November 2002
Driller M. Coffin
H&A Rep. K. Stephenson
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: B53 Mobile
Inside Diameter (in.)	2.5	1.375	-	Bit Type:
Hammer Weight (lb.)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing:
				Hoist/Hammer: Winch / Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							-WOOD CHIPS/MULCH-										
	2 3 4 5	S1 12	0.0 2.0	NO WELL INSTALLED	0.4	SM	Loose brown silty SAND (SM), damp					80	20				
					2.0	SM	Loose brown silty SAND with gravel (SM), clayey silt lenses, damp	5	10	10	30	30	15				
					3.0		Note: light brown silty SAND in cuttings 3.0-5.0 ft.										
5	2 2 2 4	S2 18	5.0 7.0		5.0	CL	Soft gray-brown mottled CLAY (CL), root fibers, trace fine SAND, damp -FILL-					5	95				
10	3 2 4 4	S3 12	10.0 12.0			CL	Medium stiff gray-brown sandy lean CLAY (CL), organic fibers, damp					40	60				
					14.0		Loose black red-brown and white ASH, dry -FILL-										
15	2 3 5 6	S4 12	15.0 17.0														
					18.5		Note: drill action indicates possible strata change at 18.5 ft.										
20							Split spoon refusal at 20.0 ft. or probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/11/02	-	-	-	-	N/E

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

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

Summary
Overburden (lin. ft.) 20.0
Rock Cored (lin. ft.) -
Samples 4S

Boring No. B201

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

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

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

USCS_TB4 USCSLB4.GLB USCSTB4-CORE4.GDT G:\GINTB\PROJECT\27481\002\27481002.GPJ 10 Dec 02

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B201
File No. 27481-002
Sheet No. 2 of 2

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	50/0	-	20.0		20.0		Note: rust-brown wet sand on tip of spoon										
		-	22.0				Bottom of Exploration at 20.0 ft.										

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

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

Boring No. B201

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B202

Project WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client ORCUTT ASSOCIATES
Contractor MAINE TEST BORINGS, INC.

File No. 27481-002
Sheet No. 1 of 2
Start 11 November 2002
Finish 11 November 2002
Driller M. Coffin
H&A Rep. K. Stephenson
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: B53 Mobile
Inside Diameter (in.)	2.5	1.375	-	Bit Type:
Hammer Weight (lb.)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing:
				Hoist/Hammer: Winch / Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 3 6 6	S1 12	0.0 2.0	NO WELL INSTALLED			Very loose dark brown silty SAND with grass roots				20	60	20				
					0.5	SM	-TOPSOIL- Medium dense brown silty SAND (SM), dry		10	30	30	15	15				
					1.8	SP	Medium dense light brown poorly-graded SAND (SP), damp					95	5				
5	1 1 1 3	S2 12	5.0 7.0		5.0	SM/CL	Very loose brown SAND, CLAY (SM/CL) and ASH layers, some glass, dry -FILL-										
10	6 13 19 14	S3 12	10.0 12.0				Dense black to brown ASH, charred wood, 1 in. piece gravel, 10% sand, dry -FILL-										
15	2 1 2 2	S4 12	15.0 17.0				Very loose black ASH Note: probable wood at 19.0 ft.										
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/11/02	1430	-	20.0	21.4	14.6

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 21.1
Rock Cored (lin. ft.) -
Samples 5S

Boring No. B202

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

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

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

USCS_TB4 USCSLIB4.GLB USCSTB-CORE4.GDT G:\GINTS\PROJECTS\27481\002\27481002.GPJ 10 Dec 02

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B202
File No. 27481-002
Sheet No. 2 of 2

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20																	
	3	S5	20.0		20.0	SP	-WOOD-(pushed from above)					95	5				
	2	13	21.4				Loose gray poorly-graded SAND (SP), wet, petroleum odor										
	50/.4				20.2		-MARINE DEPOSIT-										
					21.4		Split Spoon refusal on probable bedrock										
							Bottom of Exploration at 21.4 ft.										

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size (mm) is determined by direct observation within the limitations of sampler size.
NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. B202

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B203

Project WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client ORCUTT ASSOCIATES
Contractor MAINE TEST BORINGS, INC.

File No. 27481-002
Sheet No. 1 of 1
Start 11 November 2002
Finish 11 November 2002
Driller M. Coffin
H&A Rep. K. Stephenson
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: B53 Mobile
Inside Diameter (in.)	2.5	1.375	-	Bit Type:
				Drill Mud: None
Hammer Weight (lb.)	-	140	-	Casing:
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch / Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 9 16 23	S1 20	0.0 2.0	NO WELL INSTALLED			Stiff brown sandy SILT with grass roots -TOPSOIL-					30	70				
					1.0	GM	Dense gray-brown silty GRAVEL (GM) with sand, dry -FILL-	20	25	20	15	5	15				
5	3 2 2 2	S2 13	5.0 7.0			SW-SM	Loose light brown well-graded SAND with silt (SW-SM), dry, occasional silt lenses Note: rods dropped from 10.0-11.0 ft.		5	25	30	30	10				
10	45 4 6	S3 14	11.0 12.5				Very dense WOOD, brick, gravelly SAND, ASH in layers, dry -FILL-										
15	2 2 2 4	S4 20	15.0 17.0		15.0	CL	Soft light gray lean CLAY (CL) with sand, damp -MARINE DEPOSIT-					15	85	N		M	
					17.0		Bottom of Exploration at 17.0 ft. No refusal										

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

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

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

Summary
Overburden (lin. ft.) 17.0
Rock Cored (lin. ft.) -
Samples 4S

Boring No. B203

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

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

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

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APPENDIX B

Logs of Previous Borings

HALEY & ALDRICH

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B6

Project	Westbrook Riverfront Westbrook, Maine
Client	City of Westbrook
Contractor	Maine Test Borings, Inc.

File No. 27481-000
Sheet No. 1 of 1
Start 13 April 2001
Finish 13 April 2001
Driller M. Porter
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S		Rig Make & Model: Bombardier
Inside Diameter (in.)	2.5	1 3/8		Bit Type: Cutting Head
				Drill Mud:
Hammer Weight (lb.)		140	-	Casing:
Hammer Fall (in.)		30	-	Hoist/Hammer: Winch/ Automatic Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				NO WELL INSTALLED			Bituminous Concrete										
	3 6 7 7	S1 6	0.5 2.5		0.2	SW	Medium dense, light brown well graded SAND (SW), moist, mps 1.25in. -FILL-	5	20	25	25	20	5				
5	2 3 5 5	S2 6	5.0 7.0				Loose, brown gray silty SAND, 10% ash, 10% cinders, moist				20	25	25				
10	1 1 7 11	S3 12	10.0 12.0				Loose, gray to black SAND, 30% ash, 20% brick, 20% cinders/miscellaneous fill materials, wet -FILL-				15	15					
					14.4		Auger refusal at 14.4 ft. Bottom of Exploration at 14.4 ft.										

Water Level Data

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

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 14.4
Rock Cored (lin. ft.)
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

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

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

3 May 01

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REPORT ON
SUBSURFACE INVESTIGATION
ADDITIONAL EVALUATION
WESTBROOK RIVERFRONT
PRESUMPSCOT RIVER
WESTBROOK, MAINE

by

Haley & Aldrich, Inc.
South Portland, Maine

for

City of Westbrook
Westbrook, Maine

File No. 27481-003
March 2003

HALEY & ALDRICH

UNDERGROUND
ENGINEERING &
ENVIRONMENTAL
SOLUTIONS

Haley & Aldrich, Inc.
500 SouthBorough Drive
Suite 10
South Portland, ME 04106-6935
Tel: 207.772.5439
Fax: 207.871.5999
www.HaleyAldrich.com

HALEY & ALDRICH

12 March 2003
File No. 27481-003

City of Westbrook
Westbrook City Hall
2 York Street
Westbrook, Maine 04092

Attention: Mr. Matthew Eddy

Subject: Additional Evaluation
Westbrook Riverfront
Presumpscot River
Westbrook, Maine

Ladies and Gentlemen:

This report presents the results of our additional subsurface investigation for the proposed Westbrook Riverfront project in Westbrook, Maine. This additional investigation was completed to better define the depth to refusal east of Bridge Street. This work was completed in accordance with our proposal dated 20 February 2003.

INTRODUCTION

The Riverfront Project is located along the Presumpscot River in Westbrook, as shown on Figure 1, Project Locus. This portion of the project consists of a boardwalk along the river from approximately Bridge Street to Ash Street. The existing riverbank slopes vary from approximately 1.5 horizontal to 1 vertical (1.5:1) to 2:1. The slopes are presently covered with various sizes of riprap. The riverside of the boardwalk will be supported on 25 ton (50 kip) design capacity treated timber piles driven to bearing in the naturally deposited dense soils underlying the site.

SUBSURFACE EXPLORATIONS

Recent Explorations

Maine Test Borings, Inc. (MTB) of Brewer, Maine drilled 3 borings, B301 to B303, at locations shown on Figure 2, Site and Subsurface Exploration Plan, on 10 and 11 March 2003. MTB drilled the borings to depths below ground surface varying from 39.5 ft. to 63.9 ft. Haley & Aldrich monitored the borings and prepared the logs included in Appendix A.

OFFICES
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Massachusetts
Cleveland
Ohio
Dayton
Ohio
Denver
Colorado
Detroit
Michigan
Hartford
Connecticut
Los Angeles
California
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New Jersey
Rochester
New York
San Diego
California
Tucson
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Printed on recycled paper.

Borings were drilled using 2.5-in. diameter hollow stem augers. Soil samples were typically obtained at 5-ft. intervals in the borings. Standard Penetration Resistance (N) was measured at each sample interval in accordance with ASTM test designation D 1586.

SUBSURFACE CONDITIONS

The borings encountered four principal soil units at the site: fill, marine deposit, glacial till and weathered bedrock. Encountered thickness and generalized descriptions of the soil units are presented below in order of increasing depth below ground surface.

Fill – Fill consists of loose to very dense, gray brown to gray to brown, well-graded SAND (SW); to silty SAND (SM); to mottled lean CLAY (CL); to SILT with sand with various amounts of ash, cinders, bricks, glass, wood and organics. Encountered thickness varied from 8.0 ft. to 23.5 ft.

Marine Deposit – The marine deposit consists of loose, gray, poorly-graded SAND (SP); to silty SAND (SM); to SILT with sand; to soft to medium stiff, gray, lean CLAY (CL). The encountered thickness of marine deposit varied from 15.0 ft. to 45.5 ft.

Glacial Till – Glacial till consists of medium dense to very dense, gray to gray brown, silty SAND (SM); to poorly-graded SAND (SP); to well-graded SAND (SW) with gravel and cobbles and boulders. Encountered thickness varied from 6.6 ft. to 7.0 ft.

Weathered Bedrock – Encountered thickness of weathered bedrock varied from 1.0 ft. to 2.9 ft.

Borings encountered refusal on what was judged to be bedrock at depths below ground surface varying from 39.5 ft. to 63.9 ft.

Water was encountered in B302 at a depth below ground surface of 21.6 ft. Observations of water were made over a relatively short period of time and may not represent the stabilized groundwater level. In addition, water levels will vary with season, temperature, precipitation, water level in the Presumpscot River and construction activity in the area. Therefore, water levels during and following construction will vary from those measured in the borings.

If you have questions or need more information, please contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

Kenneth L. Recker, P.E.
Vice President

STATE OF MAINE
KENNETH L. RECKER #5435
REGISTERED PROFESSIONAL ENGINEER

Enclosures:

Figure 1	- Project Locus
Figure 2	- Site sand Subsurface Exploration Plan
Appendix A	- Logs of Recent Borings

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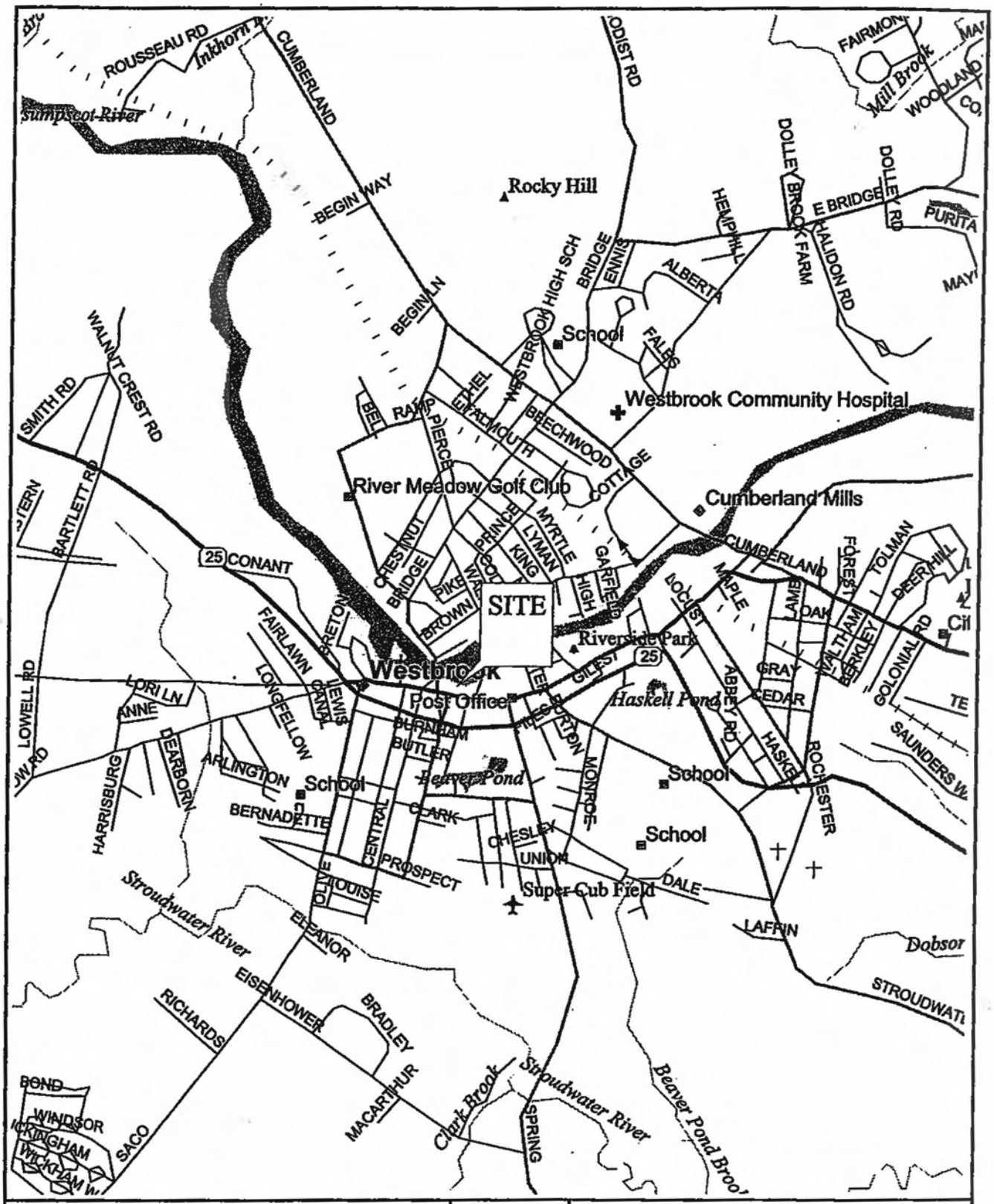

SITE COORDINATES: N43°40'37",W70°21'57"

MAP FROM DELORME, YARMOUTH, ME.
STREET ATLAS USA,V8.0, 2000

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

PROPOSED WESTBROOK RIVERFRONT
PRESUMPSCOTT RIVER
WESTBROOK, MAINE

PROJECT LOCUS

APPROX. SCALE: 1 in.= 2000 ft.

JULY 2002

FILE NO. 27481-000

FIGURE 1

APPENDIX A

Logs of Recent Borings

HALEY & ALDRICH

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B301

Project PROPOSED WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client CITY OF WESTBROOK
Contractor MAINE TEST BORINGS, INC.

File No. 27481-003
Sheet No. 1 of 2
Start 11 March 2003
Finish 11 March 2003
Driller G. Rudnicki
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: Mobile Track
Inside Diameter (in.)	2 1/2	1 3/8	-	Bit Type: Cutting Head Drill Mud: None
Hammer Weight (lb.)	-	140	-	Casing:
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch / Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				NO WELL INSTALLED			Medium dense brown poorly-graded SAND with silt (SP-SM), mps=4 mm, moist			10	15	65	10				
	9 16 12 13	S1 18	2.0 4.0		2.5		Medium dense gray-brown sandy SILT (ML), mps=1/2 in., moist, roots		5			25	70				
					3.5		Medium dense poorly-graded SAND with silt (SP-SM), mps=4 mm, moist			10	15	65	10				
5	6 12 9 8	S2 12	5.0 7.0				Medium dense brown silty SAND (SM), mps=1/4 in., moist, trace sand -FILL-		5	10	5	60	20				
10	4 5 8 5	S3 2	10.0 12.0				Medium dense brown well-graded SAND (SW), mps=1 in., moist	5	20	20	30	20	5				
15	4 6 3 2	S4 12	15.0 17.0				Loose brown silty SAND (SM), mps=3/4 in., (coal), 15% and and coal, moist				25	30	30				
					16.7		Very loose gray SILT with sand (ML), mps=0.4 mm, wet					20	80	R			
20																	

Water Level Data

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

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 39.5
Rock Cored (lin. ft.) -
Samples 9S

Boring No. B301

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B301
File No. 27481-003
Sheet No. 2 of 2

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	1 2 12 9	S5 12	20.0 22.0				Medium dense black SILT (ML), 30% ash, 5% glass, ceramic and miscellaneous fill, wet -FILL-					10	25				
					23.5												
25	WOR WOH WOH WOH	S6 24	25.0 27.0				Soft to medium stiff gray lean CLAY (CL), mps=0.4 mm, wet, black streaks -MARINE DEPOSIT-					10	90	N	M	M	
30	WOH WOH 1 1	S7 24	30.0 32.0				Soft to medium stiff gray lean CLAY (CL), mps=0.4 mm, wet, black streaks, occasional fine sand seams					15	85				
35	1 1 WOH 1	S8 24	35.0 37.0				-Alternating layers of- Gray lean CLAY (CL), mps=0.4 mm, wet -and- Gray poorly-graded SAND (SP), mps=2 mm, wet				30	5 70	95				
					38.5		-WEATHERED BEDROCK-										
	50/0	S9 0	39.5 39.5		39.5		BOTTOM OF EXPLORATION 39.5 FT. Refusal										

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

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

Boring No. B301

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B302

Project PROPOSED WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client CITY OF WESTBROOK
Contractor MAINE TEST BORINGS, INC.

File No. 27481-003
Sheet No. 1 of 3
Start 10 March 2003
Finish 10 March 2003
Driller G. Rudnicki
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: Mobile Track
Inside Diameter (in.)	2 1/2	1 3/8	-	Bit Type: Cutting Head Drill Mud: None
Hammer Weight (lb.)	-	140	-	Casing:
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch / Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				NO WELL INSTALLED	0.1		-BITUMINOUS PAVEMENT- -FROZEN SOIL-										
	34 37 38 34	S1 24	2.0 4.0				Very dense gray-brown silty SAND (SM), mps=3/4 in., moist (frozen)	5	10	10	20	40	15				
5	6 6 4 3	S2 24	5.0 7.0				Medium dense gray to brown SILT with sand (ML), mps=4 mm, moist, trace ash/coal -FILL-			5	5	10	80				
					8.5												
10	2 5 3 5	S3 24	10.0 12.0				Loose gray-brown silty SAND (SM), mps=0.4 mm, wet, fine sand seams -MARINE DEPOSIT-					70	30	R			
15	1 1 1 3	S4 24	15.0 17.0				Very loose gray SILT (ML), mps=0.4 mm, one lean CLAY layer with black streaks, wet					40	60	R			
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
3/10/03	1400	0.0	60.0	62.0	21.6

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 63.9
Rock Cored (lin. ft.) -
Samples 13S

Boring No. B302

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B302
File No. 27481-003
Sheet No. 2 of 3

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	3 9 14 12	S5 24	20.0 22.0				Gray-brown SILT (ML), moist to					10	90	R			
							Gray-brown lean CLAY (CL), moist					10	90	N	M	M	
					21.6		Medium dense gray-brown poorly-graded SAND with silt (SP-SM), mps=0.4 mm, wet					90	10				
25	1 1 1 2	S6 24	25.0 27.0		25.0		Soft to medium stiff gray lean CLAY (CL), mps=0.4 mm, wet, black streaks					5	95	N	M	M	
30	WOR WOH 1 2	S7 24	30.0 32.0				Soft to medium stiff gray lean CLAY (CL), mps=0.4 mm, wet -MARINE DEPOSIT-					5	95	N	M	M	
35	WOR WOH WOH WOH	S8 24	35.0 37.0				Soft to medium stiff gray lean CLAY (CL), mps=0.4 mm, wet, black streaks					5	95				
40	WOR WOH WOH 1	S9 24	40.0 42.0				Soft to medium stiff gray lean CLAY (CL), mps=0.4 mm, wet, black streaks					5	95				
45	WOH WOH 1 2	S10 24	45.0 47.0				-Alternating layers of- Gray lean CLAY (CL), mps=0.4 mm -and- Gray silty SAND (SM), mps=0.4 mm					10 65	90 35	N R	M	M	

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size (mm) is determined by direct observation within the limitations of sampler size.
NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. B302

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B302
File No. 27481-003
Sheet No. 3 of 3

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	2 2 1 2	S11 12	50.0 52.0				Very loose gray poorly-graded SAND (SP), mps=2 mm, wet -MARINE DEPOSIT-				5	90	5				
					54.0												
55	WOR 1 9 5	S12 8	55.0 57.0				Medium dense gray silty SAND (SM), mps=1/2 in., wet -GLACIAL TILL DEPOSIT-		5		10	70	15				
							Layered very dense gray poorly-graded SAND (SP), mps=2 mm, wet				10	90					
							-and-				95	5					
							Very dense gray poorly-graded SAND (SP), mps=2 mm, wet										
60	40 36 25 40	S13 24	60.0 62.0														
					61.0		-WEATHERED BEDROCK W / SILT- Rod Probe 62.0-63.9 ft. Depth Blows 62-63 64 63-63.9 100/.9										
					63.9		BOTTOM OF EXPLORATION 63.9 FT. Refusal										

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

Boring No. B302

HALEY & ALDRICH

TEST BORING REPORT

Boring No. B303

Project PROPOSED WESTBROOK RIVERFRONT, WESTBROOK, MAINE
Client CITY OF WESTBROOK
Contractor MAINE TEST BORINGS, INC.

File No. 27481-003
Sheet No. 1 of 3
Start 10 March 2003
Finish 10 March 2003
Driller G. Rudnicki
H&A Rep. B. Lawrence
Elevation
Datum
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	SS	-	Rig Make & Model: Mobile Track
Inside Diameter (in.)	2 1/2	1 3/8	-	Bit Type: Cutting Head Drill Mud: None
Hammer Weight (lb.)	-	140	-	Casing:
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch / Safety Hammer

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				NO WELL INSTALLED													
	5 4 4 5	S1 18	2.0 4.0				Loose brown and gray silty SAND (SM), mps=2 mm, ash, coal, moist -FILL-				10	60	30				
5	2 4 4 6	S2 8	5.0 7.0				Loose brown silty SAND (SM), mps=4 mm, moist			10	20	45	25				
					5.5		Medium stiff gray lean CLAY (CL), mps=0.4 mm, moist, trace roots -FILL-					10	90				
					8.0												
10	4 6 7 7	S3 24	10.0 12.0				Medium dense gray-brown SILT with sand (ML), mps=0.4 mm, moist -MARINE DEPOSIT-					15	85				
15	WOR WOR 1 WOH	S4 24	15.0 17.0				Very loose gray silty SAND (SM), mps=0.4 mm, wet, wood fibers, roots					70	30				
20																	

Water Level Data

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

Sample Identification

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

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 50.6
Rock Cored (lin. ft.) -
Samples 8S

Boring No. B303

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

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

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

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. B303
File No. 27481-003
Sheet No. 2 of 3

Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	WOR 3 3 4	S5 12	20.0 22.0		20.5		Loose light gray poorly-graded SAND (SP), mps=2 mm, wet, layered				40	60					
					23.5												
25	WOR WOR WOH WOH	S6 18	25.0 27.0				Soft to medium stiff gray lean CLAY (CL), mps=0.4 mm, wet -MARINE DEPOSIT-					5	95	N	M	M	
30																	
35	WOR WOH WOH WOH	S7 24	35.0 37.0				Soft to medium stiff gray lean CLAY (CL), mps=2 mm, wet, black streaks -MARINE DEPOSIT-					5	95				
40																	
					44.0		Medium dense light gray-brown well-graded SAND with gravel (SW), mps=3/4 in., wet -GLACIAL TILL DEPOSIT-		15	20	30	30	5				
45	4 6 8	S8 18	45.5 47.0														

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

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Depth (ft.)	SPT[1]	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size[2], structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50																	
					50.6		-PROBABLE BEDROCK-										
							BOTTOM OF EXPLORATION 50.6 FT.										
							Refusal										

[1]SPT = Sampler blows per 6 in. [2]Maximum particle size (mm) is determined by direct observation within the limitations of sampler size.
NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. B303