PORTSMOUTH HARBOR AND PISCATAQUA RIVER
NEW HAMPSHIRE AND MAINE
NAVIGATION IMPROVEMENT STUDY
FEASIBILITY REPORT

APPENDIX O

SEDIMENT SAMPLING & TESTING FOR THE LONG SANDS BEACH CONSIDERED NEARSHORE ALTERNATIVE PLACEMENT SITE

This appendix presents the results of two investigations of an alternative nearshore sand placement site offshore of Long Sands Beach in York, Maine. This site was identified by the Maine Geological Survey as a potential placement site for a feeder berm to address loss of sand from Long Beach. Samples taken by the Corps of Engineers from the proposed placement site were analyzed for bottom sediment grain size and benthic community analysis. The first part of this appendix presents the benthic community analysis. The second part presents the sampling trip report and grain size results.

IDENTIFICATION AND ENUMERATION OF BENTHIC MACROFAUNA FROM LONG SANDS, YORK BEACH, MAINE

Contract No. W912WJ-10-M-0029

SUBMITTED BY:

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This report represents analytical results of benthic samples received by Coastal Sciences on November 10, 2009 from the US Army Corps of Engineers.

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Peter F. Larsen, Ph.D.
Coastal Sciences

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CASE NARRATIVE

Five benthic samples from offshore of Long Sands Beach, York Beach, Maine were transferred in November 2009 to Coastal Sciences by representatives of the US Army Corps of Engineers (Fig. 1). The samples had been collected by Corps personnel just previously using a 0.04 m^2 modified Van Veen grab. The samples were then sieved on a 0.5 mm screen and fixed in formalin with the vital stain Rose Bengal.

In the laboratory, the formalin was removed from the samples by gentle washing on a 0.5 mm sieve and the samples were then preserved in 70% ethanol. The benthic macrofauna in each sample was separated from the limited inorganic debris and sorted to major taxonomic categories. This process was accomplished by trained personnel using binocular dissecting microscopes. A subsample of the residue of each sample was reexamined to insure complete removal of the fauna. No problems were detected. Each taxonomic group was examined by an experienced marine taxonomist who identified each individual to the lowest practical taxonomic level, usually the species level, and enumerated the number of individuals in each taxon. Individuals of two species, a cumacean and an amphipod, have been sent to a crustacean taxonomist for confirmation and identification. An update will follow. A common member of the community was a juvenile bivalve of the genus *Euspira*. This is most likely *Euspira heros*, but due to the absence of adults this could not be determined with certainty. The results were tabulated and are presented in the enclosed tables. The report will be submitted electronically.

The tabular results are presented as individuals per sample. A summary tabulation is presented on each station sheet indicating the number of species in the sample, density on a per square meter basis and species diversity on a natural log base.

A total of 38 putative species were identified (Table 1). This number of species is typical for a small benthic survey of a sandy nearshore environment on the Maine coast. The stations appeared to be rather homogeneous with the range of species varying only between 18 and 24. Density was rather high with a mean of 22,056 per meter square. Arthropods were the overwhelming numerical dominants lead by the burrowing amphipod *Acanthohaustorius millsi*, that is known to be locally abundant in fine sand habitats. The low informational diversity values encountered (1.34-2.22) are a reflection of the high dominance and relatively low species richness.

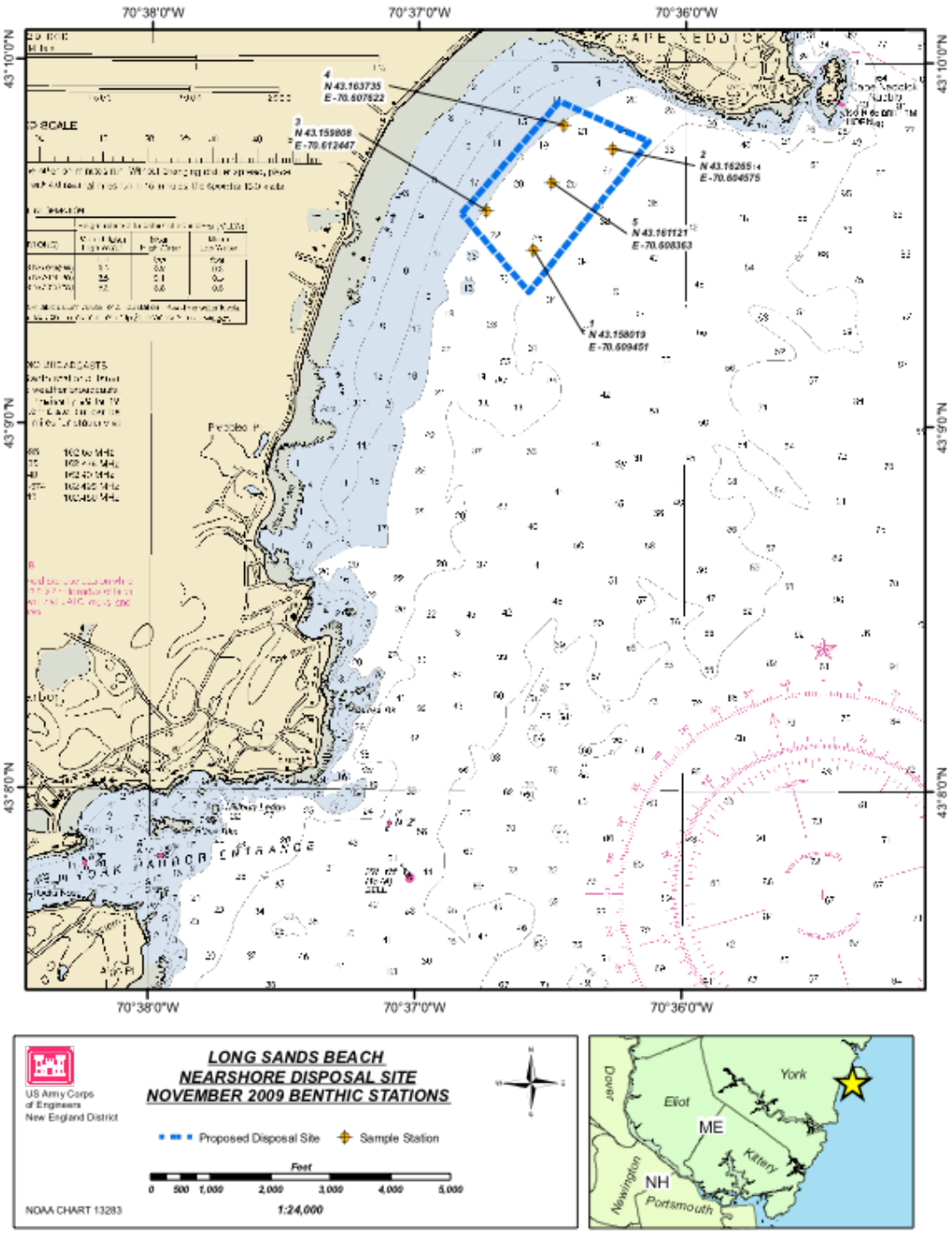


Figure 1. Long Sands station locations.

Table 1. List of species encountered during the Long Sands benthic survey.

PHYLUM CNIDARIA
Hydroid

PHYLUM RHYNCHOCOELA
Oerstedia dorsalis

PHYLUM MOLLUSCA
Ensis directus
Euspira juvenile
Modiolus modiolus
Nassarius trivittatus
Spisula solidissima
Tellina agilis
Unknown bivalve

PHYLUM ANNELIDA
Aricidea suecica
Eteone longa
Hartmania moorei
Nephtys longosetosa
Paraonis fulgens
Pholoe minuta
Phyllodoce mucosa
Phyllodoce sp.
Owenia fusiformis
Scoloplos armiger
Scoloplos sp.
Spio filicornis
Spiophanes bombyx
Tharyx acutus

PHYLUM ARTHROPODA
Acanthohaustorius millsi
Amphipod A
Cancer irroratus
Chiridotea tuftsii
Crangon septemspinosa
Diastylis polita
Diastylis sp.
Edotia triloba
Gammarus lawrencianus
Mancocuma stellifera
Photis macrocoxa
Salemia caeca
Synchelidium americanum

Unciola irrorata

PHYLUM ECHINODERMATA
Echinarachnius parma

Table 2. Summary of species numbers, densities (m^2) and diversity in the Long Sands samples.

	Long Sands Samples		
Sample #	# Species	Density	Diversity
1	24	15,280	2.22
2	18	27,680	1.67
3	22	22,800	1.49
4	18	31,960	1.39
5	20	12,560	1.34
Mean	20	22,056	1.62
Min	18	12,560	1.34
Max	24	31,960	2.22

Long Sands 1

Number of Species: 24
Density (m^{-2}): 15280
Diversity (H'): 2.2240

Species	Total	Cum. Tot.	%	Cum. %	Higher Taxon
Acanthohaustorius millsi	145	145	38.0	38.0	Arthropoda
Tellina agilis	53	198	13.9	51.8	Mollusca
Unciola irrorata	31	229	8.1	59.9	Arthropoda
Nassarius trivittatus	25	254	6.5	66.5	Mollusca
Paraonis fulgens	25	279	6.5	73.0	Annelida
Synchelidium americanum	19	298	5.0	78.0	Arthropoda
Euspira juvenile	15	313	3.9	81.9	Mollusca
Amphipod A	13	326	3.4	85.3	Arthropoda
Mancocuma stellifera	12	338	3.1	88.5	Arthropoda
Photis macrocoxa	9	347	2.4	90.8	Arthropoda
Echinarachnius parma	7	354	1.8	92.7	Echinodermata
Nephtys longosetosa	6	360	1.6	94.2	Annelida
Aricidea suecica	5	365	1.3	95.5	Annelida
Owenia fusiformis	4	369	1.0	96.6	Annelida
Modiolus modiolus	3	372	0.8	97.4	Mollusca
Tharyx acutus	2	374	0.5	97.9	Annelida
Spisula solidissima	1	375	0.3	98.2	Mollusca
Pholoe minuta	1	376	0.3	98.4	Annelida
Phyllodoce sp.	1	377	0.3	98.7	Annelida
Hartmania moorei	1	378	0.3	99.0	Annelida
Cancer irroratus	1	379	0.3	99.2	Arthropoda
Edotia triloba	1	380	0.3	99.5	Arthropoda
Chiridotea tuftsii	1	381	0.3	99.7	Arthropoda
Gammarus lawrencianus	1	382	0.3	100.0	Arthropoda

Long Sands 2

Number of Species: 18
Density (m^{-2}): 27680
Diversity (H'): 1.6739

Species	Total	Cum. Tot.	%	Cum. %	Higher Taxon
Acanthohaustorius millsi	388	388	56.1	56.1	Arthropoda
Tellina agilis	67	455	9.7	65.8	Mollusca
Mancocuma stellifera	56	511	8.1	73.8	Arthropoda
Edotia triloba	45	556	6.5	80.3	Arthropoda
Synchelidium americanum	34	590	4.9	85.3	Arthropoda
Nassarius trivittatus	27	617	3.9	89.2	Mollusca
Unciola irrorata	19	636	2.7	91.9	Arthropoda
Chiridotea tuftsii	13	649	1.9	93.8	Arthropoda
Spiophanes bombyx	10	659	1.4	95.2	Annelida
Photis macrocoxa	10	669	1.4	96.7	Arthropoda
Euspira juvenile	8	677	1.2	97.8	Mollusca
Echinarachnius parma	4	681	0.6	98.4	Echinodermata
Spisula solidissima	3	684	0.4	98.8	Mollusca
Nephtys longosetosa	3	687	0.4	99.3	Annelida
Paraonis fulgens	2	689	0.3	99.6	Annelida
Scoloplos armiger	2	691	0.3	99.9	Annelida
Aricidea suecica	1	692	0.1	100.0	Annelida
Hydroid	+				Cnidaria

Long Sands 3

Number of Species: 22
Density (m^{-2}): 22800
Diversity (H'): 1.4897

Species	Total	Cum. Tot.	%	Cum. %	Higher Taxon
Acanthohaustorius millsi	349	349	61.2	61.2	Arthropoda
Tellina agilis	72	421	12.6	73.9	Mollusca
Synchelidium americanum	46	467	8.1	81.9	Arthropoda
Mancocuma stellifera	30	497	5.3	87.2	Arthropoda
Paraonis fulgens	16	513	2.8	90.0	Annelida
Spiophanes bombyx	14	527	2.5	92.5	Annelida
Spio filicornis	7	534	1.2	93.7	Annelida
Photis macrocoxa	7	541	1.2	94.9	Arthropoda
Nassarius trivittatus	6	547	1.1	96.0	Mollusca
Edotia triloba	6	553	1.1	97.0	Arthropoda
Unciola irrorata	4	557	0.7	97.7	Arthropoda
Phyllodoce mucosa	2	559	0.4	98.1	Annelida
Chiridotea tuftsii	2	561	0.4	98.4	Arthropoda
Modiolus modiolus	1	562	0.2	98.6	Mollusca
Aricidea suecica	1	563	0.2	98.8	Annelida
Scoloplos armiger	1	564	0.2	98.9	Annelida
Eteone longa	1	565	0.2	99.1	Annelida
Amphipod A	1	566	0.2	99.3	Arthropoda
Diastylis polita	1	567	0.2	99.5	Arthropoda
Oerstedia dorsalis	1	568	0.2	99.6	Rhynchocoela
Crangon septemspinosa	1	569	0.2	99.8	Arthropoda
Salemia caeca	1	570	0.2	100.0	Arthropoda

Long Sands 4

Number of Species: 18
Density (m^{-2}): 31960
Diversity (H'): 1.3905

Species	Total	Cum. Tot.	%	Cum. %	Higher Taxon
Acanthohaustorius millsi	474	474	59.3	59.3	Arthropoda
Mancocuma stellifera	156	630	19.5	19.5	Arthropoda
Synchelidium americanum	41	671	5.1	5.1	Arthropoda
Tellina agilis	39	710	4.9	4.9	Mollusca
Edotia triloba	37	747	4.6	4.6	Arthropoda
Nassarius trivittatus	12	759	1.5	1.5	Mollusca
Paraonis fulgens	9	768	1.1	1.1	Annelida
Diastylis polita	8	776	1.0	1.0	Arthropoda
Euspira juvenile	7	783	0.9	0.9	Mollusca
Spiophanes bombyx	5	788	0.6	0.6	Annelida
Aricidea suecica	2	790	0.3	0.3	Annelida
Chiridotea tuftsii	2	792	0.3	0.3	Arthropoda
Amphipod A	2	794	0.3	0.3	Arthropoda
Spisula solidissima	1	795	0.1	0.1	Mollusca
Nephtys longosetosa	1	796	0.1	0.1	Annelida
Cancer irroratus	1	797	0.1	0.1	Arthropoda
Photis macrocoxa	1	798	0.1	0.1	Arthropoda
Bivalve A	1	799	0.1	0.1	Mollusca

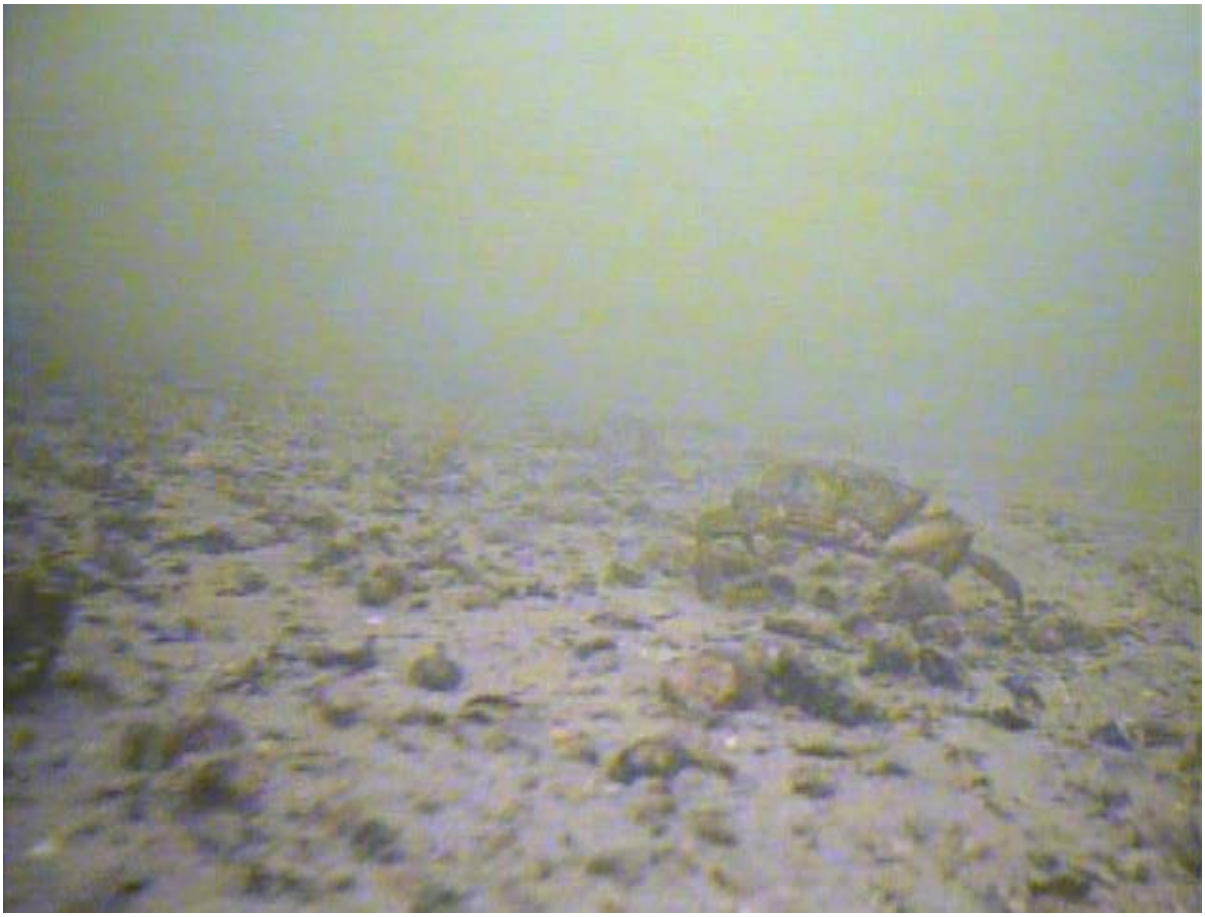
Long Sands 5

Number of Species: 20
Density (m^{-2}): 12560
Diversity (H'): 1.3417

Species	Total	Cum. Tot.	%	Cum. %	Higher Taxon
Acanthohaustorius millsi	217	217	69.1	69.1	Arthropoda
Tellina agilis	27	244	8.6	77.7	Mollusca
Synchelidium americanum	16	260	5.1	82.8	Arthropoda
Mancocuma stellifera	11	271	3.5	86.3	Arthropoda
Euspira juvenile	7	278	2.2	88.5	Mollusca
Spiophanes bombyx	7	285	2.2	90.8	Annelida
Paraonis fulgens	6	291	1.9	92.7	Annelida
Nassarius trivittatus	5	296	1.6	94.3	Mollusca
Unciola irrorata	5	301	1.6	95.9	Arthropoda
Spio filicornis	2	303	0.6	96.5	Annelida
Chiridotea tuftsii	2	305	0.6	97.1	Arthropoda
Echinarachnius parma	1	306	0.3	97.5	Echinodermata
Ensis directus	1	307	0.3	97.8	Mollusca
Spisula solidissima	1	308	0.3	98.1	Mollusca
Nephtys longosetosa	1	309	0.3	98.4	Annelida
Tharyx acutus	1	310	0.3	98.7	Annelida
Scoloplos sp.	1	311	0.3	99.0	Annelida
Edotia triloba	1	312	0.3	99.4	Arthropoda
Gammarus lawrencianus	1	313	0.3	99.7	Arthropoda
Photis macrocoxa	1	314	0.3	100.0	Arthropoda

TRIP REPORT

Piscataqua River Turning Basin
Underwater Video Survey
and Sediment Sampling
Long Sands Beach Nearshore Placement Site
Maine and New Hampshire



US ARMY CORPS
OF ENGINEERS
New England District

November 2009

1.0 INTRODUCTION

The objective of this trip was to perform a video survey to confirm the presence or absence of eelgrass in the vicinity of the proposed project area in the Piscataqua River and to collect sediment grabs from the proposed nearshore disposal site at Long Sands Beach in York, ME. The sediment grab samples were collected to evaluate site suitability and potential impacts to the benthic community.

2.0 MATERIALS AND METHODS

The video survey and sediment sampling efforts were conducted on November 5, 2009. Work was carried out on board the 24 foot Corps of Engineers Environmental Survey Launch (CEESL). In attendance were U.S. Army Corps of Engineers (USACE) marine ecologists, Todd Randall, and Ben Loyd, and Department of the Army intern Jesse Morrill-Winter. Positioning was achieved using a Garmin GPSMAP 492 WAAS enabled chart plotter and Garmin external antenna.

General areas for the video survey (i.e., proposed dredging areas and historic eelgrass areas) were plotted on the Garmin chart plotter prior to the start of field activities. Individual points for the video survey were chosen in the field (Figure 1) based on comments from Dr. Fred Short of the University of New Hampshire indicating that historic eelgrass beds had been reestablished in the area to the north of the proposed project area. Each point was recorded on the Garmin chart plotter along with the vessel track for the duration of the video feed at each station. Video footage was collected using a Sea Viewer Sea-Drop 950 Underwater Video Camera and recorded to an onboard DVR system outfitted with an LCD monitor for real time viewing. The camera was deployed off the bow of the vessel. Depth and directional adjustments were made manually by USACE personnel positioned on the bow.

Sediment grab locations at the proposed Long Sands Nearshore Disposal Site (see Figure 2) were selected by USACE team members prior to sampling activities with the intent to represent surficial sediments adequately throughout the disposal site. These locations were stored on the Garmin chart plotter which was used for navigation in the field. Sediment samples were collected by USACE personnel using a $0.04m^2$ Van Veen grab which was retrieved with a commercial grade pot hauler mounted on the CEESL.

The first grab from each station was transferred to a sample container and set aside for grain size analysis. The contents of the second grab were washed through a # 35 (0.5 mm) sieve, and the material retained was transferred to a sample container where it was treated with the biological stain rose bengal and preserved in a 10% formalin solution for benthic community analysis.

3.0 RESULTS

A video survey was successfully carried out by the above USACE personnel in the vicinity of the proposed project area in the Piscataqua River which were reported to have eelgrass beds. Depths in the area surveyed ranged from 5 to 24 feet at the time of survey (intertidal to 19 feet adjusted to MLLW). No eelgrass was observed in the survey area. Bottom type consisted of sand with cobble gravel and shell, and several areas with dense kelp beds. A record of the video survey log is presented in Table 1. Screen captures from each of the video survey stations can be found in Appendix A.

Sediment grabs were collected by USACE personnel at each of the 5 sample locations at the Long Sands Beach Nearshore Disposal Site. Sediments in the sample area uniformly consisted of well graded, medium to fine grained brownish-gray sand (see Table 1). Samples from stations LS1, LS2, LS4, and LS5 all contained polychaete worm tubes. The sample from station LS1 also included a green crab (*Carcinus maenas*) and a sand dollar (*Echinarachnius parma*). Two attempts were required to retrieve sufficient sample volume at each of the five locations. Grain size samples were transported to Geotesting Express in Boxborough, MA. Samples for benthic community analysis were sent to the Bigelow Lab for Ocean Sciences in West Boothbay Harbor, ME.

TABLE 1. Video Survey Log

Station	Easting NAD 83	Northing NAD83	Depth (ft)	Water Temp (^{o}F)	Comments
A	-70.8094	43.12047	9.5	53.6	Sandy bottom with some gravel and shell. Hermit crabs noted.
B	-70.8099	43.12103	5.1	52.3	Sandy bottom with some gravel and shell.
C	-70.8108	43.12087	11.2	51.6	Sandy bottom with gravel cobble and shell. Patches of green algae.
D	-70.8098	43.12016	6.2	52.2	Sand, gravel, and some shell. Kelp bed with red algae.
E	-70.8093	43.11955	17.9	52.2	Sandy bottom with cobble, gravel, and some shell. Several small boulders. Patches of green algae.
F	-70.8087	43.11978	7.9	52.3	Sandy bottom with cobble, gravel, and some shell. Green crab noted.
G	-70.8079	43.11994	8.2	52.2	Sand bottom with scattered gravel and shell. Hermit crabs noted.
H	-70.8088	43.12057	7.6	52.1	Sandy bottom with gravel and shell.
I	-70.8067	43.11928	6.9	52.3	Sandy bottom. Dropped to 19 feet at end and still all sand.
J	-70.8076	43.1188	18.3	52.4	Sand and shell with gravel.
K	-70.8075	43.12038	6.0	52.7	Sand with scattered gravel and shell. Spider crab noted.
L	-70.8073	43.11781	13.5	52.4	Thick kelp bed on edge of channel.
M	-70.8065	43.11749	10.4	52.0	Gravel and shell bottom adjacent to kelp bed.
N	-70.8061	43.11825	24.4	52.5	Sandy bottom with cobble, gravel, and some shell.

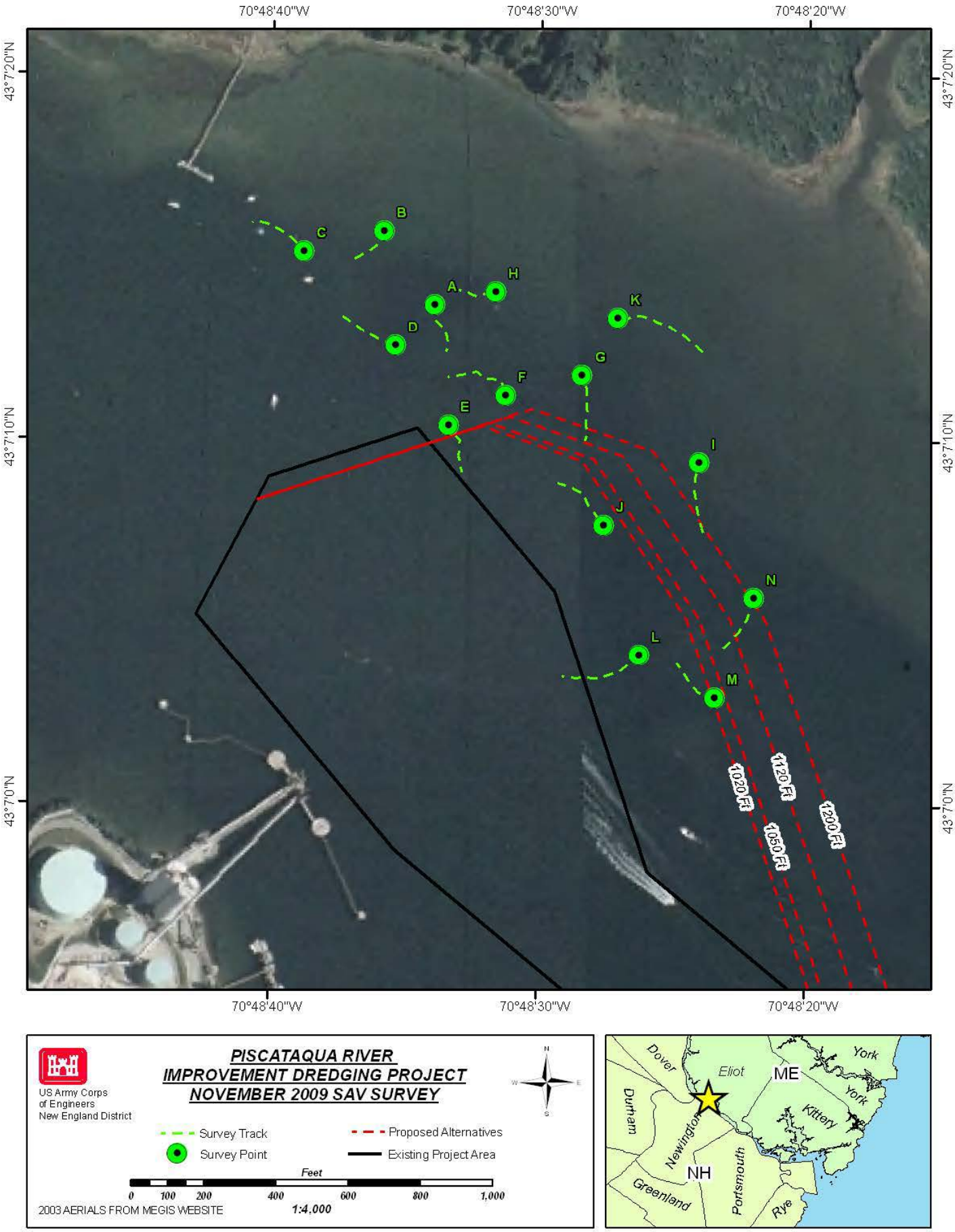

70°48'40"W
70°48'30"W
70°48'20"W
43°7'20"N
43°7'10"N
43°7'0"N
A
B
C
D
E
F
G
H
I
J
K
L
M
N
1020 Ft
1120 Ft
1200 Ft
1050 Ft
US Army Corps
of Engineers
New England District
PISCATAQUA RIVER
IMPROVEMENT DREDGING PROJECT
NOVEMBER 2009 SAV SURVEY
Survey Track
Survey Point
Proposed Alternatives
Existing Project Area
Feet
0 100 200 400 600 800 1,000
1:4,000
2003 AERIALS FROM MEGIS WEBSITE
Dover
Eliot
ME
York
York
Durham
Kittery
Newington
NH
Greenland
Portsmouth
Rye

Figure 1

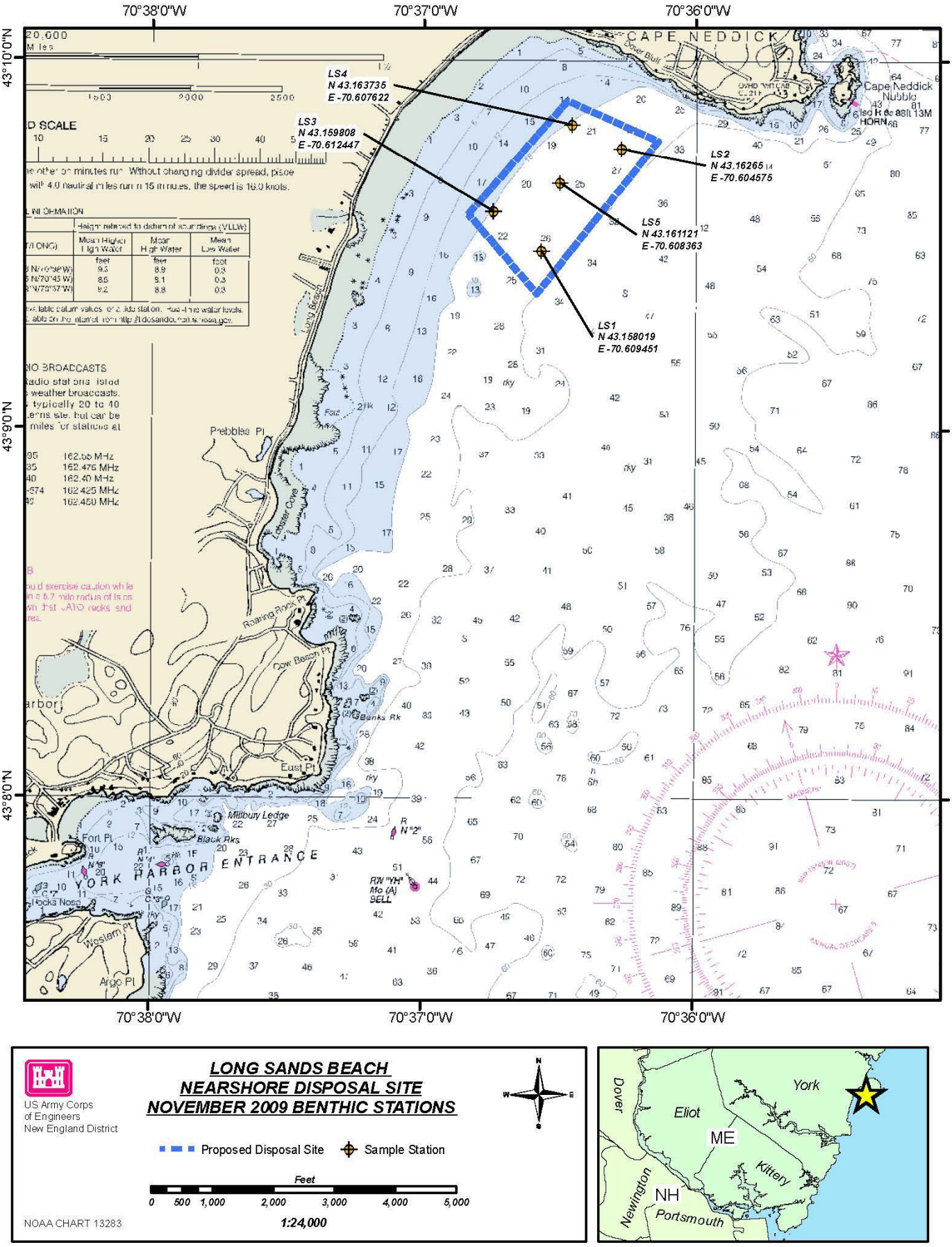
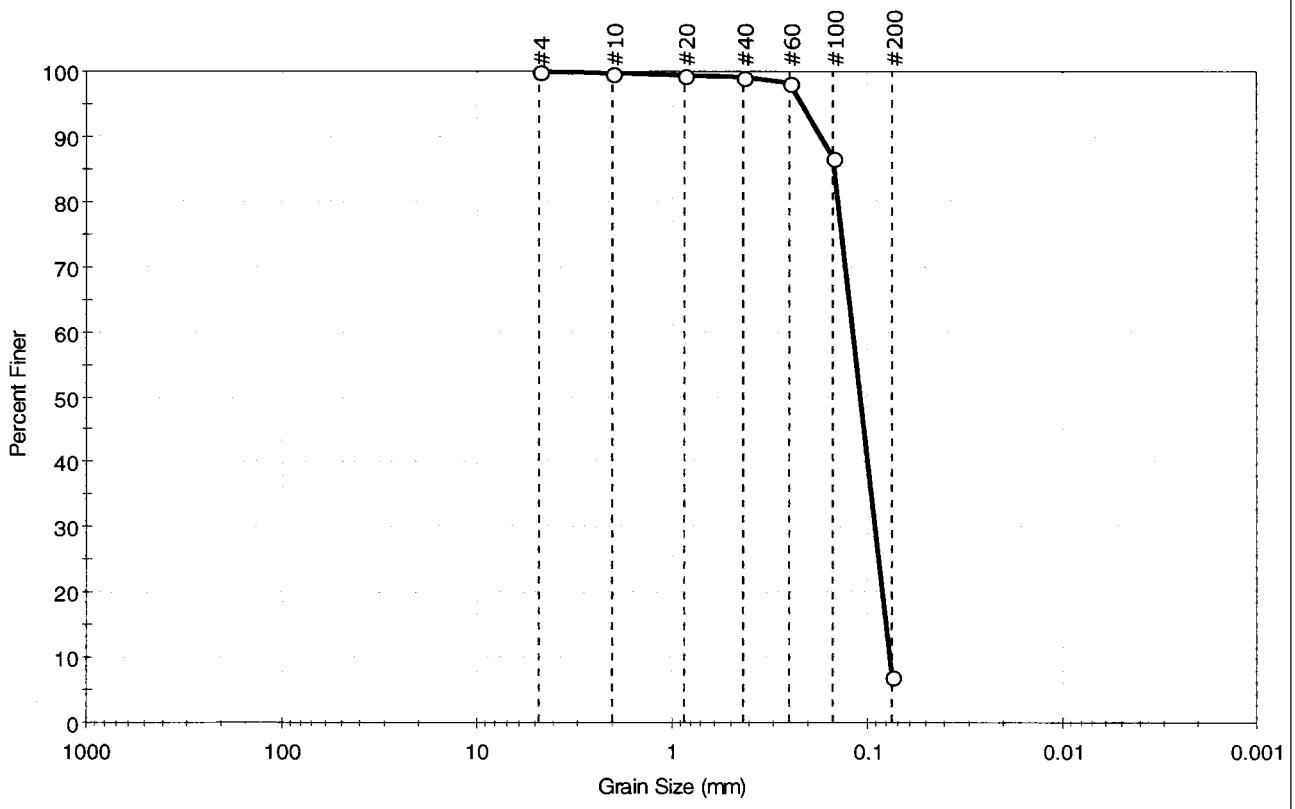

70°38'0"W
70°37'0"W
70°36'0"W
43°10'0"N
43°9'0"N
43°8'0"N
LS4
N 43.163735
E -70.607622
LS3
N 43.159808
E -70.612447
LS2
N 43.16265
E -70.604575
LS5
N 43.161121
E -70.608363
LS1
N 43.158019
E -70.609451
CAPE NEDDICK
Cape Neddick Nubble
Prebbles Pl
Roaring Rock Pl
Cow Beach Pl
East Pl
Fort Pl
Millbury Ledge
Black Rks
YORK HARBOR ENTRANCE
Western Pt
Argo Pl
Long Beach
Chester Cove
LONG SANDS BEACH
NEARSHORE DISPOSAL SITE
NOVEMBER 2009 BENTHIC STATIONS
US Army Corps
of Engineers
New England District
Proposed Disposal Site
Sample Station
Feet
0 500 1,000 2,000 3,000 4,000 5,000
1:24,000
NOAA CHART 13283
York
Eliot
ME
Kittery
Dover
Newington
NH
Portsmouth

Figure 2

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	LS-1	Sample Type:	bag	Tested By:	jbr
Sample ID:	Long Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169489		
Test Comment:	---				
Sample Description:	Moist, olive brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	93.1	6.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	98		
#100	0.15	87		
#200	0.075	7		

Coefficients

D_{85} = 0.1476 mm	D_{30} = 0.0916 mm
D_{60} = 0.1189 mm	D_{15} = 0.0804 mm
D_{50} = 0.1090 mm	D_{10} = 0.0770 mm
C_u = 1.544	C_c = 0.916

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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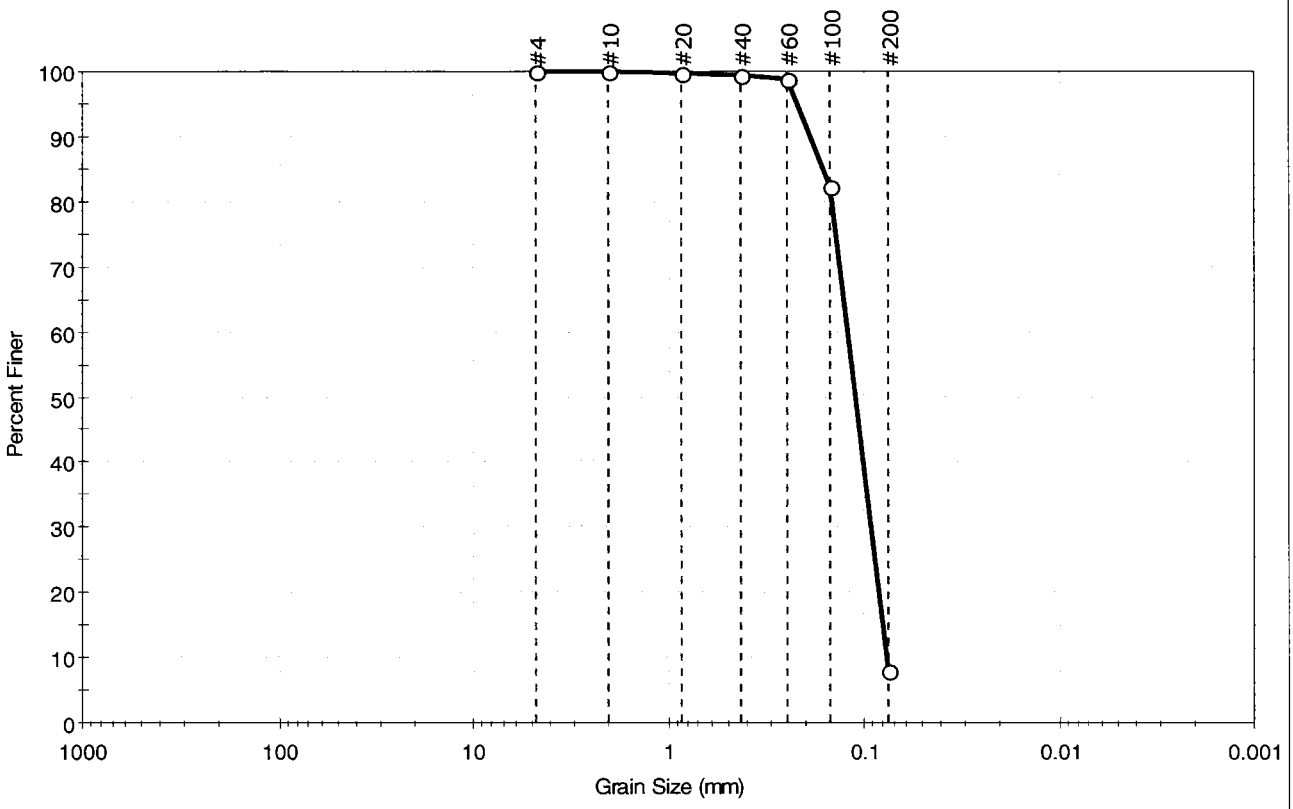
GeoTesting express
a subsidiary of Geocomp Corporation

Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	LS-2	Sample Type:	bag	Tested By:	jbr
Sample ID:	Long Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169490		
Test Comment:	---				
Sample Description:	Moist, olive brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	92.0	8.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	99		
#100	0.15	82		
#200	0.075	8		

Coefficients

D_{85} = 0.1629 mm	D_{30} = 0.0921 mm
D_{60} = 0.1218 mm	D_{15} = 0.0801 mm
D_{50} = 0.1110 mm	D_{10} = 0.0764 mm
C_u = 1.594	C_c = 0.912

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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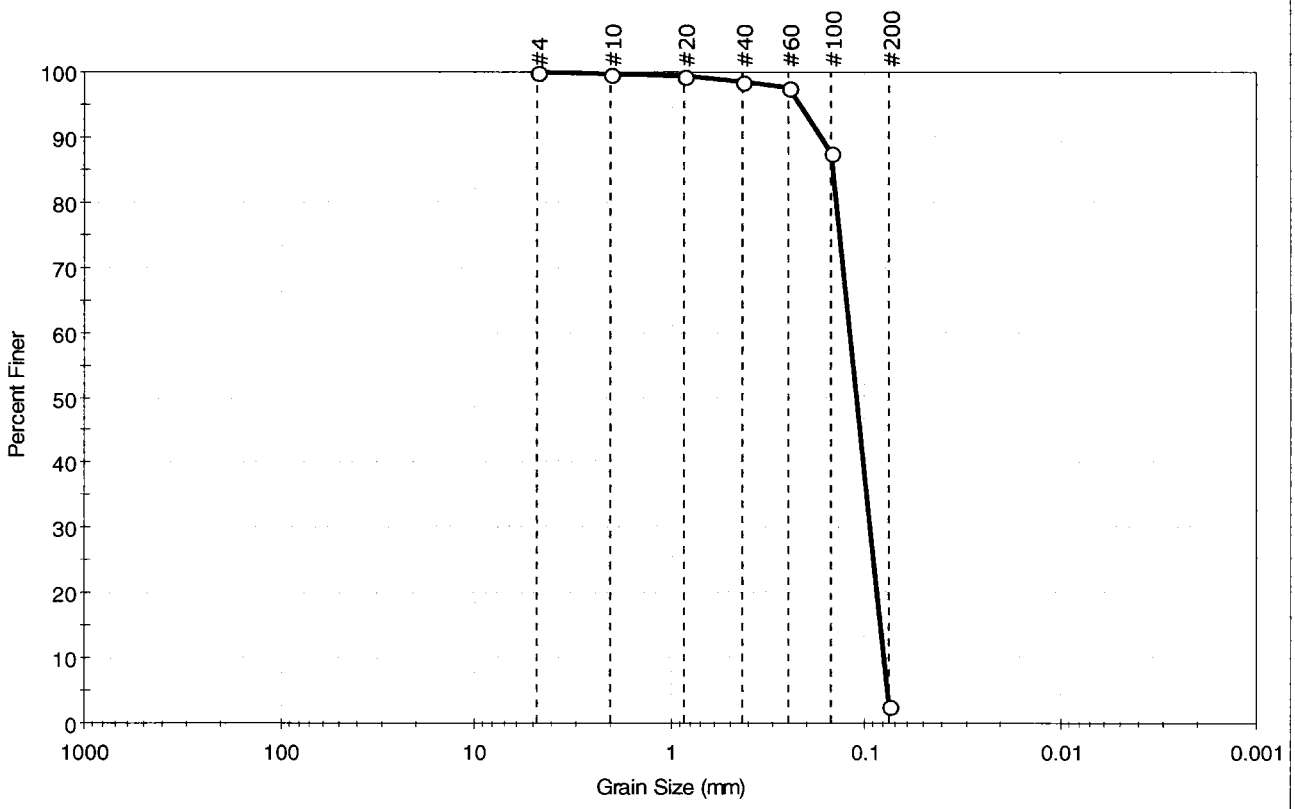
GeoTesting express
a subsidiary of Geocomp Corporation

Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	LS-3	Sample Type:	bag	Tested By:	jbr
Sample ID:	Long Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169491		
Test Comment:	---				
Sample Description:	Moist, olive brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	97.3	2.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	98		
#100	0.15	88		
#200	0.075	3		

Coefficients

D_{85} = 0.1468 mm	D_{30} = 0.0937 mm
D_{60} = 0.1197 mm	D_{15} = 0.0829 mm
D_{50} = 0.1103 mm	D_{10} = 0.0796 mm
C_u = 1.504	C_c = 0.921

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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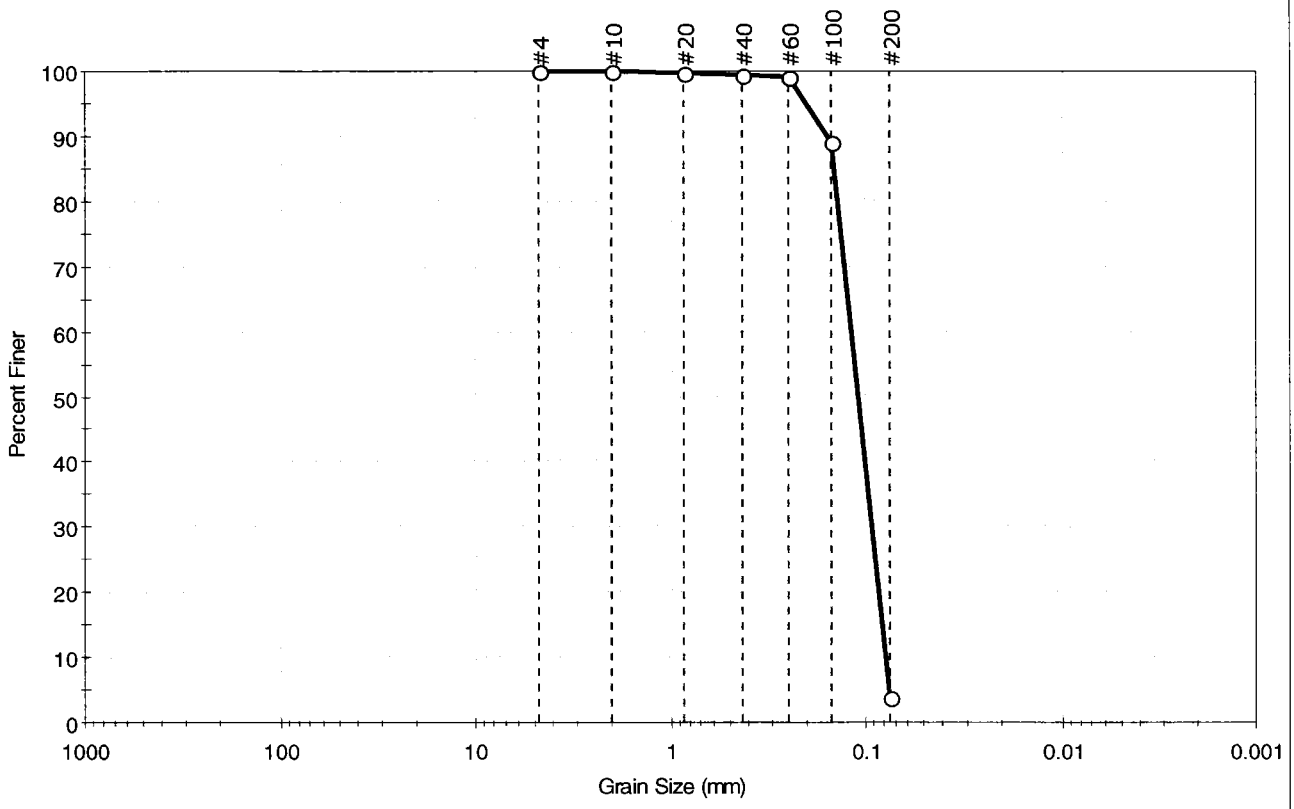
Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	LS-4	Sample Type:	bag	Tested By:	jbr
Sample ID:	Long Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169492		
Test Comment:	---				
Sample Description:	Moist, olive gray sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	—	96.2	3.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	99		
#100	0.15	89		
#200	0.075	4		

Coefficients

D_{85} = 0.1450 mm	D_{30} = 0.0928 mm
D_{60} = 0.1184 mm	D_{15} = 0.0821 mm
D_{50} = 0.1091 mm	D_{10} = 0.0789 mm
C_u = 1.501	C_c = 0.922

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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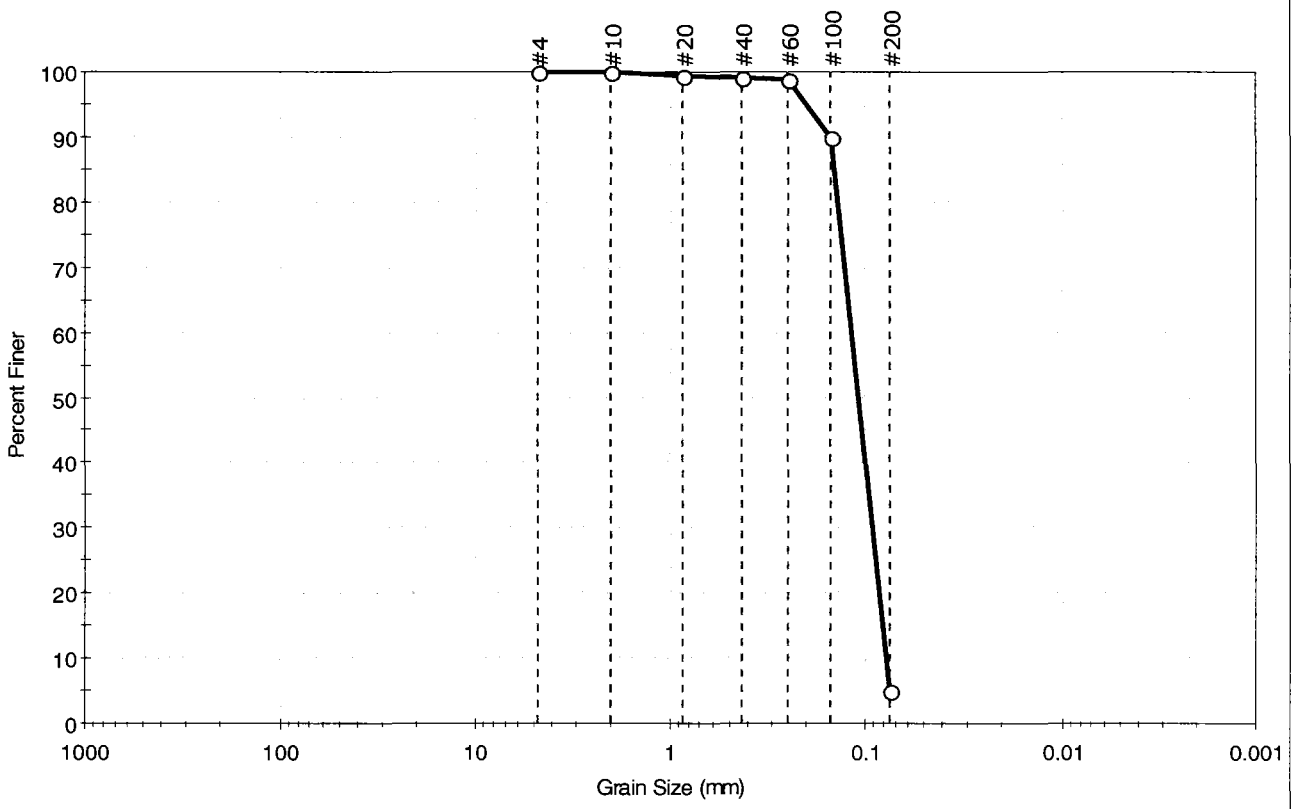
Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	LS-5	Sample Type:	bag	Tested By:	jbr
Sample ID:	Long Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169493		
Test Comment:	---				
Sample Description:	Moist, greenish gray sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	95.0	5.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	99		
#100	0.15	90		
#200	0.075	5		

Coefficients

D_{85} = 0.1440 mm	D_{30} = 0.0920 mm
D_{60} = 0.1174 mm	D_{15} = 0.0814 mm
D_{50} = 0.1082 mm	D_{10} = 0.0781 mm
C_u = 1.503	C_c = 0.923

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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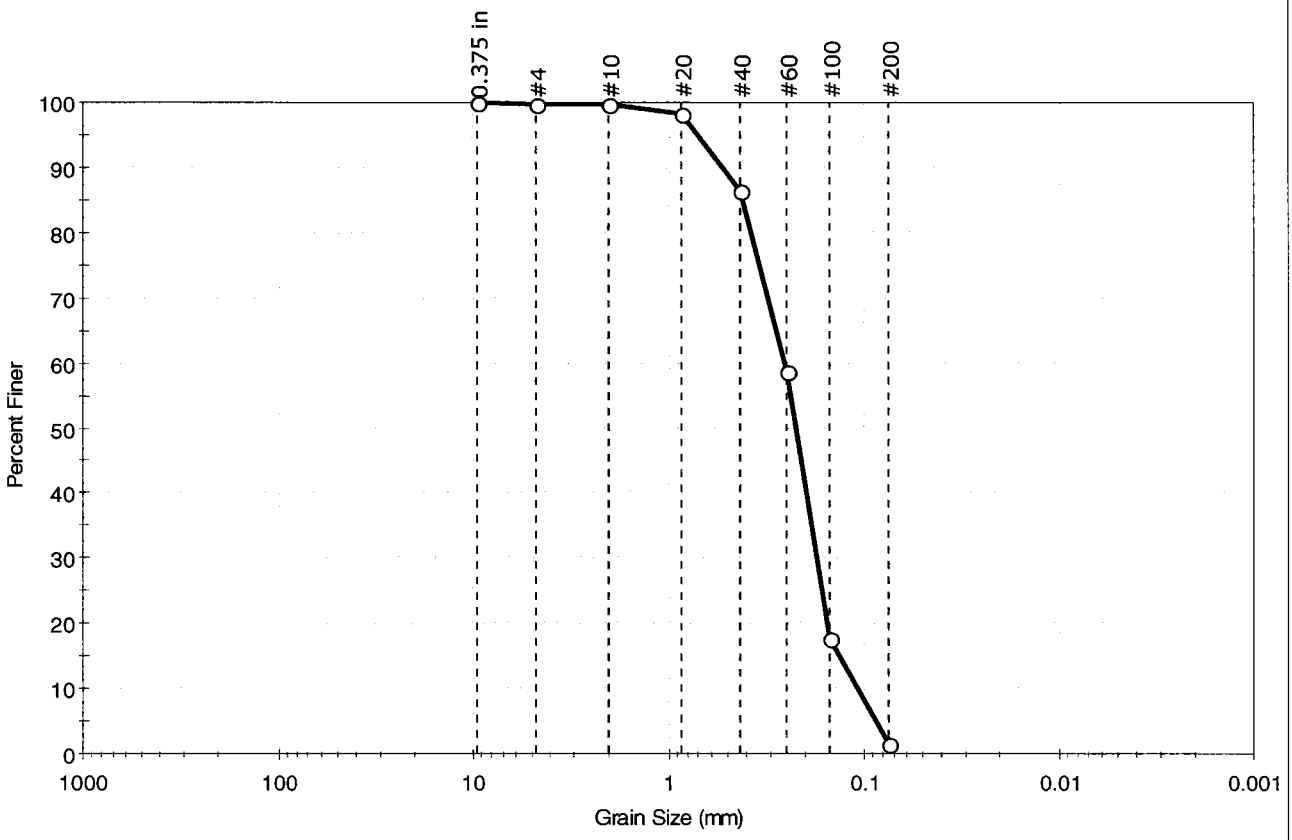
Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	WS-1	Sample Type:	bag	Tested By:	jbr
Sample ID:	Wallis Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169494		
Test Comment:	---				
Sample Description:	Moist, light yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.3	98.2	1.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	86		
#60	0.25	59		
#100	0.15	18		
#200	0.075	1		

Coefficients

D_{85} =0.4131 mm	D_{30} =0.1747 mm
D_{60} =0.2560 mm	D_{15} =0.1334 mm
D_{50} =0.2241 mm	D_{10} =0.1078 mm
C_u =2.375	C_c =1.106

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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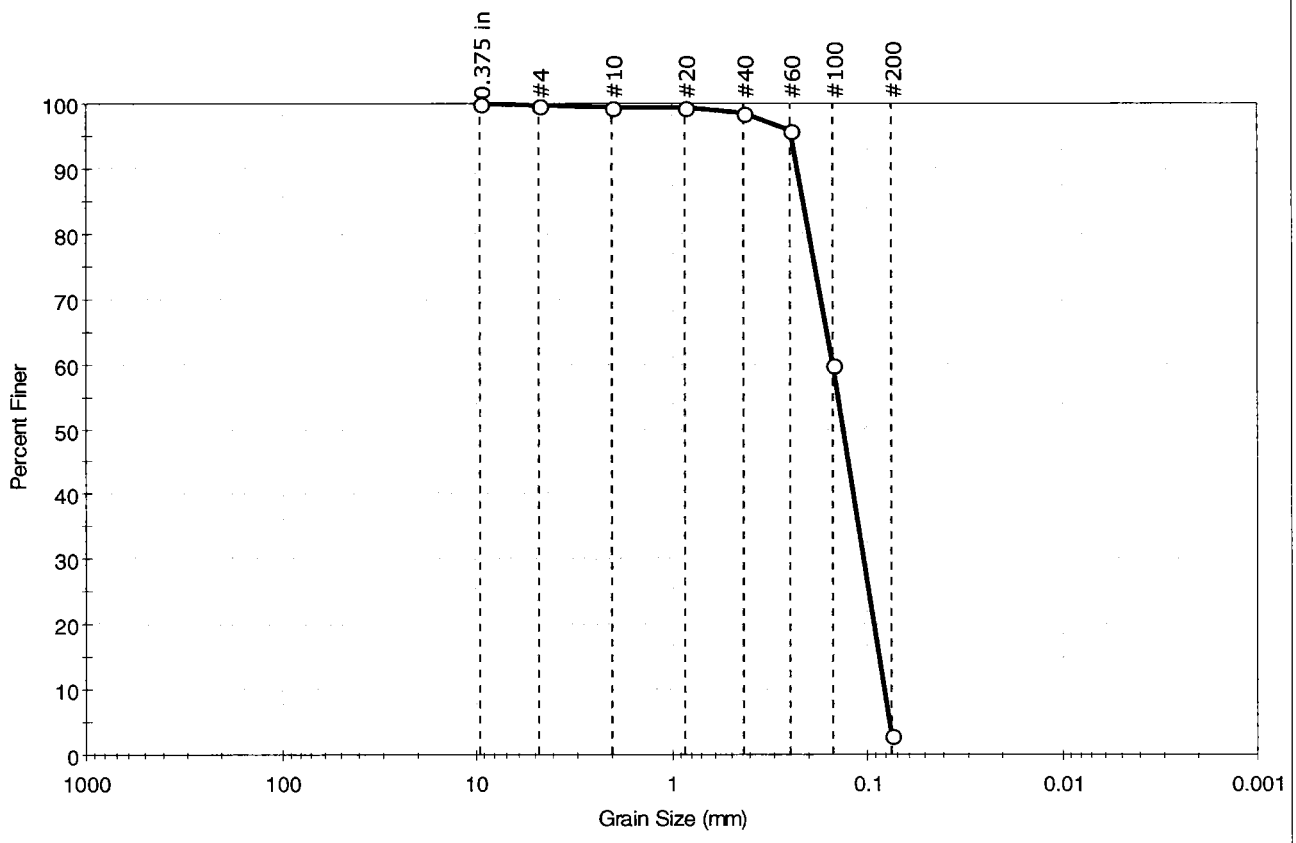
Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	WS-2	Sample Type:	bag	Tested By:	jbr
Sample ID:	Wallis Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169495		
Test Comment:	---				
Sample Description:	Moist, dark brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.3	96.7	3.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	96		
#100	0.15	60		
#200	0.075	3		

Coefficients

D_{85} = 0.2143 mm	D_{30} = 0.1042 mm
D_{60} = 0.1501 mm	D_{15} = 0.0868 mm
D_{50} = 0.1329 mm	D_{10} = 0.0816 mm
C_u = 1.839	C_c = 0.886

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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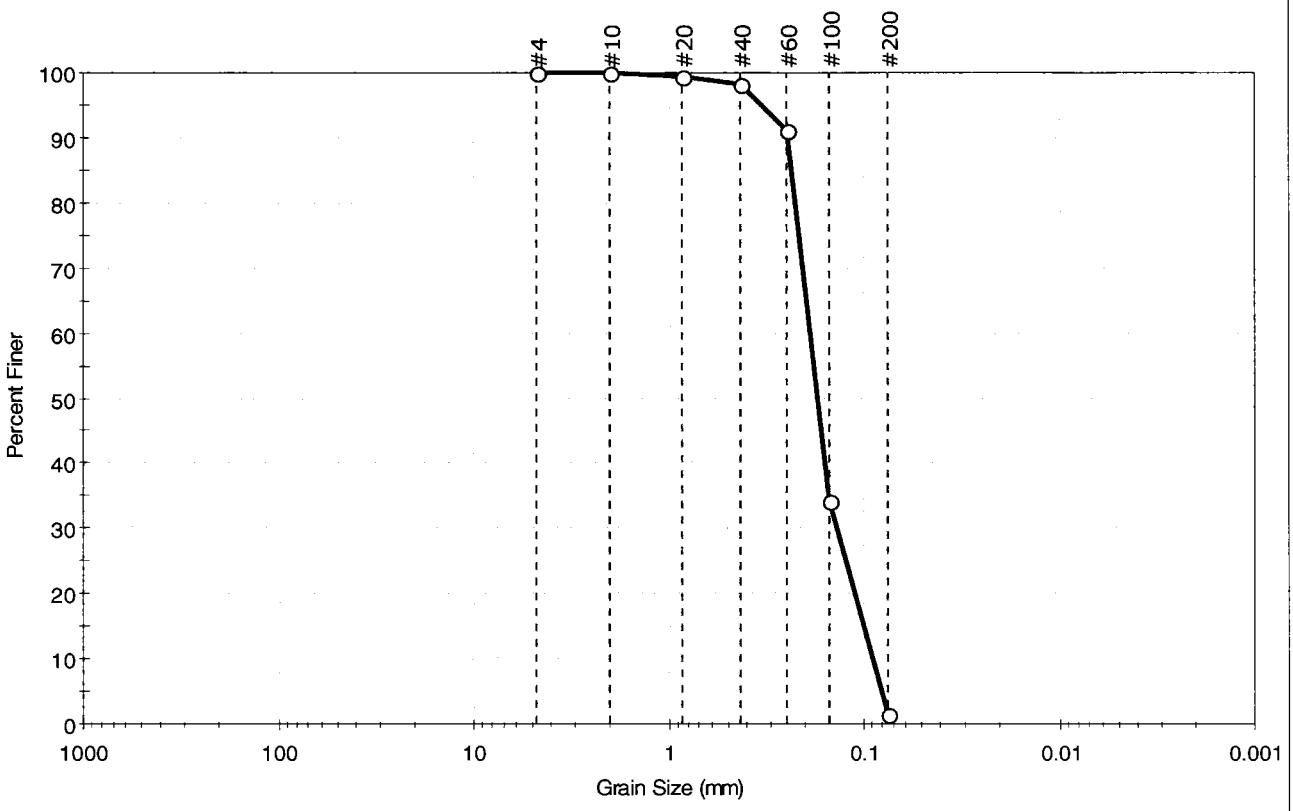
Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	WS-3	Sample Type:	bag	Tested By:	jbr
Sample ID:	Wallis Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169496		
Test Comment:	---				
Sample Description:	Moist, light yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	98.5	1.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	91		
#100	0.15	34		
#200	0.075	1		

Coefficients

D_{85} = 0.2367 mm	D_{30} = 0.1369 mm
D_{60} = 0.1890 mm	D_{15} = 0.0997 mm
D_{50} = 0.1727 mm	D_{10} = 0.0898 mm
C_u = 2.105	C_c = 1.104

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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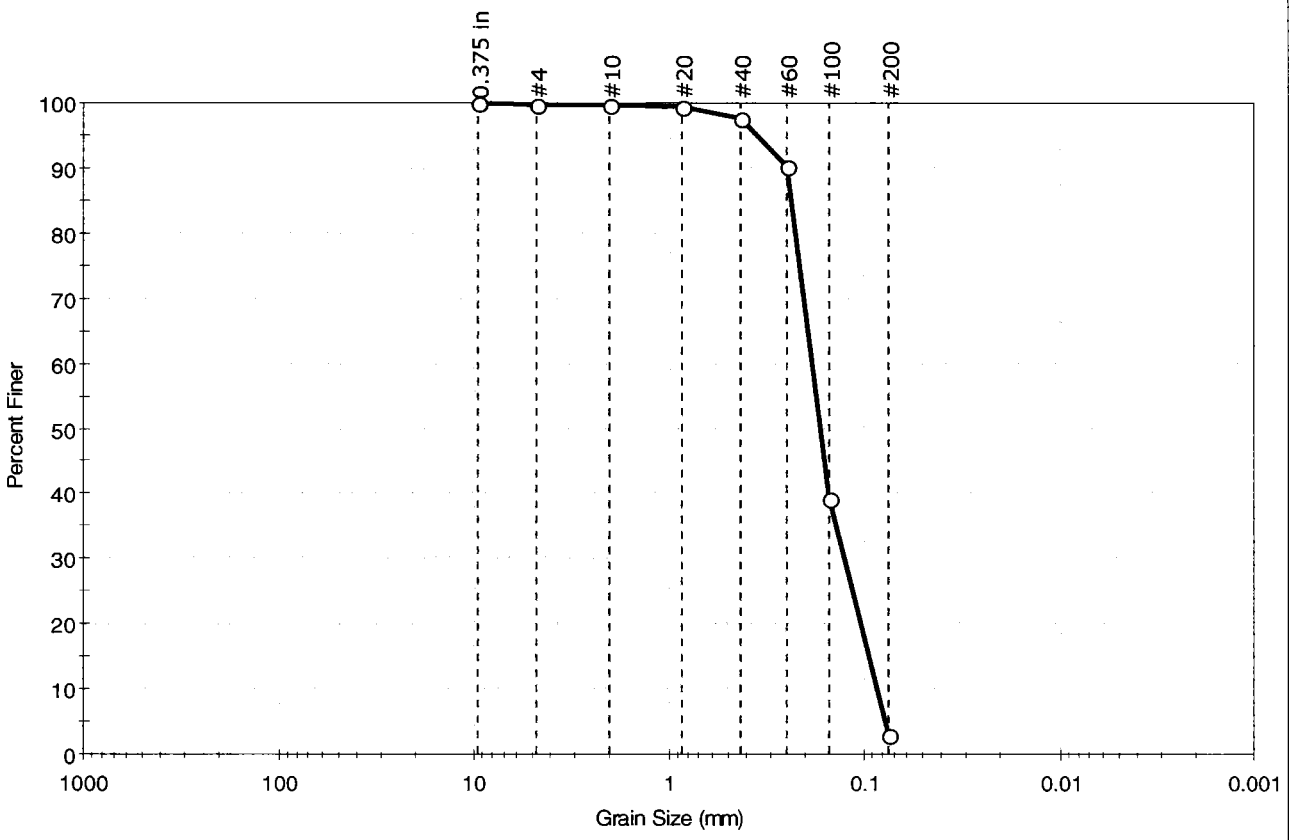
Client:	US Army Corp of Engineers				
Project:	Portsmouth Harbor/Piscataqua River-Nov 09				
Location:	ME/NH			Project No:	GTX-9499
Boring ID:	WS-4	Sample Type:	bag	Tested By:	jbr
Sample ID:	Wallis Sands Beach	Test Date:	12/03/09	Checked By:	jdt
Depth :	---	Test Id:	169497		
Test Comment:	---				
Sample Description:	Moist, light yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



%Cobble	%Gravel	%Sand	%Silt & Clay Size
--	0.3	96.7	3.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	90		
#100	0.15	39		
#200	0.075	3		

Coefficients

D_{85} =0.2372 mm	D_{30} =0.1255 mm
D_{60} =0.1846 mm	D_{15} =0.0942 mm
D_{50} =0.1670 mm	D_{10} =0.0857 mm
C_u =2.154	C_c =0.996

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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