Nobis Engineering
18 Chenell Drive
Concord, New Hampshire 03301

PROJECT
Remedial Design For Operable Unit 01
New Bedford Harbor Superfund Site
New Bedford, Massachusetts

BORING NO. FD-107
SHEET 1 of 14
FILE NO. 48138.27
CHKD. BY J. Trottier

Boring Co.	Warren George, Inc.	Boring Location	northing 2696748	easting 814534	
Driller	S. Laurenza	Mudline El.	-12.71	Datum	NGVD
Logged By	A. Juneau	Date Start	12/18/00	Date End	12/21/00

Sampler: 2-inch O.D. split-barrel sampler driven 24 inches with a 140 lb. center hole hammer free falling from a height of 30 inches.
Drill Rig: Failing Truck Rig
Drilling Method: 5-inch (PW) flush joint drill casing. 4-inch (HW) flush joint drill casing.
Casing driven with a 300 lb. center hole hammer free falling from a height of 24 inches.

Groundwater Readings Not Applicable for Offshore Borings

Date	Time	Depth	Elev.	Stabilization Time

DEPTH	Casing Blows (ft)	SAMPLE INFORMATION Type & No.	PEN/REC (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	SPT N-Value	SAMPLE DESCRIPTION (ASTM D2488)	STRATUM DESCRIPTION	REMKS
1	WOC								
2	WOC								
		UO-1	24/23	2-4	———	—	Organic soil (OH); 10% fine sand, 90% organic clay/silt, shells, strong organic odor, dark olive gray.		
							Pocket penetrometer: undrained shear strength = 0.06 kips/sf		
3	WOC						Advance PW drill casing to 5 ft.		
							Advance 4-3/4 in. roller bit to 5 ft.		
4	WOC								
5	WOC							ORGANIC CLAY	
		UO-2	24/24	5-7	———	—	Organic soil (OH); similar to UO-1		
							Pocket penetrometer: undrained shear strength = 0.03 kips/sf		
6	WOC						Advance PW drill casing to 8 ft.		
							Advance 4-3/4 in. roller bit to 8 ft.		
7	WOC								
8	WOC								
		UO-3	24/24	8-10	———	—	Sandy organic soil (OH); 60% organic clay/silt, 35% fine sand, 5% medium sand, strong organic odor, dark olive gray.		
							Pocket penetrometer: undrained shear strength = 0.19 kips/sf		
9	WOC						Advance PW drill casing to11 ft.		
							Advance 4-3/4 in. roller bit to 11 ft.		
10	WOC								

GRANULAR SOILS (N-Value)
0 to 4 - Very Loose
5 to 10 - Loose
11 to 30 - Medium Dense
31 to 50 - Dense
Over 50 - Very Dense

COHESIVE SOILS (N-Value)
0 to 2 - Very Soft
3 to 4 - Soft
5 to 8 - Medium Stiff
9 to 15 - Stiff
16 to 30 - Very Stiff
Over 30 - Hard

SYMBOLS
1. S denotes split-barrel sampler.
2. U denotes 3-inch O.D. undisturbed sample.
3. UO denotes 3-inch Osterberg undisturbed sample.
4. PEN denotes penetration length of sampler.
5. REC denotes recovered length of sample.
6. SPT denotes Standard Penetration Test.
7. PID denotes Photoionization Detector
8. PPM denotes parts per million.
9. PP denotes Pocket Penetrometer.
10. FVST denotes field vane shear test.
11. RQD denotes Rock Quality Designation.
12. R denotes core run number.

REMARKS:
1) Sample description based on laboratory classification. Refer to GeoTesting Express Report dated March 5, 2001. Laboratory description presented in bold.
2) *3-inch O.D. split-barrel sampler driven 24 inches with a 300 lb. center hole hammer free falling from a height of 24 inches.
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BORING NO. FD-107
SHEET 2 of 14
FILE NO. 48138.27
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Boring Co.	Warren George, Inc.	Boring Location	northing 2696748 easting 814534
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Logged By	A. Juneau	Date Start	12/18/00 Date End 12/21/00

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DEPTH	Casing Blows (ft)	SAMPLE INFORMATION Type & No.	PEN/REC (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	SPT N-Value	SAMPLE DESCRIPTION (ASTM D2488)	STRATUM DESCRIPTION	REMKS
11	WOC								
		UO-4	24/24	11-13	————	——	Organic soil (OH); 90% organic clay/silt, 10% fine sand, organic odor, dark olive gray.	ORGANIC CLAY	
							Pocket penetrometer: undrained shear strength = 0.19 kips/sf		
							Advance PW drill casing to 15 ft.		
12	WOC						Advance 4-3/4 in. roller bit to 15 ft.		
13	WOC							13.0 ft.	
14	26								
15	48								
		S-1	24/11	15-17	15-12-10-11	22	Silty sand (SM); medium dense, 75% fine sand, 10% medium sand, 15% silt, yellow brown, round to subround gravel.		
							Advance PW drill casing to 17 ft.		
16	9						Advance 3-7/8 in. roller bit to 17 ft.	MARINE SAND	
17	19						Perform falling head permeability test at 17 ft.		
		S-2	24/6	17-19	6-5-7-10	12	**Silty sand (SM); 62% fine sand, 15% medium sand, 2% coarse sand, 5% gravel, 16% silt, brown.**		1
							Advance PW drill casing to 22 ft.		
18	16						Advance 3-7/8 in. roller bit to 22 ft.		
19	33								
20	20								

GRANULAR SOILS (N-Value)	COHESIVE SOILS (N-Value)	NOTES
0 to 4 - Very Loose	0 to 2 - Very Soft	1. S denotes split-barrel sampler.
5 to 10 - Loose	3 to 4 - Soft	2. U denotes 3-inch O.D. undisturbed sample.
11 to 30 - Medium Dense	5 to 8 - Medium Stiff	3. UO denotes 3-inch Osterberg undisturbed sample.
31 to 50 - Dense	9 to 15 - Stiff	4. PEN denotes penetration length of sampler.
Over 50 - Very Dense	16 to 30 - Very Stiff	5. REC denotes recovered length of sample.
	Over 30 - Hard	6. SPT denotes Standard Penetration Test.
		7. PID denotes Photoionization Detector
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SHEET 3 of 14
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Boring Co. Warren George, Inc.
Driller S. Laurenza
Logged By A. Juneau

Boring Location northing 2696748 easting 814534
Mudline El. -12.71 Datum NGVD
Date Start 12/18/00 Date End 12/21/00

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21	22								
22	28								
		S-3	24/8	22-24	7-9-8-18	17	Silty sand (SM); medium dense, 70% fine sand, 10% medium sand, 5% coarse sand, 15% silt, yellow brown.		
							Advance PW drill casing to 25 ft.		
23	50						Advance 3-7/8 in. roller bit to 25 ft.		
24	66								
25	50						Perform falling head permeability test at 25 ft.	MARINE SAND	
		S-4	24/14	25-27	9-11-15-22	26*	**Silty sand with gravel (SM); 38% fine sand, 9% medium sand, 4% coarse sand, 34% gravel, 15% silt, brown.**		1,2
							Subround sand and gravel. 1 in. of coarse sand and gravel at 26 ft.		
26	46						Advance PW drill casing to 30 ft.		
							Advance 3-7/8 in. roller bit to 30 ft.		
27	59								
28	191								
29	96								
30	102								

GRANULAR SOILS (N-Value)	COHESIVE SOILS (N-Value)	SYMBOLS	
0 to 4 - Very Loose	0 to 2 - Very Soft	1. S denotes split-barrel sampler.	7. PID denotes Photoionization Detector
5 to 10 - Loose	3 to 4 - Soft	2. U denotes 3-inch O.D. undisturbed sample.	8. PPM denotes parts per million.
11 to 30 - Medium Dense	5 to 8 - Medium Stiff	3. UO denotes 3-inch Osterberg undisturbed sample.	9. PP denotes Pocket Penetrometer.
31 to 50 - Dense	9 to 15 - Stiff	4. PEN denotes penetration length of sampler.	10. FVST denotes field vane shear test.
Over 50 - Very Dense	16 to 30 - Very Stiff	5. REC denotes recovered length of sample.	11. RQD denotes Rock Quality Designation.
	Over 30 - Hard	6. SPT denotes Standard Penetration Test.	12. R denotes core run number.

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SHEET 4 of 14
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Boring Co. Warren George, Inc.
Driller S. Laurenza
Logged By A. Juneau

Boring Location northing 2696748 easting 814534
Mudline El. -12.71 Datum NGVD
Date Start 12/18/00 Date End 12/21/00

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DEPTH	Casing Blows (ft)	SAMPLE INFORMATION Type & No.	PEN/REC (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	SPT N-Value	SAMPLE DESCRIPTION (ASTM D2488)	STRATUM DESCRIPTION	REMKS
		S-5	24/9	30-32	6-7-10-11	17*	**Silty sand with gravel (SM); 21% fine sand, 12% medium sand, 4% coarse sand, 35% gravel, 28% silt, light brown.** Subround sand and gravel.		1,2
							Advance PW drill casing to 32 ft.	MARINE SAND	
31	52						Advance 3-7/8 in. roller bit to 32 ft.		
32	58							32.0 ft.	
		S-6	24/10	32-34	5-7-5-4	12*	**Poorly graded gravel with sand (GP); 52% gravel, 15% coarse sand, 25% medium sand, 5% fine sand, 3% silt, brown.** Subround to subangular sand and gravel.		1,2
							Advance PW drill casing to 35 ft.		
33	54						Advance 3-7/8 in. roller bit to 35 ft.		
34	64								
35	68						Perform falling head permeability test at 35 ft.	GLACIO FLUVIAL	
		S-7	24/2	35-37	4-5-6-6	11*	Washed sample.		2
							Advance PW drill casing to 37 ft.		
36	70						Advance 3-7/8 in. roller bit to 37 ft.		
37	55								
		S-8	24/6	37-39	5-5-10-21	15*	**Well-graded gravel with sand (GW); 61% gravel, 14% coarse sand, 17% medium sand, 7% fine sand, 1% silt, yellowish brown.** Subround to subangular sand and gravel.		1,2
38	61								
							Advance PW drill casing to 42 ft.		
							Advance 3-7/8 in. roller bit to 42 ft.		
39	98								
40	137								

GRANULAR SOILS (N-Value)
0 to 4 - Very Loose
5 to 10 - Loose
11 to 30 - Medium Dense
31 to 50 - Dense
Over 50 - Very Dense

COHESIVE SOILS (N-Value)
0 to 2 - Very Soft
3 to 4 - Soft
5 to 8 - Medium Stiff
9 to 15 - Stiff
16 to 30 - Very Stiff
Over 30 - Hard

SYMBOLS
1. S denotes split-barrel sampler.
2. U denotes 3-inch O.D. undisturbed sample.
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4. PEN denotes penetration length of sampler.
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41	126							GLACIO FLUVIAL	
42	156								
		S-9	5/2	42-42.4	50/5"	>50*	Washed sample.		2
							Advance PW drill casing to 44 ft.	42.5 ft.	
43	186						Top of competent bedrock 44 ft.	WEATHERED BEDROCK	
							Telescope HW drill casing to 44.5 ft.		
							Advance 4-3/4 in. roller bit to remove cuttings.		
44	303							44.0 ft.	
								BEDROCK	
45							Begin HQ rock core at 45.0 ft.		
							(boring log continued on next page).		
46									
47									
48									
49									
50									

GRANULAR SOILS (N-Values)	COHESIVE SOILS (N-Values)	SYMBOL KEY	
0 to 4 - Very Loose	0 to 2 - Very Soft	1. S denotes split-barrel sampler.	7. PID denotes Photoionization Detector
5 to 10 - Loose	3 to 4 - Soft	2. U denotes 3-inch O.D. undisturbed sample.	8. PPM denotes parts per million.
11 to 30 - Medium Dense	5 to 8 - Medium Stiff	3. UO denotes 3-inch Osterberg undisturbed sample.	9. PP denotes Pocket Penetrometer.
31 to 50 - Dense	9 to 15 - Stiff	4. PEN denotes penetration length of sampler.	10. FVST denotes field vane shear test.
Over 50 - Very Dense	16 to 30 - Very Stiff	5. REC denotes recovered length of sample.	11. RQD denotes Rock Quality Designation.
	Over 30 - Hard	6. SPT denotes Standard Penetration Test.	12. R denotes core run number.

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Date	Time	Depth	Elev.	Stabilization Time

DEPTH (feet)	VISUAL REPRESENTATION	CORE INFORMATION: CORE RUN	CORE INTERVAL	CORE TIME	ROCK CORE DESCRIPTION	REMKS
		R1	45.0-46.0	6.5 min.	Begin R1 at 45.0 ft.	
45.5					Fresh to moderatly hard, gray, fine to medium grained GNEISS, low angle (approx. 15 to 30 degrees) biotite/feldspar foliation.	
					REC = 80%; RQD = 32% (poor)	
					Water return observed in both HW and PW casing.	
46.0					45.2 ft.: Mechanical break in rock core. No core grinding noted.	
					45.3 to 46.8 ft.: Weathered zone. Rock distinctly discolored with iron with no fresh surfaces noted on broken, non-intact core pieces. Only 6 of 18 in. recovered from this zone (assumed).	
			46.0-47.0	5.5 min.	No water return observed from 46.0 to 50.0 ft.	
46.5						
47.0						
			47.0-48.0	4.7 min.	47.0 to 47.5 ft.: Irregular fracture: high angle (approx. 75 degrees), rough, undulating, iron stained and tight. Slight to moderate weathering extends 1/4 to 1 in. into rock.	
47.5					47.2 ft.: Mechanical break in rock core. No core grinding noted.	
					47.7 ft.: Irregular fracture: low angle (approx. 20 degrees), rough, undulating, iron stained and tight.	
48.0					47.7 to 48.0 ft.: Slightly weathered zone with iron staining throughout section.	
			48.0-49.0	4.8 min.	48.0 to 48.3 ft.: Highly weathered zone. Non-intact core section is iron stained throughout zone, highly fractured core remnants.	
48.5					48.3 ft.: Smooth parellel fractures (2): low angle, rough, planar, tight, iron staining and clay deposited on fracture surfaces. Fractures parellel to foliation.	
					48.5 to 48.8 ft.: Irregular fracture: high angle (approx. 65 degrees), rough, planar, white mineralization (Kaolinite). Additional fractures (healed) extend from 48 .0 to 49.0 ft.	
49.0					Performed packer test from 48.5 to 55.0 ft.	
			49.0-50.0	4.5 min.		
49.5					Performed packer test from 49.5 to 55.0 ft.	
50.0					End R1 at 50.0 ft.	

GRANULAR SOILS (N-VALUE)	COHESIVE SOILS (N-VALUE)	SYMBOLOGY	
0 to 4 - Very Loose	0 to 2 - Very Soft	1. S denotes split-barrel sampler.	7. PID denotes Photoionization Detector
5 to 10 - Loose	3 to 4 - Soft	2. U denotes 3-inch O.D. undisturbed sample.	8. PPM denotes parts per million.
11 to 30 - Medium Dense	5 to 8 - Medium Stiff	3. UO denotes 3-inch Osterberg undisturbed sample.	9. PP denotes Pocket Penetrometer.
31 to 50 - Dense	9 to 15 - Stiff	4. PEN denotes penetration length of sampler.	10. FVST denotes field vane shear test.
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Date	Time	Depth	Elev.	Stabilization Time

DEPTH (feet)	VISUAL REPRESENTATION	CORE INFORMATION: CORE RUN	CORE INTERVAL	CORE TIME	ROCK CORE DESCRIPTION	REMKS
		R2	50.0-51.0	4.2 min.	Begin R2 at 50.0 ft.	
					Fresh, hard, gray to dark gray, fine to medium grained GNEISS, low angle (approx. 15 to 30 degrees) biotite/feldspar foliation. Core from 50.0 to 51.0 ft. noticeably finer grained than remainder of R1 and R2.	
50.5					REC = 80%; RQD = 80% (good)	
					50.0 to 50.2 ft.: Mechanical breaks along biotite foliations.	
51.0					50.4 to 50.8 ft.: Irregular fracture: high angle (approx. 60 degrees), rough, undulating, and tight. Serpentine/Kaolinite mineralization along fracture surface. (mechanical)	
			51.0-52.0	3.8 min.	50.7 ft.: Mechanical break along biotite foliation.	
					51.2 ft.: Mechanical break along biotite foliation.	
51.5					51.2 to 53.3 ft.: Numerous stress fractures: moderate to high angle dip, rough, undulating, tight to open, extremely close to close, not broken. Fractures healed with serpentine minerlization.	
52.0						
			52.0-53.0	4 min.		
52.5						
					52.7 ft.: Mechanical break in rock core along biotite foliation.	
53.0					52.8 ft.: Mechanical break in rock core along biotite foliation.	
			53.0-54.0	4.2 min.		
53.5						
					53.6 to 54.0 ft.: Irregular joint: high angle (approx. 70 degrees), rough, planar, tight. Minor Kaolinite mineralization along joint, otherwise fresh. (mechanical)	
54.0						
	CORE NOT RECOVERED		54.0-55.0	3.8 min.		
54.5						
55.0					End R2 at 55.0 ft.	

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Date	Time	Depth	Elev.	Stabilization Time

DEPTH (feet)	VISUAL REPRESENTATION	CORE INFORMATION: CORE RUN	CORE INTERVAL	CORE TIME	ROCK CORE DESCRIPTION	REMKS
		R3	55.0-56.0	4.5 min.	Begin R3 at 55.0 ft.	
					Fresh, very hard, gray, fine to medium grained GNEISS, low angle (approx. 10 to 15 degrees) biotite/feldspar foliation.	
55.5					REC = 98%; RQD = 98% (excellent)	
56.0			56.0-57.0	4.5 min.	56.0 ft.: Mechanical break in rock core.	
56.5						
57.0			57.0-58.0	7.5 min.	57.0 to 57.5 ft.: Pair of healed joints/fractures. High angle to vertical.	
					57.2 to 57.7 ft.: Secondary joint: high angle to vertical, smooth, planar, discolored, and tight. Possible mechanical break/healed joint.	
57.5					57.5 ft.: Mechanical break in rock core.	
58.0					57.8 ft.: Healed joint/fracture.	
			58.0-59.0	7.3 min.	58.1 ft.: Mechanical break in rock core.	
					58.3 to 59.0 ft.: Secondary joint: high angle, rough, planar, discolored, and tight. Possible mechanical break/healed joint. Several mechanical breaks noted along joint surfaces.	
58.5						
59.0					58.9 to 59.2 ft.: Secondary joint: moderately dipping, rough, undulating, discolored, and tight.	
			59.0-60.0	4.5 min.	Possible mechanical break/healed joint.	
					59.3 ft.: Healed joint/fracture.	
59.5					59.4 ft.: Mechanical break in rock core.	
60.0					End R3 at 60.0 ft.	

GRANULAR SOILS (N-Value)	COHESIVE SOILS (N-Value)	SYMBOLS	
0 to 4 - Very Loose	0 to 2 - Very Soft	1. S denotes split-barrel sampler.	7. PID denotes Photoionization Detector
5 to 10 - Loose	3 to 4 - Soft	2. U denotes 3-inch O.D. undisturbed sample.	8. PPM denotes parts per million.
11 to 30 - Medium Dense	5 to 8 - Medium Stiff	3. UO denotes 3-inch Osterberg undisturbed sample.	9. PP denotes Pocket Penetrometer.
31 to 50 - Dense	9 to 15 - Stiff	4. PEN denotes penetration length of sampler.	10. FVST denotes field vane shear test.
Over 50 - Very Dense	16 to 30 - Very Stiff	5. REC denotes recovered length of sample.	11. RQD denotes Rock Quality Designation.
	Over 30 - Hard	6. SPT denotes Standard Penetration Test.	12. R denotes core run number.

REMARKS:
1) Sample description based on laboratory classification. Refer to GeoTesting Express Report dated March 5, 2001. Laboratory description presented in bold.
2) *3-inch O.D. split-barrel sampler driven 24 inches with a 300 lb. center hole hammer free falling from a height of 24 inches.
3)
4)

Nobis Engineering
18 Chenell Drive
Concord, New Hampshire 03301

PROJECT
Remedial Design For Operable Unit 01
New Bedford Harbor Superfund Site
New Bedford, Massachusetts

BORING NO. FD-107
SHEET 9 of 14
FILE NO. 48138.27
CHKD. BY J. Trottier

Boring Co.	Warren George, Inc.	Boring Location	northing 2696748	easting 814534	
Driller	S. Laurenza	Mudline El.	-12.71	Datum	NGVD
Logged By	A. Juneau	Date Start	12/18/00	Date End	12/21/00

Sampler: 2-inch O.D. split-barrel sampler driven 24 inches with a 140 lb. center hole hammer free falling from a height of 30 inches.
Drill Rig: Failing Truck Rig
Drilling Method: 5-inch (PW) flush joint drill casing. 4-inch (HW) flush joint drill casing.
Casing driven with a 300 lb. center hole hammer free falling from a height of 24 inches.

Groundwater Readings Not Applicable for Offshore Borings

Date	Time	Depth	Elev.	Stabilization Time

DEPTH (feet)	VISUAL REPRESENTATION	CORE INFORMATION: CORE RUN	CORE INTERVAL	CORE TIME	ROCK CORE DESCRIPTION	REMKS
		R4	60.0-61.0	5.2 min.	Begin R4 at 60.0 ft.	
60.5					Fresh, hard, gray, fine to medium grained GNEISS, low angle (approx. 10 to 20 degrees) foliation.	
					REC = 100%; RQD = 100% (excellent)	
61.0					60.0 to 60.2 ft.: Reddish to maroon discoloration noted. Slightly different texture noted.	
			61.0-62.0	4.2 min.		
61.5						
					61.6 ft.: Mechanical break in rock core.	
62.0						
			62.0-63.0	4.2 min.		
62.5						
					Core barrel return water blocked at 63.0 ft.	
63.0					Perform packer test from 55.0 to 63.0 ft.	
					End R4 at 63.0 ft.	
					Bottom of exploration at 63.0 ft. Boring terminated in bedrock. Grout completed borehole to mudline with cement/bentonite grout, specific gravity = 1.45.	
63.5						
64.0						
64.5						
65.0						

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Concord, New Hampshire 03301

PROJECT		BORING NO.	FD-107
Remedial Design For Operable Unit 01		SHEET	10 of 14
New Bedford Harbor Superfund Site		FILE NO.	48138.27
New Bedford, Massachusetts		CHKD. BY	J. Trottier

Boring Co.	Warren George, Inc.	Boring Location	northing 2696748	easting 814534	
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Logged By	A. Juneau	Date Start	12/18/00	Date End	12/21/00

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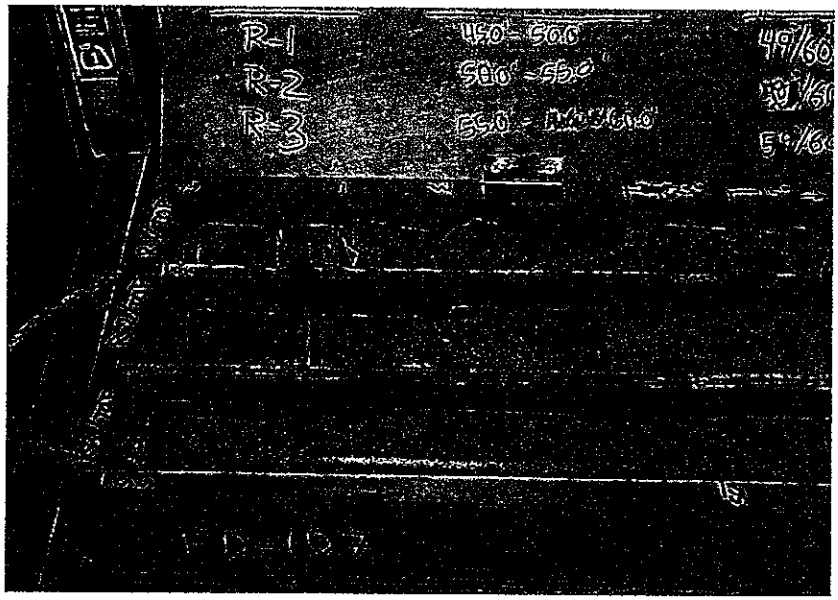
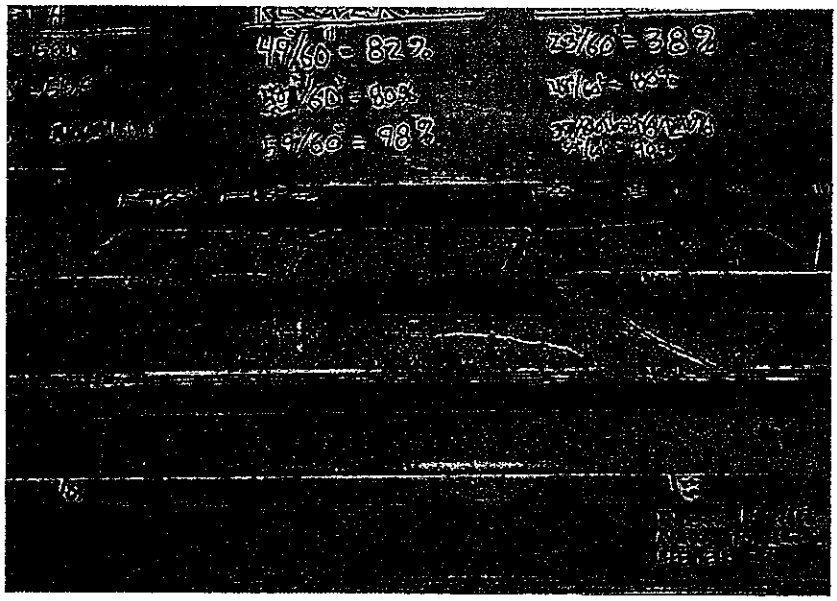
Groundwater Readings Not Applicable for Offshore Borings

Date	Time	Depth	Elev.	Stabilization Time

ROCK CORE PICTURES



Core Runs R1 through R3



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Nobis Engineering 18 Chenell Drive Concord, New Hampshire 03301	PROJECT Remedial Design For Operable Unit 01 New Bedford Harbor Superfund Site New Bedford, Massachusetts	BORING NO. FD-107 SHEET 11 of 14 FILE NO. 48138.27 CHKD. BY J. Trottier

Boring Co.	Warren George, Inc.	Boring Location	northing 2696748	easting 814534	
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Date	Time	Depth	Elev.	Stabilization Time

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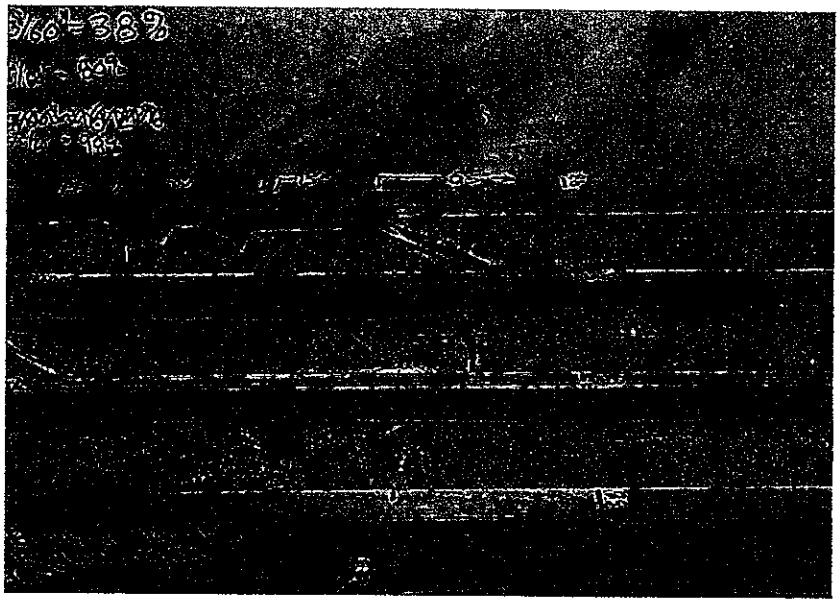
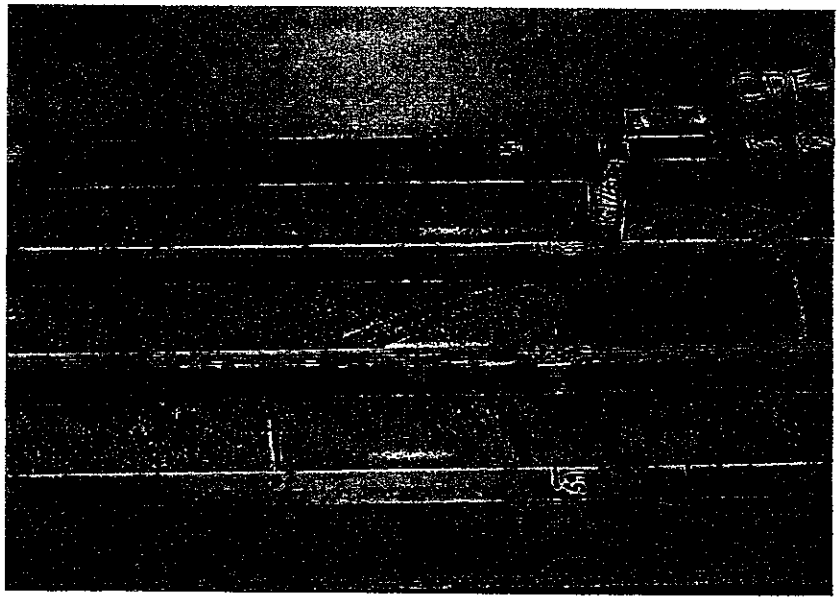


Core Runs R1 through R3



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PROJECT
Remedial Design For Operable Unit 01
New Bedford Harbor Superfund Site
New Bedford, Massachusetts

BORING NO. FD-107
SHEET 12 of 14
FILE NO. 48138.27
CHKD. BY J. Trottier

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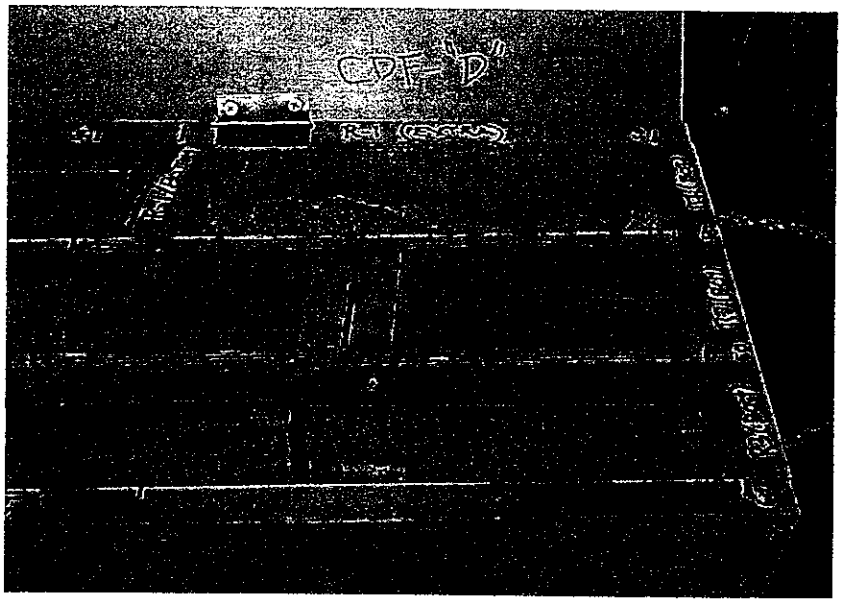
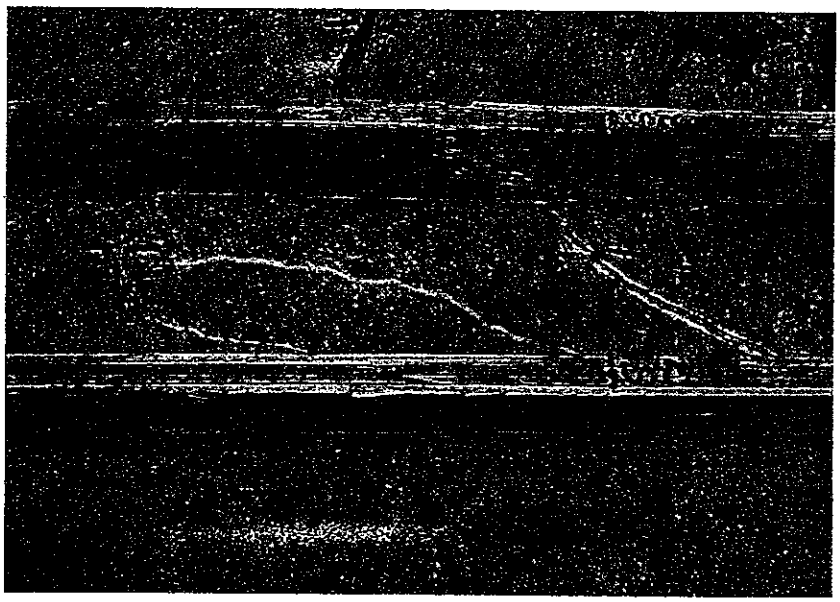
Date	Time	Depth	Elev.	Stabilization Time

ROCK CORE PICTURES



Core Runs R1 through R3



Healed fractures noted in R2

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Remedial Design For Operable Unit 01		SHEET	13 of 14
New Bedford Harbor Superfund Site		FILE NO.	48138.27
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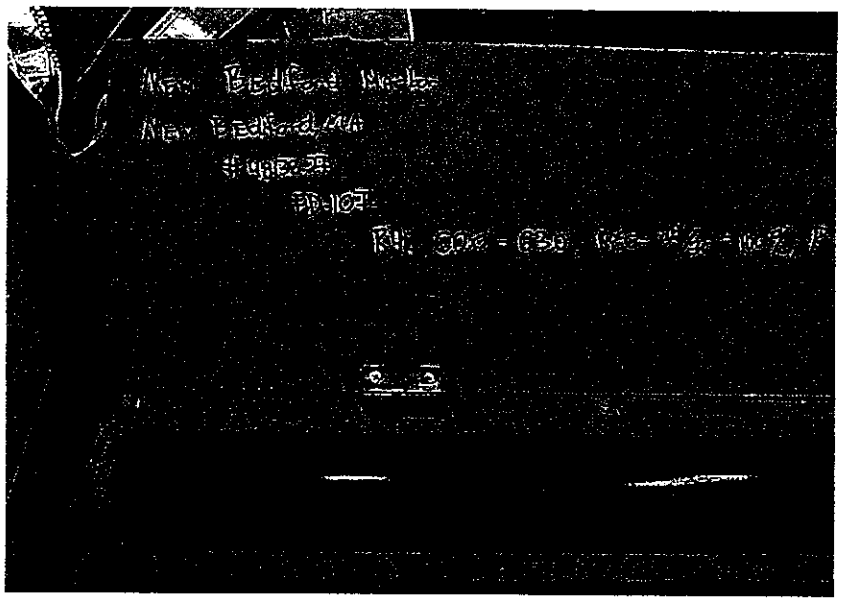
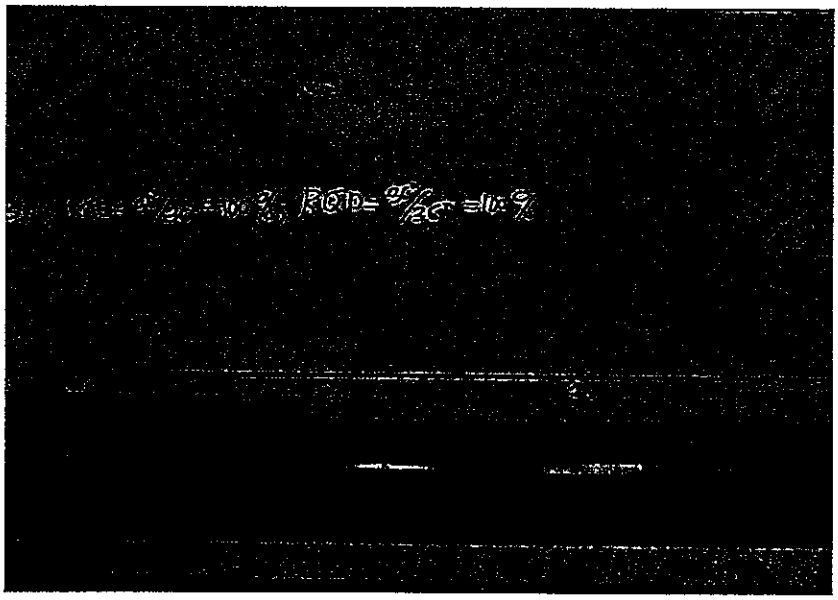


Core Run R4



Core Run R4

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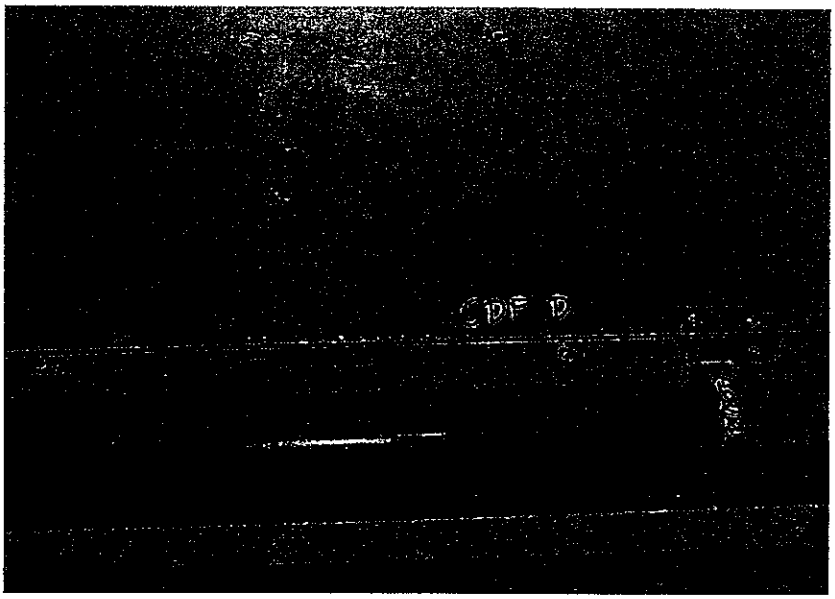
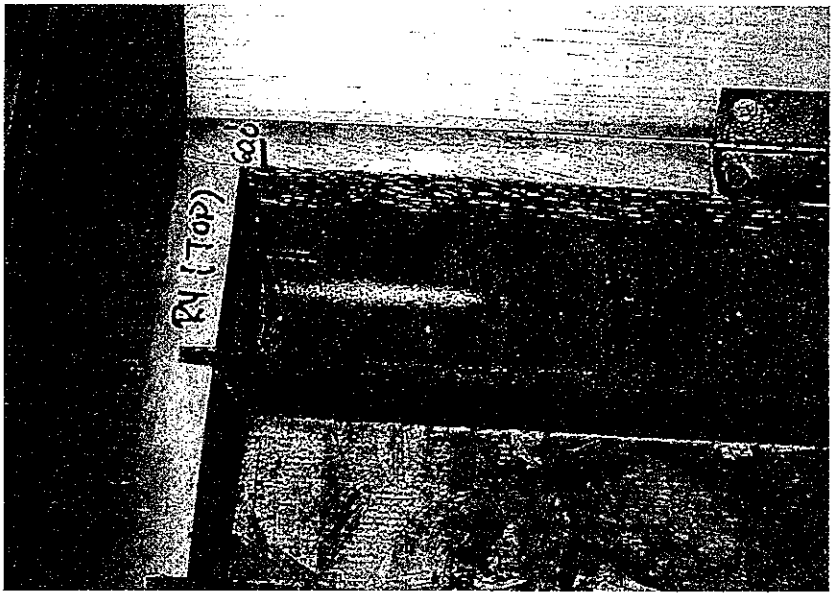


Core Run R4



Discoloration/texture change noted in top of R4

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