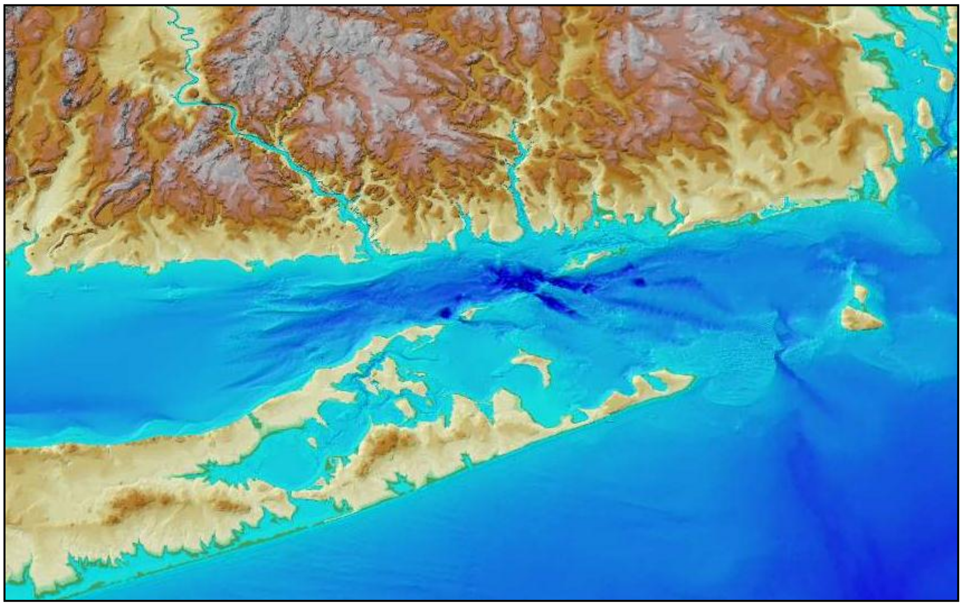
Supplemental Environmental Impact Statement for the Designation of Dredged Material Disposal Site(s) in Eastern Long Island Sound, Connecticut and New York

APPENDIX E

Biological Characterization of the Eastern Long Island Sound Dredged Material Disposal Sites



Prepared for: **NAVFAC Mid Atlantic**

and

United States Environmental Protection Agency

Prepared by: **Tetra Tech**

May 2014

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NAVFAC Atlantic Biological Resource Services

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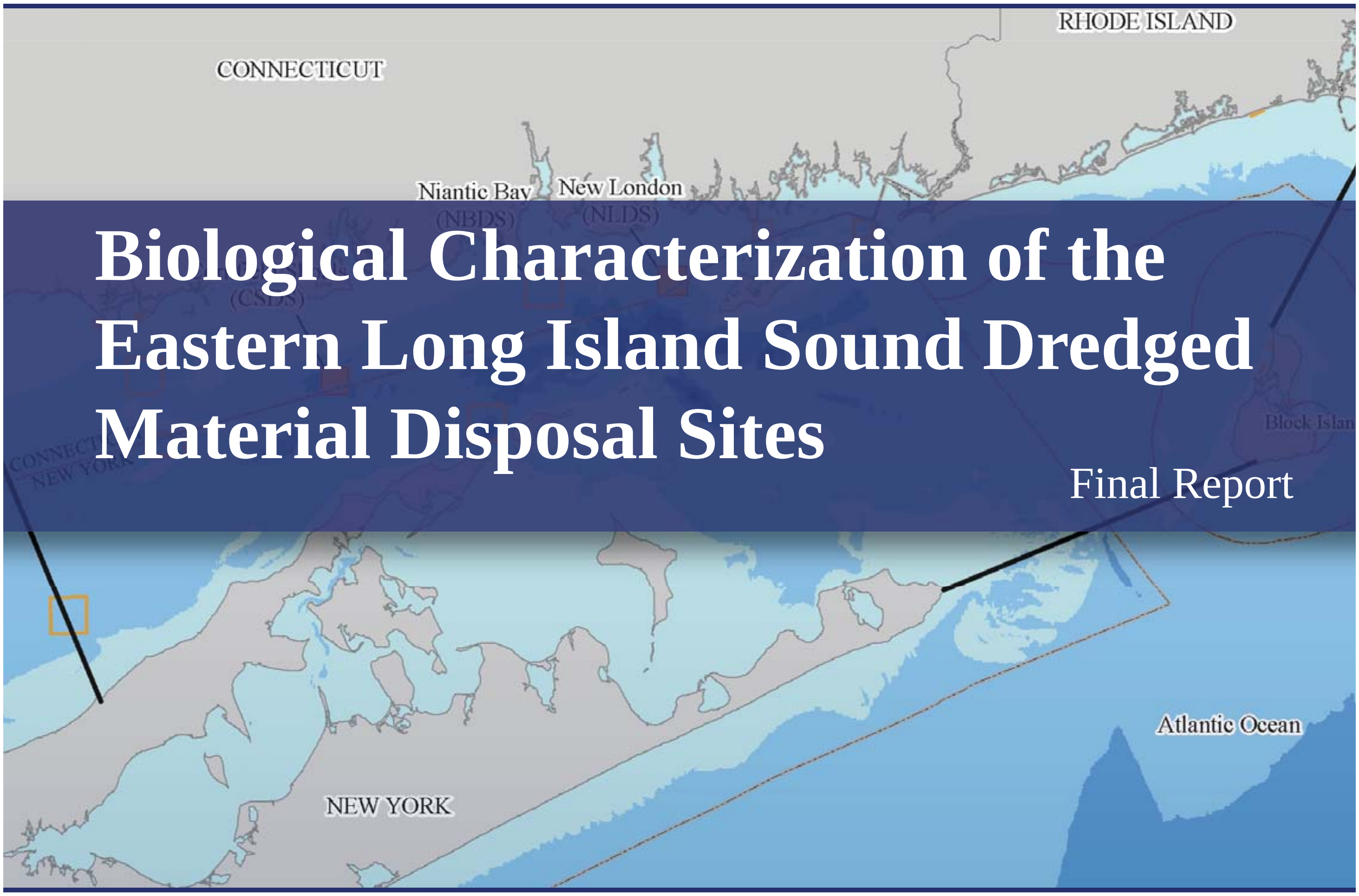
30 May 2014



Biological Characterization of the Eastern Long Island Sound Dredged Material Disposal Sites

Final Report

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LIST OF ACRONYMS

CEQ	Council on Environmental Quality
CPUE	catch per unit effort
CSDS	Cornfield Shoals Dredged Material Disposal Site
CT DEEP	Connecticut Department of Energy and Environmental Protection
CWA	Clean Water Act
DAMOS	disposal area monitoring system
DO	dissolved oxygen
EFH	essential fish habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FMP	Fishery Management Plan
GIS	geographic information system
GPS	global positioning system
LIS	Long Island Sound
MPRSA	Marine Protection, Research and Sanctuaries Act
NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Department of the Navy
NBDS	Niantic Bay Historic Dredged Material Disposal Site
NEPA	National Environmental Policy Act
NLDS	New London Dredged Material Disposal Site
NOAA	National Oceanic and Atmospheric Administration
OSV	Oceanographic Survey Vessel
psu	practical salinity units
QAPP	Quality Assurance Project Plan
RIM	Regional Implementation Manual
SAP	Sampling and Analysis Plan
SEIS	Supplemental Environmental Impact Statement
TOC	total organic carbon
USACE	United States Army Corps of Engineers
UTM	Universal Transverse Mercator
ZSF	Zone of Siting Feasibility

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1 INTRODUCTION

Tetra Tech has developed this report for biological and environmental studies through Naval Facilities Engineering Command (NAVFAC) Atlantic contract N62470-08-D-1008. The report will support the U.S. Environmental Protection Agency (EPA) and the U.S. Department of the Navy (Navy) in preparation of a Supplemental Environmental Impact Statement (SEIS) for the potential designation of one or more dredged material disposal sites in eastern Long Island Sound. The need for open-water dredged material disposal sites was evaluated in a 2009 report by the U.S. Army Corps of Engineers (USACE), New England District, which identified the future needs for dredging of navigational projects and navigation-dependent facilities in Long Island Sound in Connecticut, New York, and in Washington County, Rhode Island (USACE 2009).

Long Island Sound, a semi-enclosed estuary, is an important economic resource for both commercial and recreational fishermen. The region is occupied by more than 100 fish species; only a portion of which are considered year-round residents. Many migrate through the area in response to seasonal variations in water temperature and access to spawning and nursery grounds in the shallow estuaries and rivers that lead into Long Island Sound. Additionally, the variety of depths, salinities, and substrate attracts diverse fish species. The Long Island Sound (LIS) Trawl Survey, conducted by the State of Connecticut Department of Energy and Environmental Protection (CT DEEP), has collected fish abundance and diversity data since 1984. An annual Biomass Index (i.e., the average weight of fish per tow) has not shown a trend up or down, indicating a stable ecosystem (LISS 2012). Individual species abundance has been subject to changes, however. Since 1985, for example, winter flounder abundance has decreased, while scup abundance has increased (LISS 2012). Although the fish assemblages exhibit interannual variation, Long Island Sound continues to support many fish populations.

Certain species of shellfish also constitute some of the key commercial and recreational fishery resources in nearshore areas of Long Island Sound. Important bivalve mollusk resources include the bay scallop, eastern oyster, hard clam, softshell clam, and surfclam. The bay scallop is primarily found in the eastern part of Long Island Sound, especially Peconic Bay. Since bay scallops survive naturally for only 18 to 22 months, recruitment failure of even one spawning event may severely impact populations. Drastic declines in abundance, particularly attributed to “brown tide” algal blooms from 1985 to 1987, have prompted efforts to restore bay scallops (Wenczel et al. 1994). This commercially important shellfish, historically generating more than $1 million in harvesting, is slowly recovering (Tettelbach and Smith 2009). The oyster and clam industries have fluctuated over the past century, due to pollution, disease, and weather. Currently, harvests of oyster and clam are stable or increasing (LISS 2012). The American lobster population experienced a die-off in 1999 due to abiotic stressors coupled with disease (LISS 2012). Recruitment failure now hinders the rebuilding of the stock, and numbers remain low. Other important invertebrate resources in Long Island Sound include the horseshoe crab, squid, and conch (whelk). With the exception of lobster and longfin squid, commercially and recreationally important shellfish resources of Long Island Sound occur near shore.

A previous study by Tetra Tech (Tetra Tech Inc. 2013a) reviewed literature published since 2009 that was relevant to this project. Using a list of comprehensive key words, 191 documents were identified and summarized in a literature review, with 14 of particular relevance. All documents, both peer-reviewed and grey literature, were considered for support of this biological characterization in order to reflect the most current and accepted knowledge available. This literature is integrated throughout the report.

The purpose of this study is to characterize the fisheries industry, fisheries abundance, diversity and locations, and benthic species associated with areas in eastern Long Island Sound considered for open-water placement of dredged material. This was achieved through physical and biological sampling, as well as a survey of local fishermen. Benthic sampling, which characterized parameters such as infaunal diversity and grain size, was conducted on active or historic dredged material disposal sites and at nearby off-site locations. Fish trawls, which were used to identify the diversity and biomass of local fish species, covered a broader area in eastern Long Island Sound. Similarly, the fishing activity survey included all areas in eastern Long Island Sound, and not just areas around current or historic dredged material disposal sites. The data in this report will be used by the EPA in support of the preparation of an SEIS that will consider the potential designation of one or more dredged material disposal sites in the waters of eastern Long Island Sound, under Section 102 of the Marine Protection, Research and Sanctuaries Act (MPRSA), and 40 CFR 230.80 of the regulations of the EPA under Section 404 of the Clean Water Act (CWA).

1.1 PROJECT DESCRIPTION AND LOCATION

This project will support the SEIS process by providing information on the physical and biological environment of eastern Long Island Sound. This study provides a biological characterization of two active dredged material disposal sites (New London and Cornfield Shoals Dredged Material Disposal Sites [NLDS and CSDS, respectively]) and a historic site (Niantic Bay Historic Dredged Material Disposal Site [NBDS]). Historic dredged material disposal sites are identified as having a disposal event of dredged material as described and recorded by USACE, New England District. Additionally, off-site reference areas outside of the active and historic sites were sampled. The EPA previously screened 11 historic and active sites for more in-depth characterization; the areas chosen for sampling were considered a priority.

Studies referenced in the SEIS will be consistent with the provisions of Section 102 (c) of the MPRSA and 40 CFR Parts 228.5, 228.6, 230.80, Section 404 of the CWA, Section 404(b)(1) guidelines, National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations. Tetra Tech completed the sampling associated with the biological characterization of these sites as outlined below. The key focus sites for this study were CSDS, NLDS, and NBDS, which are shown in Figure 1 (Northeast Ocean Data Portal Working Group 2014).

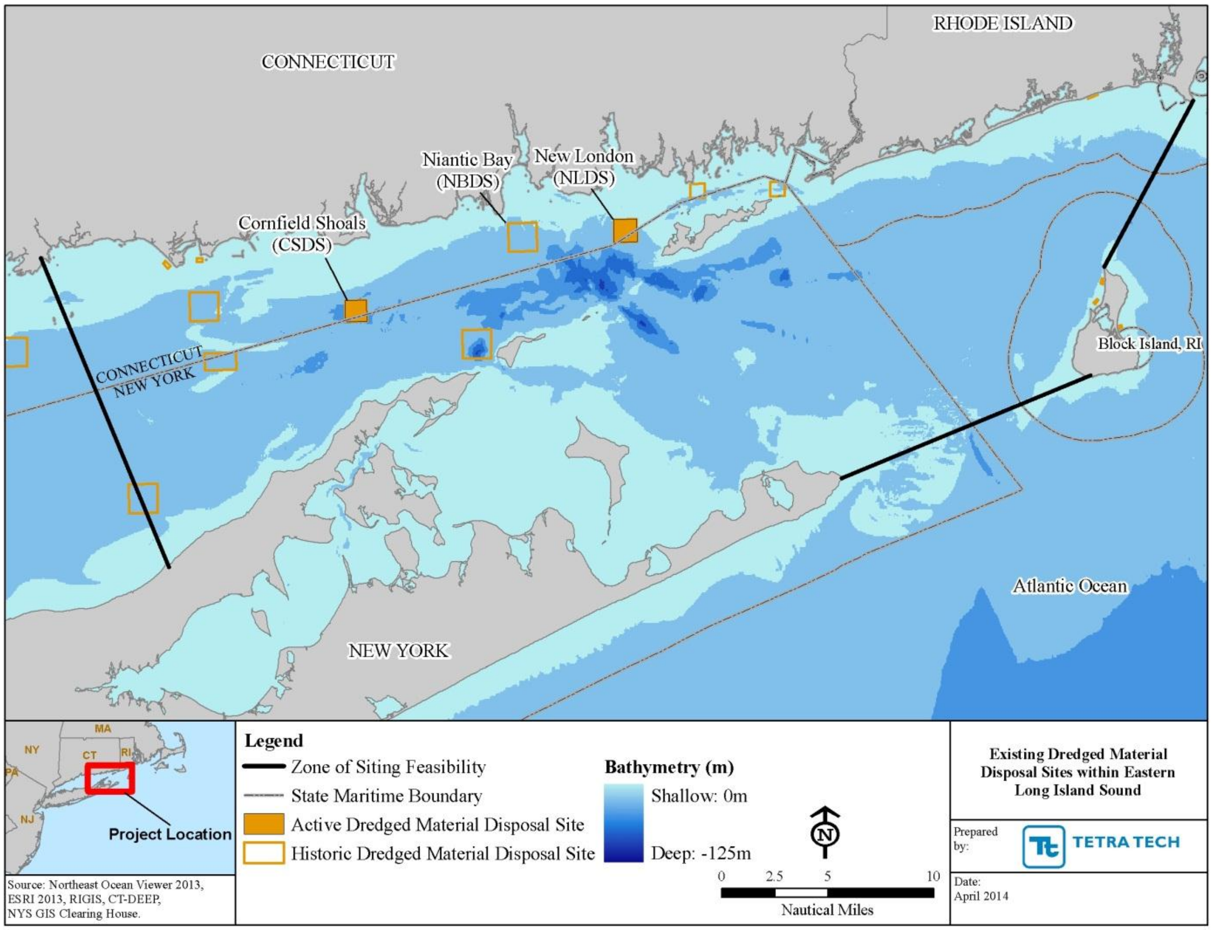


Figure 1: Existing Dredged Material Disposal Sites within Eastern Long Island Sound

The Zone of Siting Feasibility (ZSF) is a comprehensive area considered for dredged material disposal site designation, which encompasses a range of reasonable alternatives (EPA 2004). In identifying the ZSF, the EPA evaluates locations that are economical and practical relative to dredging operations. These factors are presented in further detail in the EPA's manual for site designation (EPA 1986). The EPA, with the cooperation of USACE, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, developed the ZSF for the evaluation of Long Island Sound dredged material disposal sites in 1999. The ZSF was further modified in 2002 to differentiate the western and central region from the eastern region, which was subsequently evaluated separately. Dredged material disposal sites in central and western Long Island Sound have been analyzed in an Environmental Impact Statement (EIS [EPA 2004]); an SEIS is currently under development for the eastern region. This SEIS will include in-depth information about physical properties, type of site (e.g., dispersive or non-dispersive), and past disposal activities for each historic or active dredged material disposal site that is considered for potential site designation. Some of this information is currently available through the USACE Disposal Area Monitoring System (DAMOS) (USACE 2014). For this biological characterization, parameters such as depth, sediment composition, and biological resources are summarized for each active or historic dredged material disposal site, as well as off-site reference areas.

1.2 OBJECTIVES

In support of the EPA's SEIS preparation, the objectives of this eastern Long Island Sound biological characterization included collecting benthic and fish data at priority sites: three of the eastern Long Island Sound active or historic dredged material disposal sites—Cornfield Shoals, New London, and Niantic Bay (historic)—plus additional off-site reference areas between New London and Niantic Bay. This included obtaining information around each site, as well as the identification of locations to serve as reference areas for future monitoring efforts.

The Sampling and Analysis Plan (SAP) describes data collection methods for fisheries, benthic, and toxicity testing (Tetra Tech Inc. 2013c). The benthic and toxicity testing were conducted as described further in the Quality Assurance Project Plan (QAPP) (Tetra Tech Inc. 2013b), while the fisheries data were collected by CT DEEP trawls and a fishing activity survey. Information on finfish abundances was collected by CT DEEP's annual LIS Trawl Survey, with a subset of their tows occurring near the dredged material disposal sites. Additional data on the status of fisheries resources in eastern Long Island Sound were gathered by administering a questionnaire to eastern Long Island Sound fishermen, particularly commercial lobstermen (see Appendix F). Since biological samples could not be obtained from lobsters due to their low abundance, trends in this fishery were characterized using both qualitative and quantitative data provided by fishermen, collected by a fishing activity questionnaire. Qualitative and quantitative data were collected for benthic organisms at each area and analyzed by Tetra Tech. In addition, existing technical reports and literature, such as those created by the U.S. Geological Society and the USACE DAMOS program (USACE 2014), were referenced for comparison. This study characterizes the biological resources which include the benthic, finfish, and shellfish resources of eastern Long Island Sound.

1.3 PREVIOUS INVESTIGATIONS

The EPA, with the support of USACE, evaluated sites in Long Island Sound as part of an EIS to designate one or more dredged material disposal sites in western and central Long Island Sound under section 102(c) of the MPRSA and in accordance with the NEPA and CEQ Regulations (40 CFR 1500 et. seq.). The purpose of the EIS was to evaluate the current sites used in western and central Long Island Sound, as well as other sites, for possible designation as dredged material disposal sites and to investigate the means for managing dredged material (EPA 2004).

In the earlier years of that study, data were collected sound-wide and included the eastern portion of Long Island Sound. The methods, work plans, and analyses of the current study all followed a similar approach as the central and western Long Island Sound EIS (as applicable), since the initial EIS sampling effort was presented and accepted by agencies, the public, and other stakeholders.

In 1999, a questionnaire (ENSR 2001b), completed by fishermen, was used by as a part of the Long Island Sound Dredged Material Disposal EIS (EPA 2004). Following a massive die-off in 1999, lobster fishing activities were significantly affected throughout the Sound, although the western portion experienced the greatest decrease in lobster abundance. The fixed-gear (i.e., pots and traps) lobster fishery was dominant in Long Island Sound in the years before the die-off, with more than 800 active commercial lobstermen in 1998. The survey implemented in 1999 received feedback about effort and trends from 20 fishermen from throughout Long Island Sound. For an updated comparison, another fishing activity survey, specific to eastern Long Island Sound, was implemented in 2013 as a part of this current study. This report describes the results of that survey.

2 METHODS

Data were collected from both field sampling and survey responses. Benthic grabs and fish trawls were achieved through two separate efforts, which are summarized in this introduction and described in more detail in the subsequent sections. The benthic survey was conducted by Tetra Tech biologists in coordination with a local fishing vessel captained by a fully-licensed commercial fisherman/lobsterman. During field sampling efforts, Tetra Tech held a Scientific Collecting Permit (#SC-13004) from the State of Connecticut to authorize the collection of benthic organisms for this study within the Connecticut waters of eastern Long Island Sound. All benthic sampling was conducted in accordance with the quality objectives and protocols specified in the SAP and the QAPP developed for this project (Tetra Tech Inc. 2013b, c). The methods, procedures, quality assurance, and quality control measures are fully described in those documents. Briefly, 45 sites were sampled for benthic parameters. These sites were identified by location (on or off of a dredged material disposal site) and by importance (priority or randomized). From these collected samples, measurements were made, including infaunal diversity and wet-weight biomass, organic carbon content, and grain size distribution.

Fisheries data for this report were collected in a separate effort. CT DEEP biologists provided the fish data as part of the ongoing LIS trawl survey. In addition to standard trawl sites, CT DEEP scientists collected trawl samples (fish and shellfish) from sites specifically selected for this study. This resulted in several trawl locations closer to dredged material disposal sites. Fish identification, abundance, wet-weight biomass, and lengths were then provided to Tetra Tech biologists for analysis and inclusion in this report. For an annual comprehensive report covering all of CT DEEP’s trawl locations in Long Island Sound, see Gottschall and Pacileo (2012) or CT DEEP (2014).

Sampling stations for both benthic grabs and fish trawls were targeted and identified using the vessel’s onboard global positioning system (GPS) navigation system and a Trimble Juno® Series handheld GPS unit, as a backup. Positioning data were uploaded as GPS points using the Universal Transverse Mercator (UTM), NAD-83, Connecticut State Plane Coordinate System. Sampling locations were mapped using ESRI ArcGIS v9.3.

To supplement the biological data and gain a better understanding of fisheries resources, especially the American lobster, a fishing activity survey was also implemented by Tetra Tech biologists. This survey focused exclusively on eastern LIS, but collected information from a variety of fisheries (commercial, charter/party boat, and recreational). In either electronic or hard-copy form, the anonymous survey was distributed to fishermen through fishing associations, public forums, and word-of-mouth.

2.1 FIELD SAMPLING

Field sampling was conducted in accordance with the quality objectives and protocols specified in the QAPP developed for this project. A summary of all field samples collected is provided in Table 1.

Table 1: Summary of Field Sampling Effort

Sites	Benthic Grabs 16–18 July 2013		Fish Trawl (Conducted by CT DEEP LIS Trawl Survey) 10–13 June 2013	
	# of Stations	**Number and Type of Samples**	**# of Stations**	**Data Collected**
NLDS	6 on-site (1 in triplicate)	8 TOC and grain size; 8 infauna; 1 toxicity	1 on-site trawl station	Species composition; length; weight
NBDS	8 on-site (1 in triplicate)	10 TOC and grain size; 10 infauna; 1 toxicity	1 on-site trawl station	Species composition; length; weight
CSDS	1 on-site (in triplicate)	3 TOC and grain size; 3 infauna; 1 toxicity	1 on-site trawl station	Species composition; length; weight
Off-site	30 off-site (none in triplicate)	30 TOC and grain size; 30 infauna; 1 toxicity	3 off-site trawl stations	Species composition; length; weight
Total	**45 grab sites**	**51 TOC and grain size; 51 infauna; 4 toxicity**	**6 trawl sites**	**6 trawl hauls**

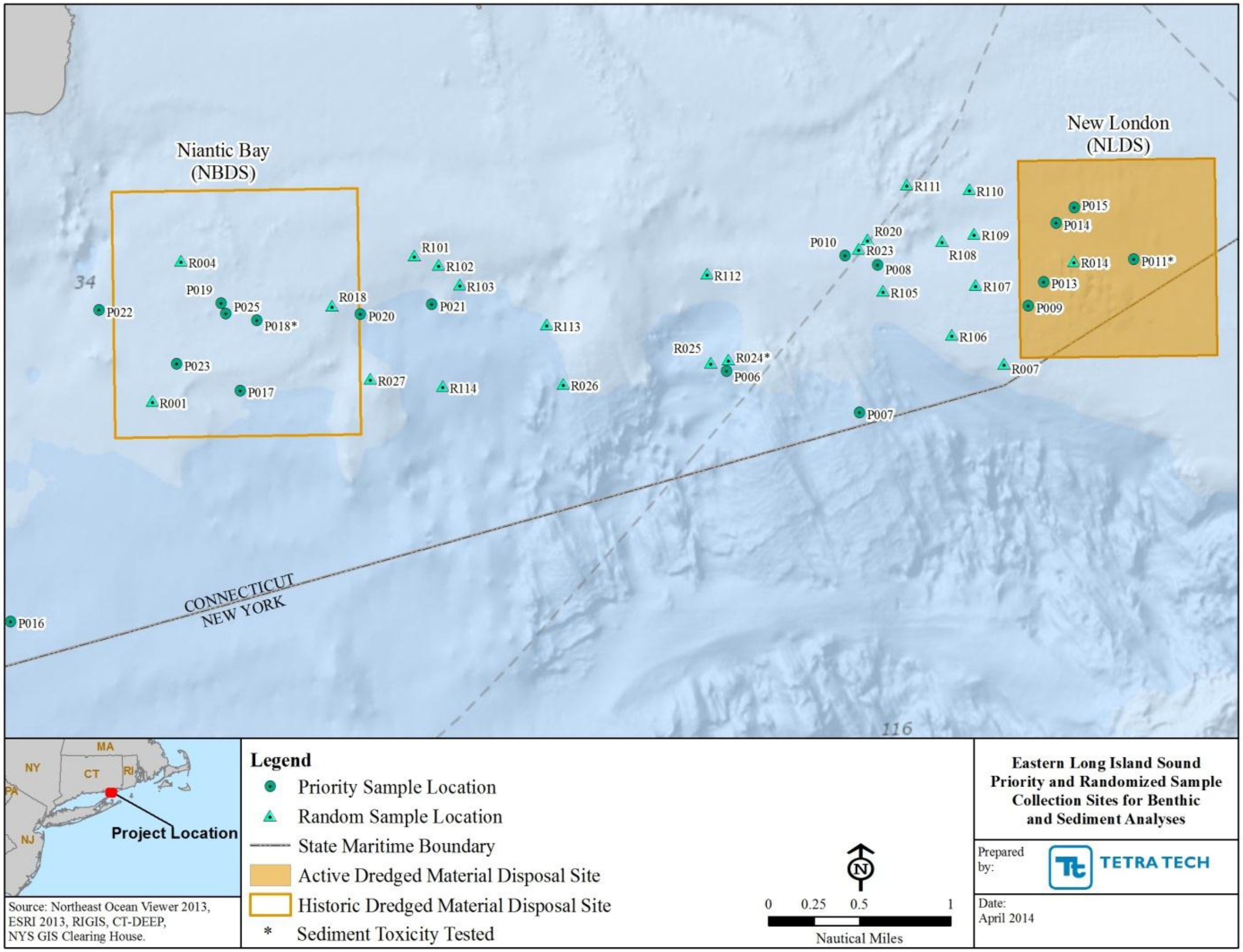
Note: LIS = Long Island Sound; CT DEEP = Connecticut Department of Energy and Environmental Protection; TOC = total organic carbon

2.1.1 BENTHIC GRABS

Sediment samples for benthic organism identification, grain size, total organic carbon (TOC), and toxicity testing were collected using a Van Veen grab sampler (0.1 m^2). The sampling strategy was designed to provide an overall characterization of the infaunal community and sedimentary regimes at the dredged material disposal sites. The original sampling plan included collecting individual samples from three in-site stations and two nearby reference stations from each area. The site-specific stations were located within 200 meters (m) of the target site boundaries.

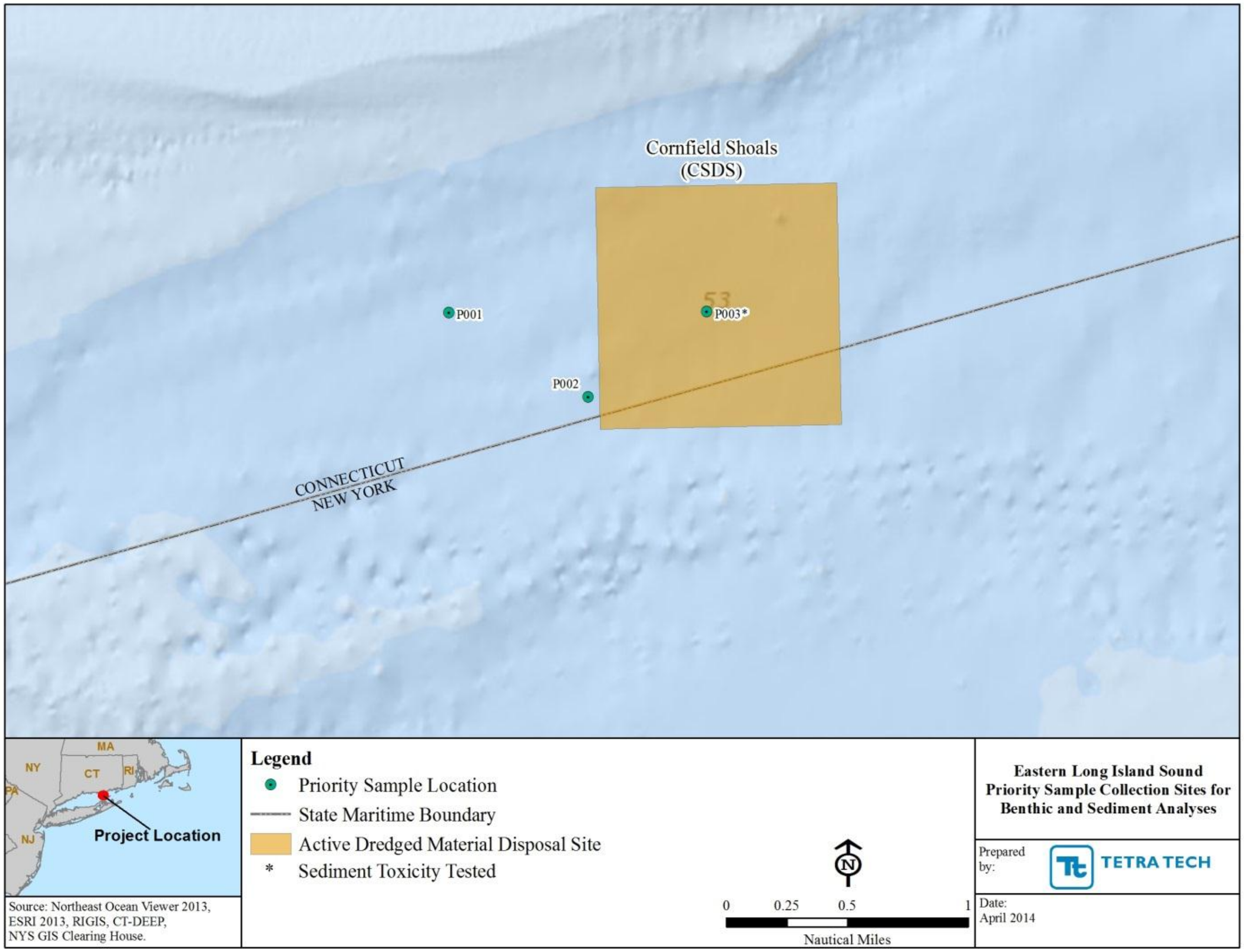
Benthic samples were collected aboard the F/V *Hostile Waters* by four Tetra Tech field biologists, the vessel captain, and one crewmember from 16–18 July 2013. The Van Veen grab was deployed from the capstan head and block on the F/V *Hostile Waters*. Upon retrieval, the grab was examined for acceptability in accordance with the QAPP (i.e., at least 50 percent full with no surface washout). Samples for TOC and grain size analysis were collected from the top 2 cm of sediment prior to any manipulation. Raw sediment was transferred to a pre-labeled 16 oz. polyethylene screw-top jar. When collected, toxicity samples were also stored in sealed 1-gallon plastic bags before sieving the sample. All screw-top lids were secured and sealed with electrical tape, and bags were double-bagged and secured with cable ties to prevent leakage. All unprocessed samples were stored and shipped on ice in coolers. The remaining sediments were then sieved to retain only the larger sediments and organisms.

A total of 45 separate sites were sampled, 21 of which were considered “Priority” (labeled as “P-XXX” and represented by circles in Figures 2 and 3). Priority sites were chosen by the EPA based on previous sampling coordinated by the EPA and USACE, and conducted aboard the OSV *Bold*. Therefore, the effort for the current sampling event was not evenly distributed, because some sites warranted more sampling than others. Eleven priority sites were located within one of three current or historic dredged material disposal sites (five in New London [NLDS], five in Niantic Bay [NBDS], and one in Cornfield Shoals [CSDS]; Table 2; Figure 2; Figure 3); ten priority sites were located off-site of a dredged material disposal site. Random sites (labeled as “R-XXX” and represented by triangles in Figure 2) were chosen by a geographic information systems (GIS) specialist by generating random points within a constraining polygon around the sample area. Three priority sites, one within each dredged material disposal site, had triplicate grabs taken for benthic infauna, grain size, and TOC analysis (sites P003, P011, and P018). Samples analyzed specifically for toxicity levels were collected at four sites: one within each active or historic dredged material disposal site (sites P003, P011, and P018) and one off-site, located outside of a dredged material disposal site (site R024). These sites used in sediment toxicity tests are identified in Figures 2 and 3 by an asterisk.



Source: Northeast Ocean Viewer 2013, ESRI 2013, RIGIS, CT-DEEP, NYS GIS Clearing House.

Figure 2: Eastern Long Island Sound Priority and Randomized Sample Collection Sites for Benthic and Sediment Analyses at New London Dredged Material Disposal Site (NLDS), Niantic Bay Historic Dredged Material Disposal Site (NBDS), and Off-site



Source: Northeast Ocean Viewer 2013, ESRI 2013, RIGIS, CT-DEEP, NYS GIS Clearing House.

Figure 3: Eastern Long Island Sound Priority Sample Collection Sites for Benthic and Sediment Analyses at Cornfield Shoals Dredged Material Disposal Site (CSDS) and Off-site

Table 2: Coordinates of Sampling Locations and Samples Collected

Site ID[1]	Date	Latitude (N)	Longitude (W)	Benthic infauna	TOC and grain size	Toxicity
New London Dredged Material Disposal Site (NLDS)						
P009 (NL-6)	16 July 2013	41.266	72.087	X	X	
P011[2]	16 July 2013	41.270	72.074	X	X	X
P013	16 July 2013	41.268	72.085	X	X	
P014	16 July 2013	41.273	72.083	X	X	
P015	16 July 2013	41.275	72.081	X	X	
R014	16 July 2013	41.270	72.081	X	X	
Niantic Bay Historic Dredged Material Disposal Site (NBDS)						
P017 (NT-26)	17 July 2013	41.260	72.182	X	X	
P018[2] (NT-25)	17 July 2013	41.266	72.180	X	X	X
P019 (NT-22)	17 July 2013	41.268	72.185	X	X	
P023	17 July 2013	41.262	72.190	X	X	
P025	17 July 2013	41.267	72.184	X	X	
R001	17 July 2013	41.259	72.193	X	X	
R004	17 July 2013	41.272	72.190	X	X	
R018	17 July 2013	41.267	72.171	X	X	
Cornfield Shoals Dredged Material Disposal Site (CSDS)						
P003[2] (CSDS-16)	17 July 2013	41.211	72.359	X	X	X
Off-site						
P001 (CSDS29-REF2)	17 July 2013	41.211	72.383	X	X	
P002 (CSDS23-REF4)	17 July 2013	41.205	72.370	X	X	
P006 (NL-8)	18 July 2013	41.261	72.123	X	X	
P007 (NL-12)	18 July 2013	41.256	72.107	X	X	
P008 (NL-3)	16 July 2013	41.270	72.105	X	X	
P010 (NL-2)	16 July 2013	41.271	72.109	X	X	
P016 (NT-19)	17 July 2013	41.239	72.211	X	X	
P020 (NT-37)	17 July 2013	41.266	72.168	X	X	
P021 (NT-38)	18 July 2013	41.267	72.159	X	X	
P022	17 July 2013	41.267	72.200	X	X	
R007	18 July 2013	41.261	72.090	X	X	
R020	16 July 2013	41.272	72.106	X	X	
R023	16 July 2013	41.271	72.107	X	X	
R024	18 July 2013	41.262	72.123	X	X	X
R025	18 July 2013	41.261	72.125	X	X	
R026	17 July 2013	41.260	72.143	X	X	
R027	17 July 2013	41.260	72.167	X	X	
R101	17 July 2013	41.272	72.161	X	X	

Site ID[1]	Date	Latitude (N)	Longitude (W)	Benthic infauna	TOC and grain size	Toxicity
R102	17 July 2013	41.271	72.158	X	X	
R103	17 July 2013	41.269	72.156	X	X	
R105	18 July 2013	41.268	72.104	X	X	
R106	18 July 2013	41.263	72.096	X	X	
R107	18 July 2013	41.268	72.093	X	X	
R108	18 July 2013	41.272	72.097	X	X	
R109	18 July 2013	41.273	72.093	X	X	
R110	18 July 2013	41.277	72.094	X	X	
R111	18 July 2013	41.277	72.101	X	X	
R112	18 July 2013	41.269	72.126	X	X	
R113	18 July 2013	41.265	72.145	X	X	
R114	18 July 2013	41.260	72.158	X	X	

[1]EPA IDs from previous surveys in parentheses; [2]Triplicate samples collected at sampling location.

Sieving was accomplished by placing sediment in the bottom of a sieve bucket with a 500 micron-mesh bottom; the bucket was then partially submerged in a wash tub. The bucket was agitated in such a manner that the finest sediment rinsed away through the sieve, leaving behind the benthic fauna, and larger materials (i.e., gravel, organisms, etc.) as the filtered sample. Once the entire contents of the Van Veen were processed in this manner, the filtered sample was transferred to a cloth bag and preserved with 10 percent buffered formalin in a 5-gallon bucket. In addition to the standard exterior label, a waterproof paper interior label was included inside each sample bag with the same information as the exterior label. The sieved, preserved samples were labeled and stored at ambient temperature prior to shipment.

TOC and grain size samples were shipped to Tetra Tech's geotechnical lab in Orlando, Florida. Toxicity samples were shipped to Tetra Tech's toxicology lab in Owings Mills, Maryland. Sieved samples for benthic infaunal identification were shipped to EcoAnalysts in Moscow, Idaho.

2.1.2 WATER QUALITY

Water quality data were collected in conjunction with the benthic sampling. *In-situ* water quality parameters were measured near the bottom, middle, and top of the water column from representative areas where sediment grabs were obtained, using a YSI 6920 sonde and water quality meter equilibrated at each site. These data provide a characterization of the ambient water quality conditions of the water column to which benthic organisms are exposed. Within each area (NLDS, NBDS, CSDS, and off-site), measured parameters included temperature, specific conductance, dissolved oxygen (DO), pH, and turbidity. The cable for the sonde was marked at 1-m depth intervals and was lowered to the appropriate measurement depth, where readings were recorded after DO readings stabilized.

2.1.3 FISH TRAWLS

Fish were collected as part of the CT DEEP Long Island Sound Trawl Survey. This survey encompasses an area from Pawcatuck to Greenwich, Connecticut and includes waters from 5 to 46 m deep in both Connecticut and New York state waters. Typically, Long Island Sound is surveyed in the spring, from April through June, and during the fall, from September through October. The sites for this project were surveyed during June 2013 in Connecticut waters: four on 10 June, one on 12 June, and one on 13 June (Table 3). This somewhat temporal spacing was a consequence of schedule; however, since all trawls were conducted within three days, it is not expected that fish assemblages would change drastically within this time frame. Trawl stations were designated from the randomly selected stations to best represent similar habitat conditions for that general site area. All sampling protocols and methods are described in detail within the most recent LIS trawl survey report (Gottschall and Pacileo 2012). A trawl net was towed through one station at each of the three active or historic dredged material disposal sites (tows AC2013001, AC2013003, and AC2013006 at NLDS, NBDS, and CSDS, respectively), plus an additional three tows off-site (tows AC2013002, AC2013004, and AC2013005) for a total of six tows (Table 3; Figure 4). Since fishes are highly mobile, tows in close proximity were considered representative of conditions on dredged material disposal sites; therefore, the on-site tows are not directly transecting sites. The selection was performed in consultation with the resource scientists of CT DEEP to ensure proper representation of the stations selected for this study aligned with their pre-selected locations. Actual trawl locations may have been adjusted in the field, taking weather, tides, and fixed fishing gear into consideration; however, CT DEEP crews strived to remain as close as possible to pre-determined trawl coordinates. For each trawl, CT DEEP employed the following naming convention: "AC" denotes a trawl specific to this project, followed by the year and the sequence number. For graphical simplicity, only the last digit of the site ID was used in Figure 4 (e.g., AC2013001 is represented as 1). Additional trawls conducted by CT DEEP as part of their annual LIS trawl survey (i.e., not specifically for this study) follow a different naming convention, with "SP" denoting spring and "FA" denoting fall. These are followed by the year and trawl sequence number. Station information for the entire trawl survey, including location, tow duration, water quality, and haul data, can be found in Gottschall and Pacileo (2012).

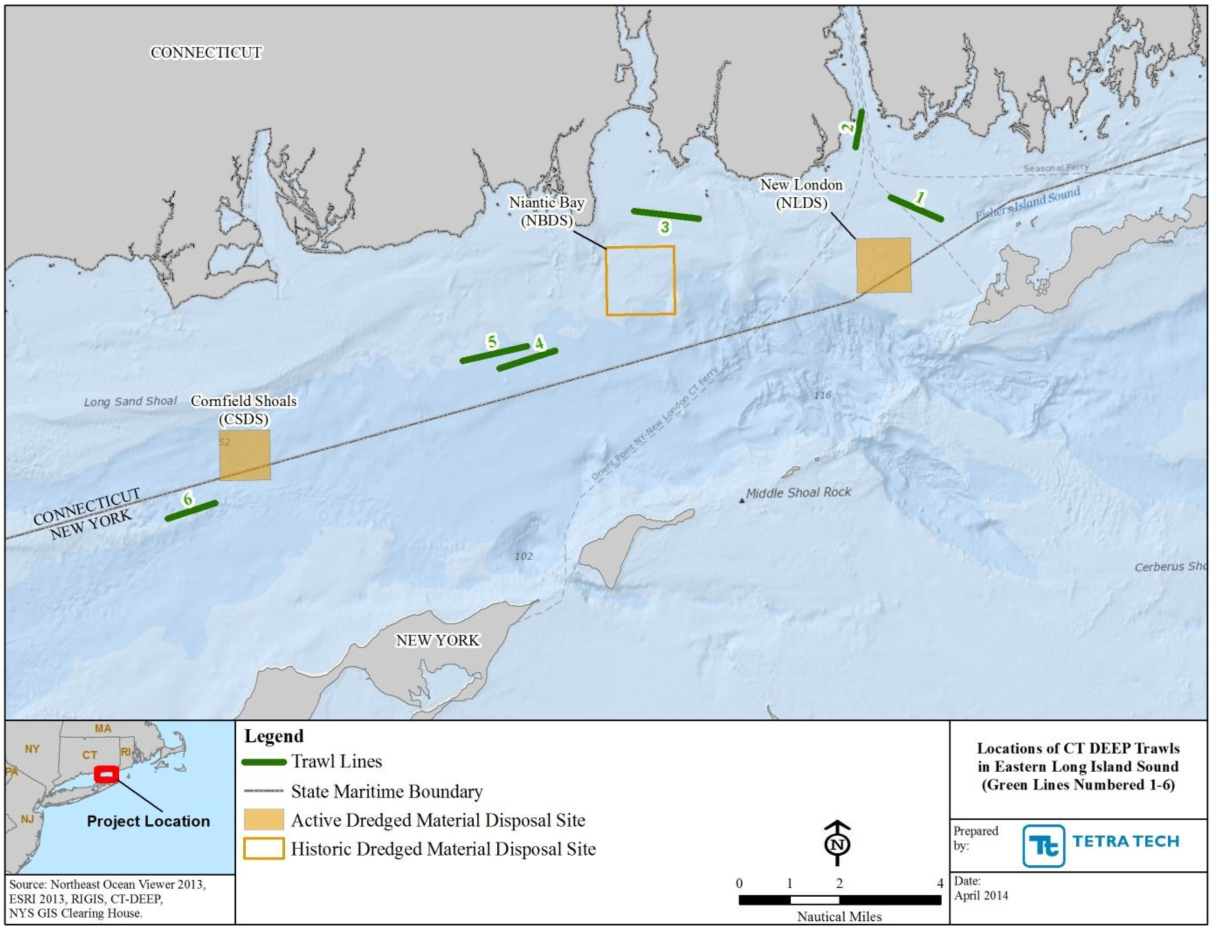


Figure 4: Locations of Connecticut Department of Energy and Environmental Protection (CT DEEP) Trawls in Eastern Long Island Sound (Green Lines Numbered 1–6)

The survey's otter trawl was towed from the 23.3 m (76.5 ft.) R/V *Connecticut* for 30 minutes at approximately 3.5 knots, depending on the tide. The trawl net was a Wilcox 14.0 m (46.0 ft) high-rise net (two seam) with steel "V" type doors. Each tow was approximately 2 miles in length. Upon completion of the tow, the catch was funneled through the sorting table and categorized by species. Catch data were obtained for each of the six tows. Additional gear specifications and methods are described in the LIS trawl survey report (Gottschall and Pacileo 2012).

Consistent with previous LIS studies at these sites and CT DEEP reports, winter flounder (*Pseudopleuronectes americanus*), scup (*Stenotomus chrysops*), bluefish (*Pomatomus saltatrix*), and striped bass (*Morone saxatilis*) were chosen as the primary species of interest (ENSR 2000). The windowpane flounder (*Scophthalmus aquosus*) and striped searobin (*Prionotus evolans*) were considered secondary species of interest. Finfish, lobsters, and squid were counted and weighed in aggregate (to the nearest 0.1 kg) by species with a precision marine-grade scale (30 kg, +/- 10 g capacity).

Table 3: Connecticut Department of Energy and Environmental Protection (CT DEEP) Trawl Times and Locations for Fish Surveys

Tow ID	Date	Time (start)	Duration (min)	Latitude (N)	Longitude (W)	Location (NLDS, NBDS, CSDS, off-site)
AC2013001	10 June 2013	0854	30	411755	720435	NLDS
AC2013003	10 June 2013	1258	30	411711	720904	NBDS
AC2013006	13 June 2013	0806	30	411141	722377	CSDS
AC2013002	10 June 2013	1048	30	411965	720510	Off-site
AC2013004	10 June 2013	1437	30	411470	721274	Off-site
AC2013005	12 June 2013	0731	30	411480	721372	Off-site

2.2 LABORATORY ANALYSIS

Benthic sampling was conducted in accordance with the quality objectives and protocols specified in the SAP and QAPP developed for this project that was approved by the EPA. The laboratory protocols were followed under the guidance of the Regional Implementation Manual (RIM), developed by the EPA and USACE (2004). Taxonomic identification was conducted by experts that specialize in the regional benthic infauna. The analysis of each sample and methods used is summarized in the following sections.

2.2.1 SEDIMENT TOXICITY

To measure the toxicity of sediments, a 10-day toxicity test was completed using unfiltered sediment collected from four benthic grabs in eastern Long Island Sound from each dredged material disposal site and off-site (Sites P011, P018, P003, and R024; Figure 2 and 3). Sediment samples were collected using a Van Veen grab, then transferred to sealed plastic bags and stored on ice before and during shipment. The Tetra Tech Ecological Testing Facility in Owings Mills, Maryland received the sediment samples on 22 July 2013. The complete methods used in the toxicity test are included in Appendix C. In summary, sediment samples were homogenized and inspected for fauna (if found, organisms were removed). Two test organisms, *Leptocheirus plumulosus* and *Americamysis bahia*, were then exposed to the sediment for a period of 10 days, after which final survival was measured. *L. plumulosus*, measuring 2–4 mm, were put into containers with artificial seawater of 19.4 practical salinity units (psu) at densities of 20 organisms per container, with five replicates. *A. bahia*, 1–5 days of age, were stocked in 25–30 psu salinity at ten organisms per container, with five replicates. Additional control samples were also maintained with identical conditions (e.g., species density, salinity, replicates), to determine organism quality and verify that the laboratory methods did not affect survival. Control sediment was from the Boardman River in Michigan. Survival of 90 percent or greater within the control sample was required to validate the acceptability of the test. This control test verified that organisms were of good health and could survive in laboratory conditions. Therefore, any significant decrease in survival in test (i.e., Long Island Sound) sediment, either from dredged material disposal sites or off-site reference areas, could be attributed to sediment toxicity rather than confounding factors.

2.2.2 TOTAL ORGANIC CARBON (TOC) AND GRAIN SIZE

Grain size and TOC samples were analyzed by Tetra Tech's Ardaman Laboratory in Orlando, Florida. Grain size samples were analyzed according to method D422, "Particle-Size Analysis of Soils," using sieve analysis (Tetra Tech 2013c). These methods require sifting the sediment samples through progressively smaller, nested sieves. Results were determined by dividing the post-drying weight of material retained by each sieve by the total post-drying weight of the sample. Size ranges for each category were as follows: gravel was retained on the No. 4 sieve (0.185"); coarse sand passed through the No. 4 sieve and was retained in the No. 10 sieve (0.078"); medium sand passed through the No. 10 sieve and was retained in the No. 40 sieve (0.0164"); fine sand passed through the No. 40 sieve and was retained in the No. 200 sieve (0.0029"); silt and clay passed through the No. 200 sieve. Sediment samples were analyzed for TOC in accordance with the SAP developed for this project (Tetra Tech 2013c) and as reported in Appendix B. TOC results were reported as percent organic content. Water content was also measured and reported as percent water content.

2.2.3 BENTHIC INFAUNA

Benthic macroinvertebrate samples were identified by EcoAnalysts in Moscow, Idaho. Individual organisms were picked from each sample, sorted into major taxonomic categories, then further identified by lowest practical taxonomic unit and enumerated. The picking, sorting, and taxonomic identification processes were subject to quality control checks by laboratory staff. Planktonic fauna and colonial epifauna were not included in the raw data files. Data were recorded electronically and taxa were coded with the relevant National Oceanographic Data Center code. Calculations based on species (e.g., diversity, evenness, and number of species) included only those taxa identified to species level.

During previous studies conducted at dredged material disposal sites in Long Island Sound, in support of the site designation EIS (ENSR 2002), a new species in the polychaete worm family Cirratulidae were discovered (Battelle 2003). To ensure that the current taxonomic identification of these worms is consistent with those made for previous studies, the most up-to-date taxonomic references were used for this region. Additional technical documents used for reference and background information were obtained from the DAMOS website (USACE 2014).

2.3 DATA ANALYSIS

Characteristics and patterns within the benthic data were investigated using several different parameters. Species richness (R) is the overall number of species. To measure diversity, the Shannon Diversity Index (H') was calculated as:

$$H' = -\sum_{i=1}^{R} p_i \ \ln \ p_i$$

where p_i is the proportion of an individual species relative to the total species abundance. Greater values of H' correspond to higher diversity. This diversity index can then be used to look at relative abundances of different species, or evenness. Pielou's evenness index,

$$J' = \frac{H'}{H'_{max}}$$

estimates the evenness of different species. H'_{max} is the maximum value of H', equivalent to the natural log of R (where R = total number of species). J' ranges from 0 to 1, with low values representing greater variation between species and high values indicative of more even abundances. A community with similar abundances of various species is considered more even and will have a J' value approaching 1. Statistical comparisons of benthic and finfish data among sites were tested using a two-tailed t-test. All statistical tests used a significance level of $\alpha = 0.05$.

2.4 FISHING ACTIVITY SURVEY

The fishing survey included 22 questions that focused on topics that were similar to the information collected by the 2001 survey (ENSR 2001b). The goal was to generate the greatest response rate of fishermen while ensuring their anonymity. Questions focused on fishing activity by area and season; information was also gathered on trends in catches, such as size, health, and bycatch, observed by fishermen (full survey in Appendix F). The map included in the survey was developed by the EPA and a Tetra Tech fisheries biologist. Within the ZSF, 13 areas (labeled A-M) were delineated based on state boundaries and geographic features, with a conscious effort to avoid overlap with regulatory boundaries (e.g., state or federal management areas). These smaller areas provided a finer spatial scale on which to identify fishing patterns. This survey was offered in several formats, namely website link, phone, social media, and hard copy, in order to generate the greatest response rate. Names, vessels, and contact information were not required; however, individuals had the opportunity to voluntarily identify themselves. The 2001 questionnaire was implemented as a phone survey, relying almost exclusively on unsolicited “cold” calls. The current study used an online survey tool (FluidSurveys), so that a link could be distributed via email or social media (e.g., fishing message boards, electronic newsletters, and websites). A hard copy of the survey, which included the same questions, was also offered by mail to be returned to a Tetra Tech fisheries biologist. The same fisheries biologist's direct line was also available to assist respondents with completing the survey over the phone or to provide additional information. Respondents could choose the most convenient of the response options, leading to an increased response rate. The survey was available for 37 days, from 25 November to 31 December 2013.

Before and during the survey period, fishermen were contacted to encourage participation. Networking efforts included a Tetra Tech biologist attending the executive board meeting of the Southern New England Fishing and Lobster Association in Stonington, Connecticut. The input of commercial, charter, and recreational fishermen was solicited primarily through fishing associations. Multiple associations distributed survey information, including the electronic link and hard copy surveys (Table 4). Often, the cooperation of one organization or individual led to the inclusion of more groups, so the effort to reach out to the fishing community continued throughout the open survey period. Survey data were then analyzed to better understand areas of both biological and socioeconomic importance within eastern Long Island Sound. Initially, any responses that were irrelevant or that contained insufficient information were omitted (e.g., surveys that were not completed beyond the first five questions were excluded).

For analysis, data were organized by relation to the fishing industry (commercial, charter/party boat, and recreational). Commercial fishing data were then further divided by target species (lobster, mollusk, and finfish) due to the substantial differences in gear, location, and seasonality. The charter/party boat industry and the recreational fishery both identified rod and reel as the primary gear type and almost exclusively targeted finfish; therefore, these two categories were not split further. Overall averages (i.e., for all survey respondents regardless of fishery type) were determined using a weighted mean, to account for varying sample sizes of each fishery category.

Table 4: Network Efforts and 2013 Fishing Activity Survey Participation

Individual contacted	Organization	First contacted	Method of contact	Fishermen reached/result
President/lobsterman	Rhode Island Lobstermen's Association	08 November	Emailed; called	75 members; sent 25 hard copies and link
Liaison	Long Island Commercial Fishing Association	08 November	Facebook message; called	Sent 50 hard copies and 40 postcards; link posted on Facebook page; information shared to multiple contacts in industry and regional FMCs
President/lobsterman	Connecticut Commercial Lobstermen's Association	13 November	Called	No response
President/lobsterman	Southern New England Fisherman and Lobsterman Association	13 November	Called	25 members; attended executive board meeting (~12 fishermen); left 25 hard-copy surveys and 10 postcards
Liaison	Commercial Fisheries Center of Rhode Island	20 November	Emailed	Forwarded info to Executive Committee and Commercial Fisheries Center of Rhode Island
President/charter boat captain	Rhode Island Party and Charter Boat Association	20 November	Emailed; called	70 members; sent 20 hard copies and link; meeting held 17 December
Two members/charter boat captains	Mid-Atlantic Fisheries Management Council	26 November	Emailed both individuals	No response from either individual
President/charter boat captain	Connecticut Charter and Party Boat Association	02 December	Called	35 members; sent 20 hard copies and link; meeting held 12 December
President/fisherman	Rhode Island Saltwater Anglers Association	02 December	Called	Sent link electronically
Members	Long Island Fishing Charters	04 December	Emailed individuals	Link sent electronically to 20 individuals
Finfish and crustacean biologist	New York State Department of Environmental Conservation	10 December	Emailed; called	Distributed link electronically to about 13,000 contacts
President	Rhode Island Fishermen's Alliance	11 December	Called	200 members (~75% fishermen); link distributed in weekly newsletter
Liaison	Viking Fleet charter/party boat fleet (NY)	11 December	Emailed	Distributed link electronically
NEFMC/captain	Frances Fleet charter/party boat fleet (RI)	11 December	Emailed	No response
Elected board member	East Hampton Fisheries Committee	11 December	Emailed	Circulated link to Fisheries Committee and local fishermen
President/fisherman	Rhode Island Commercial Fishermen's Association	11 December	Called	Missed calls; no response to last two calls

Individual contacted	Organization	First contacted	Method of contact	Fishermen reached/result
Member/captain	North Fork Captains Association; Montauk Boatman's Association	11 December	Called	20 members; sent link electronically
Public fishery forum	Noreast.com	11 December	Posted survey online	Over 1,000 views; fishermen of all types
Member/captain	Anonymous	06 December	Called in	Completed online survey
Member/captain	Anonymous	09 December	Called in	Completed online survey
Captain	Anonymous	11 December	Called in	Completed online survey
Commercial charter fisherman	Anonymous	13 December	Called in	Completed online survey
Lobsterman	Anonymous	18 December	Called in	Completed hard-copy survey
Fisherman	Anonymous	19 December	Called in	Completed online survey
Fisherman	Anonymous	23 December	Called in	Completed online survey

3 RESULTS

Results from the sampling effort in eastern Long Island Sound are summarized below. For the Benthic sampling effort, sediment descriptions are provided in Table 5. Grain size, water quality, and benthic infauna abundance are summarized in Tables 6, 7, and 8, respectively. Datasheets used in the field are included in Appendix A. Detailed results of TOC, grain size, toxicity, and infauna diversity are further presented by area. For information pertaining to dredged material disposal activities and monitoring programs, refer to USACE's DAMOS website (USACE 2014). Results of the fish trawl survey, executed by CT DEEP, are also included within this section. Additional detail and historic data from the annual LIS trawl survey are kept up to date by CT DEEP (2014). Finally, the fishing activity survey results are included at the end of this section.

Table 5: Site Location and Sediment Description for Benthic Sampling in Eastern Long Island Sound

Site ID	Date	Depth (ft.)	Description
New London Dredged Material Disposal Site (NLDS)			
P009	16 July 2013	61.8	Light brown to black clayey sand with trace shell
P011a	16 July 2013	59.1	Light brown to brown silty sand with shell
P011b	16 July 2013	59.1	Light brown to brown silty sand with shell and trace roots
P011c	16 July 2013	59.1	Light brown to brown sand with silt, shell and trace roots
P013	16 July 2013	66.3	Brown to black clay with sand and trace roots and shell
P014	16 July 2013	61.4	Gray sandy clay with trace shell and roots
P015	16 July 2013	59.3	Brown to dark gray clayey sand with shell
R014	16 July 2013	61.9	Gray to light brown clayey sand with shell
Niantic Bay Historic Dredged Material Disposal Site (NBDS)			
P017	17 July 2013	123.0	Orangey-brown clayey sand with shell and trace roots
P018a	17 July 2013	109.0	Light brown to brown sand with gravel and shell
P018b	17 July 2013	109.0	Light brown to brown sand with shell
P018c	17 July 2013	105.0	Light brown to brown sand with shell
P019	17 July 2013	92.0	Light brown to brown sand with silt and shell
P023	17 July 2013	88.7	Light brown to brown sand with gravel and shell
P025	17 July 2013	92.1	Light brown to brown sand with shell and trace roots
R001	17 July 2013	100.0	Light brown to brown sand with shell
R004	17 July 2013	84.0	Light brown to brown sand with shell and trace roots
R018	17 July 2013	54.2	Light brown to brown sand with gravel and shell
Cornfield Shoals Dredged Material Disposal Site (CSDS)			
P003a	17 July 2013	178.0	Light brown to brown sand with gravel, shell and trace roots
P003b	17 July 2013	158.0	Light brown to brown sand with silt and gravel and shell and trace roots
P003c	17 July 2013	157.0	Light brown to brown sand with silt, shell and trace roots
Off-site			
P001	17 July 2013	178.0	Light brown to brown sand with shell and roots
P002	17 July 2013	171.0	Light brown to brown sand with silt and shell
P006	18 July 2013	143.0	Light brown to brown sand with silt, shell and trace roots
P007	18 July 2013	115.0	Light brown to brown gravel (shell) with sand; live shells removed from sand
P008	16 July 2013	65.7	Dark gray to light brown clayey sand with shell and trace roots
P010	16 July 2013	66.8	Light brown to brown sand with silt, shell and trace roots
P016	17 July 2013	132.0	Light brown to brown sand with gravel and shell
P020	17 July 2013	95.1	Light brown to gray clayey sand with shell

Site ID	Date	Depth (ft.)	Description
P021	18 July 2013	105.0	Light brown to brown clayey sand with shell and trace roots
P022	17 July 2013	87.9	Light brown to brown sand with silt and shell
R007	18 July 2013	78.9	Light brown to dark gray clayey sand with shell
R020	16 July 2013	71.6	Light brown to brown sand with silt, shell and trace roots
R023	16 July 2013	69.3	Light brown to brown sand with silt, shell and trace roots
R024	18 July 2013	119.0	Light brown to brown clayey sand with gravel and shell
R025	18 July 2013	144.0	Orangeish-brown to dark gray clayey sand with shell and trace roots
R026	17 July 2013	140.0	Light brown to dark gray sand with silt and gravel and shell
R027	17 July 2013	93.5	Light brown to brown sand with clay and gravel and shell
R101	17 July 2013	69.1	Light brown to brown sand with clay, shell and trace roots
R102	17 July 2013	81.1	Brown sand with trace shell
R103	17 July 2013	112.0	Light brown to brown gravel with clay and sand and trace roots
R105	18 July 2013	69.0	Light brown to brown clayey sand with shell
R106	18 July 2013	67.3	Light brown to brown sand with silt and shell
R107	18 July 2013	59.6	Light brown to brown clayey sand with gravel and shell and trace roots
R108	18 July 2013	89.5	Light brown to brown clayey sand with shell
R109	18 July 2013	80.3	Brown clayey sand with shell
R110	18 July 2013	66.3	Brown clayey sand with shell
R111	18 July 2013	69.4	Brown clayey sand with shell
R112	18 July 2013	69.6	Light brown to brown sand with shell
R113	18 July 2013	101.0	Brown sand with silt and shell
R114	18 July 2013	161.0	Light brown to brown sand with clay and shell

Individual grab characteristics are described in the following sections, but Table 6 and Figure 5 summarize average conditions for all sites by area. Medium sand dominated the grabs from NBDS, CSDS, and off-site. NLDS, however, was dominated by silt and clay. Complete grain size and organic content data are included in Appendix B.

Table 6: Average Grain Size and Organic Content of Sediment Samples Collected within Eastern Long Island Sound

Grab Location	Organic Content (%)	Water Content (%)	Particle-size Distribution (from dry mass)					
			Sample Dry Mass (grams)	Gravel-size (%)	Sand-size (%)			Silt- & Clay-size (%)
					Coarse	Medium	Fine	
NLDS	2.7	59.4	263.9	9.1	5.5	22.2	29.2	34.1
NBDS	0.6	23.5	421.5	18.5	14.6	48.8	13.4	4.7
CSDS	0.6	25.0	354.7	23.7	9.2	46.3	15.8	5.0
Off-site	1.0	32.5	336.1	16.4	8.7	37.3	27.0	10.6

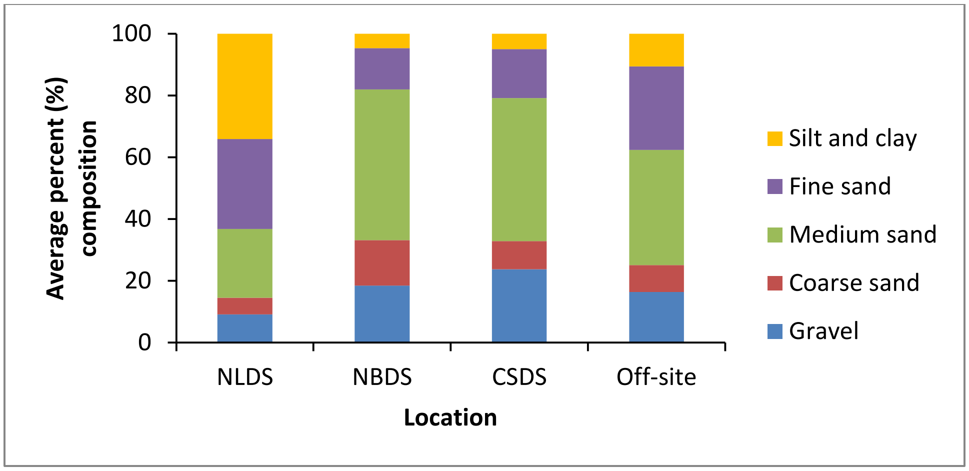


Figure 5: Average Percentage of Sediment Type for Each Location

Water quality parameters were measured at the surface, middle, and bottom of the water column within each dredged material disposal site, as well as two off-site stations (Table 7). These values represent the expected conditions of eastern Long Island Sound: mild stratification with the bottom layer containing the denser (i.e., colder and saltier) water. Since the water quality meter used was not capable of taking actual salinity readings, conductivity was used as a surrogate to represent ionic concentrations. Like salinity, greater values of conductivity indicate greater ion concentration. Conductivity measured in the field was used to calculate salinity, reported in Table 7. Temperature decreased with depth, while salinity and DO increased with depth. Based on these data, a slight pycnocline (i.e., density gradient) existed during sampling efforts. Mixing was expected between the top and bottom layers, though, which ensures adequate levels of nutrients and oxygen throughout the water column. Since most marine life requires DO concentrations of at least 5 mg/L, the entire water column appears to provide sufficient oxygen for organisms. During benthic sampling, the study area did not have any oxygen issues (e.g., hypoxia or anoxia). Temperature and salinity data collected by CT DEEP during fish trawls for this study show similar results (Section 3.5.1).

Table 7: Water Column Measurements (Surface, Middle, and Bottom) for All Sites, Collected with a YSI 6920 during Benthic Sampling, July 2013

Site	Date	Depth (ft)	Surface				Middle				Bottom			
			Temp (°C)	Salinity (psu)	DO (mg/L)	pH	Temp (°C)	Salinity (psu)	DO (mg/L)	pH	Temp (°C)	Salinity (psu)	DO (mg/L)	pH
NLDS	19 July 2013	59.0	19.50	28.1	6.85	8.21	19.56	29.5	6.72	8.19	19.37	28.9	6.66	8.19
NBDS	19 July 2013	70.0	19.45	28.2	7.19	8.18	18.58	29.7	6.91	8.17	18.51	30.0	6.84	8.16
CSDS	19 July 2013	149.0	19.82	29.8	7.94	8.19	19.25	29.7	7.40	8.16	19.14	28.8	7.29	8.17
Off-site A	19 July 2013	81.0	19.42	28.9	7.09	8.22	18.42	30.9	6.74	8.18	17.37	32.2	6.51	8.14
Off-site B	19 July 2013	71.0	19.58	29.0	6.99	8.22	19.20	29.9	6.75	8.19	17.50	31.4	6.52	8.15

The benthic samples collected during this survey exhibited a high degree of taxonomic diversity (see Appendix D for full results). Sampling intensity varied by site, with eight sites at NLDS, ten at NBDS, three at CSDS, and 30 off-site. The total number of individuals, biomass, and species richness is affected by numbers of sample sites; all other parameters are standardized for comparison. At all sites, the top three phyla with the highest number of individuals were Annelida, Arthropoda, and Mollusca, with the remaining seven phyla representing less than 3 percent of the infaunal composition at any given site (Table 8). In NLDS, NBDS, and CSDS, arthropods were the most numerically dominant taxa, making up between 35 and 45 percent of all individuals. Off-site grabs were dominated by annelids, which made up almost 38 percent of all individuals. The average density of individuals per grab (i.e., total individuals/number of samples) were similar among all four sites, ranging from the lowest of 528 (NBDS) to 693 (CSDS), with NLDS and off-site densities intermediate at 615 and 625, respectively.

Table 8: Abundance of Individuals by Phyla for All Sites

Phylum	**NLDS**		**NBDS**		**CSDS**		**Off-site**	
	Total	**% of individuals**	**Total**	**% of individuals**	**Total**	**% of individuals**	**Total**	**% of individuals**
Annelida	2,039	41.43	1,413	26.77	618	29.70	7,120	37.95
Arthropoda	2,215	45.01	1,980	37.51	745	35.80	6,125	32.65
Mollusca	611	12.42	1,735	32.87	656	31.52	5,153	27.47
Nemertea	33	0.67	54	1.02	55	2.64	160	0.85
Echinodermata	22	0.45	90	1.71	3	0.14	143	0.76
Cnidaria	0	0.00	2	0.04	3	0.14	46	0.25
Sipuncula	1	0.02	3	0.06	0	0.00	10	0.05
Platyhelminthes	0	0.00	0	0.00	1	0.05	3	0.02
Phoronida	0	0.00	0	0.00	0	0.00	1	0.01
Chordata	0	0.00	1	0.02	0	0.00	0	0.00
Average density (individuals per grab)	615		528		693		625	
Species Richness	208		196		115		282	
Species Diversity (H')	3.297		2.934		2.851		2.753	
Pielou's Evenness (J')	0.754		0.714		0.675		0.696	
Number of samples (n)	8		10		3		30	

In addition to abundance, wet-weight biomass (in mg), was determined for major taxa represented in each benthic grab. These results are summarized in Table 9 as weight and percent of total. For all sites, mollusks contributed the most biomass, from about 82 percent in off-site grabs to 96 percent at CSDS. Crustaceans and polychaetes had the next highest biomass by taxa; however, they made up a relatively low proportion of the samples compared to phylum Mollusca. Within-site comparisons of diversity, as well as species-specific abundances, are provided in the following sections.

Table 9: Biomass of All Samples Collected Within Each Dredged Material Disposal Site and Off-site

Taxa	NLDS		NBDS		CSDS		Off-site	
	Weight (mg)	% of total	Weight (mg)	% of total	Weight (mg)	% of total	Weight (mg)	% of total
Mollusca	90,464	84.55	102,293	92.29	24,993	96.09	160,570	82.09
Crustacea	12,101	11.31	4,516	4.07	326	1.25	20,592	10.53
Polychaeta	4,323	4.04	2,247	2.03	643	2.47	12,222	6.25
Echinodermata	35	0.03	1,514	1.37	12	0.05	1,986	1.02
Cnidaria	0	0.00	225	0.20	110	0.42	701	0.36
Other taxa[1]	66	0.06	46	0.04	35	0.13	202	0.10
Total	**106,989**		**110,841**		**26,010**		**195,602**	

[1] Other taxa include nemerteans, sipunculids, echiurids, ascidians, urochordates, lophophorates, and Platyhelminthes.

3.1 NEW LONDON DREDGED MATERIAL DISPOSAL SITE (NLDS)

3.1.1 STATION CHARACTERISTICS

Within the New London Dredged Material Disposal Site (NLDS), six sites were targeted for benthic grabs, with one site sampled in triplicate, for a total of eight benthic samples: P011 (triplicate samples), R014, P014, P015, P013, and P009. All eight samples were analyzed for benthic infauna, TOC, and grain size. P011 sediment was also used in a 10-day toxicity test. The DAMOS program has additional data on NLDS characteristics from previous monitoring studies (USACE 2014).

3.1.2 BENTHIC HABITAT AND SEDIMENT TYPES

In addition to descriptive observations (Table 5), each benthic grab at NLDS was characterized by particle size. Table 10 includes site-by-site organic content (or TOC), water content, sample mass, and particle size distributions for all benthic grabs within NLDS. These are represented graphically in Figure 6.

Table 10: Grain Size and Organic Content of Sediment Samples Collected within New London Dredged Material Disposal Site (NLDS)

Grab Sample	Organic Content (%)	Water Content (%)	Particle-size Distribution (from dry mass)					
			Sample Dry Mass (grams)	Gravel-size (%)	Sand-size (%)			Silt- & Clay-size (%)
					Coarse	Medium	Fine	
P009	3.8	79.6	154.83	5.3	4.6	17.9	34.1	38.1
P011a	1.5	30.8	406.15	16.2	7.2	31	35.7	9.9
P011b	1.5	32.9	321.09	16.7	6.2	24.3	40.4	12.4
P011c	1.2	28.9	383.02	10.4	7.0	34.8	39.5	8.3
P013	6.2	124.9	116.36	3.1	1.1	3.8	11.5	80.5
P014	3.7	85.1	165.48	1.7	2.8	9.1	22.1	64.3
P015	1.2	33.0	323.58	5.5	7.3	39.3	31.6	16.3
R014	1.9	60.1	240.34	14.0	7.4	17.2	18.3	43.1
Average	**2.7**	**59.4**	**263.9**	**9.1**	**5.5**	**22.2**	**29.2**	**34.1**

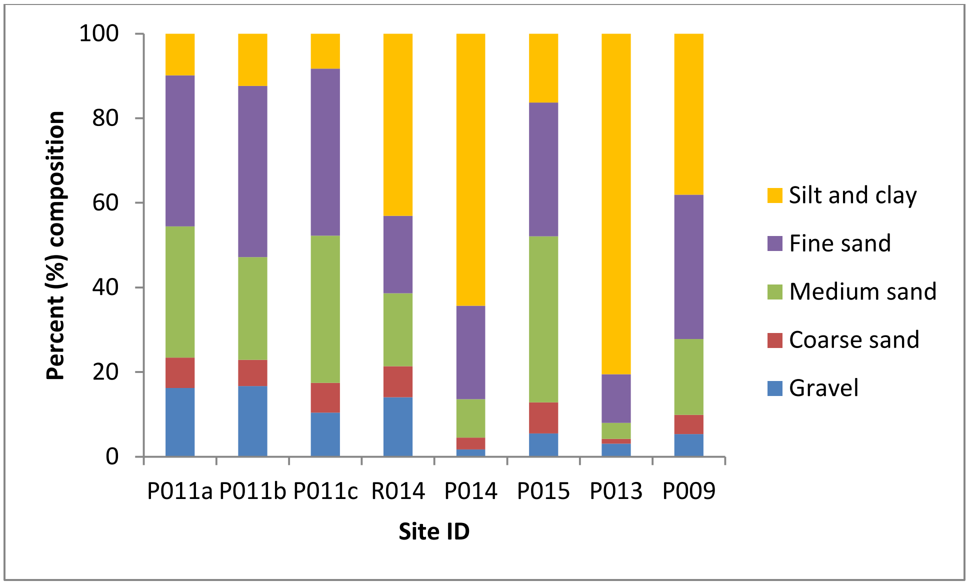


Figure 6: Percentage of Sediment Type for Each Benthic Grab within New London Dredged Material Disposal Site (NLDS)

Of the eight benthic grabs analyzed, five were dominated by sand-size particles, while three were dominated by silt- and clay-size particles (Figure 6). Where sand-size particles were dominant, medium and fine sand, not coarse sand, made up most of the sample. On average, NLDS grabs consisted of approximately 57 percent sand, 34 percent silt and clay, and 9 percent gravel. Organic content ranged from 1.2 to 6.2 percent, averaging 2.6 percent.

3.1.3 SEDIMENT TOXICITY

A toxicity test was conducted using sediment collected at site P011 (See Appendix C). As required, the test was validated by a greater than 90 percent survival of organisms in control sediment. *L. plumulosus* experienced a mean survival of 96 percent. Mean survival of *A. bahia* was 82 percent.

3.1.4 BENTHIC INFAUNA

The results of benthic infauna analysis are summarized in Table 11. The number of individuals collected in one benthic grab with NLDS ranged from 259 at site R014 to 875 at site P011b, with an average of 617 individuals. Two sites, P014 and R014, both had 60 species identified, which were the fewest. The greatest species richness was 100, which occurred at both site P011c and P015. Species richness, denoted as R, was 208 for the NLDS. Diversity indices ranged from 2.840 to 3.761. The most diverse sample was P011c; the least diverse was P014. The average Shannon diversity index was 3.297. The three most abundant species were two amphipods, *Ampelisca* sp. and *Ampelisca vadorum*, and the polychaete *Ampharete cf. lindstroemi*.

Table 11: Total Individuals, Species, and Diversity Indices for Benthic Samples Collected within New London Dredged Material Disposal Site (NLDS)

Sample ID	Total individuals	Species richness (R)	Diversity index (H')	Pielou's evenness (J')
P009	733	92	3.089	0.683
P011a	511	65	3.147	0.754
P011b	875	94	3.474	0.765
P011c	752	100	3.761	0.817
P013	634	73	3.044	0.709
P014	396	60	2.840	0.694
P015	772	100	3.801	0.825
R014	259	60	3.218	0.786
Average	**617**	**208**[1]	**3.297**	**0.754**

[1] This value represents total species richness for the site; it is not an average.

3.2 OFF-SITE AREA SURROUNDING BARTLETT REEF/GOSHEN POINT/THE RACE

3.2.1 STATION CHARACTERISTICS

Off-site areas adjacent and intermediate to the dredged material disposal sites were sampled. Off-site areas were sampled with 30 benthic grabs at 30 sites (i.e., no triplicate samples were taken at off-site grab locations). All 30 samples were analyzed for benthic infauna, TOC, and grain size. Sediment from site R024 was submitted to a 10-day toxicity test.

3.2.2 BENTHIC HABITAT AND SEDIMENT TYPES

In addition to descriptive characterizations (Table 5), each benthic grab conducted off-site was characterized by particle size. Table 12 includes site-by-site organic content (or TOC), water content, sample mass, and particle size distributions for all off-site benthic grabs. These are represented graphically in Figure 7.

Table 12: Grain Size and Organic Content of Sediment Samples Collected Off-site of Dredged Material Disposal Sites

Grab Sample	Organic Content (%)	Water Content (%)	Particle-size Distribution (from dry mass)					
			Sample Dry Mass (grams)	Gravel-size (%)	Sand-size (%)			Silt- & Clay-size (%)
					Coarse	Medium	Fine	
P001	0.4	22.6	360.15	25.8	16.9	43.3	12.2	1.8
P002	0.5	22.1	388.45	14.5	15.3	56.8	7.3	6.1
P006	1.1	29.0	301.53	8.6	15.7	50.8	13.6	11.3
P007	1.9	33.5	77.72	74.9	8.0	10.9	3.0	3.2
P008	1.4	40.9	208.05	4.6	5.9	23.8	48.4	17.3
P010	1.0	36.3	294.99	4.3	5.2	26.6	55.1	8.8
P016	0.4	20.3	428.21	29.3	7.6	48.3	11.8	3.0
P020	1.4	36.2	272.71	9.3	6.4	37.5	29.8	17.0
P021	1.1	34.9	282.47	4.3	7.1	47.1	28.7	12.8
P022	0.5	22.6	430.09	24.6	13.7	41.2	15.2	5.3
R007	1.7	52.3	233.20	4.8	5.5	23.1	41.6	25.0
R020	0.8	33.7	377.29	3.2	4.4	26.0	59.1	7.3

Grab Sample	Organic Content (%)	Water Content (%)	Particle-size Distribution (from dry mass)					
			Sample Dry Mass (grams)	Gravel-size (%)	Sand-size (%)			Silt- & Clay-size (%)
					Coarse	Medium	Fine	
R023	1.5	42.5	278.57	5.1	5.6	23.0	56.9	9.4
R024	0.9	30.7	434.61	27.7	13.2	31.5	14.1	13.5
R025	1.3	41.1	315.47	11.2	5.8	28.6	29.0	25.4
R026	1.2	36.9	264.29	29.7	15.6	35.1	9.8	9.8
R027	0.8	23.5	418.68	31.7	12.9	43.2	3.6	8.6
R101	0.5	19.6	464.91	19.8	18.3	44.1	12.5	5.3
R102	0.2	25.0	237.60	0.1	2.0	95.8	1.4	0.7
R103	1.0	19.2	539.20	64.2	5.1	13.0	8.5	9.2
R105	1.3	42.8	287.89	6.1	4.9	28.8	44.0	16.2
R106	0.7	34.2	388.06	7.3	7.4	41.5	37.3	6.5
R107	1.3	32.1	369.77	19.8	8.1	32.8	28.3	11.0
R108	1.3	40.6	321.78	7.3	2.6	25.2	49.8	15.1
R109	1.4	37.1	345.04	11.0	4.6	19.8	48.0	16.6
R110	0.9	32.8	296.57	4.8	5.3	29.4	48.5	12.0
R111	1.8	42.0	313.72	10.8	7.0	24.9	37.1	20.2
R112	0.6	26.2	436.98	3.5	19.3	64.3	11.1	1.8
R113	0.7	34.4	389.90	5.5	5.4	56.2	23.7	9.2
R114	1.1	30.7	325.54	19.0	5.9	46.1	20.8	8.2
Average	**1.0**	**32.5**	**336.10**	**16.4**	**8.7**	**37.3**	**27.0**	**10.6**

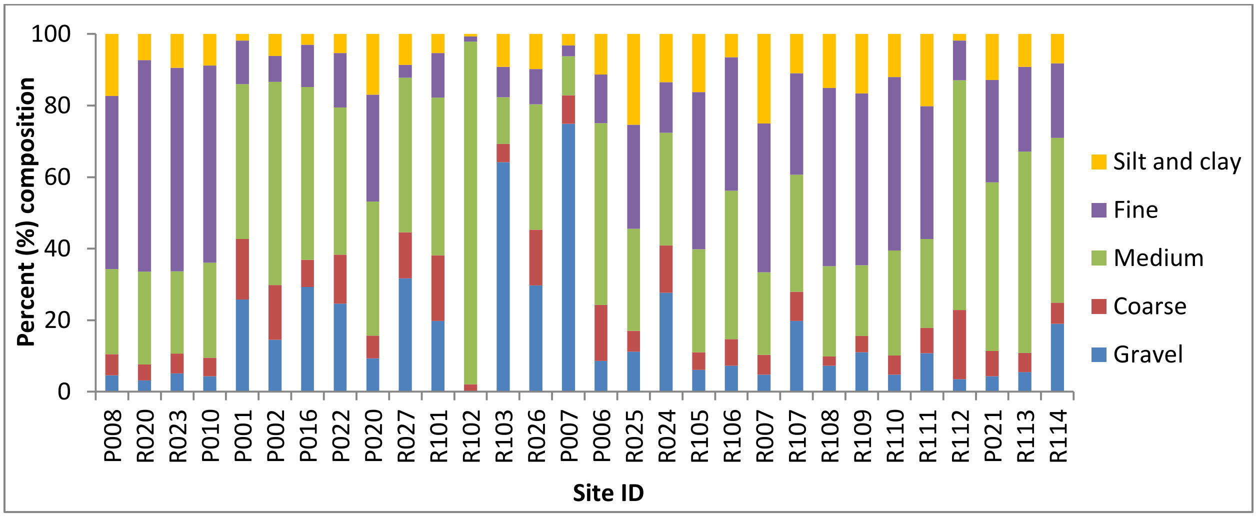


Figure 7: Percentage of Sediment Type for Each Benthic Grab Off-site

In areas adjacent to dredged material disposal sites, 30 off-site benthic sites were sampled. Of these, 28 benthic grabs were dominated by sand-size particles, while only two were dominated by gravel-size particles (Table 12). On average, off-site grabs consisted of approximately 73 percent sand, 16 percent gravel, and 11 percent silt and clay. Organic content ranged from 0.2 to 1.9 percent and averaged 1.0 percent.

3.2.3 SEDIMENT TOXICITY

The 10-day toxicity test for the off-site area was run with the sediment sample from site R024 (See Appendix C). The test was validated by a greater than 90 percent survival of organisms in control sediment. The species *L. plumulosus* had an average survival of 94 percent. Mean survival of *A. bahia* was 88 percent.

3.2.4 BENTHIC INFAUNA

Results from benthic grabs collected off-site of dredged material disposal sites were quite variable (Table 13). Site R102 had the fewest individuals, only 52, as well as the fewest number of species, 12. The greatest number of individuals at any one site was 3,905 at site P016. This site also had 104 identified species, the most of any off-site sample. On average, however, a sample contained 626 individuals. The species richness for the off-site area was 282. The lowest diversity index of 1.320 was reflected by site R110. The highest diversity index of 3.652 belonged to site R027. The mean diversity index for off-site samples was 2.753. At off-site locations, the three most abundant species were two bivalves, *Anadara transversa* and *Crassinella lunulata*, as well as the barnacle *Sessilia* spp.

Table 13: Total Individuals, Species, and Diversity Indices for Benthic Samples Collected off site

Sample ID	Total individuals	Species richness (R)	Diversity index (H')	Pielou's evenness (J')
P001	2,121	66	2.390	0.570
P002	134	32	2.654	0.766
P006	866	65	2.931	0.702
P007	1,874	78	2.326	0.534
P008	703	91	3.392	0.752
P010	312	43	2.820	0.750
P016	3,905	104	2.609	0.562
P020	397	60	3.068	0.749
P021	395	61	2.818	0.685
P022	398	48	2.173	0.561
R007	433	58	2.694	0.663
R020	416	53	3.057	0.770
R023	467	66	3.344	0.798
R024	575	69	3.227	0.762
R025	764	73	3.123	0.728
R027	215	61	3.652	0.888
R101	349	68	3.231	0.766
R102	52	12	1.602	0.645
R103	721	71	2.452	0.575
R104	600	62	2.830	0.686
R105	320	65	3.200	0.767
R106	245	58	3.457	0.851
R107	187	47	3.050	0.792
R108	548	43	2.142	0.569

Sample ID	Total individuals	Species richness (R)	Diversity index (H')	Pielou's evenness (J')
R109	439	33	1.422	0.407
R110	419	33	1.320	0.378
R111	331	61	3.115	0.758
R112	59	21	2.679	0.880
R113	135	32	2.870	0.828
R114	396	54	2.939	0.737
Average	**626**	**282**[1]	**2.753**	**0.696**

[1] This value represents total species richness for the site; it is not an average.

3.3 NIANTIC BAY HISTORIC DREDGED MATERIAL DISPOSAL SITE (NBDS)

3.3.1 STATION CHARACTERISTICS

The Niantic Bay Historic Dredged Material Disposal Site (NBDS) was sampled at eight sites, one of which was sampled in triplicate. Therefore, ten sediment samples were collected: R004, P019, P025, P023, R001, P017, P018 (triplicate samples), and R018. All ten samples were analyzed for benthic infauna, TOC, and grain size. P018 sediment was used in a 10-day toxicity test.

3.3.2 BENTHIC HABITAT AND SEDIMENT TYPES

In addition to descriptive characterizations (Table 5), each benthic grab at NBDS was characterized by particle size. Table 14 includes site-by-site organic content (or TOC), water content, sample mass, and particle size distributions for all benthic grabs within NBDS. These are represented graphically in Figure 8.

Table 14: Grain Size and Organic Content of Sediment Samples Collected within Niantic Bay Historic Dredged Material Disposal Site (NBDS)

Grab Sample	Organic Content (%)	Water Content (%)	Particle-size Distribution (from dry mass)					
			Sample Dry Mass (grams)	Gravel-size (%)	Sand-size (%)			Silt- & Clay-size (%)
					Coarse	Medium	Fine	
P017	0.9	29.1	433.23	17.7	14.8	45.4	9.1	13.0
P018a	0.6	23.1	259.52	25.1	11.6	49.7	10.1	3.5
P018b	0.4	19.8	430.78	25.3	13.0	47.9	10.8	3.0
P018c	0.6	22.9	388.13	18.4	14.7	54.9	8.2	3.8
P019	0.8	28.1	456.66	13.4	13.5	41.3	23.7	8.1
P023	0.4	19.0	510.07	20.9	25.1	39.7	10.8	3.5
P025	0.7	25.6	444.78	12.0	12.3	48.9	22.3	4.5
R001	0.4	19.6	543.99	16.9	13.1	53.7	14.2	2.1
R004	0.5	23.1	459.46	6.4	15.3	60.0	15.0	3.3
R018	0.4	25.1	288.51	28.8	13.0	46.7	9.6	1.9
Average	**0.6**	**23.5**	**421.5**	**18.5**	**14.6**	**48.8**	**13.4**	**4.7**

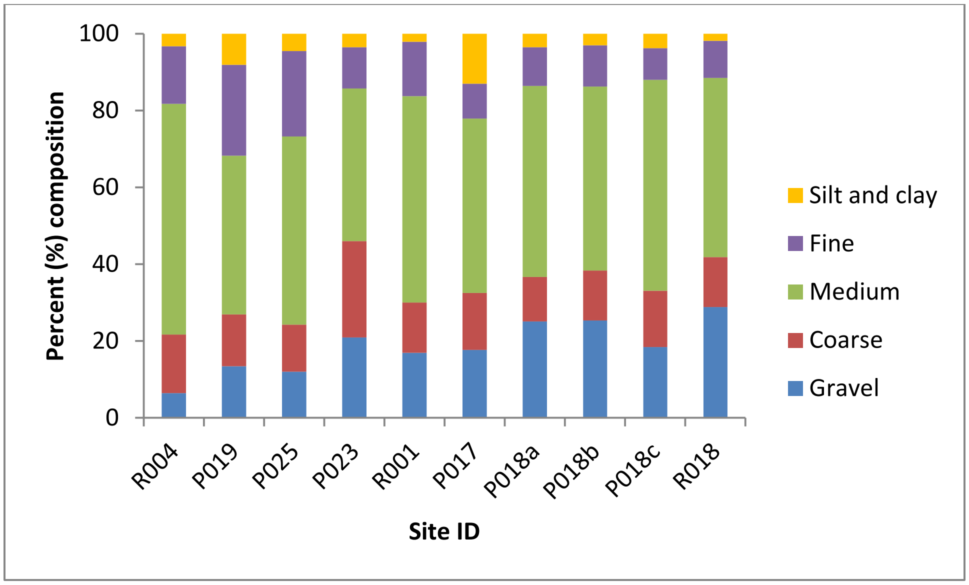


Figure 8: Percentage of Sediment Type for Each Benthic Grab within Niantic Bay Historic Dredged Material Disposal Site (NBDS)

Niantic Bay was sampled at eight sites, one of which was sampled in triplicate, yielding ten total benthic samples. All ten of these samples were dominated by sand-size particles (Table 14). More specifically, the dominant sand-size particle for all NBDS samples was in the medium sand-size category. When averaged, NBDS grabs consisted of approximately 77 percent sand, 19 percent gravel, and 5 percent silt and clay. Organic content ranged from 0.4 to 0.9 percent and averaged 0.6 percent.

3.3.3 SEDIMENT TOXICITY

The sediment from site P018 in NBDS was tested using the 10-day toxicity test (See Appendix C). Since organisms in the control sediment realized greater than 90 percent survival, the test was validated. Mean survival of *L. plumulosus* was 98 percent. Survival of *A. bahia* averaged 92 percent.

3.3.4 BENTHIC INFAUNA

A summary of the benthic infauna found in NBDS samples is provided in Table 15. The average number of individuals collected at a site within NBDS was 529. The maximum number of individuals collected was 837, at site P017. The fewest number of individuals collected was 134 at site R004. The total number of species in a sample ranged from 30 at site R004 to 86 at site P018b. The species richness for these ten samples in NBDS was 196. Diversity indices ranged from a minimum of 1.991 at site R018 to a maximum of 3.595 at site P018b. The average diversity index, however, was 2.934. The three most abundant species at NBDS were the bivalve *Crassinella lunulata*, the amphipod *Ampelisca vadorum*, and the barnacle *Sessillia* spp.

Table 15: Total Individuals, Species, and Diversity Indices for Benthic Samples Collected in Niantic Bay Historic Dredged Material Disposal Site (NBDS)

Sample ID	Total individuals	Species richness (R)	Diversity index (H')	Pielou's evenness (J')
P017	837	79	3.127	0.716
P018a	505	85	3.730	0.840
P018b	680	86	3.595	0.807
P018c	574	71	3.080	0.723
P019	502	57	2.271	0.562
P023	610	62	2.815	0.682
P025	741	65	2.773	0.664
R001	436	56	3.464	0.861
R004	134	30	2.498	0.734
R018	267	37	1.991	0.551
Average	**529**	**196**[1]	**2.934**	**0.714**

[1] This value represents total species richness for the site; it is not an average.

3.4 CORNFIELD SHOALS DREDGED MATERIAL DISPOSAL SITE (CSDS)

3.4.1 STATION CHARACTERISTICS

One site was sampled by triplicate benthic grabs within the Cornfield Shoals Dredged Material Disposal Site (CSDS). Therefore, three sediment samples were collected from site P003. All three samples were analyzed for benthic infauna, TOC, and grain size. Sediment from P003 was also used in a 10-day toxicity test. USACE's DAMOS program has additional data and reports regarding CSDS from previous sampling efforts (USACE 2014).

3.4.2 BENTHIC HABITAT AND SEDIMENT TYPES

In addition to descriptive characterizations (Table 5), each benthic grab at CSDS was characterized by particle size. Table 16 includes site-by-site organic content (or TOC), water content, sample mass, and particle size distributions for all benthic grabs within CSDS. These are represented graphically in Figure 9.

Table 16: Grain Size and Organic Content of Sediment Samples Collected within Cornfield Shoals Dredged Material Disposal Site (CSDS)

Grab Sample	Organic Content (%)	Water Content (%)	Particle-size Distribution (from dry mass)					
			Sample Dry Mass (grams)	Gravel-size (%)	Sand-size (%)			Silt- & Clay-size (%)
					Coarse	Medium	Fine	
P003a	0.6	22.4	410.09	33.5	5.7	41	15.3	4.5
P003b	0.6	24.5	386.84	24.7	10.4	44.4	14.9	5.6
P003c	0.7	28.1	267.11	12.9	11.4	53.5	17.2	5.0
Average	**0.6**	**25.0**	**354.7**	**23.7**	**9.2**	**46.3**	**15.8**	**5.0**

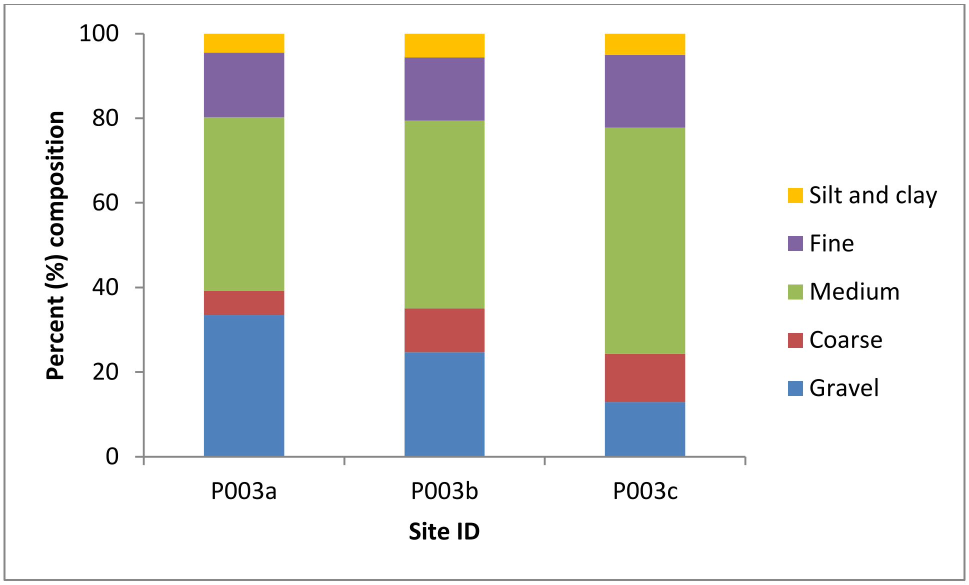


Figure 9: Percentage of Sediment Type for Each Benthic Grab within Cornfield Shoals Dredged Material Disposal Site (CSDS)

Cornfield Shoals Dredged Material Disposal Site was sampled at one site, in triplicate, for a total of three benthic samples. All of the CSDS samples were dominated by sand-size particles (Table 16). More specifically, the dominant sand-size particle for all CSDS samples was categorized as medium sand-size. When averaged, these benthic grabs consisted of approximately 71 percent sand, 24 percent gravel, and 5 percent silt and clay. Organic content ranged from 0.6 to 0.7 percent, with an average of 0.6 percent.

3.4.3 SEDIMENT TOXICITY

The sediment sample from site P003 in CSDS was subjected to a 10-day toxicity test. The test was validated by a greater than 90 percent survival of organisms in control sediment. *L. plumulosus* experienced a mean survival of 98 percent. Survival of *A. bahia* was an average of 92 percent.

3.4.4 BENTHIC INFAUNA

Table 17 includes a summary of benthic infauna characteristics of the three CSDS samples. Sample P003a had 665 individuals, the fewest, while P003b had the greatest at 1,136 individuals. The average number of individuals was 893 per sample. The total species found ranged from 62 in P003b to 71 in P003c, with a total species richness of 115. The diversity index was greatest for P003c and least for P003b; the average was 2.851. At CSDS, the three most abundant taxa were the bivalve mussel *Mytilus edulis*, the amphipod *Corophiidae* spp., and the bivalve clam *Anadara transversa*.

Table 17: Total Individuals, Species, and Diversity Indices for Benthic Samples Collected in Cornfield Shoals Dredged Material Disposal Site (CSDS)

Sample ID	Total individuals	Species richness (R)	Diversity index (H')	Pielou's evenness (J')
P003a	665	70	3.206	0.755
P003b	1,136	62	2.099	0.509
P003c	879	71	3.247	0.762
Average	**893**	**115**[1]	**2.851**	**0.675**

[1] This value represents total species richness for the site; it is not an average.

3.5 FISH SURVEY

3.5.1 SITE CHARACTERISTICS

Water quality data were collected at the surface and bottom of each trawl site in eastern Long Island Sound from 10 to 13 June 2013 (Table 18; Figure 4). Similar to the measurements made during the benthic sampling, these data suggest that there is mild vertical stratification in the water column. Strong stratification precludes exchange between top and bottom layers. Since temperatures are within roughly 1°C from surface to bottom, however, it appears that mixing does occur occasionally. As found during benthic sampling, the abiotic conditions of the water column appear to be suitable for most marine organisms, with no major water quality issues. One anomaly in these measurements is apparent at site AC2013002. At this area off-site, the surface salinity was measured as 18.3 psu. Based on this measurement and the location of the trawl, it is evident that the trawl occurred in the Thames River Estuary. Due to different abiotic conditions at this particular site, trawl data were considered carefully since salinity and thermal tolerance might restrict certain species' distributions.

Table 18: Water Quality Parameters Measured at Trawl Stations

Site ID	Date	Location (NLDS, NBDS, CSDS, off-site)	Depth (ft)	Surface			Bottom		
				Temp (°C)	Salinity (psu)	Sp. Cond. (mS/m)	Temp (°C)	Salinity (psu)	Sp. Cond. (mS/m)
AC2013001	10 June 2013	NLDS	40.7	15.0	27.6	34.66	13.9	30.8	37.37
AC2013003	10 June 2013	NBDS	38.4	15.2	27.7	34.26	14.2	30.0	36.63
AC2013006	13 June 2013	CSDS	110.9	15.5	27.7	35.23	14.2	29.7	36.43
AC2013002	10 June 2013	Off-site	28.2	15.9	18.3	24.90	14.3	30.0	36.73
AC2013004	10 June 2013	Off-site	123.4	14.6	29.7	36.73	13.9	30.6	37.05
AC2013005	12 June 2013	Off-site	116.5	14.7	26.0	31.13	14.1	30.2	36.85

3.5.2 CATCH COMPOSITION

3.5.2.1 Trawls On Dredged Material Disposal Sites

Three trawls were conducted near active or historic dredged material disposal sites (Figure 4). NLDS was sampled by trawl AC2013001, NBDS by AC2013003, and CSDS by AC2013006. Species occurrence and abundance for each site is presented in Table 19. Field data sheets are included in Appendix E.

Of trawls on dredged material disposal sites, NLDS had the greatest number of individuals, while NBDS had the greatest biomass (i.e., weight). CSDS had the lowest number and biomass of fish. From all sites combined, scup was the most abundant species. For the NLDS and NBDS trawls, the most abundant fish by weight was scup, composing greater than 50 percent of the catch by weight. Winter skate made up more than 35 percent of the CSDS trawl and was the most abundant species by weight. The primary target species were scup, striped bass, winter flounder, and bluefish. Scup was present in all three trawls. These fish dominated the NLDS and NBDS catches at 55 and 59.5 percent, respectively, but was less abundant at CSDS at only 8.4 percent. Striped bass were absent at NLDS, and only one individual was caught at each of NBDS and CSDS. Winter flounder was present in all three trawls but at relatively low abundance; the greatest proportion of biomass was 3.2 percent at NLDS. No bluefish were caught at NLDS or NBDS; only one bluefish, which made up 3.6 percent of the catch weight, was caught at CSDS. Secondary target species, striped searobin and windowpane flounder, were not present at NLDS or NBDS but were caught at CSDS. Two striped searobin comprised 1.3 percent of the biomass, and 11 windowpane flounder made up 4.1 percent of the catch. The invasive red algae *Heterosiphonia japonica* from Japan was present in all three trawls at these sample sites.

Table 19: Catch Composition of Trawls On New London, Niantic Bay (Historic), and Cornfield Shoals Dredged Material Disposal Sites (NLDS, NBDS, CSDS)

Common name	Species	AC2013001 (NLDS)			AC2013003 (NBDS)			AC2013006 (CSDS)		
		Count	Weight (kg)	Percent composition	Count	Weight (kg)	Percent composition	Count	Weight (kg)	Percent composition
scup[1]	*Stenotomus chrysops*	676	61.6	55.0	444	76.4	59.5	17	4.5	8.4
striped bass[1]	*Morone saxatilis*	--	--	--	1	3.2	2.5	1	3.4	6.4
winter flounder[1]	*Pseudopleuronectes americanus*	13	3.6	3.2	2	0.4	0.3	1	0.3	0.6
bluefish[1]	*Pomatomus saltatrix*	--	--	--	--	--	--	1	1.9	3.6
striped searobin[2]	*Prionotus evolans*	--	--	--	--	--	--	2	0.7	1.3
windowpane flounder[2]	*Scophthalmus aquosus*	--	--	--	--	--	--	11	2.2	4.1
Asian red algae	*Heterosiphonia japonica*	NA[3]	8.8	7.9	NA[3]	23.9	18.6	NA[3]	0.2	0.4
longfin squid	*Loligo pealeii*	433	22.3	19.9	130	4.9	3.8	5	0.3	0.6
winter skate	*Leucoraja ocellata*	--	--	--	--	--	--	17	19	35.6
little skate	*Leucoraja erinacea*	10	5.2	4.6	1	0.4	0.3	19	12	22.5
spider crab	*Libinia emarginata*	NA[3]	5.9	5.3	NA[3]	3.4	2.6	NA[3]	0.2	0.4
kelp	*Laminaria* spp.	NA[3]	0.6	0.5	NA[3]	7	5.5	--	--	--
smooth dogfish	*Mustelus canis*	--	--	--	--	--	--	2	5.6	10.5
tautog	*Tautoga onitis*	1	1.8	1.6	2	2.4	1.9	--	--	--
mixed algae species	*Algae* spp.	NA[3]	0.7	0.6	NA[3]	2.9	2.3	NA[3]	0.1	0.2
northern searobin	*Prionotus carolinus*	--	--	--	--	--	--	15	2.2	4.1
boring sponge	*Cliona celata*	--	--	--	NA[3]	1.5	1.2	--	--	--
American lobster	*Homarus americanus*	5	1.2	1.1	--	--	--	--	--	--
summer flounder	*Paralichthys dentatus*	--	--	--	1	0.9	0.7	--	--	--
ulva	*Ulva lactuca*	NA[3]	0.1	0.1	NA[3]	0.7	0.5	NA[3]	0.1	0.2

Common name	Species	AC2013001 (NLDS)			AC2013003 (NBDS)			AC2013006 (CSDS)		
		Count	Weight (kg)	Percent composition	Count	Weight (kg)	Percent composition	Count	Weight (kg)	Percent composition
fourspot flounder	*Paralichthys oblongus*	--	--	--	--	--	--	2	0.4	0.8
butterfish	*Peprilus triacanthus*	3	0.1	0.1	1	0.1	0.1	--	--	--
bay anchovy	*Anchoa mitchilli*	--	--	--	1	0.1	0.1	--	--	--
squid eggs	*Loligo pealeii* eggs	--	--	--	NA[3]	0.1	0.1	--	--	--
rock crab	*Cancer irroratus*	--	--	--	NA[3]	0.1	0.1	--	--	--
flat claw hermit crab	*Pagurus pollicaris*	--	--	--	--	--	--	NA[3]	0.1	0.2
rockweed, fucus	*Fucus* spp.	--	--	--	--	--	--	NA[3]	0.1	0.2
Total		**1,141**	**111.9**	**100.0**	**583**	**128.4**	**100.0**	**93**	**53.3**	**100.0**

[1]Primary targeted species; **[2]**Secondary targeted species; [3]Counts not obtained, only weights.

3.5.2.2 Trawls Off-site of Dredged Material Disposal Sites

In addition to the three trawls conducted within dredged material disposal sites, three trawls were made in off-site areas near dredged material disposal sites (Figure 4). Trawl AC2013002 was conducted near NLDS. Trawls AC2013004 and AC2013005 occurred in an area between NBDS and CSDS. Field data sheets are included in Appendix E.

Overall, AC2013005 had the greatest number and biomass of fish compared to trawls both on and off of dredged material disposal sites. The most abundant fish by weight was scup at two of the three sites, 29.7 percent of the catch at AC2013002 and 26.7 percent at AC2013004; smooth dogfish was most abundant at AC2013005, constituting 28 percent of the catch weight (Table 20). Of the primary target species, scup and winter flounder were present in all three trawls, striped bass was only present in one trawl, and bluefish was not present in any of the three trawls. At AC2013005, the high frequency of smooth dogfish drove down the percent composition of scup. Therefore, scup abundance was comparable among all three sites, even though the percent composition varied. Winter flounder abundance was relatively consistent among trawls, making up between 2.1 and 2.6 percent of total biomass. Only one individual striped bass was caught; it occurred at site AC2013002. No bluefish were caught in off-site trawl tows. Striped searobin and windowpane flounder were caught in all three tows. Striped searobin abundance was relatively similar, ranging from 0.2 to 0.9 percent of the total biomass. Windowpane flounder abundance was slightly more variable, ranging from 0.7 to 7.2 percent of biomass caught. Similar to trawls on dredged material disposal sites, all trawls conducted off of a dredged material disposal site contained the non-native Asian red algae *Heterosiphonia japonica*.

Table 20: Catch Composition of Trawls Off-site

Common name	Species	AC2013002			AC2013004			AC2013005		
		Count	Weight (kg)	Percent composition	Count	Weight (kg)	Percent composition	Count	Weight (kg)	Percent composition
scup[1]	*Stenotomus chrysops*	165	16	29.7	292	32.9	26.7	209	20.5	11.6
striped bass[1]	*Morone saxatilis*	1	8.7	16.1	--	--	--	--	--	--
winter flounder[1]	*Pseudopleuronectes americanus*	3	1.4	2.6	10	3.2	2.6	13	3.7	2.1
windowpane flounder[2]	*Scophthalmus aquosus*	1	0.4	0.7	14	3	2.4	62	12.7	7.2
striped searobin[2]	*Prionotus evolans*	1	0.5	0.9	4	0.8	0.6	1	0.3	0.2
smooth dogfish	*Mustelus canis*	--	--	--	6	16.8	13.6	16	49.5	28.0
northern searobin	*Prionotus carolinus*	--	--	--	214	14.6	11.9	351	26.3	14.9
little skate	*Leucoraja erinacea*	2	1.3	2.4	36	19.7	16.0	35	16.8	9.5
spiny dogfish	*Squalus acanthias*	--	--	--	1	3.9	3.2	5	21.4	12.1
winter skate	*Leucoraja ocellata*	--	--	--	10	11.9	9.7	5	5.1	2.9
longfin squid	*Loligo pealeii*	147	6	11.1	59	4.3	3.5	78	4.8	2.7
Asian red algae	*Heterosiphonia japonica*	NA[3]	7.8	14.5	NA[3]	5	4.1	NA[3]	1.2	0.7
summer flounder	*Paralichthys dentatus*	6	3.4	6.3	1	0.8	0.6	3	5.9	3.3
black sea bass	*Centropristis striata*	3	0.5	0.9	14	2	1.6	15	2.4	1.4
spider crab	*Libinia emarginata*	NA[3]	2	3.7	NA[3]	0.7	0.6	--	--	--
fourspot flounder	*Paralichthys oblongus*	--	--	--	11	1.8	1.5	6	0.9	0.5
kelp	*Laminaria* spp.	NA[3]	2.3	4.3	NA[3]	0.3	0.2	NA[3]	0.1	0.1
clearnose skate	*Raja eglanteria*	--	--	--	--	--	--	1	1.9	1.1
bluecrab	*Callinectes sapidus*	8	1.4	2.6	--	--	--	--	--	--
silver hake	*Merluccius bilinearis*	--	--	--	10	0.7	0.6	9	0.7	0.4
spot	*Leiostomus xanthurus*	--	--	--	--	--	--	20	1.4	0.8
mixed algae species	*Algae* spp.	NA[3]	0.8	1.5	--	--	--	NA[3]	0.2	0.1
spotted hake	*Urophycis regia*	--	--	--	4	0.2	0.2	14	0.6	0.3

Common name	**Species**	**AC2013002**			**AC2013004**			**AC2013005**		
		Count	**Weight (kg)**	**Percent composition**	**Count**	**Weight (kg)**	**Percent composition**	**Count**	**Weight (kg)**	**Percent composition**
American lobster	*Homarus americanus*	2	0.6	1.1	--	--	--	--	--	--
ulva	*Ulva lactuca*	NA[3]	0.2	0.4	NA[3]	0.3	0.2	NA[3]	0.1	0.1
flat claw hermit crab	*Pagurus pollicaris*	--	--	--	NA[3]	0.1	0.1	NA[3]	0.2	0.1
lion's mane jellyfish	*Cyanea capillata*	4	0.2	0.4	--	--	--	--	--	--
red hake	*Urophycis chuss*	--	--	--	2	0.1	0.1	1	0.1	0.1
bay anchovy	*Anchoa mitchilli*	9	0.1	0.2	--	--	--	--	--	--
butterfish	*Peprilus triacanthus*	3	0.1	0.2	--	--	--	--	--	--
Atlantic herring	*Clupea harengus*	1	0.1	0.2	--	--	--	--	--	--
common slipper shell	*Crepidula fornicata*	NA[3]	0.1	0.2	--	--	--	--	--	--
rock crab	*Cancer irroratus*	--	--	--	NA[3]	0.1	0.1	--	--	--
moon snail egg case	*Naticidae* spp.	--	--	--	--	--	--	NA[3]	0.1	0.1
Total		**356**	**53.9**	**100.0**	**688**	**123.2**	**100.0**	**844**	**176.9**	**100.0**

[1] Primary targeted species; [2] Secondary targeted species; [3] Counts not obtained, only weights.

3.5.3 LOBSTERS

Although lobsters were not a target species, they are of particular interest due to decreasing abundance in southern New England, including Long Island Sound. Five lobsters were collected by a single trawl on a dredged material disposal site, all at NLDS site AC2013001. Two additional lobsters were collected by a single trawl off-site, both in AC2013002. In addition to obtaining lengths, CT DEEP biologists also recorded information on biological condition (Table 21). After observation, all collected organisms were released back into Long Island Sound.

Table 21: Biological Parameters of Lobsters Collected by Connecticut Department of Energy and Environmental Protection (CT DEEP) Trawls

Site ID	Sex	Length (mm)	Egg Development	Shell hardness	Crusher claw	Pincher claw	Condition	Shell disease
AC2013001 (NLDS)	M	72.7	None	Hard	Bud	Present	Alive	None
AC2013001 (NLDS)	F	58.8	None	Hard	Small	Present	Alive	None
AC2013001 (NLDS)	F	70.7	None	New hard shell	Present	Present	Alive	None
AC2013001 (NLDS)	M	67.4	None	Hard	Present	Present	Alive	11–50% covered
AC2013001 (NLDS)	M	69.7	None	Hard	Present	Present	Alive	None
AC2013002 (Off-site)	F	70.3	None	Hard	Present	Present	Alive	None
AC2013002 (Off-site)	M	54.4	None	Hard	Present	Present	Alive	None

3.5.4 SPECIES LENGTH DISTRIBUTIONS

Of the six targeted species, only three were in high enough abundance to produce meaningful length frequency graphs (raw data and additional lengths may be found in Appendix E). Striped bass, bluefish, and striped searobin were caught by the trawl infrequently, so there were not enough length measurements to infer demographic trends. The two on-site striped bass were 655 and 665 mm; the single off-site individual was 905 mm. The single bluefish caught was on-site, measuring 537 mm in length. The two on-site striped searobin were 285 and 295 mm; the five off-site striped searobin ranged from 225 to 275 mm. Scup, winter flounder, and windowpane flounder had high enough abundance that length distributions could be used to investigate demographic structuring. Due to the variability in effort and sample size, however, statistical comparisons were not feasible; the results below should be interpreted as trends rather than statistical differences.

There is a relatively strong trimodal pattern in scup lengths. Two peaks are evident at 110 and 170 mm, with a third, more gradual peak at 230 for on-site trawls and 270 for off-site trawls (Figure 10). Scup collected both on and off of dredged material disposal sites displayed the same overall length frequency pattern.

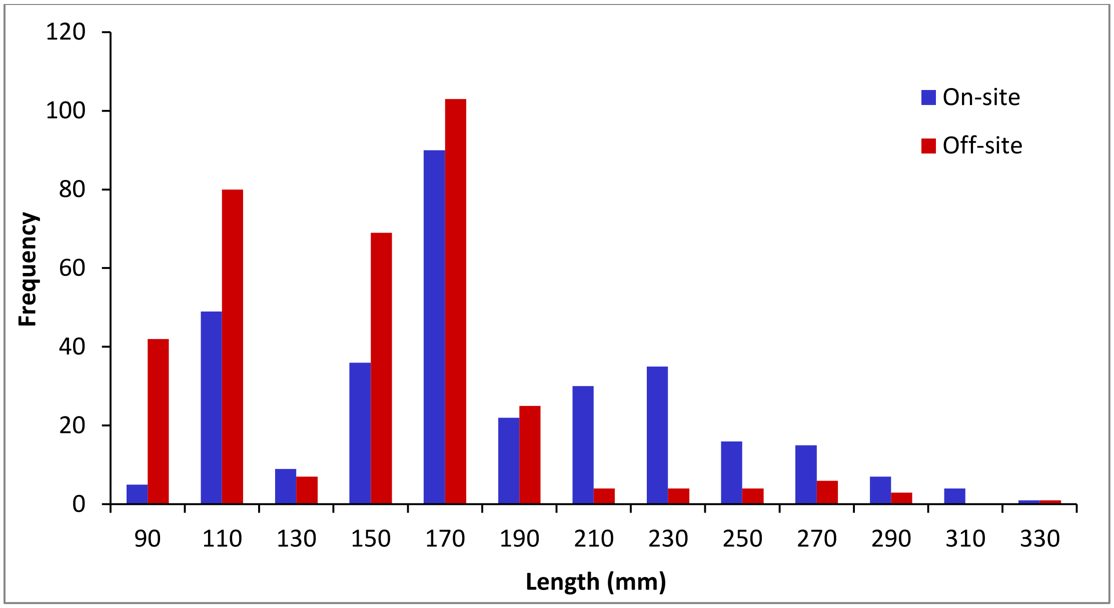


Figure 10: Length Frequency Distribution for Scup On and Off Dredged Material Disposal Sites

Winter flounder had a range of lengths, from 145 to 405 mm (Figure 11). The frequency of each length is spread fairly evenly, with only a slight increase at 245 mm for off-site trawls and at 225 and 305 mm for on-site trawls. No strong difference in length pattern between on- and off-site tows is evident, however.

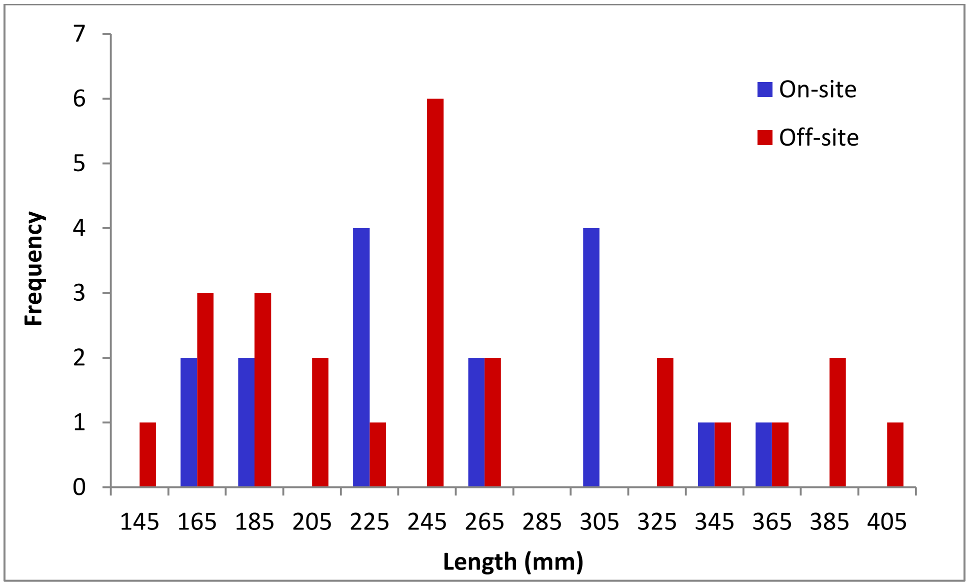


Figure 11: Length Frequency Distribution for Winter Flounder On and Off Dredged Material Disposal Sites

Windowpane flounder showed a strong unimodal length distribution (Figure 12), with a peak at 265 mm for both on- and off-site trawls. Since more windowpane flounder were collected off-site, the pattern is more defined than on-site tows, with a notable increase around 225 mm, peak at 265 mm, and a steady decrease to 325 mm. Windowpane flounder collected on dredged material disposal sites have a similar, though dampened pattern, likely due to fewer total individuals.

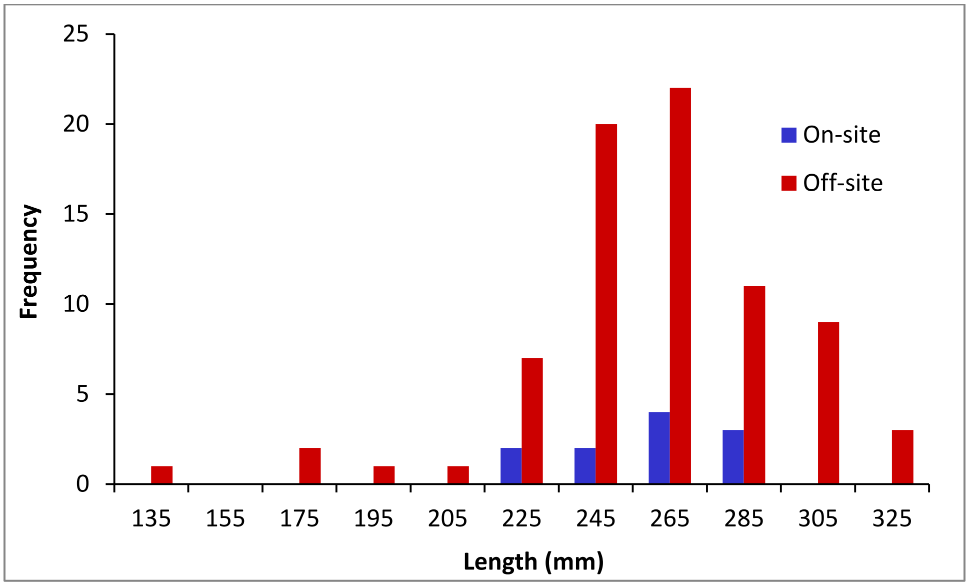


Figure 12: Length Frequency Distribution for Windowpane Flounder On and Off Dredged Material Disposal Sites

3.6 STATISTICAL COMPARISONS

3.6.1 BENTHIC HABITAT AND INFAUNA

Diversity, as measured by the Shannon Diversity Index (H'), was averaged for all benthic grabs on and off a dredged material disposal site. When the diversity indices of on-site grabs were compared with those of off-site grabs using a two-tailed t-test, on-site diversity was higher, though the difference was just below statistical significance (P = 0.057, α = 0.05; Table 22). Therefore, benthic infaunal diversity was marginally higher in dredged material disposal sites relative to intermediate sites adjacent to dredged material disposal sites.

Pielou's evenness (J') estimates the relative abundance of benthic infauna (i.e., more similar abundances correlate to greater evenness). Evenness for on-site samples was not significantly different than off-site samples (P = 0.401, α = 0.05; Table 22) when tested with a two-tailed t-test.

Table 22: Average Diversity (H') of Benthic Grabs On and Off Dredged Material Disposal Sites

Parameter	On-site	Off-site	P-value
Average diversity (H')	3.060	2.753	0.056924
Average evenness (J')	0.724	0.696	0.401414

3.6.2 FINFISH ABUNDANCE

The sampling effort of this biological characterization was variable among sites, therefore statistical comparisons among dredged material disposal sites were not be performed. By combining the three on-site tows and the three off-site tows, however, statistical tests could be run to identify differences in abundance on and off of a dredged material disposal site. No significant difference was evident in species abundance between targeted species collected on and off dredged material disposal sites (two-tailed, equal variance t-test with a significance level of 0.05; all P > 0.323, α = 0.05; Table 23). Figure 13 illustrates the percent of the catch composed by different targeted species resulting from trawls conducted on and off dredged material disposal sites.

Table 23: Average Percent Composition of Targeted Species from Trawls Located On and Off Dredged Material Disposal Sites

Targeted species		Average % Composition		P-value
		On-site	Off-site	
Primary	scup	41.0	22.7	0.348
	winter flounder	1.4	2.4	0.323
	striped bass	4.4	16.1	0.692
	bluefish	3.6	0.0	0.374
Secondary	windowpane flounder	4.1	3.5	0.430
	striped searobin	1.3	0.6	0.783

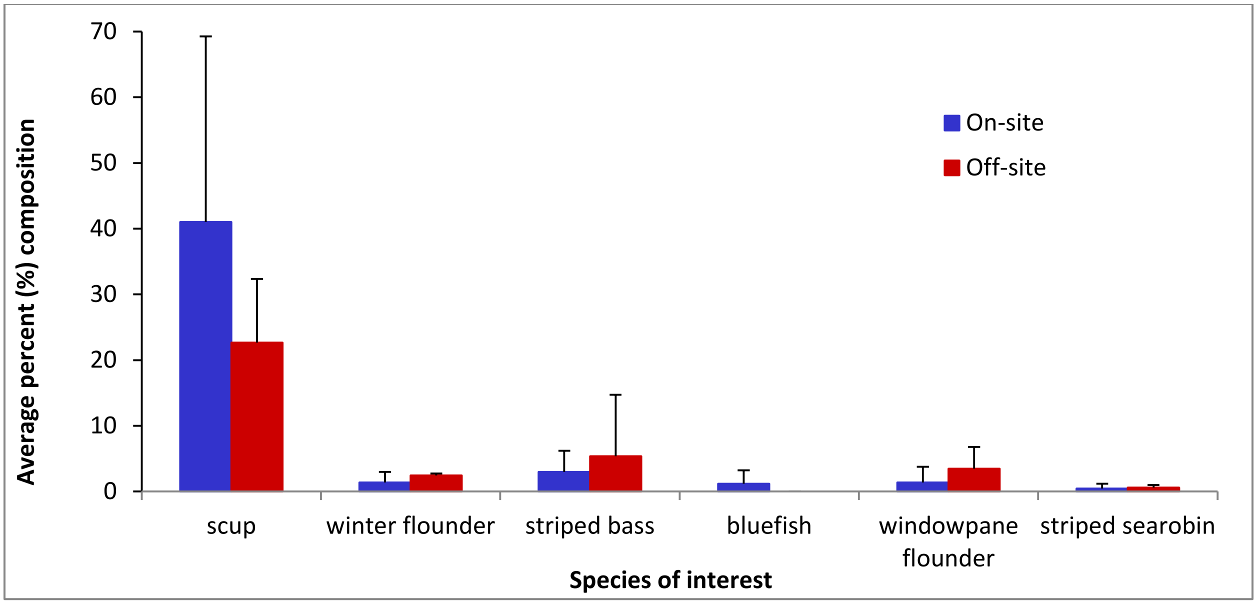


Figure 13: Comparison of Average Percent Composition of Targeted Species between Trawls Conducted On and Off Dredged Material Disposal Sites

A proportional measure of abundance is catch per unit effort (CPUE). The total number of fish (count) per trawl is standardized by time of tow, which was 30 minutes for each. The CPUE was then averaged across sites, for trawls conducted on and off dredged material disposal sites (Table 24). Abundance, as estimated by CPUE, did not differ between sites located on and off dredged material disposal sites.

Table 24: Average Catch per Unit Effort (CPUE) for Targeted Species On and Off Dredged Material Disposal Sites

Targeted species		Average CPUE		P-value
		On-site	Off-site	
Primary	scup	8.19	7.40	0.919
	winter flounder	0.18	0.29	0.530
	striped bass	0.02	0.01	0.519
	bluefish	0.01	0.00	0.374
Secondary	windowpane flounder	0.12	0.86	0.309
	striped searobin	0.02	0.07	0.329

3.7 FISHING ACTIVITY SURVEY

Over the approximately 5 weeks that the fishing activity survey was available to fishermen, 440 individuals visited the survey website and 10 individuals mailed in hard copies. Of these, 45 did not fill out a single question and 160 had insufficient information (less than five questions answered); these 205 respondents were excluded from further analysis. Six additional surveys were omitted due to irrelevance, because they were not completed by a fisherman. Therefore, 229 surveys were considered relevant and useful (Table 25), and only those responses were carried forward in the analysis of fishing activity in eastern Long Island Sound. As outlined in Section 2.4, results were analyzed in five groups, based on fishery type:

- Commercial lobster
- Commercial mollusk
- Commercial finfish
- Charter/party boat
- Recreational

Commercial results were delineated by target species (lobster, mollusk, and finfish), while charter/party and recreational fishing were analyzed separately. The recreational fishing industry had the highest number of respondents; however, a variety of fishermen participated, with the dominant fisheries in eastern Long Island Sound well-represented. Data are presented here as catch observations, spatial and temporal variation in fishing effort, and the relation of fishing activity to active and historic dredged material disposal sites.

3.7.1 FISHING TRENDS

A summary of the results of the survey is presented in Table 25, but notable results are highlighted in the following paragraphs. Each value in Table 25 represents the percentage of fishermen that chose a particular answer. Not all respondents completed every question, so the percentages may be calculated from a value less than n, the total number of participants. Due to the use of whole percentage values, a few categories do not sum to exactly 100 percent. Detailed results are included in Appendix G.

On average, the commercial and charter/party boat industries had more years of experience than recreational fishermen; at least 50 percent of commercial and 60 percent of charter/party boat fishermen had more than 30 years of experience, while only 35 percent of recreational fishermen have been fishing that long. Of all 229 fishermen that responded to the survey, 90 percent actively fished in 2013. Conflicting opinions regarding abundance of target species were found among the five fishery types. In the lobster and mollusk commercial industries, 40 percent indicated a decrease in quantity. The majority (60 percent) of lobstermen cited no change in abundance. Out of the 19 commercial fishermen targeting finfish, 69 percent noted an increase in abundance. In contrast, 68 percent of charter/party boat fishermen and 69 percent of recreational fishermen thought abundance of their target species has decreased. The minority (0 to 40 percent) of all commercial fishermen felt that target species size has decreased. The charter/party boat and recreational responses were almost in exact agreement with each other, but differed from the commercial industry opinions. More than half (55 percent) of both the charter/party boat and recreational fishermen thought the size of their target species has decreased. Despite the somewhat variable input regarding location, the majority (between 58 and 100 percent) of each fishery has not changed fishing grounds. The majority of all groups thought the health of the catch had not changed or had improved. Between 18 and 40 percent of fishermen thought target species health has declined. The only group that has not observed a change in bycatch composition is mollusk fishermen, who encounter various crab species. Of the other groups, between 20 and 70 percent has noticed a change in bycatch. A couple of groups cited more scup, black sea bass, and dogfish as bycatch, but some also claimed that more selective gear has decreased the overall quantity of non-target species.

Table 25: Results Summary of Fishing Activity Survey for Eastern Long Island Sound[1]

Fishing activity parameter		**Commercial**			**Charter/party**	**Recreational**	**Overall[2]**
		Lobsters	**Mollusks**	**Finfish**			
Number of participants (n)		8	6	19	30	166	229
Length of activity	≤ 30 yrs	50%	50%	26%	40%	65%	58%
	> 30 yrs	50%	50%	74%	60%	35%	42%
Current activity	Active	75%	100%	100%	100%	88%	90%
	Not active	25%	0%	0%	0%	12%	10%
Shift in target species	Yes	14%	67%	53%	40%	37%	39%
	No	86%	33%	47%	60%	63%	61%
	Reason for changing target species	Regulations	Pollution effect on lobsters; market demand	Regulations; market demand; abundance	Regulations; seasonality; abundance; quality	Regulations; seasonality; abundance; sport	--
Quantity	No change	60%	40%	23%	23%	14%	18%
	Increase	0%	20%	69%	9%	17%	20%
	Decrease	40%	40%	8%	68%	69%	62%
Size	No change	80%	40%	38%	23%	24%	27%
	Increase	20%	20%	46%	23%	20%	23%
	Decrease	0%	40%	15%	55%	55%	49%
Location	No change	100%	80%	58%	81%	71%	72%
	Increase	0%	0%	33% (in H, I, J, K, L)	14% (in I, J)	6% (in I, J, K, M)	9%
	Decrease	0%	20% (in F, G)	8% (in L)	5% (in G)	23% (in B, E, F, G, I, L, M)	19%
Gender composition	No change	100%	100%	100%	74%	85%	86%
	Increase in males	0%	0%	0%	26%	10%	11%
	Increase in females	0%	0%	0%	0%	6%	4%

Fishing activity parameter		**Commercial**			**Charter/party**	**Recreational**	**Overall**[2]
		Lobsters	**Mollusks**	**Finfish**			
Health of catch	No change	40%	60%	64%	61%	78%	73%
	Improved	20%	0%	18%	13%	9%	10%
	Poorer	40%	40%	18%	26%	13%	17%
Bycatch	No change	80%	100%	30%	73%	56%	58%
	Change	20%	0%	70%	27%	44%	42%
	Observations	More scup, black sea bass, dogfish	Mostly spider crabs, rock crabs, green crabs	Less bycatch overall; more black sea bass and mid-Atlantic species; less lobsters	Greater quantity and size of dogfish, bluefish, sea robins; more blowfish and weakfish	Less bycatch overall; more scup, bluefish, sea robin, sculpin, black sea bass (especially juveniles), spiny dogfish; fewer blue claw crabs	--
Gear fouling	No change	75%	50%	56%	100%	81%	80%
	Fouling	25%	50%	44%	0%	19%	20%
	Reasons	Weather	Weather; seaweed	Weather; *H. japonica*; vandalism	NA	Snags; vandalism	--

[1] Due to rounding to whole numbers, some categories may not sum to exactly 100%; [2] Averages calculated using a weighted mean to account for different sample sizes.

A variety of finfish species are targeted by members of the commercial, charter/party boat, and recreational industries, though at different intensities (Table 26). Each percentage represents the relative frequency that each finfish is targeted out of all identified species. The most highly sought-after finfish by commercial fishermen are summer flounder and tautog, each targeted 18 percent of the time. In general, the commercial industry focuses its effort more evenly across species, though not necessarily on more species. Charter/party boats target striped bass at a higher frequency than any other species (29 percent); summer flounder are the next-highest target species (15 percent). Recreational fishermen are the least balanced, with much of their effort focused on only a few species. Of all target species, summer flounder and striped bass are each targeted 28 percent of the time by recreational fishermen. As summarized in Table 26, the reason for shifting target species may explain slight differences in target finfish by these three different industries. While respondents in all groups cited regulations as a driving determinant, commercial fishermen are understandably more influenced by market demands. Charter/party boat and recreational fishermen both mentioned seasonal fluctuations in species abundance as a motivating factor for choosing target species. Only recreational fishermen identified personal preferences, such as a harder challenge or better taste, as reasons for shifting target species.

Table 26: Finfish Species Most Targeted by Eastern Long Island Sound Fisheries Based on a Fishing Survey

Target finfish[1]	**Relative targeted effort**		
	Commercial	**Charter/party**	**Recreational**
summer flounder	18%	15%	28%
striped bass[2]	11%	29%	28%
bluefish[2]	5%	14%	14%
tautog	18%	14%	11%
scup	11%	12%	7%
black sea bass	13%	8%	3%
false albacore	--	--	2%
all local fish	5%	5%	<1%
mollusks	3%	--	2%
weakfish	--	--	1%
lobster	--	2%	1%
squid	5%	--	
blowfish (pufferfish)	--	--	<1%
kingfish	--	--	<1%
shark	--	--	<1%
Spanish mackerel	--	--	<1%
winter flounder[2]	--	--	<1%
tilefish	--	2%	--
tuna	--	2%	--
butterfish	3%	--	--
Whiting/silver hake (*Merluccius* spp.)	3%	--	--
Atlantic herring	3%	--	--
Atlantic mackerel	3%	--	--

[1]Fish common names as reported in survey; [2]Targeted species in current study's finfish trawls

3.7.2 SPATIAL AND TEMPORAL TRENDS IN FISHING EFFORT

A strong seasonal trend in fishing effort is apparent for all fishery groups. With the exception of the commercial mollusk fishery, all other groups have peak activity in the summer (Figure 14). Commercial lobstermen increase fishing effort in March, dropping off again in September. Commercial finfish, charter/party boat, and recreational fishermen have a similar trend, but it is temporally offset relative to lobstermen. For these three groups, activity increases in May and does not drop off until November. Commercial mollusk fishermen have a different seasonal pattern altogether. While there is a slight increase in fishing activity from May to September, the greatest effort occurs in November.

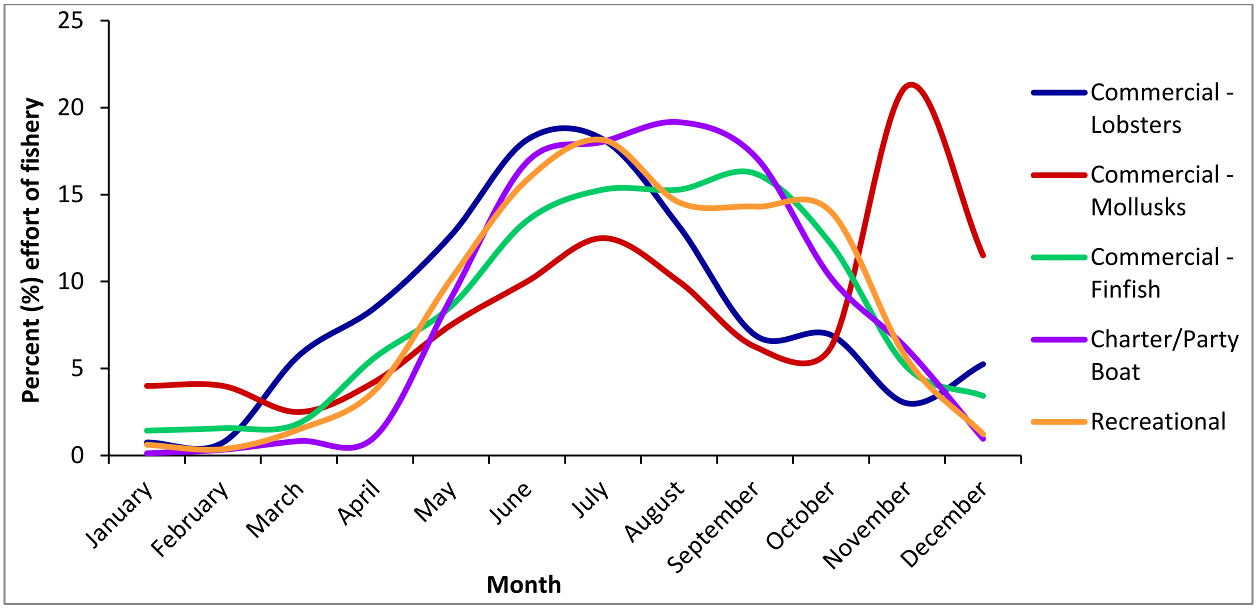


Figure 14: Fishing Effort by Month for Eastern Long Island Sound Fisheries, Based on Fishing Survey

To further characterize fishing activity spatially, effort was described for 13 distinct areas in eastern Long Island Sound. These areas, labeled A-M, are not based on management areas, but some borders do follow state lines. See the figures below for location of these areas. The yellow line demarking fishing area boundaries used in the survey may obscure portions of state maritime boundaries, which are identified in Figure 1. Of the 229 fishermen that participated in the survey, 199 respondents (or 87 percent) identified which areas they frequented each season (spring, summer, fall, and winter). These data were compiled to find high-use areas by season for each fishery type. The patterns for each fishery are summarized below, along with the corresponding figure that depicts the spatiotemporal trends in fishing effort.

- Commercial lobstermen identified 10 of the 13 areas as fishing grounds, 7 of which are active year-round. The most frequented areas is L, followed by I. Most commercial lobster activity occurs in the summer, and the least is in the winter. Of the western portion of the study area (areas A, B, E, F, G), there is little overall activity, with a slight increase in A and F during the summer (Figure 15).
- Commercial mollusk fishermen have the most concentrated effort, utilizing only 7 of the 13 areas of eastern Long Island Sound. Area G is fished most extensively, with nearby F and H also experiencing high use. Fall is the season of highest activity; minimal fishing occurs in the winter (Figure 16).

- Commercial finfishermen use nearly every area year-round; however, seasonal and geographical trends are still apparent. Area I is most frequented by finfishermen, but other eastern areas (H, J, K, L, and M) are also common fishing grounds. The western portion of the area of interest has the least fishing activity. Effort is almost evenly spread between spring, summer, and fall, but it drops substantially in the winter (Figure 17).
- The charter/party boat industry identified fishing grounds in each of the areas of eastern Long Island Sound. The most highly used area is H, with I and M also fished often. In general, the western portion has lower activity than the eastern portion. Seasonally, summer and fall have the highest activity. There is very little charter/party boat fishing in the winter, with no fishing in most areas (Figure 18).
- Recreational fishing is the most evenly spread both spatially and temporally than any other fishery type. Each of the 13 areas supports recreational fishing every season of the year. Areas E, F, G, H, and I have the highest activity, while B, C, and D have the lowest. Summer and fall are the most common times to fish, and winter has the least fishing (Figure 19).

Each of the following figures (Figures 15 through 19) uses the same color convention, with purples and blues representing less effort and oranges and reds representing more effort. Each fishery group is presented individually, but comparisons may be made between figures. This scale extends from the minimum amount of effort (0.2 percent) to the maximum (11.8 percent) across all five groups. Each figure includes a color scale for reference. Full results are included in Appendix G.

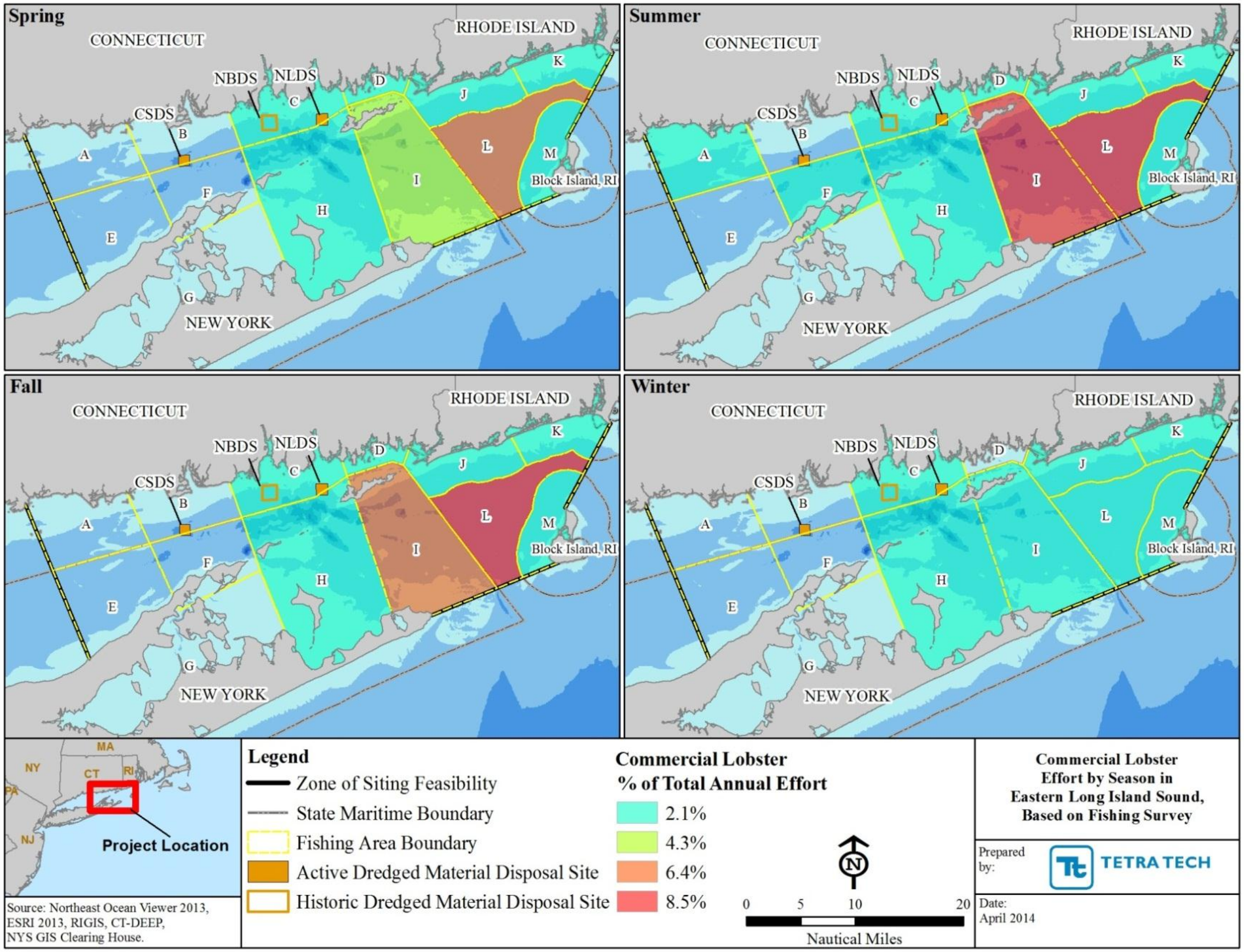


Figure 15: Commercial Lobster Effort by Season in Eastern Long Island Sound, Based on Fishing Survey

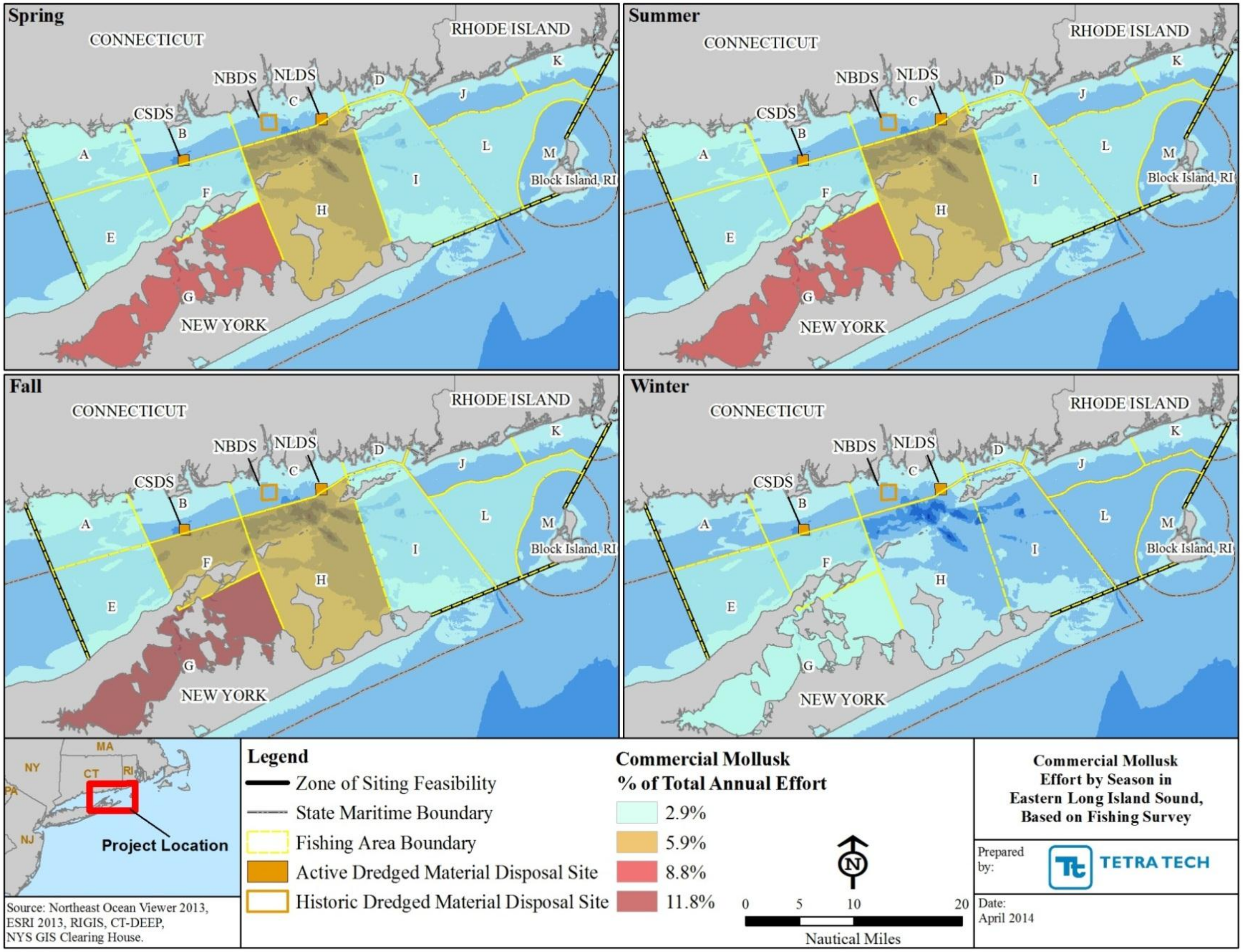


Figure 16: Commercial Mollusk Effort by Season in Eastern Long Island Sound, Based on Fishing Survey

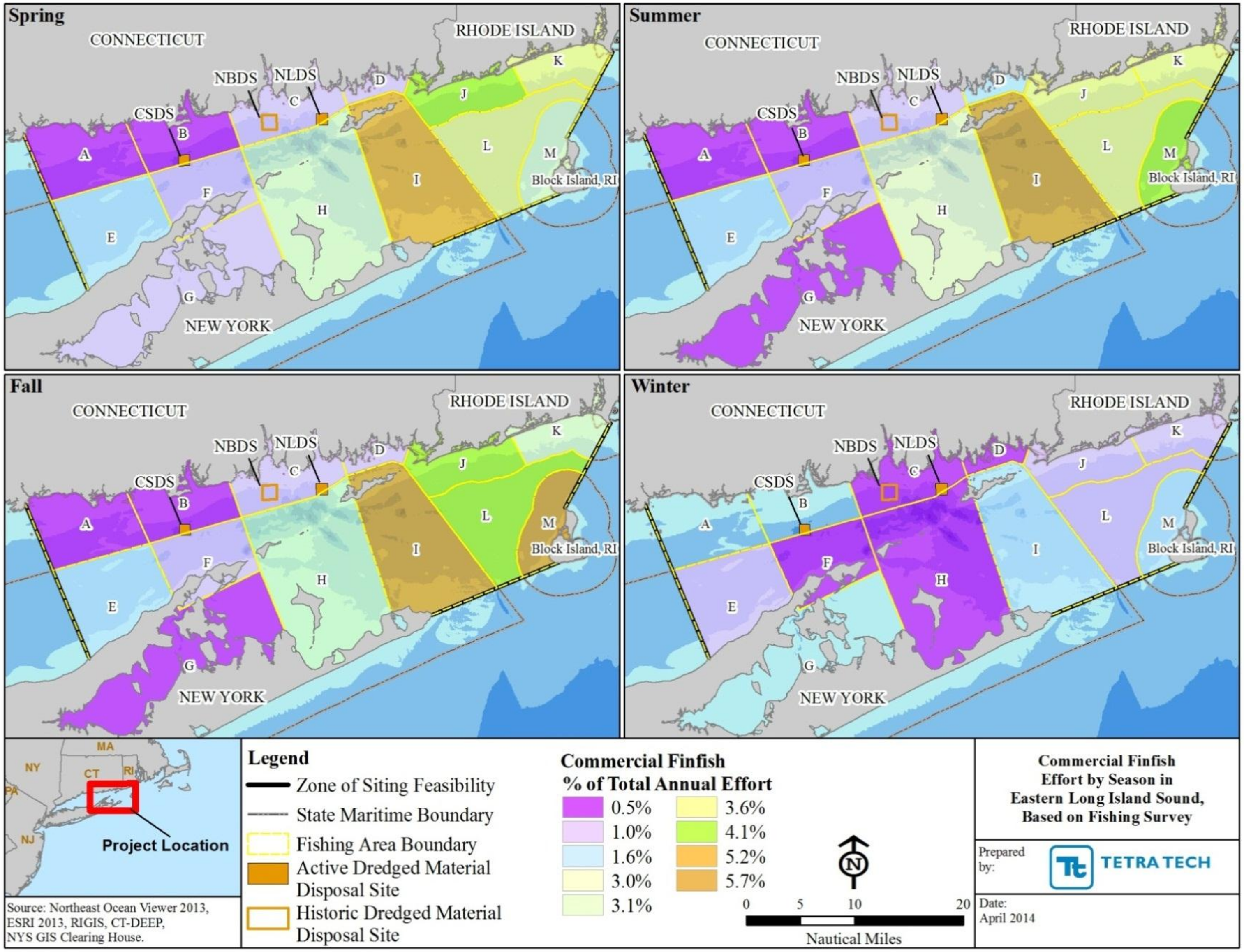


Figure 17: Commercial Finfish Effort by Season in Eastern Long Island Sound, Based on Fishing Survey

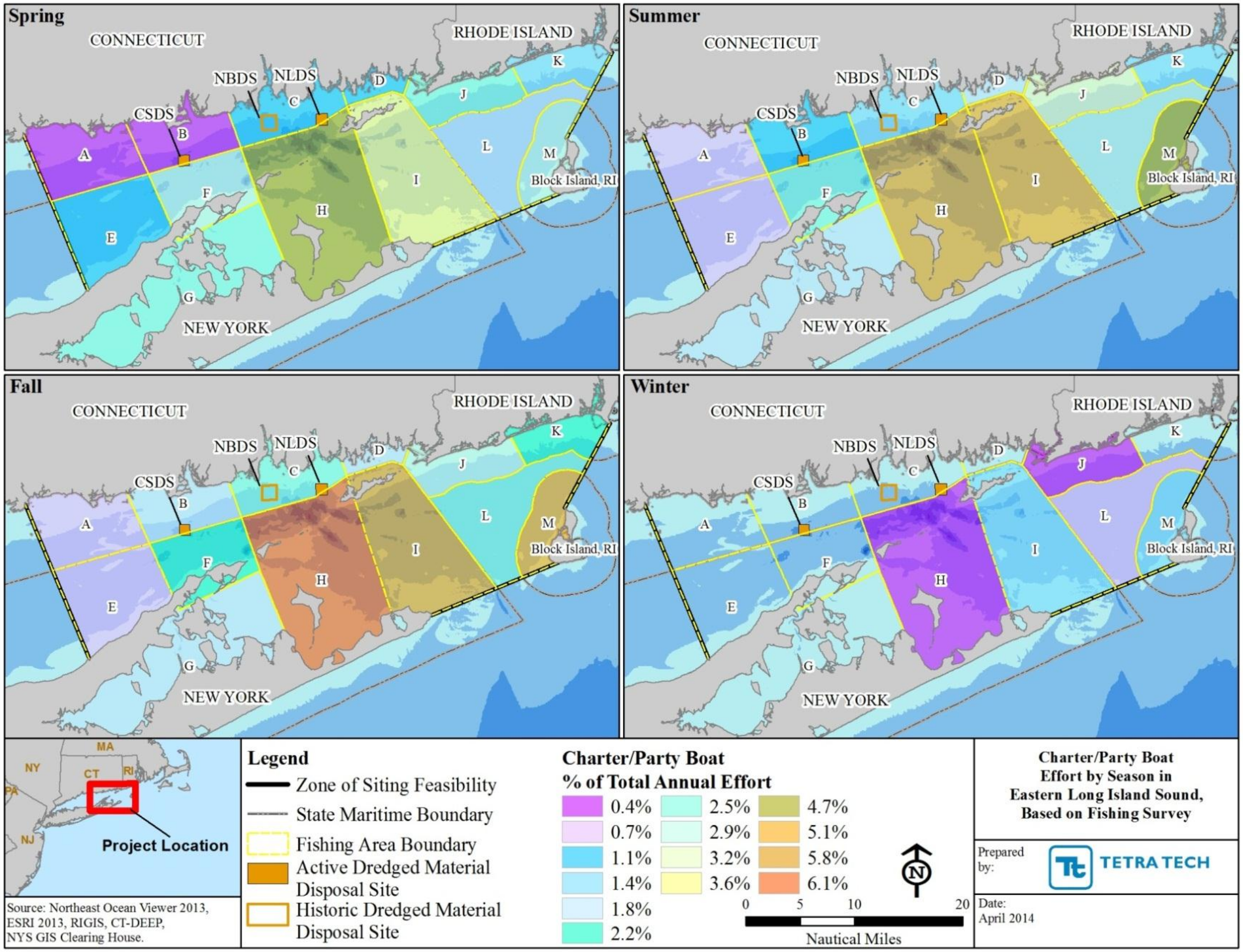


Figure 18: Charter/Party Boat Effort by Season in Eastern Long Island Sound, Based on Fishing Survey

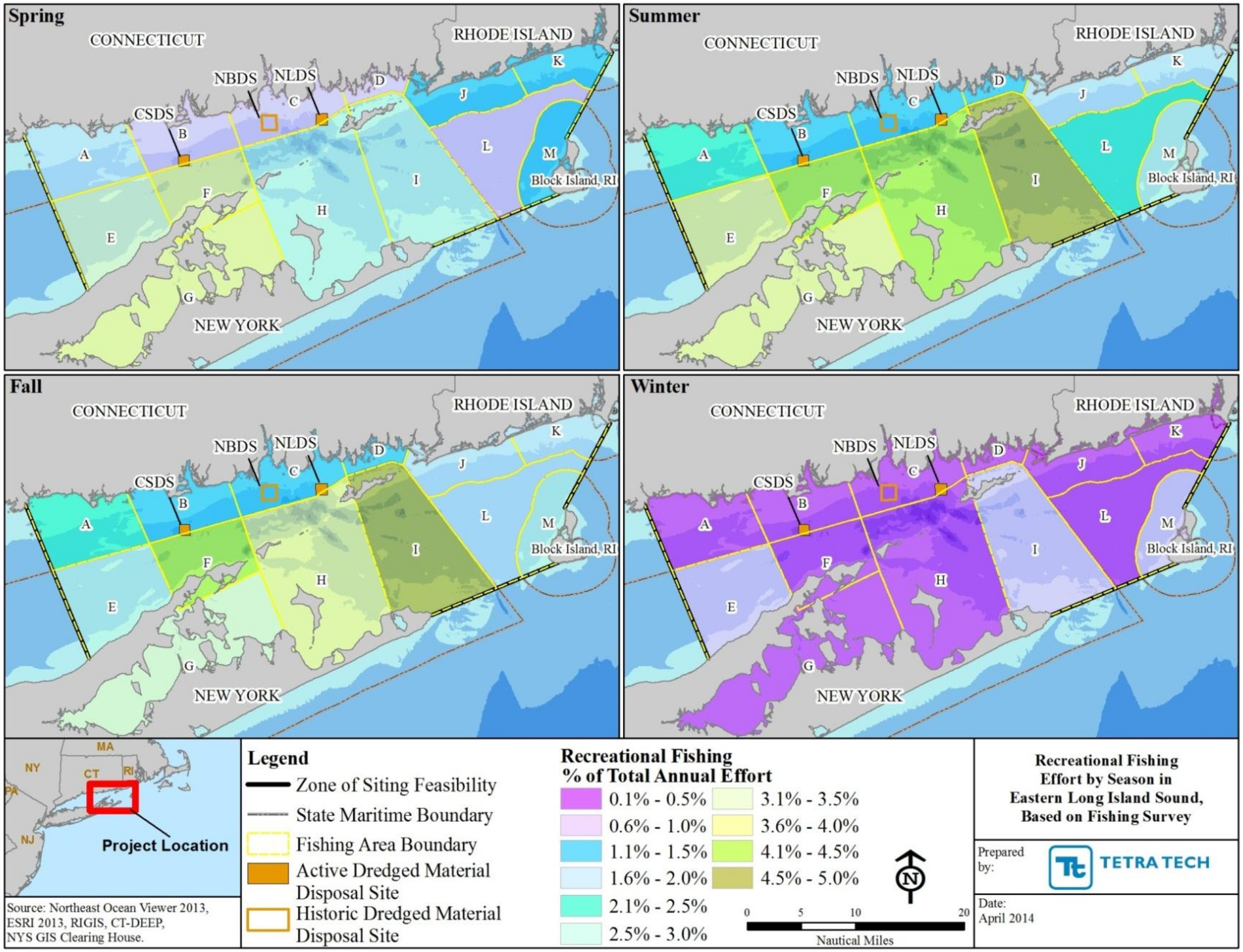


Figure 19: Recreational Fishing Effort by Season in Eastern Long Island Sound, Based on Fishing Survey

3.7.3 FISHING NEAR DREDGED MATERIAL DISPOSAL SITES

On average, only 6 percent of surveyed fishermen fish near dredged material disposal sites (1 percent regularly; 5 percent occasionally; Table 27). Many (44 percent) were unsure whether their fishing grounds were near a dredged material disposal site at all. Only four commercial lobstermen provided information regarding fishing near dredged material disposal sites. Of these, one individual (25 percent) did not know whether the fishing grounds was within 0.5 nautical miles of a dredged material disposal site. The other three (75 percent) do not fish near sites. None of the commercial mollusk fishermen knew if they fished near a site. One commercial fisherman who switched target species from lobster to finfish to shellfish mariculture identified "New London [dredged material disposal site]" as a regular fishing ground. This particular fisherman has noticed that more mid-Atlantic species are found near dredged material disposal sites. The majority of commercial finfishermen do not fish near dredged material disposal sites, and a quarter of those surveyed did not know. Two charter/party boat fishermen occasionally fish near dredged material disposal sites; one near New London, the other near Old Saybrook, Connecticut. Old Saybrook is geographically closest to Niantic Bay Historic Dredged Material Disposal Site, but it is not clear whether this is the dredged material disposal site referenced. No difference in catch was reported for Old Saybrook, but an increase in catch was observed at the New London Dredged Material Disposal Site. Just over half of charter/party boat fishermen do not fish near sites, and 36 percent were unsure. Four recreational fishermen occasionally fish near dredged material disposal sites. One fisherman historically fished the New London Dredged Material Disposal Site for winter flounder and scup and believed that, "site activity improves fishing quality." Another recreational fisherman who fished near New London felt that flounder are "all gone," but that scup were "highly abundant." A different recreational fisherman fished near dredged material disposal sites near Narragansett Harbor, Block Island Port, and New York bight (beyond the eastern Long Island Sound study area) but did not identify any changes in catch in these areas.

Table 27: Fishing Trends near Dredged Material Disposal Sites in Eastern Long Island Sound

Fishing activity parameter		**Commercial**			**Charter/ party boat**	**Recreational**	**Overall**
		Lobsters	**Mollusks**	**Finfish**			
Dredged material disposal site proximity	Regular fishing	0%	0%	8%	0%	0%	1%
	Occasional fishing	0%	0%	0%	9%	5%	5%
	No fishing	75%	0%	67%	55%	48%	50%
	Unsure	25%	100%	25%	36%	47%	44%
	Locations[1]	NA	NA	NLDS	NLDS, Old Saybrook	NLDS; Narragansett Harbor; Block Island Port; NY Bight; Hudson River, NY	--

Note: NLDS indicates the New London Dredged Material Disposal Site

[1] Of the 6 percent of all fishermen that fish near dredged material disposal sites, locations were provided by very few and therefore often correspond to one individual's feedback.

4 DISCUSSION

Results of the benthic and finfish sampling are summarized in Table 28. In general, the results are consistent with previous studies, indicating a stable marine benthic community both within and outside of the dredged material disposal sites. The ambient water quality data are consistent with healthy abiotic conditions. For benthic and finfish characteristics, no significant differences were found between samples collected on dredged material disposal sites and samples collected off-site (areas adjacent to dredged material disposal sites).

Water quality issues often have a variety of sources and can vary interannually. The water characteristics of Long Island Sound have been found to fluctuate with levels of the Connecticut River plume (Ackleson and O'Donnell 2011). One of the most detrimental water quality problems is low oxygen, or hypoxia, which occurs when DO concentrations drop below 2 mg/L (in extreme cases, no oxygen, or anoxia results). Hypoxia may be caused by many factors that often act synergistically; in particular, stratification, nutrient loading, and water exchange can decrease DO, with non-linear effects on the local ecosystem (Zhang et al. 2010). Since LIS is semi-enclosed, with freshwater input and potential nutrient loading, this ecosystem is susceptible to hypoxic conditions. Since 1987, the area affected by hypoxia has fluctuated dramatically (LISS 2012). In 2012, an area of 289 square miles was affected, with hypoxic conditions lasting 80 days, 23 days more than average (LISS 2012). Relative to the western and central basins of Long Island Sound, the eastern basin has the best overall water quality, attributed to current-driven mixing (LISS 2012). Although it has been found that most marine animals need at least 5 mg/L of DO, this may not be as limiting as previously believed. Some marine species, like weakfish (*Cynoscion regalis*), are capable of tolerating DO concentrations as low as 2 mg/L, only displaying avoidance behavior of water with 1 mg/L DO (Stierhoff et al. 2009). Many species may be able to survive hypoxic conditions in Long Island Sound. During the sampling efforts of this study, however, low oxygen was not apparent.

4.1 BENTHIC CHARACTERISTICS

Sediment characterization of Long Island Sound, especially in the context of dredged material disposal sites, has been described in several different studies. The Millstone Power Station has conducted sampling in eastern Long Island Sound near the power plant and at a reference site located approximately five nautical miles from NBDS since 1976. The long time-series of this dataset offers a unique insight into local conditions over time. Among the parameters studied, the Millstone studies have observed sediment characteristics, benthic infauna, and fish abundance. Increased grain size was evident at Millstone's thermal discharge sites due to scouring (Dominion Resources Services Inc. 2006). Natural variation in sediment composition was observed at the reference site, but overall, silt and clay made up 12.4 and 5.5 percent of the sediment in June and September, respectively, with a significant decrease in mean grain size over a 33-year period (Dominion Resources Services Inc. 2013). In the present study, mean silt and clay composition ranged from 4.7 to 34.1 percent among the three dredged material disposal sites and off-site areas. NBDS, the site nearest to the Millstone study, had an average of about 5 percent silt and clay, which is similar to the Millstone reference site. Sediment samples were collected as part of a benthic analysis of Long Island Sound conducted by ENSR (2002); results of eastern Long Island Sound will be discussed here. At CSDS, both active and reference sites were dominated by sand-size particles, which is consistent with the findings of this study (i.e., 46 percent of CSDS sediment was medium-size sand). In about half of the samples collected in the NLDS, fine particles dominated; the other half was dominated by sand-size particles. There were almost no particles categorized as gravel. These findings are consistent with the current finding of silt and clay comprising the majority of NLDS sediment. A different study conducted by AECOM (2009) to monitor the effects and recovery of dredged material disposal at NLDS found that on-site and reference samples were remarkably similar, with thick layers of brown sand. One site that was recently used for deposition was quite different, though, with irregular topography and clumps of shell or clay. These different characteristics are likely more representative of the dredged material source than local sediment. Since NLDS is an active dredged material disposal site, sediment is not expected to be homogeneous, which was reflected in the high variation among samples collected within the site. Relative to previous investigations, sediment characteristics have not drastically changed, with sand and fine particles dominating eastern Long Island Sound.

Total organic content, or TOC, of Long Island Sound sediment generally increases with decreasing grain size. Previous studies found values ranging from 0.02 to 1.05 percent at CSDS, which is inclusive of the values measured in this study (ENSR 2002). TOC at NLDS was measured between 0.70 and 2.69 percent in 2002 (ENSR 2002); current values (1.2–6.2 percent) are somewhat higher overall than these measurements. NLDS had the highest TOC values of any of the sites sampled in this study. As concluded in other studies, sites with smaller grain size were correlated with higher TOC content. Survival challenges with two model organisms during 10-day sediment toxicity testing suggest that sediment in Long Island Sound does not pose a health threat to benthic infauna.

Benthic infauna at Millstone showed evidence of long-term successional development (Dominion Resources Services Inc. 2013), with most sites dominated by annelids; the reference site was comprised of 48 percent annelids. In samples collected off-site in the current study, Annelida was the most abundant phylum; however, the most abundant species in off-site samples were two mollusks and one arthropod. The site of thermal discharge at Millstone was dominated by the mollusk *Mytilus edulis*, an epifaunal organism. NBDS, which is located near the Millstone plant, had an abundance of arthropods, but a bivalve was the single most abundant species. Another study (ENSR 2002) found that the dominant phylum at CSDS was Annelida in February and Arthropoda in July. Although Arthropoda was the most abundant phyla at CSDS in this study, the mussel *Mytilus edulis* was the most abundant species. At NLDS, arthropods were the most abundant taxon (ENSR 2002), similar to this study. NLDS, which had the highest percent composition of silt/clay and fine sand, was dominated by tube-dwelling amphipods (*Ampelisca* spp.) that prefer fine sand and muddy bottoms. These amphipods were also found in high number at NBDS, though primarily in two samples (P019 and P025) within close proximity of each other, both of which had the highest fine sand and silt/clay composition. The three areas dominated by medium sand particles (NBDS, CSDS, and off-site) had a higher occurrence of bivalves and barnacles. A benthic quality index developed by the Long Island Sound Study (2012) indicates that in the eastern basin, the conditions are 75 percent “good,” and 25 percent “poor,” which is better than the western basin but worse than the central basin.

The Millstone reference sites had both the lowest total individuals (2,058) and fewest number of taxa (107), which had significantly decreased since 1980. None of the four sites have displayed species richness (R) greater than 150 since sampling began in 1979 (Dominion Resources Services Inc. 2013). In the present study, three of the four sites exhibited species richness values bordering or exceeding 200. In comparison to the previous studies, species richness was notably higher in the present study. Species diversity, indexed by H', at CSDS has been recorded between 2.60 and 4.68, with higher values corresponding to samples taken from active disposal areas (ENSR 2002). Current estimates for CSDS range from 2.099 to 3.247, slightly less than the 2002 study. Diversity indices, or H', for NLDS have been estimated between 2.68 to 4.77 (ENSR 2002), a range that encompasses the values currently found in this study. Areas in central Long Island Sound have been recorded with diversity indices ranging from 3.0 to 3.6 and evenness indices between 0.6 and 0.7 (EPA 2004); both of these parameters are close to estimates calculated in the current study. Overall, diversity is relatively high with sufficient evenness in all sampled areas in eastern Long Island Sound, which is in agreement with previous studies. Although patterns may change interannually, the current benthic community appears to be well-developed and diverse.

Table 28: Summary of Benthic Characteristics and Finfish Abundance

Parameter	NLDS	NBDS	CSDS	Off-site
Number of samples	8	10	3	30
Average grain size	34% silt/clay, 29% fine, 22% medium, 9% gravel, 6% coarse	49% medium, 19% gravel, 15% coarse, 13% fine, 5% silt/clay	46% medium, 24% gravel, 16% fine, 9% coarse, 5% silt/clay	37% medium, 27% fine, 16% gravel, 11% silt/clay, 9% coarse
Total organic content	1.2–6.2%	0.4–0.9%	0.6–0.7%	0.2–1.9%
Abundance (individuals/sample)	259–875 (2,590–8,750/m^2)	134–837 (1,340–8,370/m^2)	665–1,136 (6,650–11,360/m^2)	52–3,905 (520–39,050/m^2)
Species richness	208	196	115	282
Species diversity (H')	2.840 – 3.761	1.991 – 3.595	2.099 – 3.247	1.320 – 3.652
Pielou's evenness (J')	0.683 – 0.825	0.551 – 0.861	0.509 – 0.762	0.378 – 0.888
Dominant phyla	Arthropoda, Annelida, Mollusca	Arthropoda, Mollusca, Annelida	Arthropoda, Mollusca, Annelida	Annelida, Arthropoda, Mollusca
Dominant finfish and % abundance	Scup (48.5%), *Heterosiphonia japonica* (11.2%), long-finned squid (9.4%)			Scup (19.6%), smooth dogfish (18.7%), northern searobin (11.6%)

4.2 FISHERIES PATTERNS

Finfish abundance in eastern Long Island Sound has fluctuated for many species, due to many factors, some yet unidentified. The CT DEEP (previously CT DEP) has been conducting trawl surveys in Long Island Sound since 1984. The data from these surveys were organized and analyzed by ENSR in a 2001 report. The most current data from the CT DEEP trawl survey (Gottschall and Pacileo 2012) are also incorporated into this discussion. Generally, the western and central basins had significantly higher finfish abundance compared to the eastern portion. This may be due to western and central Long Island Sound having more mud habitat, which is known to support greater fish densities (ENSR 2001a). Strong currents and irregular bathymetry in the eastern basin limits the ability to sample spatially random areas and results in the higher frequency of trawls in the coastal areas of Connecticut. Based on the available data, ENSR (2001a) concluded that all of the eastern Long Island Sound areas had low CPUE and less species richness compared to the central and western portions. Specific patterns for several species of interest are presented here.

In eastern Long Island Sound, essential fish habitat (EFH) has been designated for 38 managed species (Table 29). These data were compiled from the National Oceanic and Atmospheric Administration's

(NOAA's) *Guide to Essential Fish Habitat Designations in the Northeastern United States* (http://www.nero.noaa.gov/hcd/webintro.html; accessed 3 February 2014). This guide summarizes designated EFH in 10-minute by 10-minute squares, so EFH in any of the squares within the area of interest (Figure 1) was included in Table 29 and described by life stage. Of these, 12 were caught in the finfish trawls conducted by CT DEEP. Many of these species, as well as the early life history stages of all species, would not be susceptible to the bottom otter trawl gear type, however, so the presence or absence of a species in the trawl is not necessarily indicative of whether the animal inhabits eastern Long Island Sound.

Table 29: Essential Fish Habitat Designations within Eastern Long Island Sound

Species	Eggs	Larvae	Juveniles	Adults	Occurrence in Present Study
Atlantic salmon *(Salmo salar)*			X	X	
Atlantic cod *(Gadus morhua)*	X	X	X	X	
haddock *(Melanogrammus aeglefinus)*		X			
pollock *(Pollachius virens)*			X	X	
whiting/silver hake *(Merluccius bilinearis)*	X	X	X	X	X
red hake *(Urophycis chuss)*	X	X	X	X	X
witch flounder *(Glyptocephalus cynoglossus)*	X	X			
winter flounder *(Pseudopleuronectes americanus)* [1]	X	X	X	X	X
yellowtail flounder *(Limanda ferruginea)*	X	X	X	X	
windowpane flounder *(Scophthalmus aquosus)*[1]	X	X	X	X	X
American plaice *(Hippoglossoides platessoides)*			X	X	
summer flounder *(Paralichthys dentatus)*		X	X	X	X
ocean pout *(Macrozoarces americanus)*	X	X	X	X	
Atlantic sea herring *(Clupea harengus)*			X	X	X
monkfish *(Lophius americanus)*	X	X	X	X	
bluefish *(Pomatomus saltatrix)* [1]	X		X	X	X
Atlantic butterfish *(Peprilus triacanthus)*		X			X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X	
scup *(Stenotomus chrysops)* [1]	X	X	X	X	X
black sea bass *(Centropristis striata)*	NA		X	X	X
king mackerel *(Scomberomorus cavalla)*	X	X	X	X	
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X	
skipjack tuna *(Katsuwonus pelamis)*				X	
bluefin tuna *(Thunnus thynnus)*			X	X	
cobia *(Rachycentron canadum)*	X	X	X	X	
longfin squid *(Loligo pealeii)*	NA	NA	X	X	X
shortfin squid *(Illex illecebrosus)*	NA	NA			
surf clam *(Spisula solidissima)*	NA	NA	X		
ocean quahog *(Artica islandica)*	NA	NA	X	X	
spiny dogfish *(Squalus acanthias)*	NA	NA	X	X	X

Species	Eggs	Larvae	Juveniles	Adults	Occurrence in Present Study
blue shark (*Prionace glauca)*	NA	X	X	X	
dusky shark *(Carcharhinus obscurus)*	NA	X	X		
sandbar shark *(Carcharhinus plumbeus)*	NA	X	X	X	
sand tiger shark *(Carcharias taurus)*	NA	X			
white shark *(Carcharodon carcharias)*	NA		X		
tiger shark *(Galeocerdo cuvieri)*	NA		X		
shortfin mako shark *(Isurus oxyrinchus)*	NA	X	X		
common thresher shark *(Alopias vulpinus)*	NA	X	X	X	

Note: NA indicates that this lifestage does not exist for the species or EFH has not been designated

[1]Targeted species in current study's fish trawls

To characterize biological activity in eastern Long Island Sound, the feedback of fishermen was critical to the overall success of the fishing survey. Regardless of opinion or industry, the fishing activity survey appeared to be well-received. It is difficult to estimate a response rate, since it is unknown how many fishermen were exposed to the survey. To increase survey availability, respondents were encouraged to distribute the survey freely. Despite an occasional reluctance, the majority of the industry was receptive to participating in and distributing the survey among fishermen. Most respondents recognized the importance of their input. The ability to supplement biological data with fishing patterns was accomplished through the cooperation of fishing groups and individuals.

Since each of the six tows had the same effort (30 minutes), catches from the three tows on-site can be compared with the three tows off-site. Abundance, or the number of individuals, was about the same (1,817 on-site; 1,888 off-site). Biomass was higher in off-site tows, likely due to a high occurrence of smooth dogfish in one trawl. Length distributions on and off dredged material disposal sites did not exhibit any clear patterns. It appeared that a greater proportion of large scup were present in trawls on dredged material disposal sites. Windowpane flounder had a greater proportion of large fish off-site, though. Winter flounder did not have a discernible pattern, and the other targeted species had too low of abundance to make any inferences. Based on the catch composition and lengths of fish collected in the CT DEEP trawls, there is no clear difference between fish assemblages on and off dredged material disposal sites.

Scup were caught often in the CT DEEP surveys. The eastern basin yielded lower catches of scup during the fall than western areas; however, some areas had high abundances in the spring. These fish move seasonally, from offshore in the winter to inshore in the summer. With the adoption of a Fishery Management Plan (FMP) in 1996, measures were put in place to effectively manage the scup resource. As defined by NOAA's National Marine Fisheries Service, a fish stock is considered overfished if its biomass is depleted below a level needed to achieve maximum sustainable yield. Overfishing occurs if the fishing mortality (i.e., harvest) exceeds the rate needed to reach the maximum sustainable yield. In 2009, the scup stock was deemed rebuilt, meaning the previously overfished stock had recovered to levels that support maximum sustainable yield; therefore, the most recent stock assessment in 2012 concluded that the stock was not overfished and overfishing was not occurring (Mid-Atlantic Fishery Management Council 2013b). In both the spring 2012 CT DEEP data and the current study, scup were the most abundant species. In this study, only the Cornfield Shoals Dredged Material Disposal Site had a notably low abundance of scup, which also had a high abundance of little and winter skates. Scup spawn once a year in the summer, which explains the trimodal length frequency diagram (Figure 10); as each year-class matures and grows, a distinct peak forms. Therefore, at least three year-classes were collected by CT DEEP for this survey. Males and females become sexually mature at 2 years, which corresponds to about 16 cm (160 mm). Of the measured scup, the first peak at 110 mm is likely age-0 fish, just before their first birthday. The following, highest peak at 170 mm represents fish turning 2 years of age and reproducing for the first time. The last, smaller peak (230 mm) would be composed of fish 3 or more years old. Scup are targeted more often by commercial and charter/party boat fishermen than the recreational industry.

Winter flounder abundances have decreased since 1992, and though they are broadly distributed throughout the Sound, the eastern basin had the lowest catches. Data from 2010 indicated that the southern New England and mid-Atlantic stock was overfished (i.e., biomass level below maximum sustainable yield) but that overfishing was not occurring (i.e., fishing mortality did not exceed levels needed to rebuild the stock) (Atlantic States Marine Fisheries Commission 2013c). Winter flounder, one of this study's primary targeted species and of high commercial importance, was also studied by Dominion Resources Services Inc. (2006) during their investigation of the ecological impacts of the Millstone Power Station. Historically, there was a decline in stock abundances after the early 1980s, presumably due to low recruitment, warmer winter temperatures, and increased fisheries exploitation. In a follow-up study, Dominion Resources Services Inc. (2013) found that abundance decreased further, though larval abundance was greater in Niantic Bay relative to Niantic River, suggesting Long Island Sound may be more important to reproductive success than estuaries. This species has a seasonal migration that is the reverse of many of the other species found in Long Island Sound. Winter flounder overwinter in the inshore bays and estuaries, then migrate offshore during the summer months. Consequently, the relatively low abundance in this study's trawl survey may be a result of preferred offshore habitat in June. Sexual maturity is reached at 2 to 3 years of age, or 20 to 25 cm (200–250 mm). Based on fish length, most of the winter flounder collected in this survey were sexually mature. The somewhat protracted spawning period may also explain why a distinct peak for each year-class is not evident (Figure 11). Since winter flounder were scarce, though, there may simply be insufficient length data to discern a pattern. Winter flounder were only identified by recreational fishermen as a target species, and at low rates.

Three striped bass were collected in three different tows throughout eastern Long Island Sound for this study. Striped bass stocks have been deemed recovered as of 1995, following strict regulations in the mid-1980s. The most recent assessment from 2013 found that the stock is not overfished nor is overfishing occurring (Atlantic States Marine Fisheries Commission 2013a). This increase in abundance since the 1980s is also reflected in the CT DEEP survey. Since spawning occurs in freshwater between April and June, it is possible that adult fish were not yet using habitat in eastern Long Island Sound during this trawl survey. Juvenile striped bass (<20 cm) often disperse to low salinity habitat in non-natal estuaries (Able et al. 2012) before growing and moving into the main estuary and ocean. From Plum Island Estuary, Massachusetts, sub-adult striped bass migrate south in the fall, with about half stopping in Long Island Sound, and the other half continuing on to the Delaware Estuary (Mather et al. 2010). Two adults that were collected on a dredged material disposal site in this study were estimated to be approximately 6 years of age; one that was collected off-site was likely 10 years of age. Sexual maturity is reached between 2 and 4 years for males and 5 to 8 for females, so the 6-year-old individuals may or may not have been sexually mature. This anadromous fish is the most sought-after species by charter/party boat and recreational fishermen.

Bluefish primarily occur in eastern Long Island Sound seasonally, moving through the Mid-Atlantic Bight during their summer spawning period, though larger fish may reside there year-round. The bluefish stock is considered rebuilt, with both commercial and recreational fishermen under-harvesting the stock (Atlantic States Marine Fisheries Commission 2013b). Since the start of the survey, bluefish catch per tow varied, with a higher frequency of age-0 fish than age-1+. In 2012, approximately thirteen age-0 and one age-1+ bluefish per tow were caught, with greater biomass during the fall sampling period. Therefore, the finfish trawl sampling effort in this study had below average abundance of bluefish, but that could be due, at least in part, to their seasonal migration restricting them from Long Island Sound until later in the summer. To determine age class, CT DEEP uses 30 cm as the length to partition age-0 and age-1+ bluefish (CT DEEP 2012). Using this to determine age, the single bluefish collected in the westernmost tow of this study, measured at 537 mm fork length (53.7 cm), is considered older than 1 year of age. Bluefish are the third-most targeted finfish by both charter/party boat and recreational fishermen.

Both secondary targeted species, windowpane flounder and striped searobin, were among the top 10 most abundant species in the CT DEEP Long Island Sound survey in 2012, comprising 2.2 and 1.9 percent of the total catch, respectively. However, ENSR (2001a) found that the highest catches of these two species occurred in western Long Island Sound. In this study, both species occurred at low densities, except windowpane flounder in tow AC2013005. In this tow, 62 fish made up over 7 percent of the catch. This was also the one tow with an above-average occurrence of smooth dogfish, which is unexpected since dogfish are a common predator of this flounder species. Split spawning occurs for windowpane flounder in the spring and fall; since only one peak is evident in the length frequency graph (Figure 12), other cohorts may have been excluded by the size or speed of the trawl net. The average age at maturity for striped searobin is 221 mm fork length, for both males and females (McEachran and Davis 1970). Therefore, most, if not all, of the collected individuals (225–295 mm) were sexually mature. Neither windowpane flounder nor striped searobin were specifically mentioned as a target species in the fishing activity questionnaire.

Commercial finfishermen rely heavily on eastern portions of Long Island Sound, while charter/party boat and recreational fishermen frequent the central to southwestern portions. Interestingly, commercial fishermen were the only group in which the majority felt that the quantity of their target species had increased over time; all other fishery groups felt abundance of their target species had not been changing or had been decreasing. All finfish groups listed summer flounder and striped bass as important target species, but commercial fishermen were alone in identifying black sea bass and tautog among their most-targeted species. Although tautog are currently characterized as overfished (Atlantic States Marine Fisheries Commission 2011), the black sea bass stock was considered rebuilt in 2009 and is at 102 percent of the necessary spawning stock biomass for maximum sustainable yield (Atlantic States Marine Fisheries Commission 2009, Mid-Atlantic Fishery Management Council 2013a). This recent increase in abundance may have influenced many of the fishermen targeting black sea bass to report greater numbers.

Shellfish fisheries patterns display a slightly different spatial and temporal pattern than that for finfish. The three most abundant shellfish species collected by on-site trawls were longfin squid, spider crab, and lobster. For off-site trawls, they were longfin squid, spider crab, and blue crab. The trawl data are not likely to fully complement the survey data for the commercial shellfish fishermen, because of gear effects. Many fishermen use pots, traps, or dredges to target shellfish, especially for animals that reside below the sediment surface. Based on the CT DEEP trawl survey in all of Long Island Sound, lobster abundance has been below average for the last decade (Gottschall and Pacileo 2012; Figure 20). In the six eastern Long Island Sound trawls included in this study, lobsters were only collected in the eastern-most trawls, toward the highly used commercial lobster grounds in the eastern portion of the survey area (Figure 15). Since trawls did not collect any lobsters and commercial fishermen do not use the area, the western portion (areas A, B, E, F, and G) may be suboptimal lobster habitat. In addition to habitat usage, the overall low abundance of lobsters in this study may be due to the decreasing population abundance throughout the Sound. Based on feedback from the fishing activity survey, the eastern portion of the study area is important to the lobster fishery, while the southwestern portion is used frequently by the commercial mollusk industry. Commercial mollusk fishermen were the only group that did not report peak fishing effort in the summer; rather, they focused their efforts in the fall. Many shellfish areas in New York waters, where the commercial mollusk fishery is focused, have seasonal closures from May to October or November (New York State Department of Environmental Conservation 2014), so mollusk fishermen may increase their effort when the areas reopen in the fall.

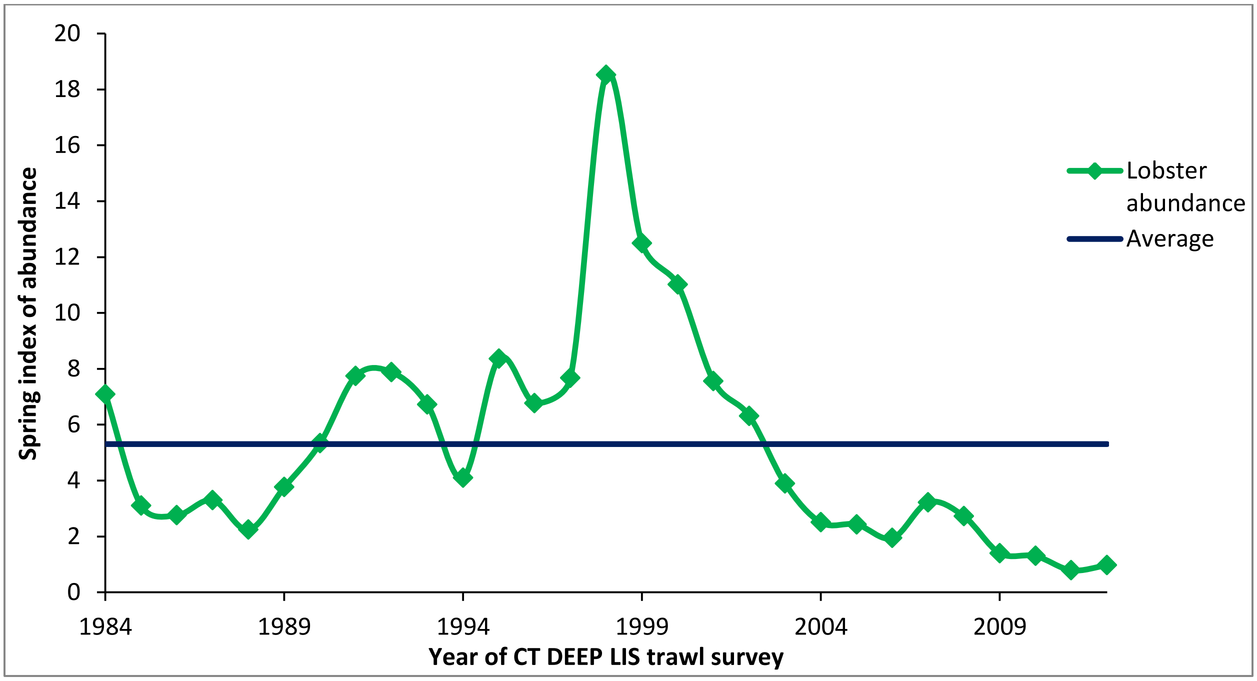


Figure 20: Spring Index of Abundance for Lobster, Based on the CT DEEP LIS Trawl Survey

Fishing near dredged material disposal sites was infrequent, regardless of the fishery type. Half of all respondents do not fish near dredged material disposal sites at all and a large percentage of them (44 percent) were unsure. Since these individuals are not seeking out these specific dredged material disposal site areas, it is unlikely that they would frequent them by chance. Only a small portion (6 percent total) fished near a dredged material disposal site occasionally or regularly. The NLDS was the only dredged material disposal site included in the current study that was explicitly mentioned by fishermen who fished close to such sites. NBDS and CSDS do not appear to attract fishermen. Since few of the questionnaire's respondents fished near dredged material disposal sites, feedback on the effect of dredged material disposal sites on fishing activity was limited. The few that did identify changes in catch near a dredged material disposal site mentioned an increase in mid-Atlantic species, as well as an overall increase in catch quantity. Based strictly on those fishermen that commented on changes in catch near dredged material disposal sites, the only negative observation was that flounders were “all gone;” all other responses were neutral or positive. It may be assumed that this one particular fisherman's response was regarding the most sought-after flatfish, summer flounder (Table 26). If this is the case, however, the observation contradicts the increase in summer flounder abundance observed over the last decade; a recent stock assessment from 2011 found that the summer flounder stock had reached its biomass target in 2010 (Northeast Fisheries Science Center 2011).

One recurring comment throughout the survey was a greater incidence of warmer-water species. This observation has been substantiated by years of catch data. More than 20 years of CT DEEP's trawl data were compared to 32 years of water temperature data by Howell and Auster (2012). Bottom water temperature significantly increased over this time period. With it, fish assemblages shifted from cold-adapted to warm-adapted species. Northern fish like windowpane flounder, winter flounder, red hake, and little skate have shown declining numbers, while southern fish like scup, butterfish, summer flounder, and black sea bass have proliferated (Benson 2012). The 2012 Long Island Sound trawl survey caught pinfish (*Lagodon rhomboids*) for the first time in two fall trawls (Gottschall and Pacileo 2012). This warm-water species tolerates water temperatures from 10°F to 35°F and are generally found in more southern waters (Ohs et al. 2011). Fish assemblages have already undergone alterations in response to increased water temperatures, as evidenced by trawl catch composition and fishery target species. This increase in water temperature may further stress cold-water species, increasing susceptibility to disease or parasites, or driving populations offshore.

4.3 DISEASE AND TOXICITY

The American lobster may be particularly vulnerable to environmental changes, such as warmer water. Shell disease was first documented in 1992 and increased dramatically after 1999. This increase in shell disease was concurrent with temperatures regularly exceeding 20°C, a pattern that was not evident before the mid-1990s. Shell disease results in bacterial growth that weakens the lobster's shell, with a simultaneous attack on the immune system. Molting can get rid of shell disease, but under the same stressful environmental conditions, the animals easily become re-infected. Eastern Long Island Sound has had the highest incidence of the disease relative to the central and western basins, with rates ranging from a low of 14.4 percent in 2008 to a high of 35.5 percent in 2002 (Giannini and Howell 2010). Though shell disease incidence has remained elevated since 1999, the most recent estimates from 2009 show a slight decrease in occurrence from 2002-2007 levels, with 22 percent of lobsters affected by the disease (Giannini and Howell 2010). Disease severity has been linked to poor immune systems (Homerding et al. 2012), but it does not appear to result from metal contamination (LeBlanc and Prince 2012). The disease is more common in egg-bearing females, with up to 92.1 percent showing signs of shell disease in 2002 (Giannini and Howell 2010). In addition to this biological affliction, there is some evidence that lobsters are beginning to spawn offshore in deeper waters, which may negatively affect recruitment rates. Larvae released offshore are transported away from historic nursery sites in Long Island Sound estuaries, resulting in higher losses at sea or settlement in more northern areas (Bell 2010). Environmental changes, rather than fishing pressure, have been implicated in the decline of the southern New England stock of American lobster (Bell 2010). Decreased health, coupled with recruitment failure, has likely contributed to the relatively few commercial lobstermen still actively fishing, as well as low abundances, both apparent in the current study.

From 1988 to 2010, chemical contaminants from land, air, and water have collectively decreased by 86 percent within Long Island Sound (LISS 2012). This decline has been attributed to toxic chemical bans, tighter regulations, and less manufacturing, which has led to the recovery of several species, including the osprey (LISS 2012). Contaminants still threaten marine and coastal organisms, however. Bluefish, an important recreational species, has been found with levels of mercury high enough to pose a risk to human health (Szczebak and Taylor 2011). In fact, bioaccumulation is correlated to bluefish length, because as these fish grow, they prey on larger food items with more mercury. Both summer and winter flounders have exhibited bioaccumulation of mercury as well, with evidence that mercury is transferred through the food web (Payne and Taylor 2010). Therefore, some of the largest fishes (and most sought-after by fishermen) often contain the highest contaminant concentrations. Not only can contaminants like mercury pose a risk to human health, but they may also decrease the fitness of an organism. The saltmarsh sparrow, an endangered coastal bird, has been observed with mercury levels that may reduce nesting success (LISS 2012). As previously stated, contaminant levels have decreased overall, however, with many beneficial results. Levels of contaminants such as metals, dioxins, and pesticides were low enough in shellfish that 2,500 acres of LIS shellfish areas were reopened in 2011 after 40 years (LISS 2011). Although some organisms continue to be affected by contaminants, the health of Long Island Sound has improved, resulting in the recovery of several species.

As discussed in Sections 3.1 to 3.4, the 10-day sediment toxicity testing completed for this study resulted in survival rates ranging from 82 to 92 percent of *A. bahia* and 94 to 98 percent of *L. plumulosus*, suggesting that the toxicity of sediments within the disposal sites is not a major concern for survival of benthic organisms.

4.4 SITE-SPECIFIC TRENDS

The NLDS is distinguished by the high proportion of silt and clay sediment. Likewise, NLDS samples have slightly elevated organic content. Species density varied substantially from site to site, with a minimum of 30 in NBDS and a maximum of 3,905 in an off-site grab. Since the variation occurs within all of the sites sampled, there is not one particular site or area that shows a notable trend in species density. Species richness was highest off-site where the greatest number of grabs occurred, which is supported by species-area relationships in marine ecosystems (Valiela 1995, Neigel 2003). Diversity, indexed by H', was also somewhat variable, but was relatively high. No one site had significantly different diversity. Off-site samples were dominated by annelids, while all others had arthropods as the dominant taxon. On a species-specific basis, however, the fine-grained NLDS contained more tube-dwelling amphipods compared with the other three medium-grained sites, which had more barnacles and bivalves. Based on average abundance by biomass, scup was greatest both on and off dredged material disposal sites, however it occurred in different percentages. Off-site, scup made up about 20 percent of the catch, while it made up almost 50 percent of on-site trawls.

4.5 COMPARISONS AMONG SITES

In general, the sediment composition was consistent with expectations, and similar between dredged material disposal sites and off-site areas. Based on the grain size analysis of this study, the areas sampled in eastern Long Island Sound were primarily made up of medium-size sand. This type of sand often provides habitat for many marine invertebrates, but does not support seagrasses in the open-water habitat of the study area due to minimal light penetration to the ocean bottom. Likewise, no evidence of hardbottom or livebottom in the sampled area of eastern Long Island Sound was found. Organic content was relatively low across all sites, with the highest TOC at NLDS, which coincides with a high proportion of silt and clay. The number of individuals per sample ranged from 30 to 875 for on-site benthic grabs, and ranged from 52 to 3,905 for off-site grabs. Only three of the off-site grabs attained more than 1,000 individuals per sample; the average was 626. This is comparable to the averages of NLDS (617), NBDS (529), and CSDS (893). Species richness was higher than expected based on previous measurements (Dominion Resources Services Inc. 2013), which indicates a diverse infaunal community. Diversity indices were marginally significant between samples collected on and off dredged material disposal sites, with H' increased on-site. Based on H', benthic infauna species diversity is greater on a dredged material disposal site relative to adjacent areas. Arthropods dominated on-site samples, while annelids were the majority taxon for off-site samples. However, Arthropoda, Mollusca, and Annelida were almost equally abundant across sample sites. Therefore, no difference between taxa was apparent between grabs on and off dredged material disposal sites. Toxicity of the sediment to two organisms was not different among eastern Long Island Sound sites, and none of the field sites resulted in differential survival when compared to survival in control sediment.

A variety of organisms were brought up in the trawls conducted in eastern Long Island Sound. Scup, one of the primary targeted species, was the most abundant species by weight for both on- and off-site tows. The only targeted fish, either primary or secondary, that did not appear in both areas was the bluefish, which was absent from off-site tows. CPUEs, which are proportional to population abundances, did not differ significantly between catches on and off of dredged material disposal sites for targeted species of interest (scup, striped bass, winter flounder, bluefish, striped searobin, and windowpane flounder).

Overall, eastern Long Island Sound is dominated by medium sand that supports a healthy, diverse group of benthic organisms. Dredged material disposal sites do not appear to be correlated to changes in fish or benthic infauna abundance or habitat alterations; rather, local processes seem to dictate differences between samples and sites. Finfish abundance is presumably greatly influenced by seasonal movements of many species, including some of the target species of this study, such as scup, winter flounder, and bluefish. For all of the five fishery groups, the majority of fishing activity was concentrated in the eastern and southwestern portions of the Sound. The northwest portion of the study area appeared to have the least fishing activity. Eastern Long Island Sound provides important habitat for many benthic and fish species, as well as fishing opportunities for many commercial fishermen and recreational anglers.

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APPENDIX A – FIELD DATA SHEETS; BENTHIC SAMPLING

WATER QUALITY - 7/19/2013

SITE		TIME	DEPTH	TEMP	COND ms/cm	DO	DO%	pH	REMARKS
CSDS	SURF ~~Bottom~~	0605	149	19.82	41.37	7.94	99.6%	8.19	NIANTIC EDGE
	MID			19.25	40.74	7.40	93.7%	8.16	
	BOTTOM ~~SURF~~			19.14	39.46	7.29	91.6%	8.17	
NIANTIC	SURF ~~BOT~~	0730	70	19.45	38.99	7.19	90.5%	8.18	
	MID			18.58	40.07	6.91	85.9%	8.17	
	BOT ~~SURF~~			18.51	40.41	6.84	85.1%	8.16	
R 028	SURF ~~BOT~~	0745	81	19.42	39.86	7.09	89.5%	8.22	
	MID			18.42	41.40	6.74	84.1%	8.18	
	BOT ~~SURF~~			17.37	42.00	6.51	79.7%	8.14	
RH12	SURF ~~BOT~~	0755	71	19.58	40.11	6.99	88.6%	8.22	
	MID			19.20	40.96	6.75	85.5%	8.19	
	BOT ~~SURF~~			17.50	41.17	6.52	79.6%	8.15	
NLDS	~~BOT~~ SURF	0810	59	19.50	38.94	6.85	86.5%	8.21	mS/cm is ~4.5 [illegible]
	MID			19.56	~~3~~ 40.78	6.72	85.4%	8.19	mScm
	~~SURF~~ BOT			19.37	39.77	6.66	84.1%	8.19	

DONE - 0900

TETRA TECH

Benthics, Sheet 1 of 1

Project: LIS Benthics Date: 7/16/13 Vessel: Hostile Waters Location: LIS New London Interim Disposal Site

Crew: BD, DA, TG, LR + BoBo T-Bone Grab Type: VanVeen Calibration: N/A

Weather Conditions: Sunny, warm, humid (80's)

Additional Notes P011 - triplicate sample collected; P011 toxicity sample collected
59+ ft is min depth for sampling

Site/Station ID	Time	GPS?	Depth ~~(m)~~ ft	% Full	Penetration?	Water Overlay?	Even Surface?	Sediment Description (color, odor, texture)	Picture ~~RPD~~	TOC	Grain Size	# of #	
P011a	1240 ~~0900~~	✓	59.1	50	yes	yes	yes	sand w/shell hash	NO	✓	✓	1	Bag
P011b	1225		59.1	50	yes	yes	yes	sand w/shell hash	NO	✓	✓	1	Bag
P011c	1230		59.1	75	yes	yes	yes	sand w/shell hash	NO	✓	✓	1	Bag
~~R014~~	1245	✓	61.9	50	yes	yes	yes	sand w/shell hash	NO	✓	✓	1	Bag
P014	12:50	✓	61.4	50	yes	yes	yes	silty clay	NO	✓	✓	1	Bag
P015	1308	✓	59.3	50	yes	yes	yes	sand w/shell hash	NO	✓	✓	1	Bag
P013	1330	✓	66.3	50	yes	yes	yes	sandy, silt, clay	NO	✓	✓	1	Bag
P009	1351	✓	61.8	50	yes	yes	yes	silty clay	NO	✓	✓	1	
~~R007~~	~~1412~~		~~98.2~~										
P008	1422	✓	65.7 ~~65.7~~	75	yes	yes	yes	sand	NO	✓	✓	1	BAG
R020	1442	✓	71.6	50	yes	yes	yes	sand	NO	✓	✓	1	BAG

Additional Notes Troubleshoot problems w/ VanVeen collection of sd mple · moved in shore; went back to marina to get a swivel, which solved grab issue. Regrouped @ P011 @ 1200 noon.
P009 + ~~R008~~ = 2 25% grabs to generate 50% total

P008 = 25% + 50% grabs to generate 75% total

10 samples
8 sites

TETRA TECH

Benthics, Sheet 2 of 7

Project: Long Island Benthics **Date:** 7/16/13 **Vessel:** Hostile Waters **Location:** LI Sound
Crew: BD, TF, DA, CR **Grab Type:** Van Veen **Calibration:** N/A
Weather Conditions: Sunny, hot (90's)
Additional Notes

Site/Station ID	Time	GPS?	Depth (m)	% Full	Penetration?	Water Overlay?	Even Surface?	Sediment Description (color, odor, texture)	RPD	TOC	Grain Size	# of #
R023	1500	✓	69.3	50%	yes	yes	yes	Sand		✓	✓	1
~~R020~~ R010	1516	✓	66.8	50%	yes	yes	yes	Sand		✓	✓	1
Additional Notes	END SAMPLING FOR DAY @ 1540											

Bag
Bag

2 samples
2 sites

Benthics, Sheet 3 of 7

Project: LIS Benthics **Date:** 07/17/13 **Vessel:** F/V Hostile Waters **Location:** eastern LIS
Crew: DA, BD, LR, TG, Capt Bob + Tyler **Grab Type:** Van Veen **Calibration:** n/a
Weather Conditions: Sunny + hot (high 80s), no wind
Additional Notes

Site/Station ID	Time	GPS?	Depth (m)	% Full	Penetration?	Water Overlay?	Even Surface?	Sediment Description (color, odor, texture)	Pic ~~RPD~~	TOC	Grain Size	# of #	
P001	0902	✓	178	50	Yes	Yes	Yes	Sandy w/hash	X	✓	✓	1	Bag
P002	0925	✓	171	50	Yes	Yes	Yes	Sand, few pebbles	X	✓	✓	1	Bag
~~P002b~~	[illegible]	✓											
~~P00~~	[illegible]	✓											
P003a	1015	✓	178	50	Yes	Yes	Yes	Sand + pebbles	X	✓	✓	1	Bag
P003b	1038	|	158	50	Yes	Yes	Yes	Sand + gravel	X	✓	✓	1	Bag
P003c	1056	|	157	50	Yes	Yes	Yes	Sand + hash	X	✓	✓	1	Bag
P016	1154	✓	132	50	Yes	Yes	Yes	Sand, few pebbles	X	✓	✓	1	Bag
P022	1215	✓	87.9	50	Yes	Yes	Yes	Sand + hash	X	✓	✓	1	Bag
R004	1226	✓	84.0	75	Yes	Yes	Yes	Sand + hash	X	✓	✓	1	Bag
P019	1241	✓	92.0	75	Yes	Yes	Yes	Sand, few pebbles	X	✓	✓	1	Bag

Additional Notes - Triplicates & toxicity samples collected at site P003.

9 samples
7 sites

TETRA TECH

Benthics, Sheet 4 of 7

Project: US Benthics Date: 07/17/13 Vessel: F/V Hostile Waters Location: eastern US
Crew: DA, BD, LR, TG, Capt Bobby Tyler Grab Type: Van Veen Calibration: n/a
Weather Conditions: Hot & Sunny, no wind
Additional Notes

Site/Station ID	Time	GPS?	Depth (m)	% Full	Penetration?	Water Overlay?	Even Surface?	Sediment Description (color, odor, texture)	Pic ~~RPD~~	TOC	Grain Size	# of #	
P025	1252	✓	92.1	75	Yes	Yes	Yes	Sand, few hash	X	✓	✓	1	Bag
P023	1318	✓	89.7	50	Yes	Yes	Yes	Sand few pebbles	X	✓	✓	1	Bag
R001	1330	✓	100	75	Yes	Yes	Yes	Sand	X	✓	✓	1	Bag
P017	1347	✓	123	50	Yes	Yes	Yes	Sand, lighter color	X	✓	✓	1	Bag
P018a	1404	✓	109	50	Yes	Yes	Yes	Sand & hash	X	✓	✓	1	Bag
P018b	1410	|	109	50	Yes	Yes	Yes	Sand	X	✓	✓	1	Bag
P018c	1415	|	105	75	Yes	Yes	Yes	Sand few hash	X	✓	✓	1	Bag
R018	1432	✓	84.2	50	Yes	Yes	Yes	Sand few pebbles	X	✓	✓	1	Bag
P020	1447	✓	95.1	50	Yes	Yes	Yes	Clay & Sand	X	✓	✓	1	Bag
R027	1502	✓	93.5	50	Yes	Yes	Yes	Sand	X	✓	✓	1	Bag
~~R021~~		~~✓~~	~~100~~										

Additional Notes

10 samples
8 sites

WE11_Benthic_DataSheet 4/3/2013

TETRA TECH

Benthics, Sheet 5 of 7

Project: LIS Benthics **Date:** 07/17/13 **Vessel:** F/V Hostile Waters **Location:** eastern LIS

Crew: DA, BD, LR, TG, Capt Bob, Tyler **Grab Type:** Van Veen **Calibration:** n/a

Weather Conditions: Hot + Sunny, light breeze

Additional Notes

Site/Station ID	Time	GPS?	Depth (m)	% Full	Penetration?	Water Overlay?	Even Surface?	Sediment Description (color, odor, texture)	Pic ~~RPD~~	TOC	Grain Size	# of #
R101	1608	✓	69.1	50	Yes	Yes	Yes	Sand	X	✓	✓	1
R102	1618	✓	81.1	90	Yes	Yes	Yes	Sand	X	✓	✓	1
R103	1630	✓	112	50	Yes	Yes	Yes	Sand + gravel	X	✓	✓	1
R104	1645	✓	140	50	Yes	Yes	Yes	Sand & trash	X	✓	✓	1
→ R026												
Additional Notes	- end of sampling @ 1700											

Bag
Bag
Bag
Bag

4 samples
4 sites

TETRA TECH

Benthics, Sheet 6 of 7

Project: LIS Benthics Date: 07/18/13 Vessel: F/V Hobbie Waters Location: eastern LIS

Crew: DA, BD, LR, TG, Capt Bob - Tyler Grab Type: Van Veen Calibration: n/a

Weather Conditions: Sunny + hot (mid 80s), light breeze

Additional Notes

Site/Station ID	Time	GPS?	Depth (m)	% Full	Penetration?	Water Overlay?	Even Surface?	Sediment Description (color, odor, texture)	Pic ~~RPD~~	TOC	Grain Size	# of #	
P007	0737	✓	115	50	Yes	Yes	Yes	Gravel hash	X	✓	✓	1	Bag
P006	0757	✓	143	50	Yes	Yes	Yes	Sand, hash	X	✓	✓	1	Bag
R025	0814	✓	144	50	Yes	Yes	Yes	Sand, few hash	X	✓	✓	1	Bag
R024	0821	✓	119	50	Yes	Yes	Yes	Sand, few hash	X	✓	✓	1	Bag
R105	0850	✓	69.0	50	Yes	Yes	Yes	Sand clay	X	✓	✓	1	Bag
R106	0902	✓	67.3	50	Yes	Yes	Yes	Sand, hash	X	✓	✓	1	Bag
R007	0911	✓	78.9	50	Yes	Yes	Yes	Sand, hash	X	✓	✓	1	Bag
R107	0925	✓	59.6	50	Yes	Yes	Yes	Sand few hash	X	✓	✓	1	Bag
R108	0948	✓	89.5	50	Yes	Yes	Yes	Sand, few hash	X	✓	✓	1	Bag
R109	0956	✓	80.3	50	Yes	Yes	Yes	Sand few hash	X	✓	✓	1	Bag
R110	1008	✓	66.3	50	Yes	Yes	Yes	Sand, some clay	X	✓	✓	1	Bag
Additional Notes	- Toxicity collected at R024												

11 samples
11 sites

TETRA TECH

Benthics, Sheet 1 of 1

Project: US Benthics Date: 07/18/13 Vessel: F/V Hostile Waters Location: eastern US

Crew: DA, BD, LR, TG, Capt Bob, + Tyler Grab Type: Van Veen Calibration: n/a

Weather Conditions: Hot + sunny (high 80s), light breeze

Additional Notes

Site/Station ID	Time	GPS?	Depth (m)	% Full	Penetration?	Water Overlay?	Even Surface?	Sediment Description (color, odor, texture)	Pic ~~RPD~~	TOC	Grain Size	# of #	
R111	1022	✓	69.4	50	Yes	Yes	Yes	Sand, gravel	X	✓	✓	1	Bag
R112	1043	✓	69.6	100	Yes	Yes	Yes	Sand, some muck	X	✓	✓	1	Bag
~~R113~~		~~✓~~											
P021	1311	✓	105	50	Yes	Yes	Yes	Sand, some hash	X	✓	✓	1	Bag
R113	1321	✓	101	50	Yes	Yes	Yes	Sand, few hash	X	✓	✓	1	Bag
R114	1412	✓	161	50	Yes	Yes	Yes	Sand, gravel	X	✓	✓	1	Bag
~~R026~~		~~✓~~	~~114~~										

Additional Notes	-R026: not able to obtain sample with grab

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APPENDIX B – RAW LABORATORY DATA; GRAIN SIZE AND TOC

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

September 20, 2013
File Number 13-13-0083

Tetra Tech Inc.
889 Elm St.
Manchester, NH 03101

Attention: Brian Dresser

Subject: Laboratory Testing Services, Eastern Long Island Sound, Biological and Environmental Studies to Support the Environmental Protection Agency and the US Navy in Preparation of a Supplemental Environmental Impact Statement

Gentlemen:

As requested, laboratory testing has been completed on fifty-one benthic sediment grab samples received on July 23, 2013.
Each sample was homogenized and specimens obtained for determination of particle-size distribution, organic content and water content by the following test methods:

- Particle-size distribution was determined using sieve analyses in general accordance with ASTM Standard D422 “Particle-Size Analysis of Soils”.

- Organic content was determined in general accordance with ASTM Standard D 2974 “Moisture, Ash, and Organic Matter of Peat and Other Organic Soils” using Method C.

- Water content was determined in general accordance with ASTM Standard D2216 “Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass” using method B and an oven temperature of 107°C.

The test results are presented on the attached Particle-Size Analysis Test Reports. The percent gravel-size particles (≥2.00 mm [U.S. Standard No. 10 sieve]) and sand-size particles (<2.00 mm and ≥0.063 mm [U.S. Standard No. 230 sieve]) as defined in the scope of services using the Udden-Wentworth grain-size scale for siliciclastic sediment is listed on Table 1. The particle-size analysis test reports show gravel-size particles as ≥4.75 mm (U.S. Standard No. 4 sieve) in accordance with ASTM Standard D422.

The test samples were reported to be from the client-specified designations herein. The test results are indicative of only the specimens that were actually tested. The test results presented are based upon accepted industry practice as well as the test method(s) listed.

Please contact us if you have any questions about the test results or require additional information.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Thomas S. Ingra, P.E.
Laboratory Director
Florida License No. 31987

8008 S. Orange Avenue 32809, Post Office Box 593003, Orlando, Florida 32859-3003 Phone (407) 855-3860 FAX (407) 859-8121
Louisiana: Alexandria, Baton Rouge, Monroe, New Orleans, Shreveport
Florida: Bartow, Cocoa, Fort Myers, Miami, Orlando, Port St. Lucie, Sarasota, Tallahassee, Tampa, West Palm Beach

Table 1

PARTICLE-SIZE DISTRIBUTION TEST RESULTS

Sample No.	Group Symbol	Organic Content (%)	Soil-Fraction (% dry mass)		
			Gravel (≥2.00 mm)	Sand (2.00-0.063 mm)	Silt/Clay (<0.063 mm)
P001	SP	0.4	25.8	72.4	1.8
P002	SP-SM	0.5	14.5	79.4	6.1
P003A	SP	0.6	33.5	62.0	4.5
P003B	SP-SM	0.6	24.7	69.7	5.6
P003C	SP-SM	0.7	12.9	82.1	5.0
P006	SP-SM	1.1	8.6	80.1	11.3
P007	GW	1.9	74.9	21.9	3.2
P008	SC	1.4	4.6	78.1	17.3
P009	SC	3.8	5.3	56.6	38.1
P010	SP-SM	1.0	4.3	86.9	8.8
P011A	SM	1.5	16.2	73.9	9.9
P011B	SM	1.5	16.7	70.9	12.4
P011C	SP-SM	1.2	10.4	81.3	8.3
P013	CL or CH	6.2	3.1	16.4	80.5
P014	CL or CH	3.7	1.7	34.0	64.3
P015	SC	1.2	5.5	78.2	16.3
P016	SP	0.4	29.3	67.7	3.0
P017	SC	0.9	17.7	69.3	13.0
P018A	SP	0.6	25.1	71.4	3.5
P018B	SP	0.4	25.3	71.7	3.0
P018C	SP	0.6	18.4	77.8	3.8
P019	SP-SM	0.8	13.4	78.5	8.1
P020	SC	1.4	9.3	73.7	17.0
P021	SC	1.1	4.3	82.9	12.8
P022	SP-SM	0.5	24.6	70.1	5.3
P023	SP	0.4	20.9	75.6	3.5
P025	SP	0.7	12.0	83.5	4.5
R001	SP	0.4	16.9	81.0	2.1
R004	SP	0.5	6.4	90.3	3.3
R007	SC	1.7	4.8	70.2	25.0
R014	SC	1.9	14.0	42.9	43.1
R018	SP	0.4	28.8	69.3	1.9
R020	SP-SM	0.8	3.2	89.5	7.3
R023	SP-SM	1.5	5.1	85.5	9.4
R024	SC	0.9	27.7	58.8	13.5
R025	SC	1.3	11.2	63.4	25.4
R026	SW-SM	1.2	29.7	60.5	9.8
R027	SP-SC	0.8	31.7	59.7	8.6
R101	SP-SC	0.5	19.8	74.9	5.3
R102	SP	0.2	0.1	99.2	0.7
R103	GP-GC	1.0	64.2	26.6	9.2
R105	SC	1.3	6.1	77.7	16.2
R106	SP-SM	0.7	7.3	86.2	6.5
R107	SC	1.3	19.8	69.2	11.0
R108	SC	1.3	7.3	77.6	15.1
R109	SC	1.4	11.0	72.4	16.6
R110	SC	0.9	4.8	83.2	12.0
R111	SC	1.8	10.8	69.0	20.2
R112	SP	0.6	3.5	94.7	1.8
R113	SP-SM	0.7	5.5	85.3	9.2
R-114	SP-SC	1.1	19.0	72.8	8.2

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P001**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P001
SAMPLE DESCRIPTION: Light brown to brown sand with shell and roots (SP)
$C_u = 4.9$; $C_c = 0.7$

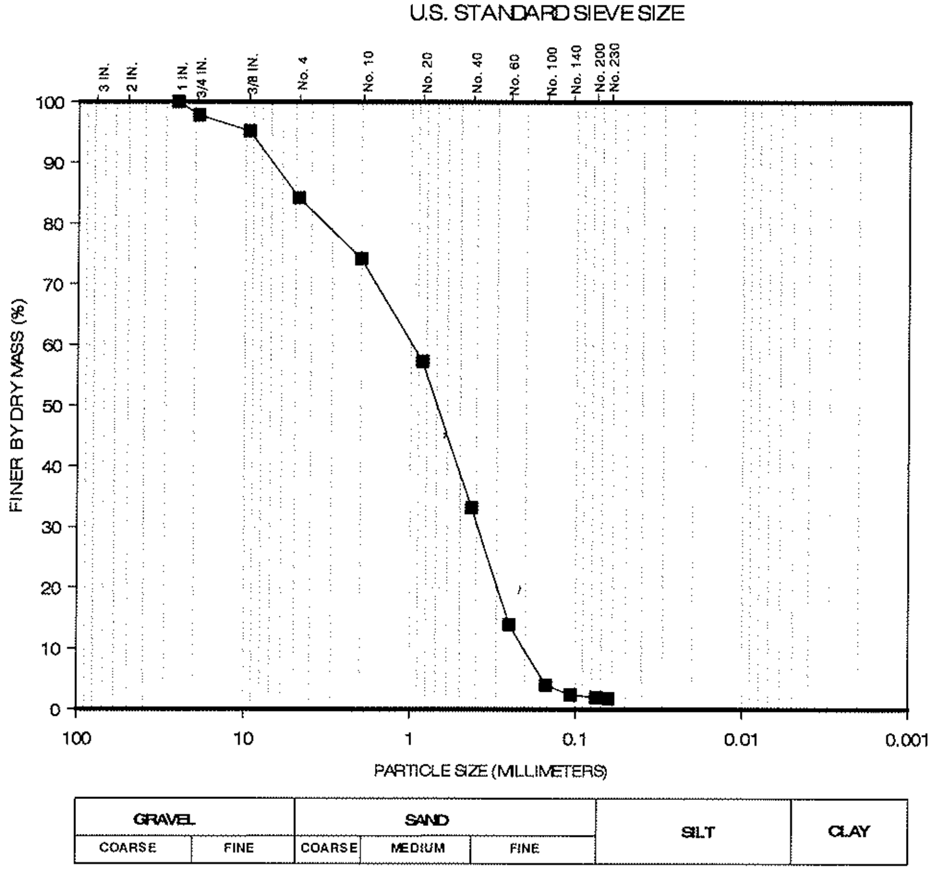
TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 22.6
Mass Dry Solids (grams): 360.15
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	97.8	95.2	84.2	74.2	57.3	33.2	14.0	4.0	2.4	2.0	1.8	-	-	-

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: TM Date: 09/20/13

Coars = No.10 - No.20
Med = No.20 - No.60
Fine = No.60 - No.200

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS

PROJECT: Eastern Long Island Sound

FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13

DATE TEST SET-UP: 07/25/13

DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P002**

BORING: - SAMPLE: -

DEPTH: - ☐ ft; ☐ m

LABORATORY IDENTIFICATION: 0083/P002

SAMPLE DESCRIPTION: Light brown to brown sand with silt and shell (SP-SM)

$C_u = 3.9$; $C_c = 1.6$

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis

☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other

Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 22.1

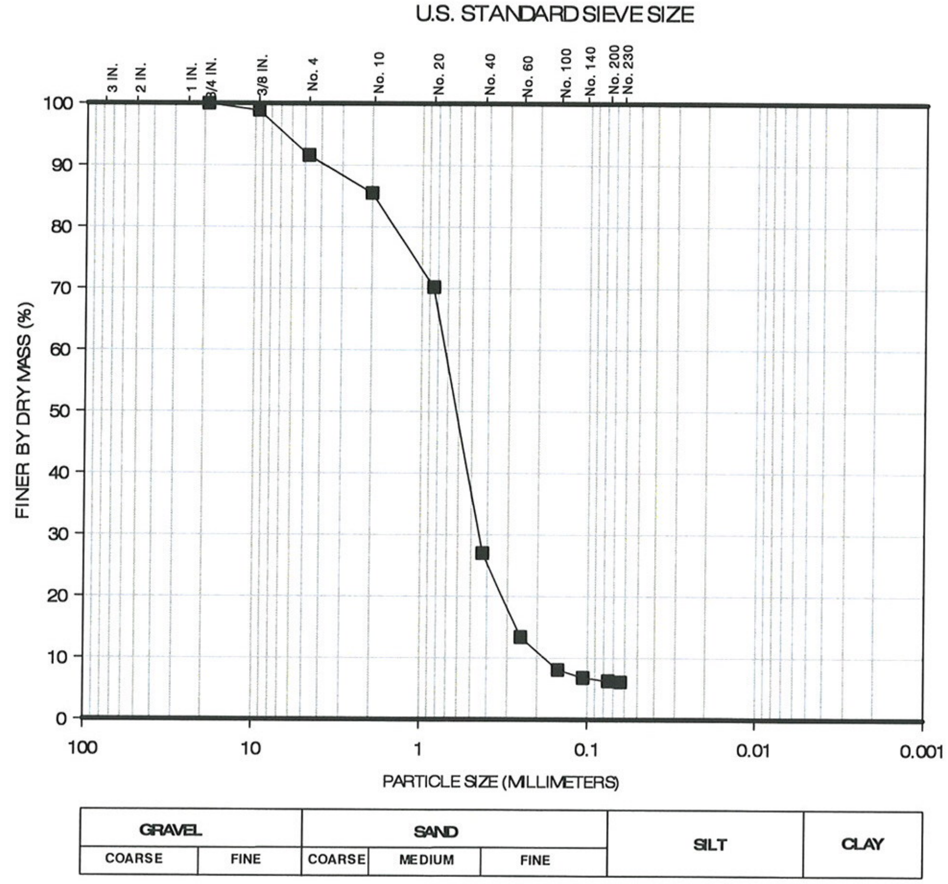
Mass Dry Solids (grams): 388.45

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.5

ASTM Standard D2974

Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis											Hydrometer Analysis		
Gravel-Size				Sand-Size							Silt-Size	Clay-Size	
				Coarse	Medium		Fine						
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	98.9	91.6	85.5	70.2	27.0	13.4	8.1	6.8	6.3	6.1	-	-	-

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P003A**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P003A
SAMPLE DESCRIPTION: Light brown to brown sand with gravel, shell and trace roots (SP)
$C_u = 4.8$; $C_c = 0.7$

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

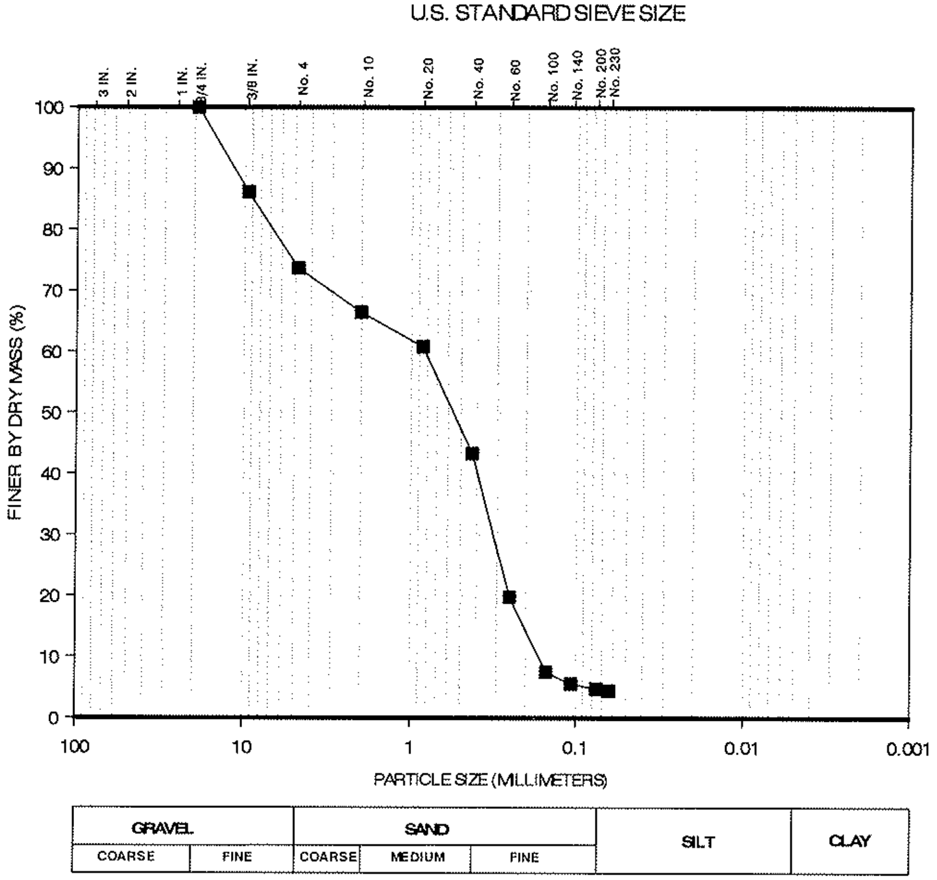
☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 22.4
Mass Dry Solids (grams): 410.09

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.6
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	86.2	73.7	66.5	60.8	43.3	19.8	7.5	5.6	4.8	4.5	-	-	-

Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P003B**
BORING: SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P003B
SAMPLE DESCRIPTION: Light brown to brown sand with silt and gravel and shell and trace roots (SP-SM)
$C_u = 4.3$; $C_c = 0.8$

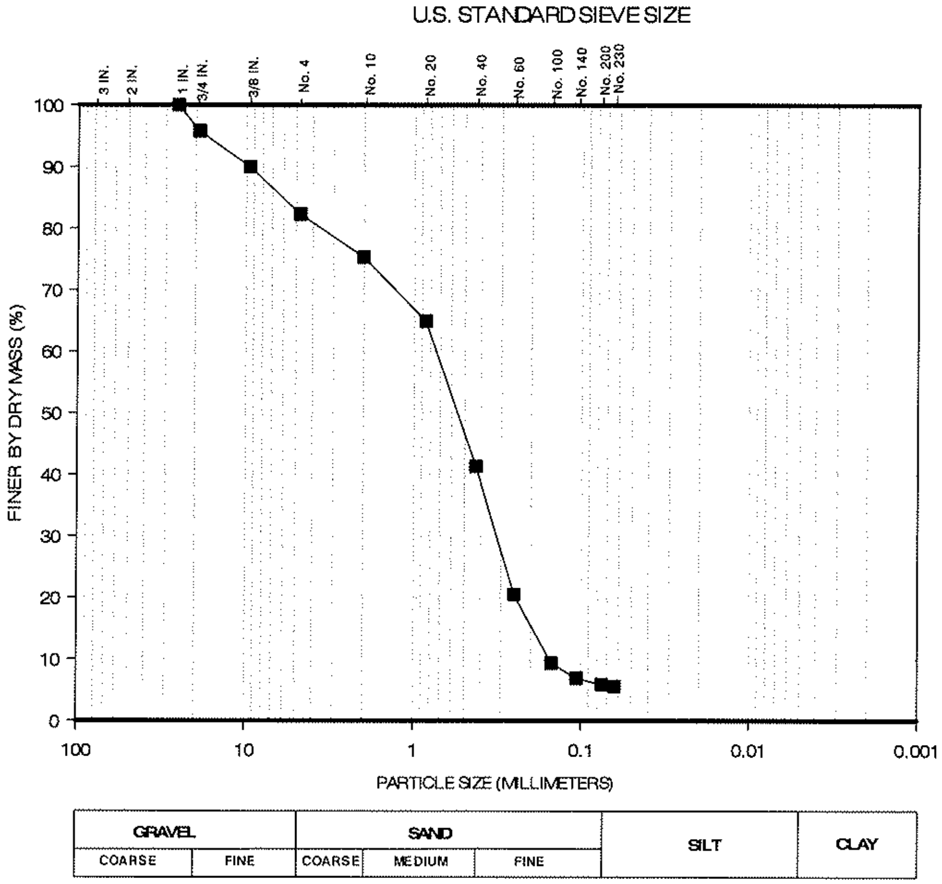
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 24.5
Mass Dry Solids (grams): 386.84
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.6
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	95.8	90.0	82.3	75.3	64.9	41.3	20.5	9.4	6.9	5.9	5.6	-	-	-

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P003C**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P003C
SAMPLE DESCRIPTION: Light brown to brown sand with silt, shell and trace roots (SP-SM)
$C_u = 3.4$; $C_c = 0.9$

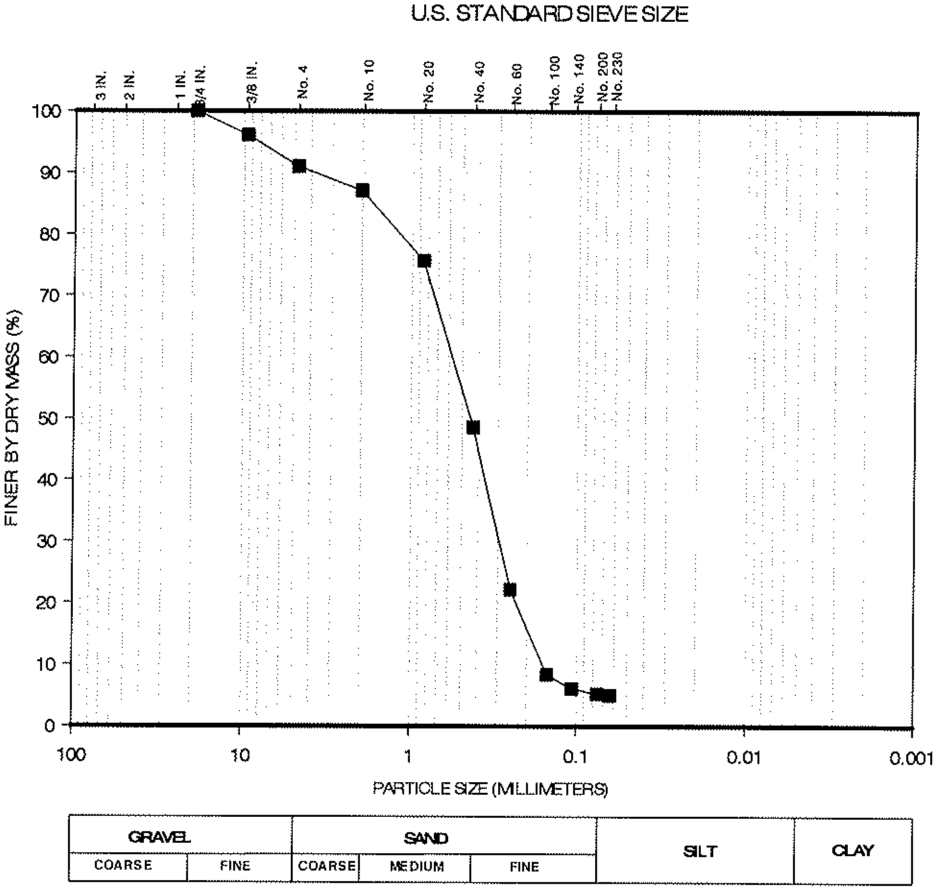
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 28.1
Mass Dry Solids (grams): 267.11
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.7
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	96.1	91.0	87.1	75.7	48.6	22.2	8.4	6.1	5.3	5.0	-	-	-

Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P006**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P006
SAMPLE DESCRIPTION: Light brown to brown sand with silt, shell and trace roots (SP-SM)

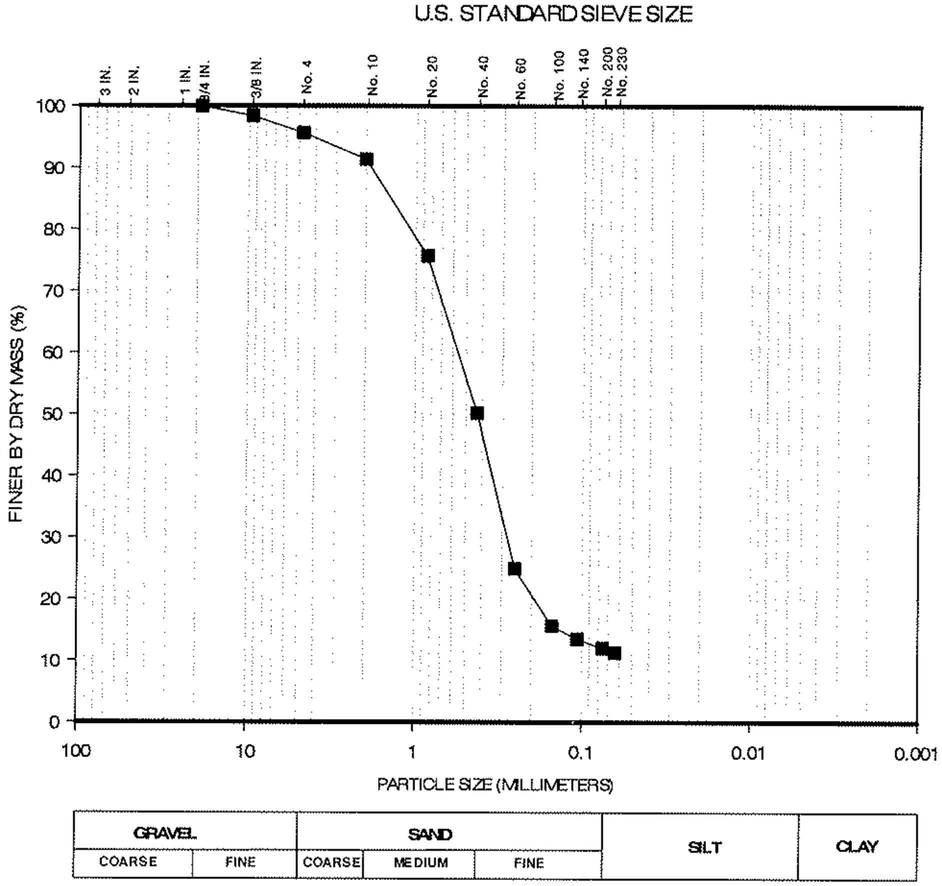
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 39.0
Mass Dry Solids (grams): 301.53
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.1
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	98.4	95.7	91.4	75.7	50.2	24.9	15.6	13.5	12.0	11.3	-	-	-

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Checked By: JM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

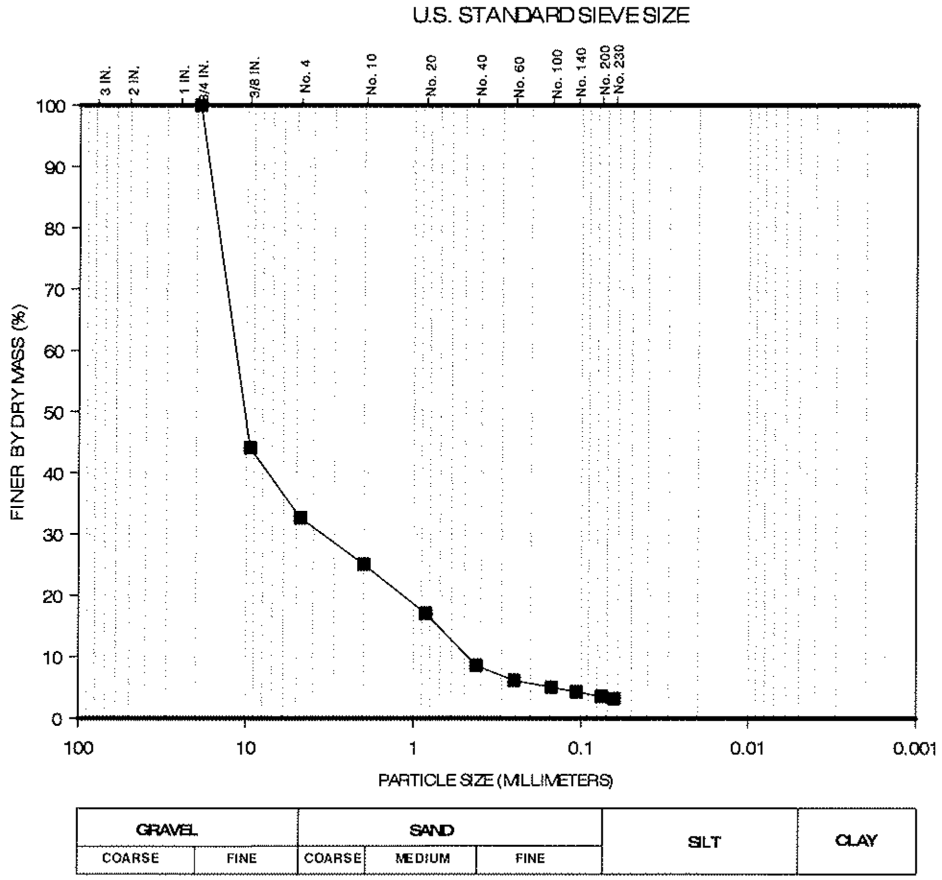
INCOMING SAMPLE NO.: **P007**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P007
SAMPLE DESCRIPTION: Light brown to brown gravel (shell) with sand (GW) C_u = 25; C_c = 2.1. Live shells were removed from sample.

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis
☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 33.5
Mass Dry Solids (grams): 77.72
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.9
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	44.1	32.7	25.1	17.1	8.6	6.2	5.1	4.3	3.6	3.2	-	-	-

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Checked By: ____ Date: 09/20/13

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ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P008**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P008
SAMPLE DESCRIPTION: Dark gray to light brown clayey sand with shell and trace roots (SC)

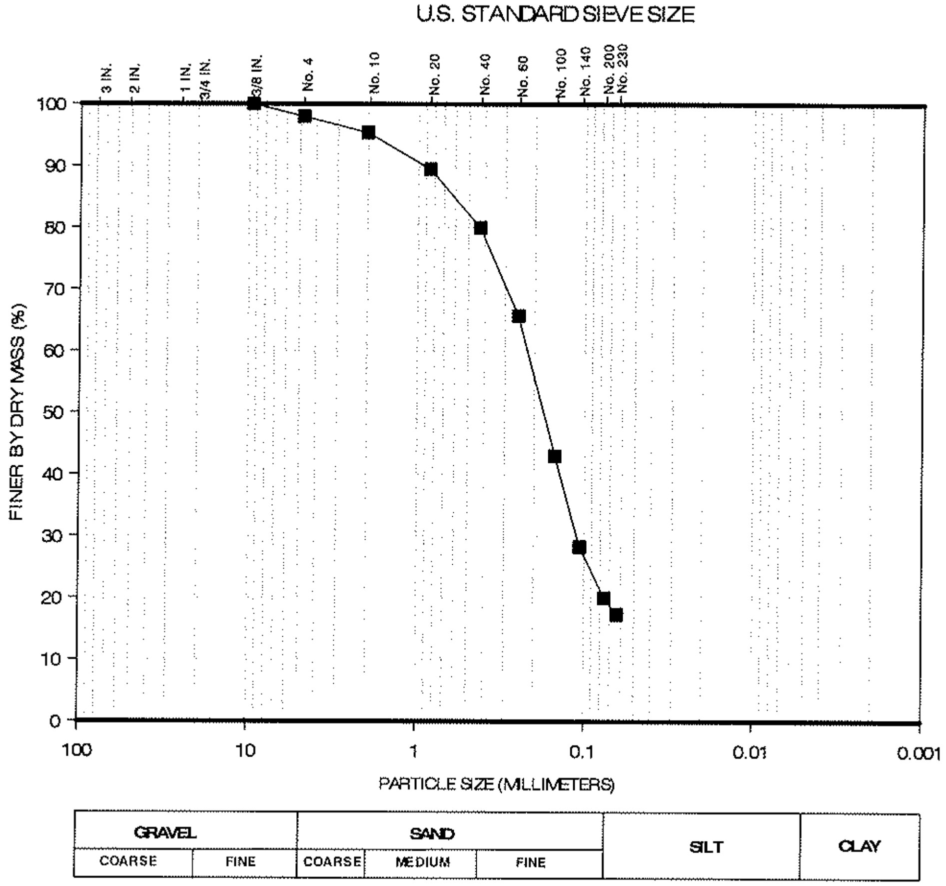
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ______

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other ______
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ______

Water Content (%): 40.9
Mass Dry Solids (grams): 208.05
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	100	98.0	95.4	89.5	80.0	65.7	43.0	28.3	20.0	17.3	-	-	-

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Checked By: M Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P009**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P009
SAMPLE DESCRIPTION: Light brown to black clayey sand with trace shell (SC)

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate
☐ Other

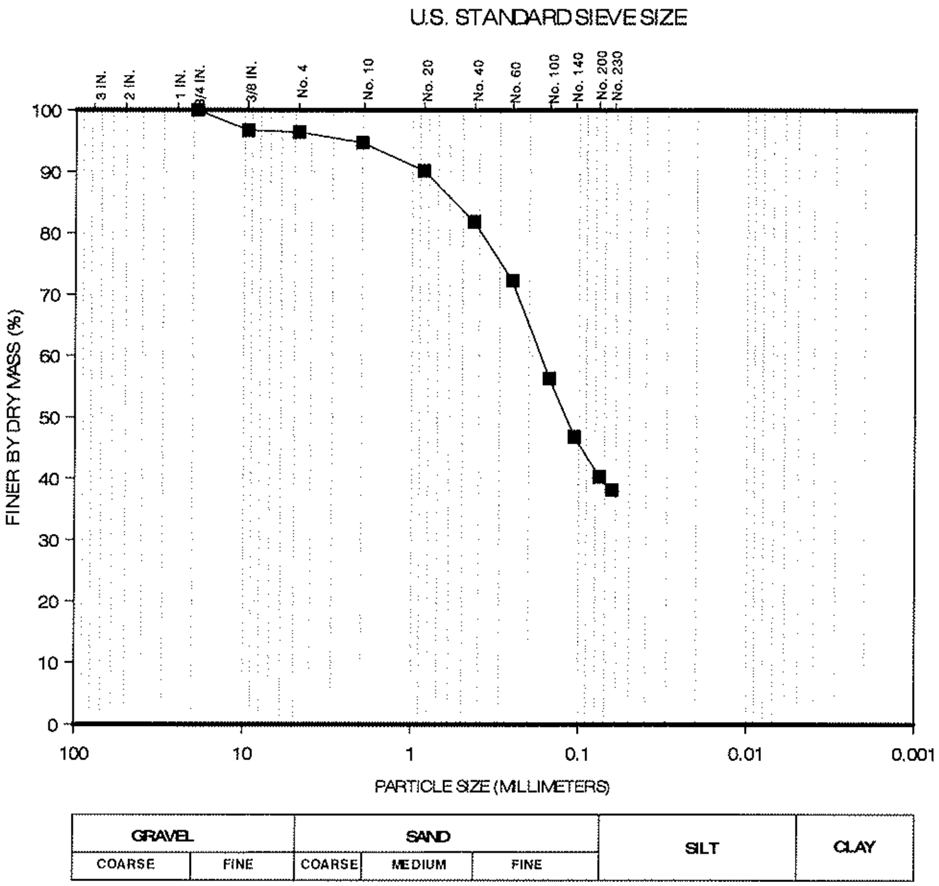
Dispersion Device: ☐ Apparatus A
☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 79.6
Mass Dry Solids (grams): 154.83

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 3.8
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	96.7	96.4	94.7	90.1	81.8	72.2	56.3	46.8	40.3	38.1	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P010**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P010
SAMPLE DESCRIPTION: Light brown to brown sand with silt, shell and trace roots (SP-SM)
$C_u = 3.4$; $C_c = 1.5$

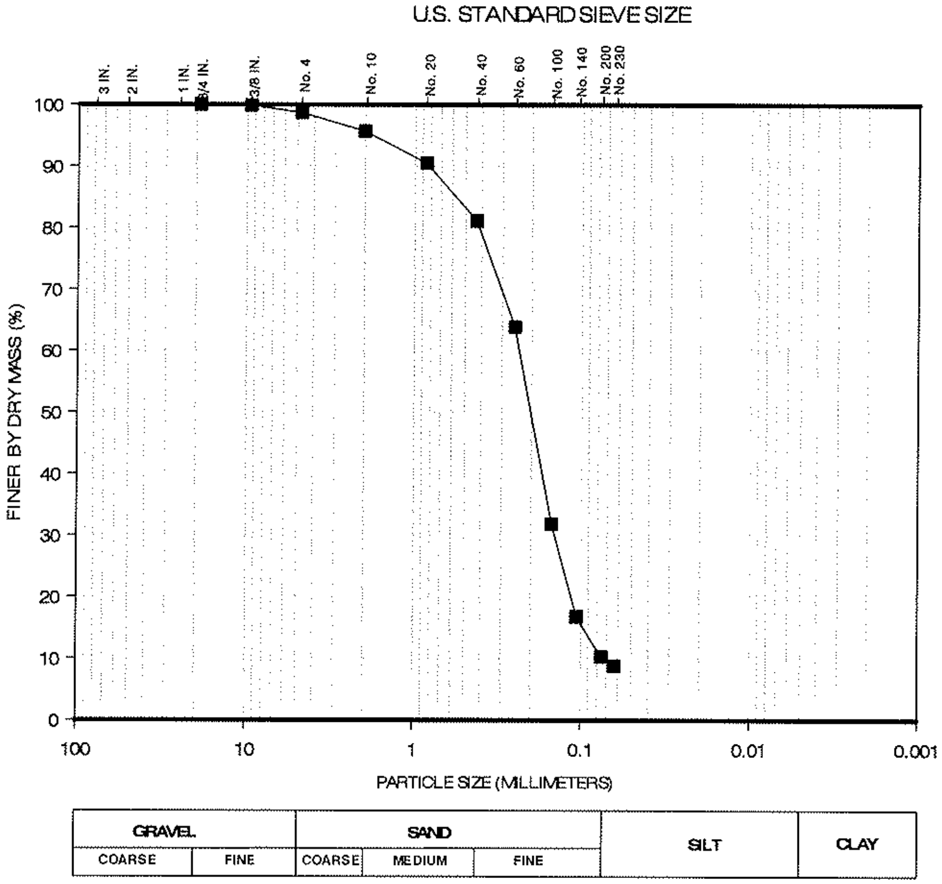
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ______

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other ______
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ______

Water Content (%): 36.3
Mass Dry Solids (grams): 294.99
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.0
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.9	98.7	95.7	90.5	81.1	63.9	31.9	16.8	10.3	8.8	-	-	-

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Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P011A**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P011A
SAMPLE DESCRIPTION: Light brown to brown silty sand with shell (SM)
$C_u = 5.3$; $C_c = 0.9$

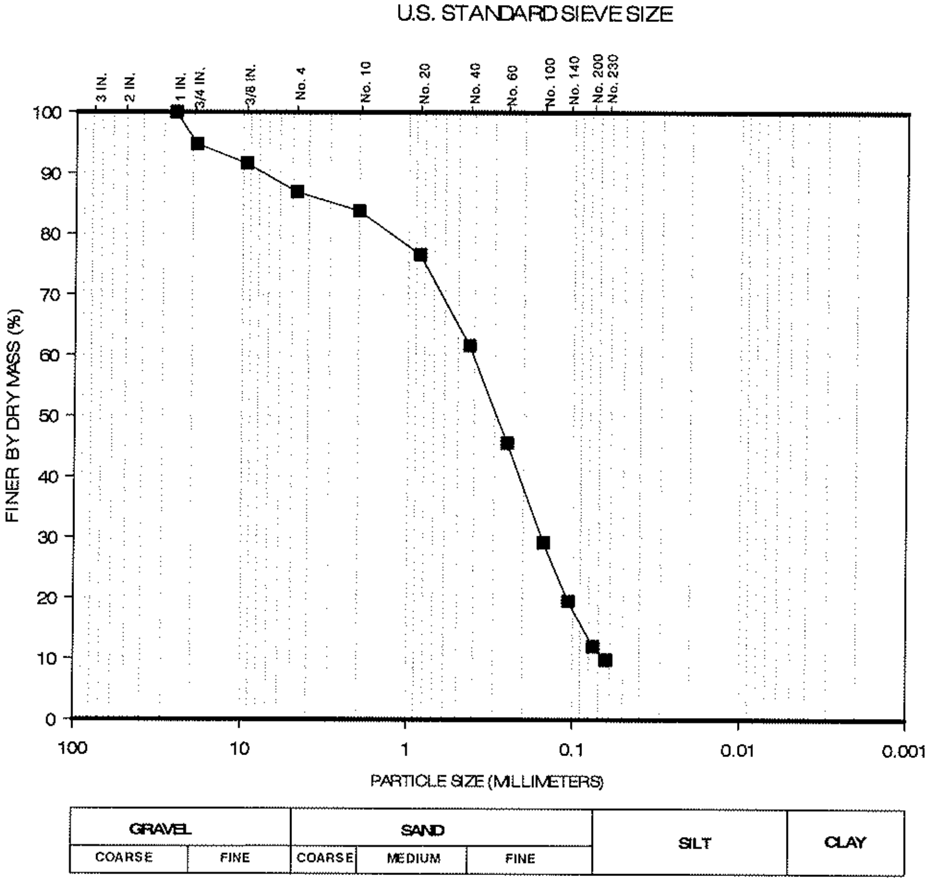
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 30.8
Mass Dry Solids (grams): 406.15
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.5
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	94.8	91.6	86.9	83.8	76.6	61.6	45.6	29.2	19.5	12.1	9.9	-	-	-

Checked By: Date: 09/20/13

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ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P011B**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P011B
SAMPLE DESCRIPTION: Light brown to brown silty sand with shell and trace roots (SM)

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other

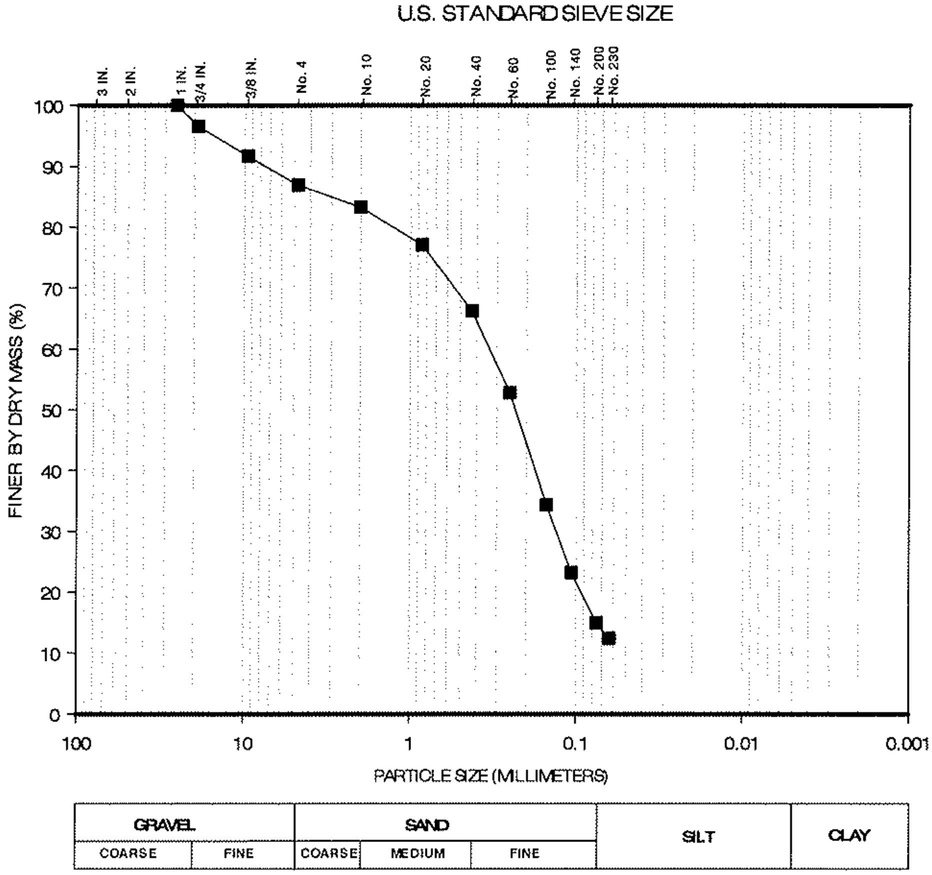
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 32.9
Mass Dry Solids (grams): 321.09

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 1.5
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	96.6	91.7	86.9	83.3	77.1	66.2	52.8	34.4	23.2	15.0	12.4	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P011C**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P011C
SAMPLE DESCRIPTION: Light brown to brown sand with silt, shell and trace roots (SP-SM)
$C_u = 5.1$; $C_c = 0.9$

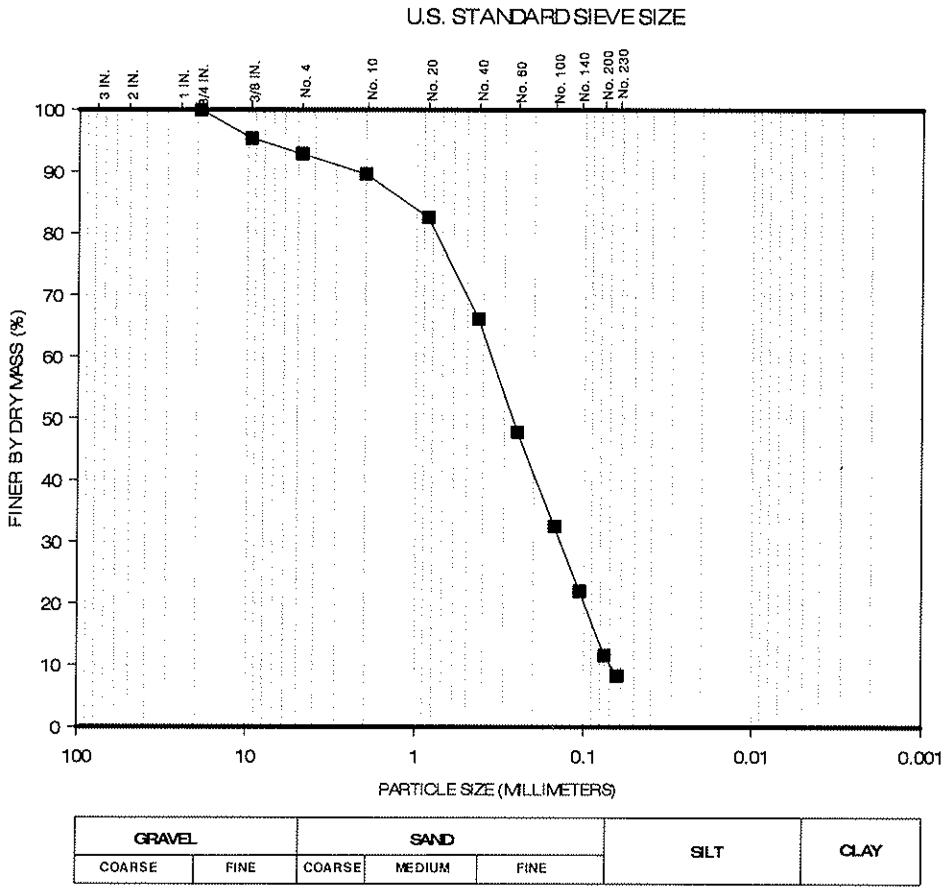
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____________

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____________
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____________

Water Content (%): 28.9
Mass Dry Solids (grams): 383.02
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.2
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	95.4	92.9	89.6	82.6	66.1	47.8	32.5	22.0	11.6	8.3	-	-	-

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Checked By: ______ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P013**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P013
SAMPLE DESCRIPTION: Brown to black clay with sand and trace roots and shell

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate
☐ Other

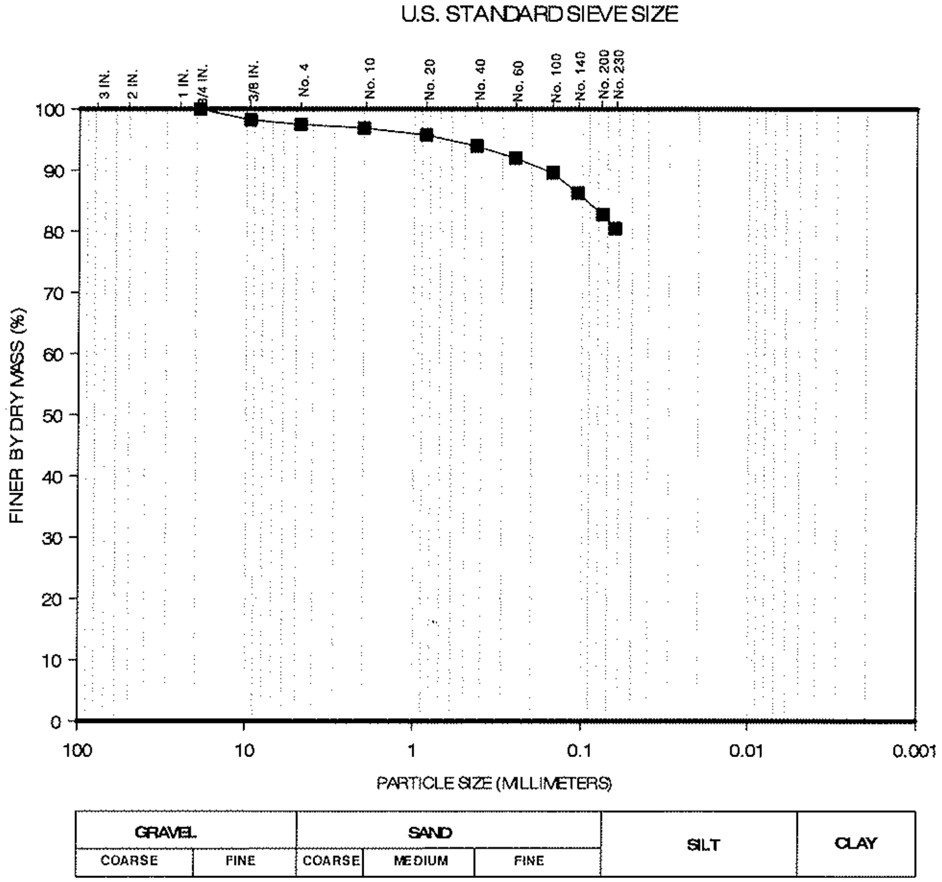
Dispersion Device: ☐ Apparatus A
☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 124.9
Mass Dry Solids (grams): 116.36

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 6.2
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	98.2	97.5	96.9	95.8	94.0	92.0	89.6	86.3	82.8	80.5	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P014**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P014
SAMPLE DESCRIPTION: Gray sandy clay with trace shell and roots

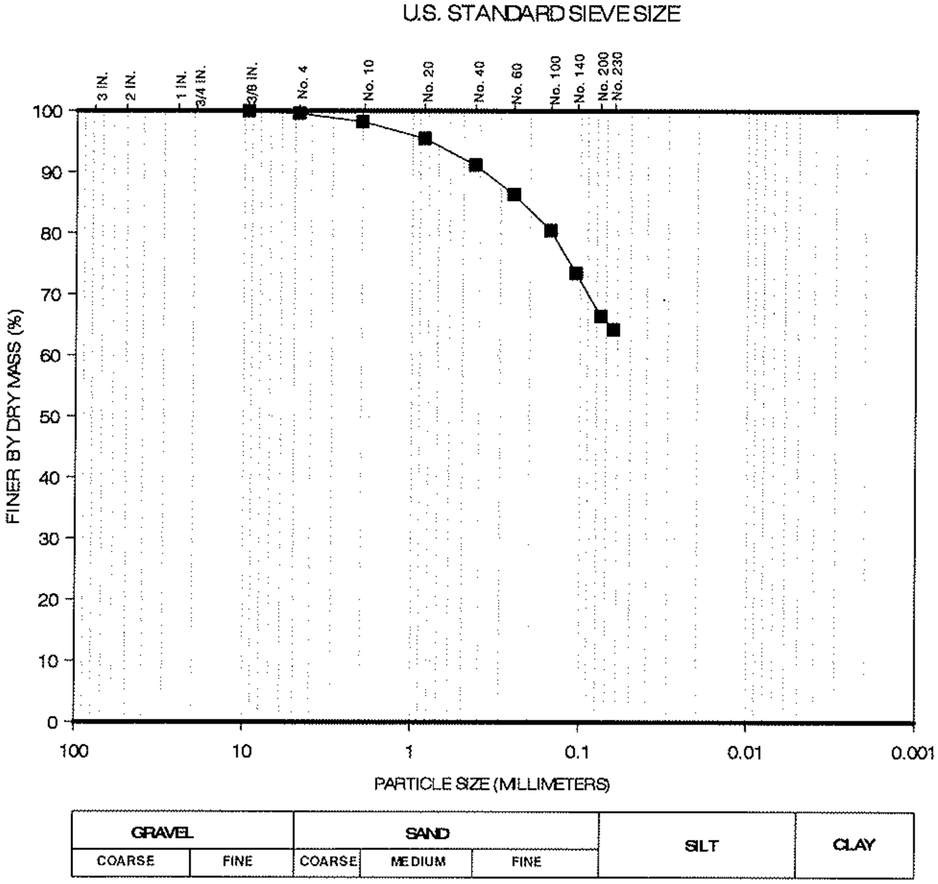
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 85.1
Mass Dry Solids (grams): 165.48
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 3.7
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	100	99.6	98.3	95.5	91.2	86.4	80.5	73.5	66.5	64.3	-	-	-

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Checked By: Date: 09/20/13

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ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P015**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P015
SAMPLE DESCRIPTION: Brown to dark gray clayey sand with shell (SC)

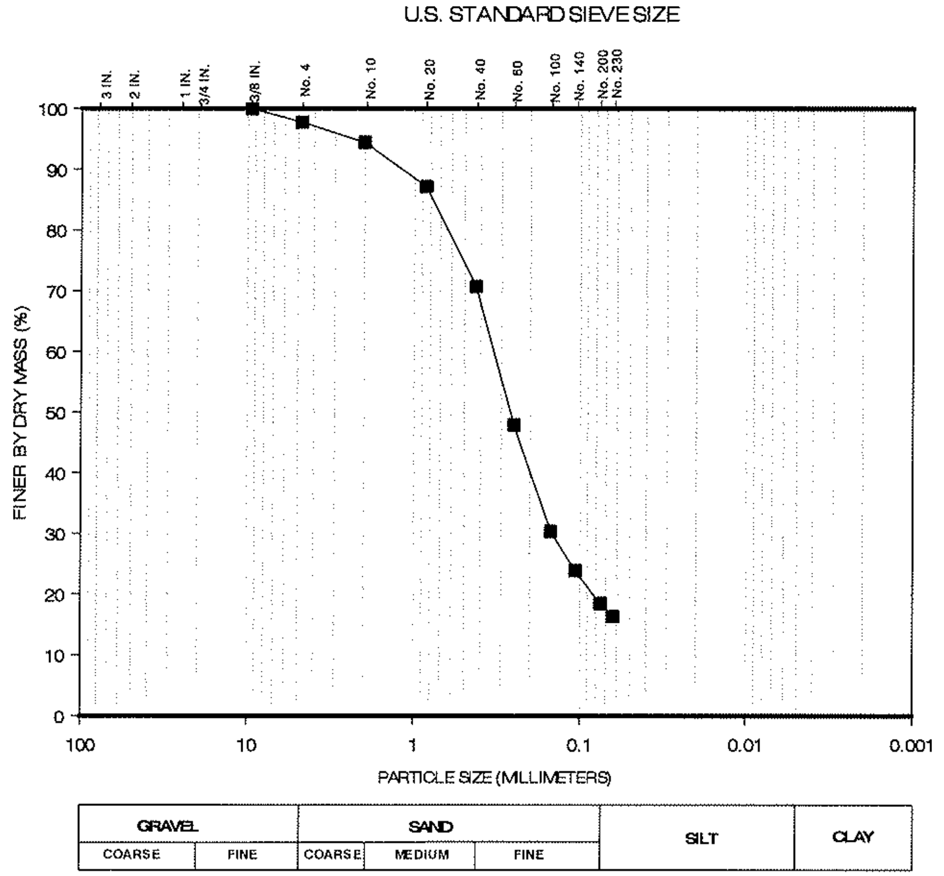
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 33.0
Mass Dry Solids (grams): 323.58
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.2
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	100	97.8	94.5	87.2	70.7	47.9	30.4	23.9	18.5	16.3	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P016**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P016
SAMPLE DESCRIPTION: Light brown to brown sand with gravel and shell (SP)
$C_u = 3.9$; $C_c = 0.7$

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other

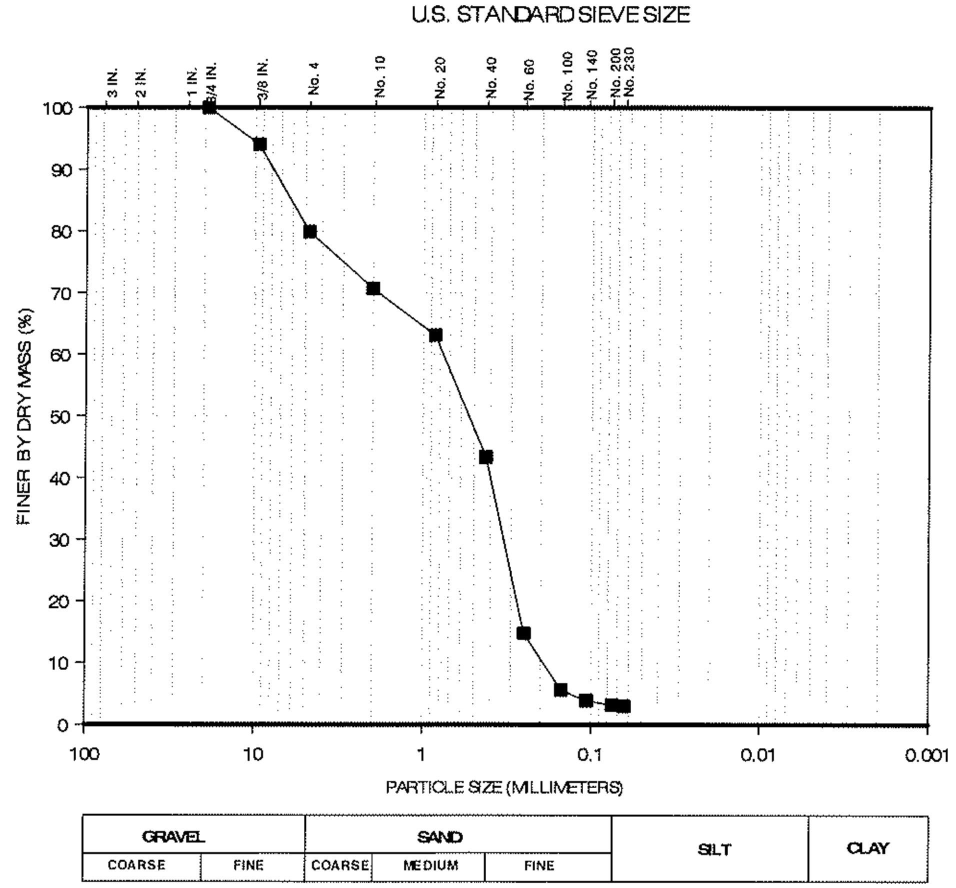
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 20.3
Mass Dry Solids (grams): 428.21

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	94.1	79.9	70.7	63.1	43.4	14.8	5.6	3.9	3.2	3.0	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/25/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P017**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P017
SAMPLE DESCRIPTION: Orangish-brown clayey sand with shell and trace roots (SC)

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other

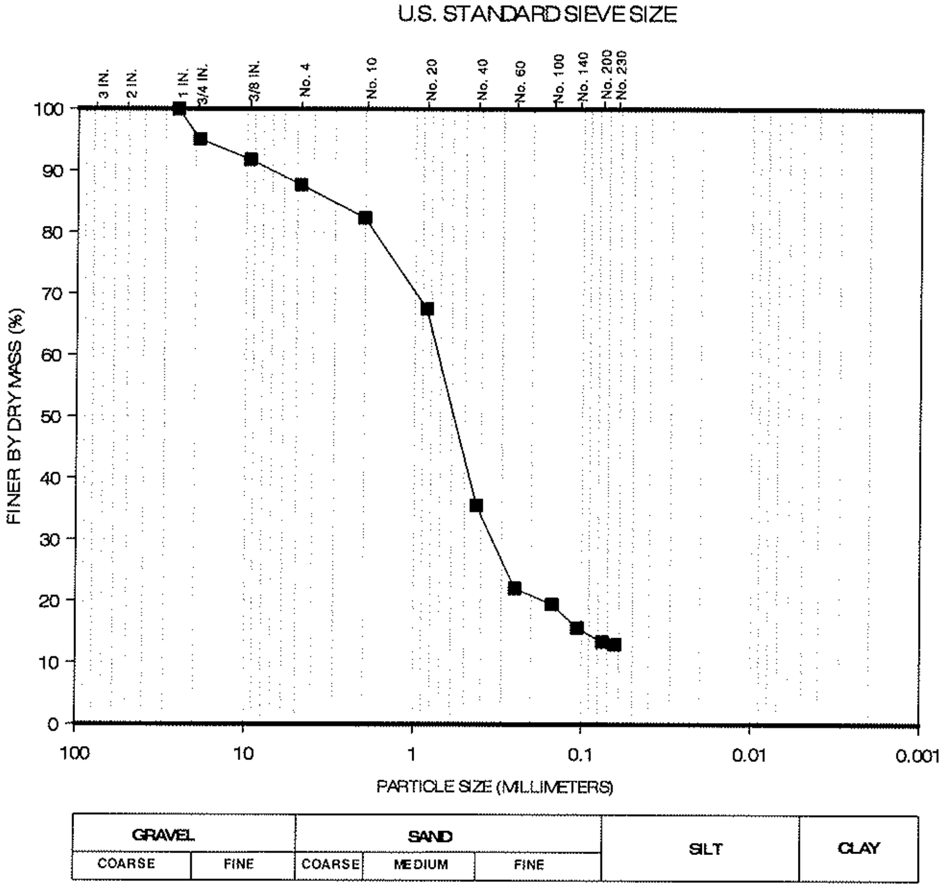
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 29.1
Mass Dry Solids (grams): 433.23

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.9
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	95.1	91.8	87.7	82.3	67.5	35.6	22.1	19.5	15.7	13.4	13.0	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P018A**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P018A
SAMPLE DESCRIPTION: Light brown to brown sand with gravel and shell (SP)
$C_u = 3.8$; $C_c = 0.8$

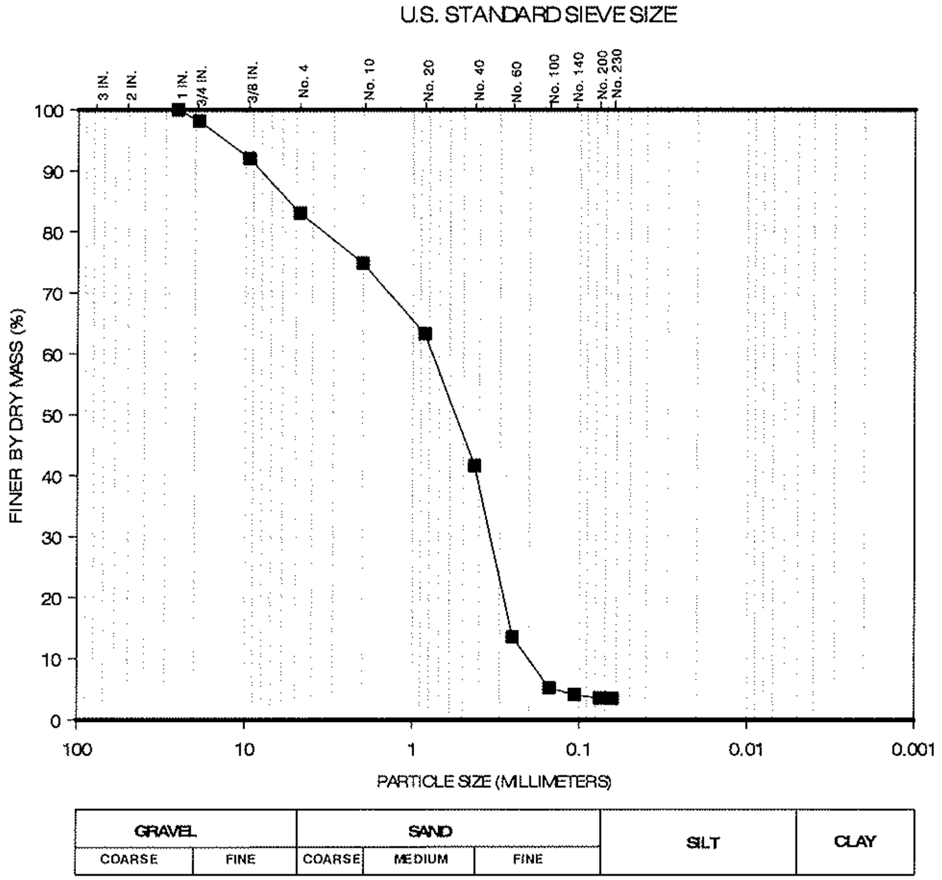
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 23.1
Mass Dry Solids (grams): 259.52
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.6
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	98.2	92.1	83.1	74.9	63.3	41.7	13.6	5.3	4.1	3.6	3.5	-	-	-

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Checked By: JM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P018B**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P018B
SAMPLE DESCRIPTION: Light brown to brown sand with shell (SP)
$C_u = 4.0$; $C_c = 0.7$

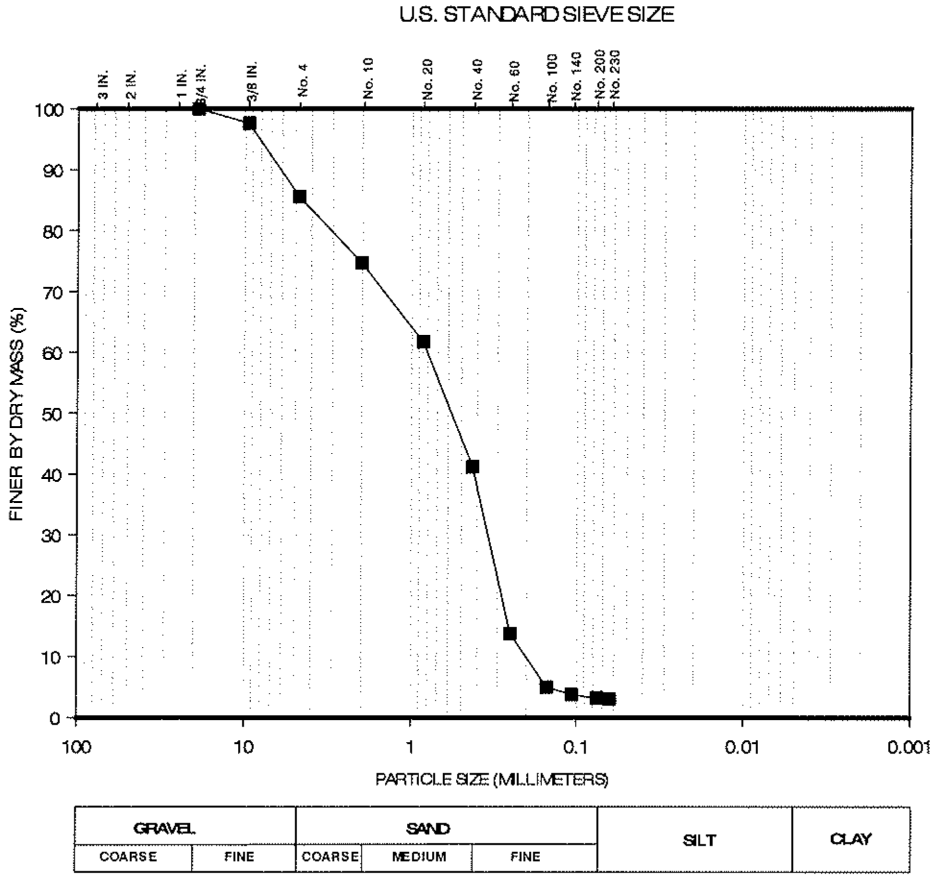
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____________

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other ____________
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____________

Water Content (%): 19.8
Mass Dry Solids (grams): 430.78
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	97.7	85.6	74.7	61.7	41.2	13.8	5.0	3.8	3.2	3.0	-	-	-

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Checked By: ________ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P018C**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P018C
SAMPLE DESCRIPTION: Light brown to brown sand with shell (SP)
$C_u = 3.4$; $C_c = 0.9$

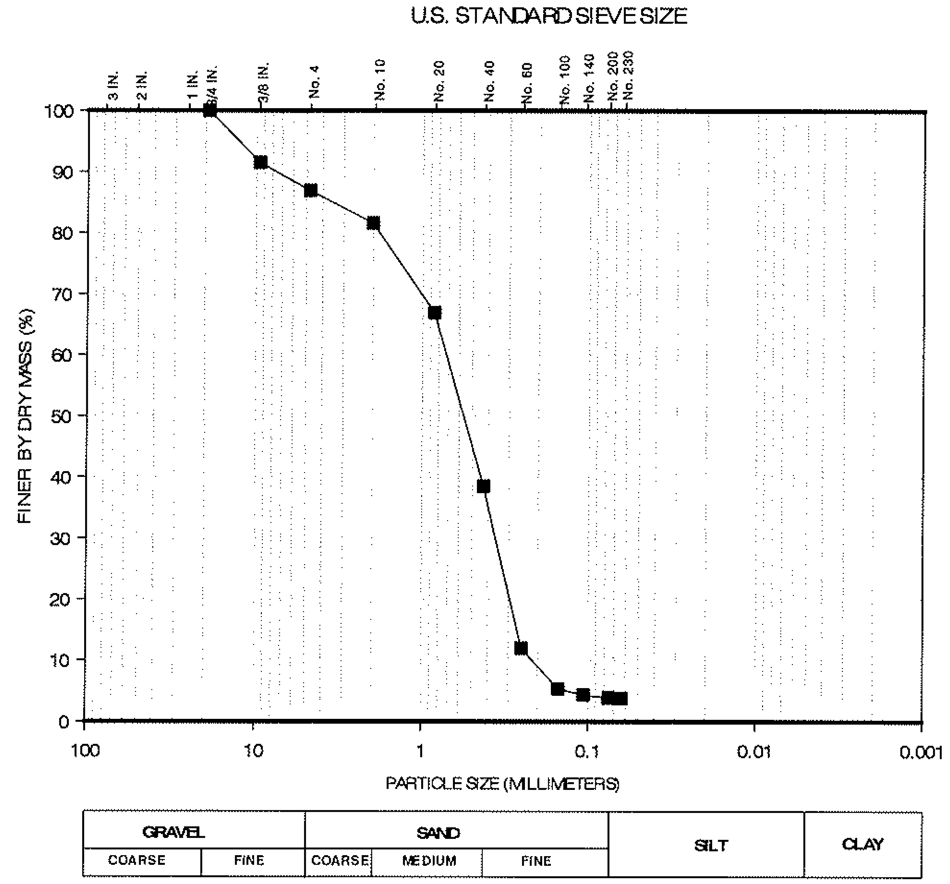
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 22.9
Mass Dry Solids (grams): 388.13
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.6
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	91.5	86.9	81.6	66.9	38.5	12.0	5.4	4.4	3.9	3.8	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P019**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P019
SAMPLE DESCRIPTION: Light brown to brown sand with silt and shell (SP-SM)
$C_u = 5.0$; $C_c = 1.5$

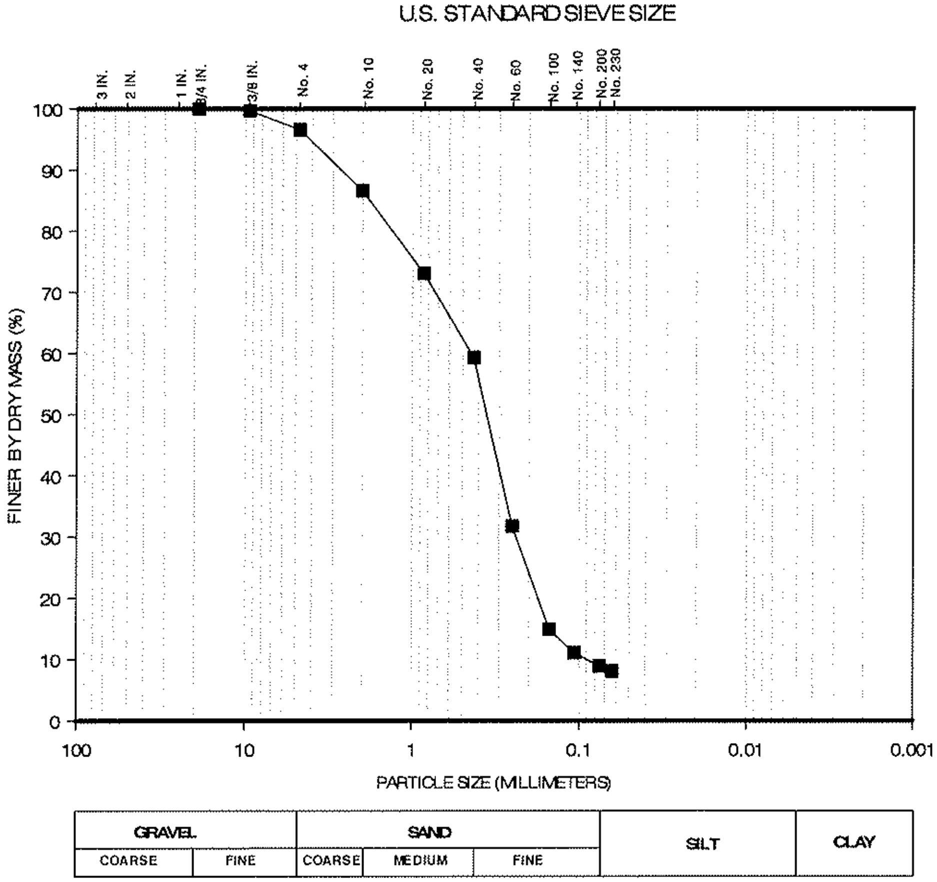
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 28.1
Mass Dry Solids (grams): 456.66
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.8
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.7	96.6	86.6	73.1	59.3	31.8	14.9	11.1	8.9	8.1	-	-	-

Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P020**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P020
SAMPLE DESCRIPTION: Light brown to gray clayey sand with shell (SC)

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

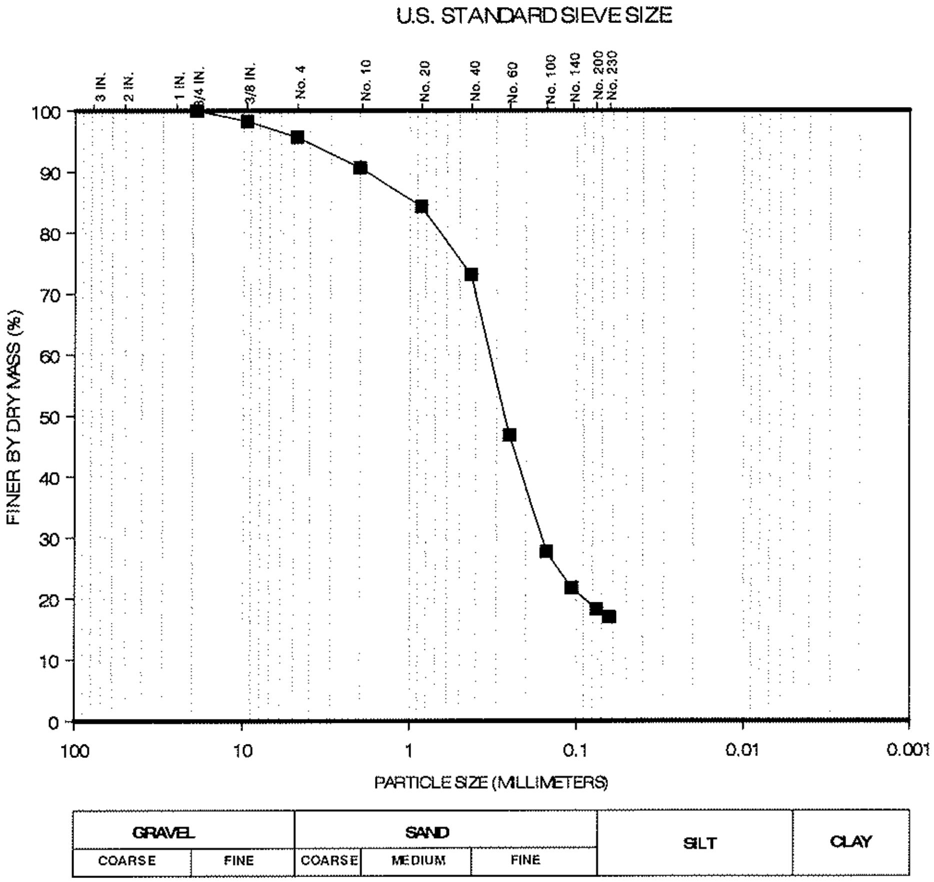
☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 36.2
Mass Dry Solids (grams): 272.71

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 1.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	98.3	95.7	90.7	84.3	73.1	46.8	27.7	21.8	18.3	17.0	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P021**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P021
SAMPLE DESCRIPTION: Light brown to brown clayey sand with shell and trace roots (SC)

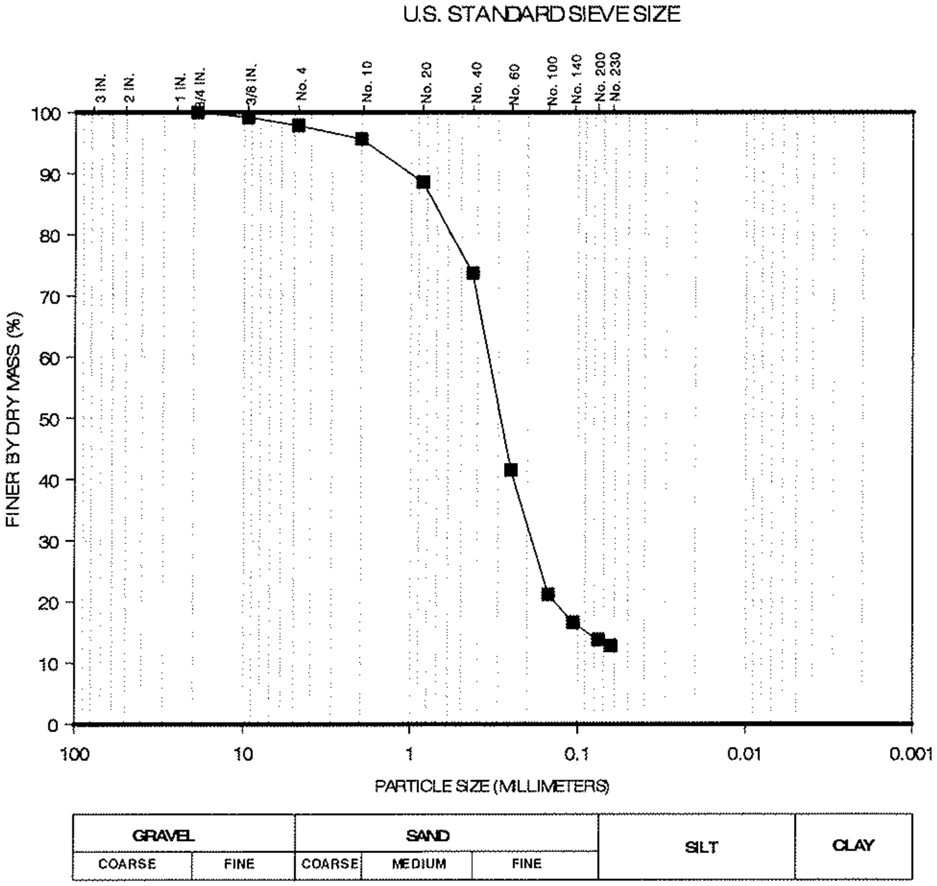
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 34.9
Mass Dry Solids (grams): 282.47
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.1
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.2	97.9	95.7	88.6	73.7	41.5	21.2	16.6	13.8	12.8	-	-	-

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Checked By: ____ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P022**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P022
SAMPLE DESCRIPTION: Light brown to brown sand with silt and shell (SP-SM)
$C_u = 4.7$; $C_c = 0.7$

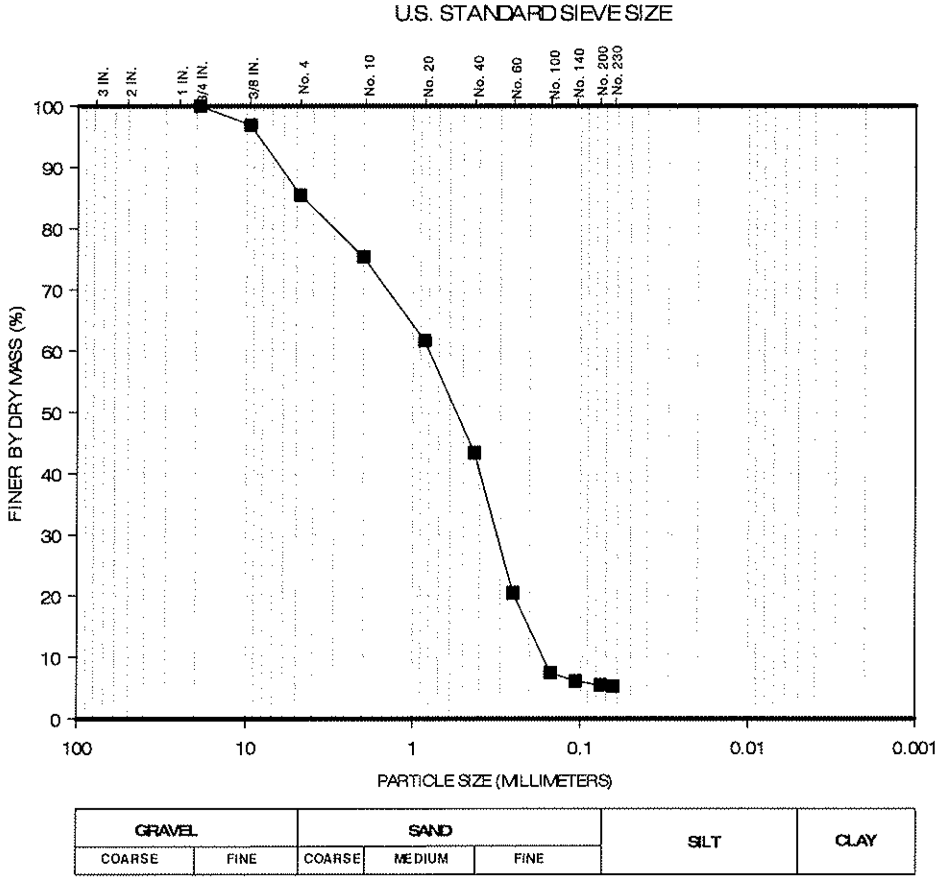
TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 22.6
Mass Dry Solids (grams): 430.09
G_s: ☐ Assumed ☐ Measured
Organic Content (%): 0.5
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	96.9	85.5	75.4	61.7	43.4	20.5	7.5	6.1	5.5	5.3	-	-	-

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Checked By: M Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **P023**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P023
SAMPLE DESCRIPTION: Light brown to brown sand with gravel and shell (SP)
C_u = 5.5; C_c = 0.6

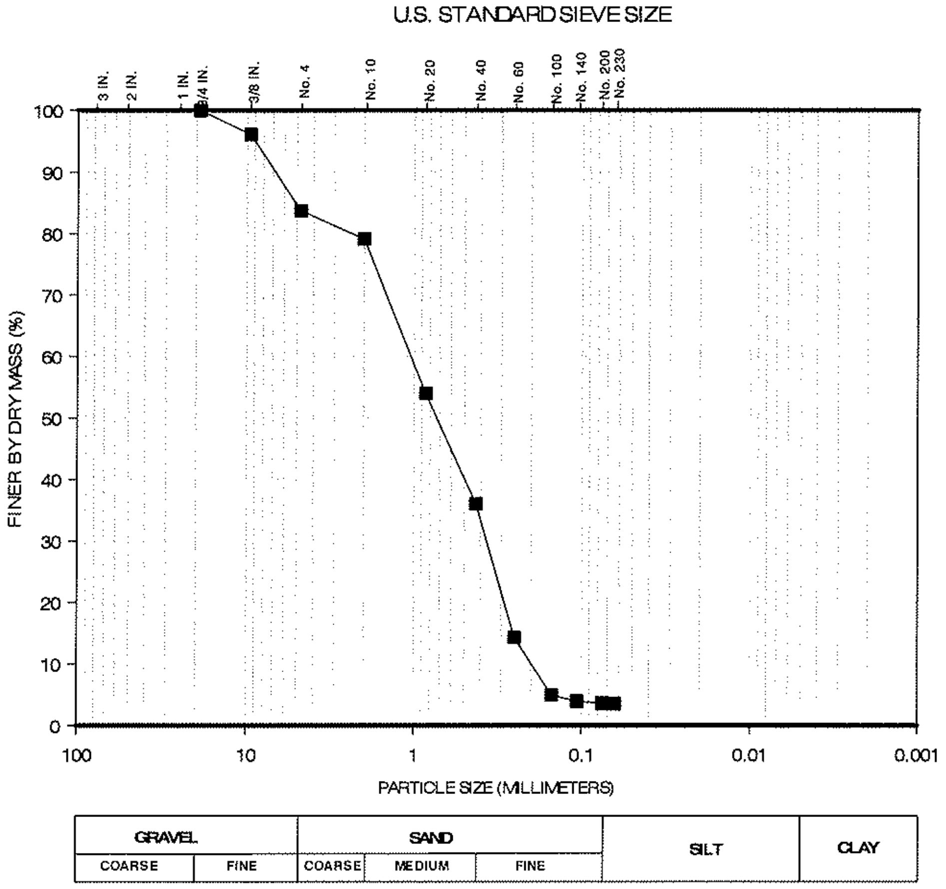
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 19.0
Mass Dry Solids (grams): 510.07
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	96.1	83.7	79.1	54.0	36.0	14.3	4.9	3.9	3.6	3.5	-	-	-

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Checked By: JM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: P025
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/P025
SAMPLE DESCRIPTION: Light brown to brown sand with shell and trace roots (SP)
$C_u = 2.9$; $C_c = 1.1$

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

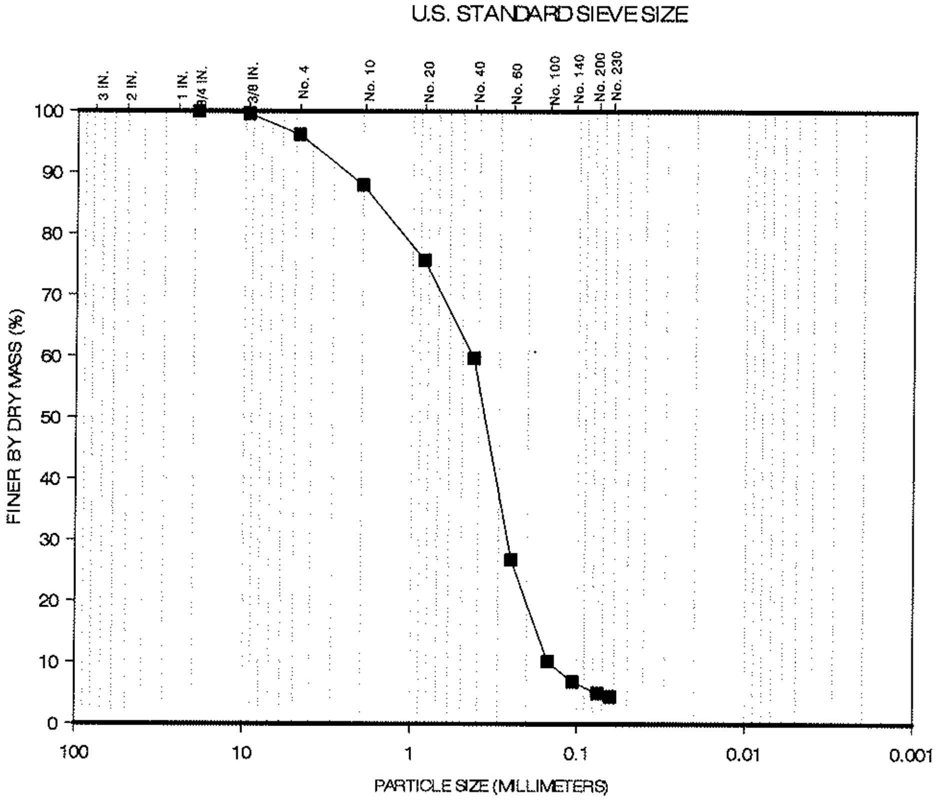
☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 25.6
Mass Dry Solids (grams): 444.78

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.7
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.6	96.2	88.0	75.7	59.7	26.8	10.2	6.9	5.0	4.5	-	-	-

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R001**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R001
SAMPLE DESCRIPTION: Light brown to brown sand with shell (SP)
$C_u = 3.3$; $C_c = 0.9$

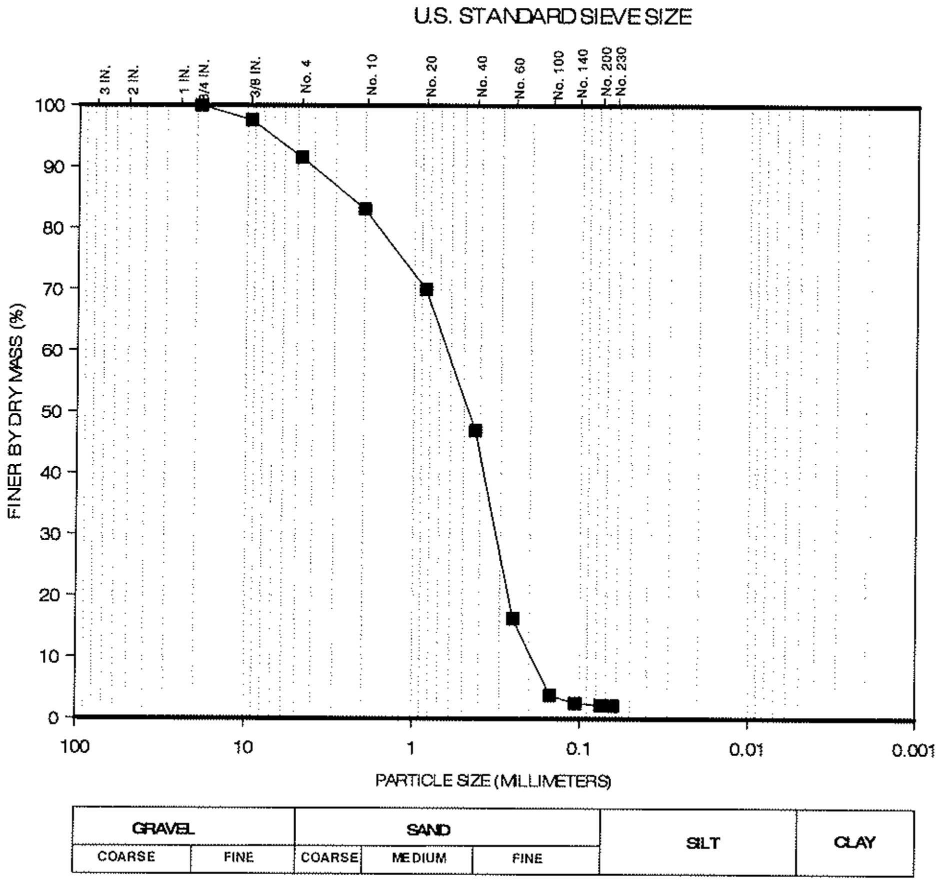
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____________

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____________
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____________

Water Content (%): 19.6
Mass Dry Solids (grams): 543.99
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	97.6	91.5	83.1	70.0	47.0	16.3	3.8	2.5	2.2	2.1	-	-	-

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Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R004**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R004
SAMPLE DESCRIPTION: Light brown to brown sand with shell and trace roots (SP)
$C_u = 3.1$; $C_c = 1.4$

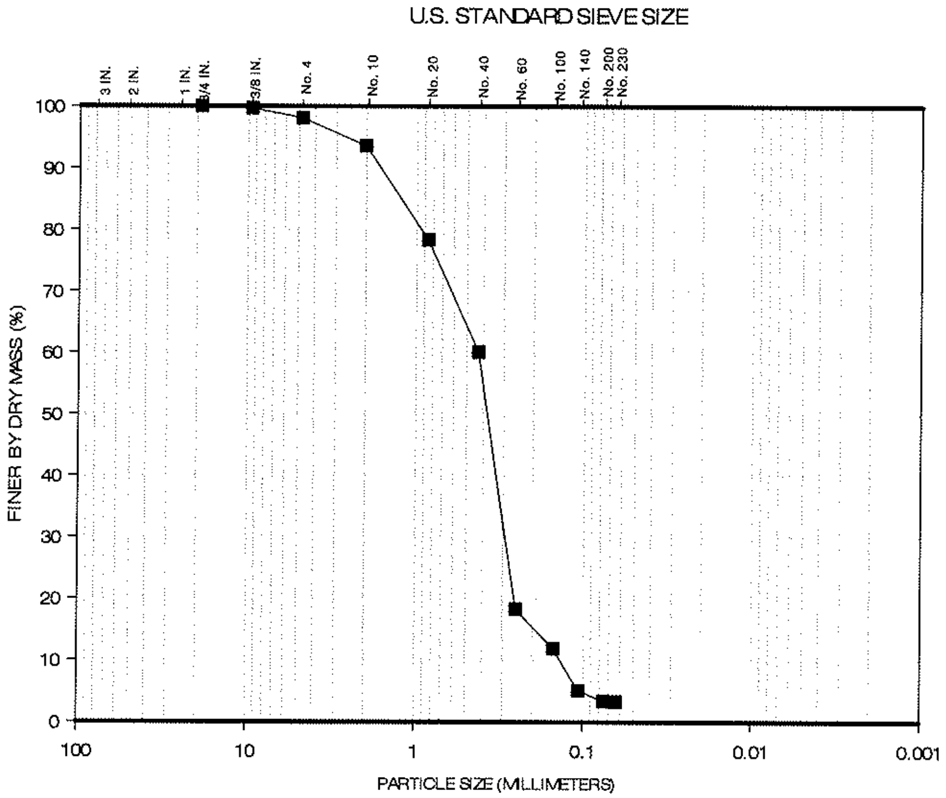
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 23.1
Mass Dry Solids (grams): 459.46
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.5
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

Percent Finer (dry mass basis)														
Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.7	98.1	93.6	78.3	60.1	18.3	11.9	5.1	3.4	3.3	-	-	-

Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R007**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R007
SAMPLE DESCRIPTION: Light brown to dark gray clayey sand with shell (SC)

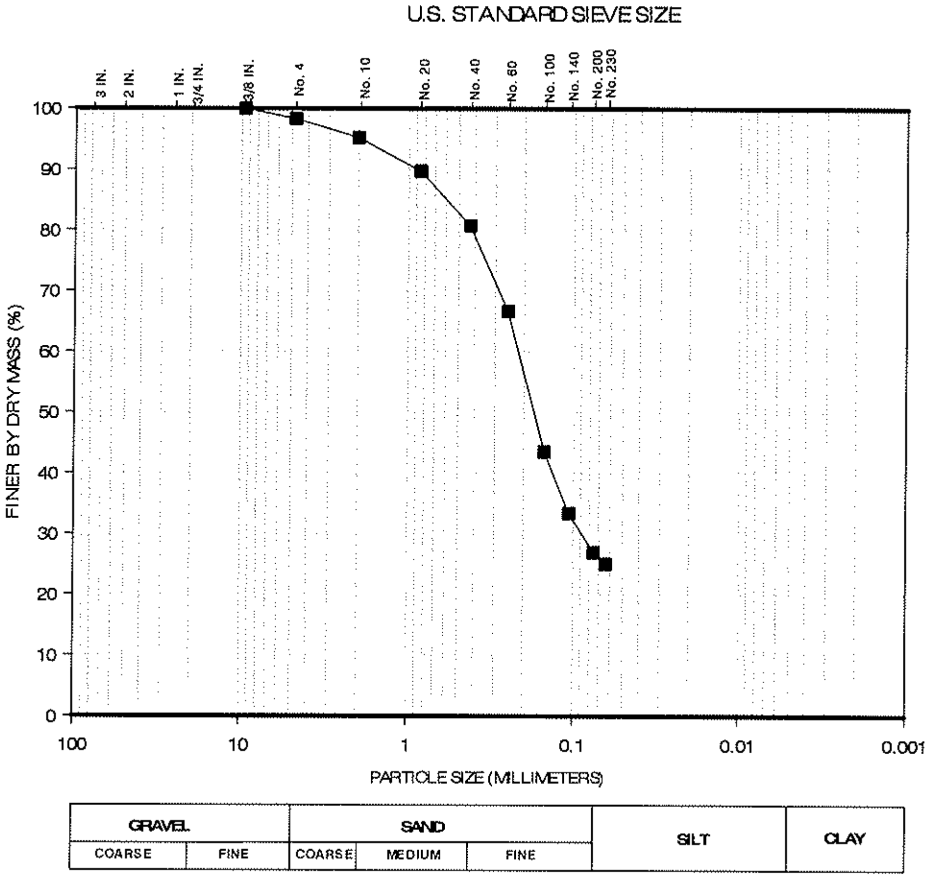
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 52.3
Mass Dry Solids (grams): 233.20
Gₛ: - ☐ Assumed ☐ Measured
Organic Content (%): 1.7
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	100	98.3	95.2	89.7	80.7	66.6	43.5	33.4	26.9	25.0	-	-	-

Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R014**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R014
SAMPLE DESCRIPTION: Gray to light brown clayey sand with shell (SC)

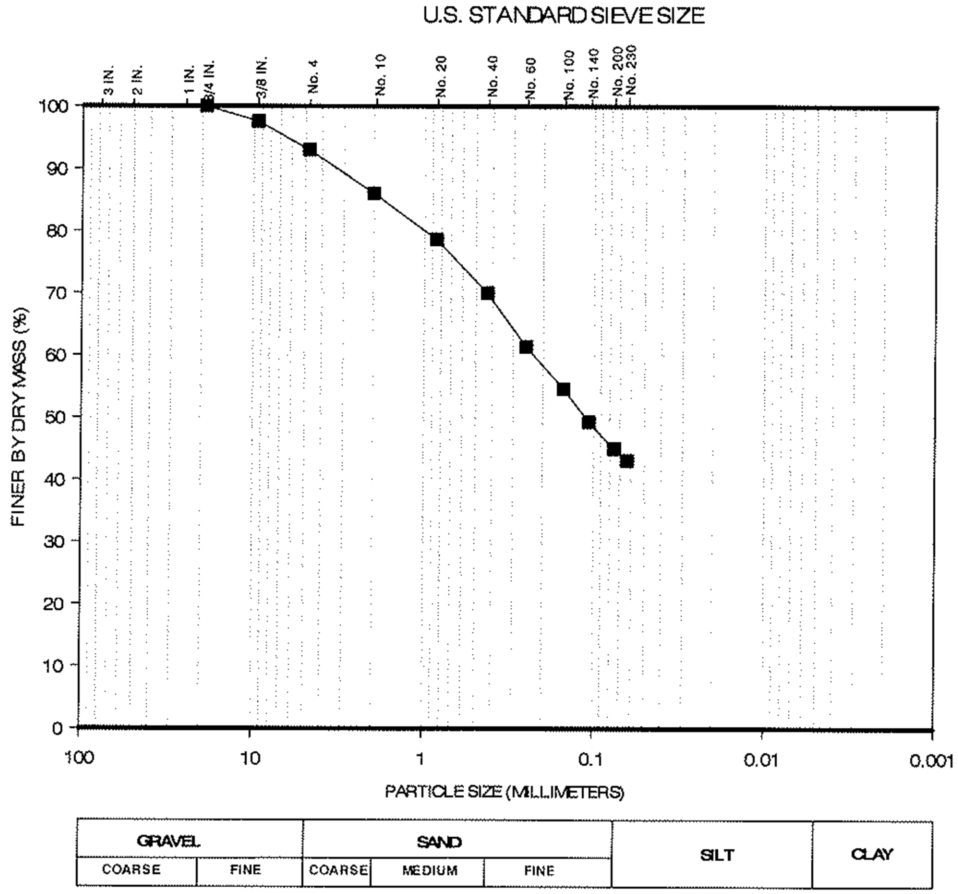
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 60.1
Mass Dry Solids (grams): 240.34
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.9
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis													Hydrometer Analysis		
Gravel-Size				Sand-Size									Silt-Size	Clay-Size	
				Coarse	Medium		Fine								
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230		0.005 mm	0.002 mm	0.001 mm
100	100	97.6	93.0	86.0	78.6	70.0	61.4	54.6	49.3	45.0	43.1		-	-	-

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Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R018**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R018
SAMPLE DESCRIPTION: Light brown to brown sand with gravel and shell (SP)
$C_u = 4.1$; $C_c = 0.6$

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____________

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____________

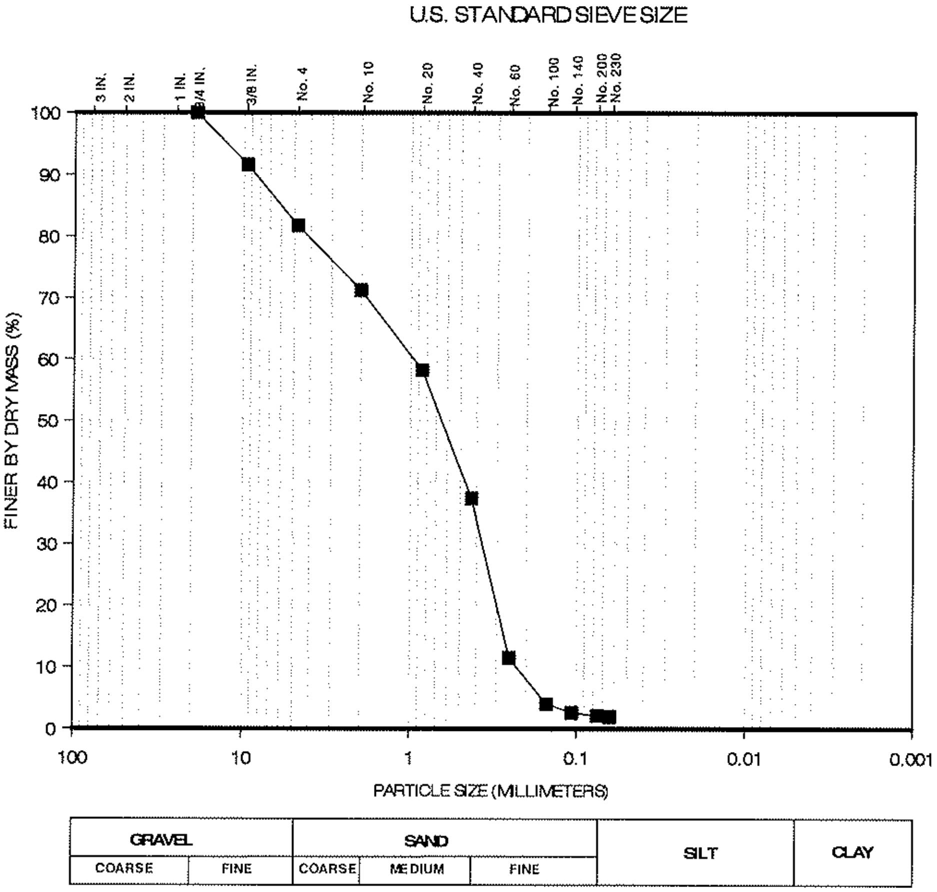
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours): ____________

Water Content (%): 25.1
Mass Dry Solids (grams): 288.51

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	91.6	81.7	71.2	58.2	37.4	11.5	4.0	2.6	2.1	1.9	-	-	-

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Checked By: JM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R020**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R020
SAMPLE DESCRIPTION: Light brown to brown sand with silt, shell and trace roots (SP-SM)
$C_u = 2.9$; $C_c = 1.4$

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

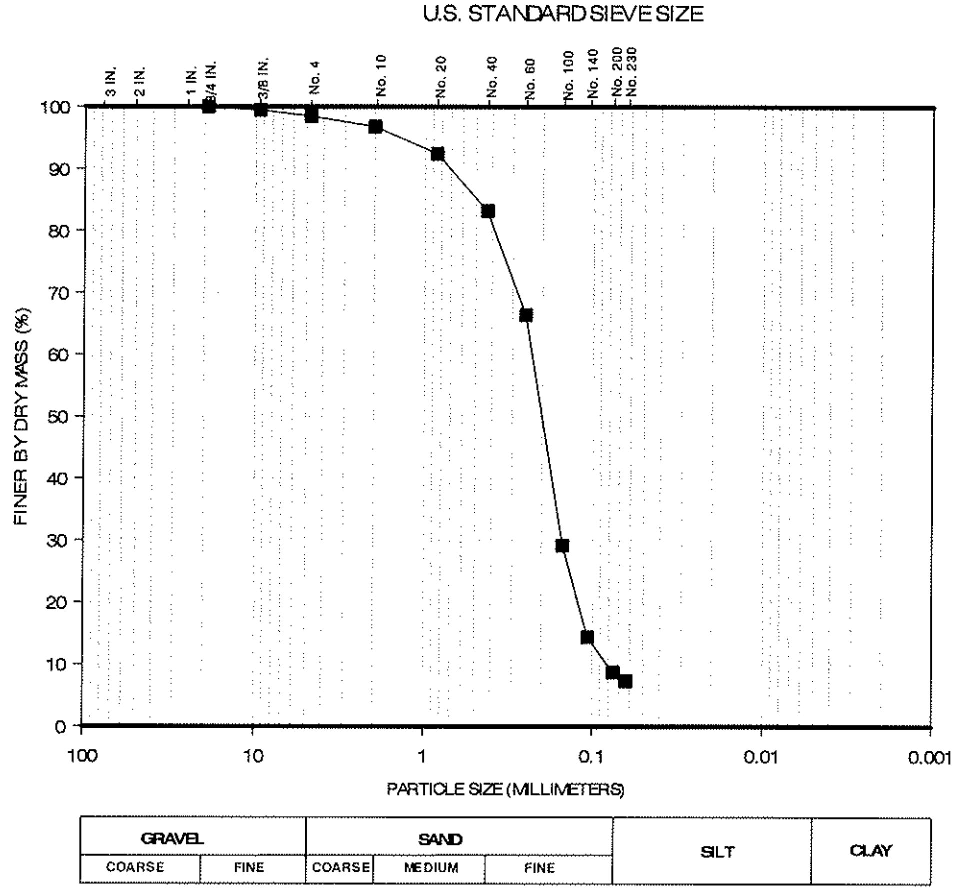
☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 33.7
Mass Dry Solids (grams): 377.29

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.8
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.5	98.5	96.8	92.4	83.2	66.4	29.2	14.4	8.7	7.3	-	-	-

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Checked By: ____ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R023**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R023
SAMPLE DESCRIPTION: Light brown to brown sand with silt, shell and trace roots (SP-SM)
$C_u = 3.3$; $C_c = 1.4$

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other

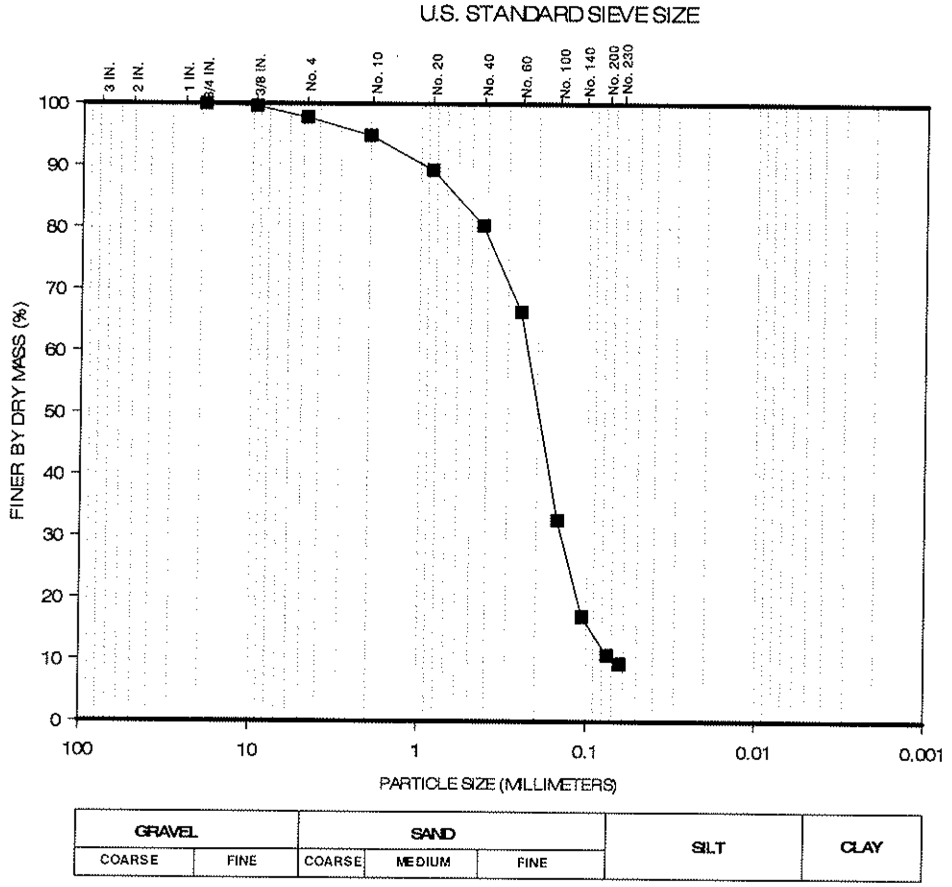
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 42.5
Mass Dry Solids (grams): 278.57

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 1.5
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.6	97.8	94.9	89.3	80.3	66.3	32.6	17.0	10.8	9.4	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R024**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R024
SAMPLE DESCRIPTION: Light brown to brown clayey sand with gravel and shell (SC)

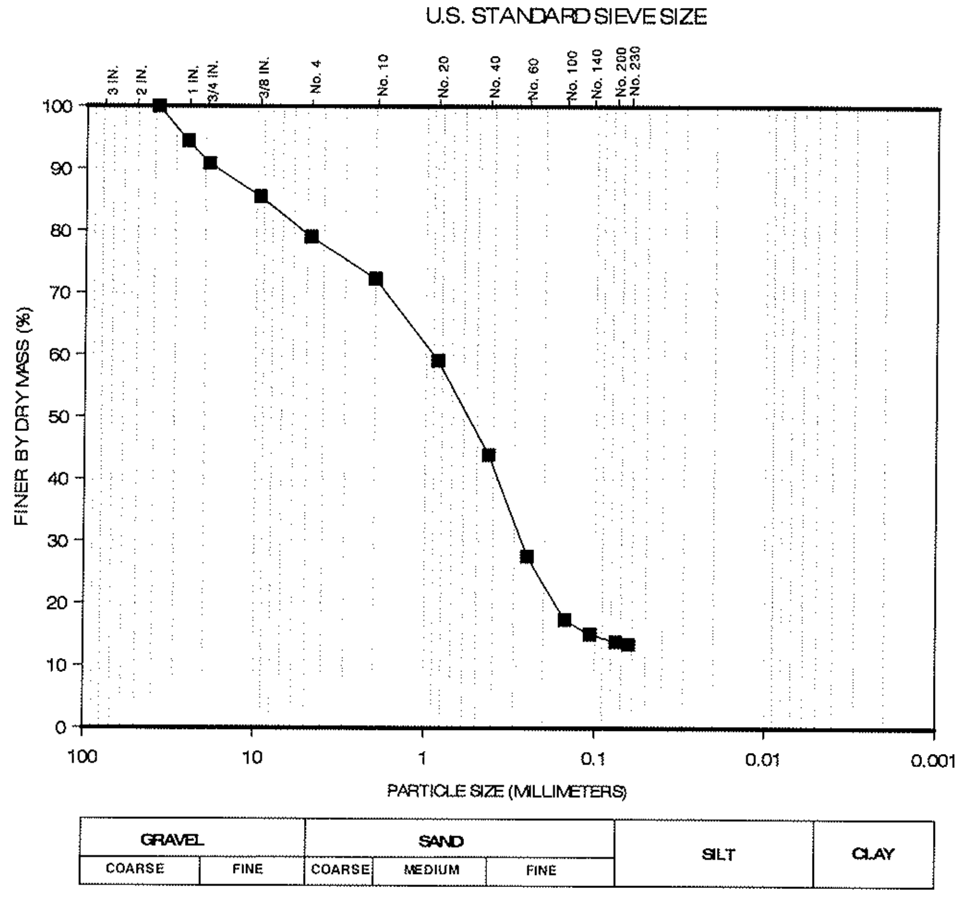
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 30.7
Mass Dry Solids (grams): 434.61
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.9
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis													Hydrometer Analysis		
Gravel-Size					Sand-Size								Silt-Size	Clay-Size	
					Coarse	Medium		Fine							
1½"	1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	94.4	90.8	85.5	79.0	72.3	59.1	43.9	27.6	17.4	15.1	13.9	13.5	-	-	-

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Checked By: TW Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R025**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R025
SAMPLE DESCRIPTION: Orangish-brown to dark gray clayey sand with shell and trace roots (SC)

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other

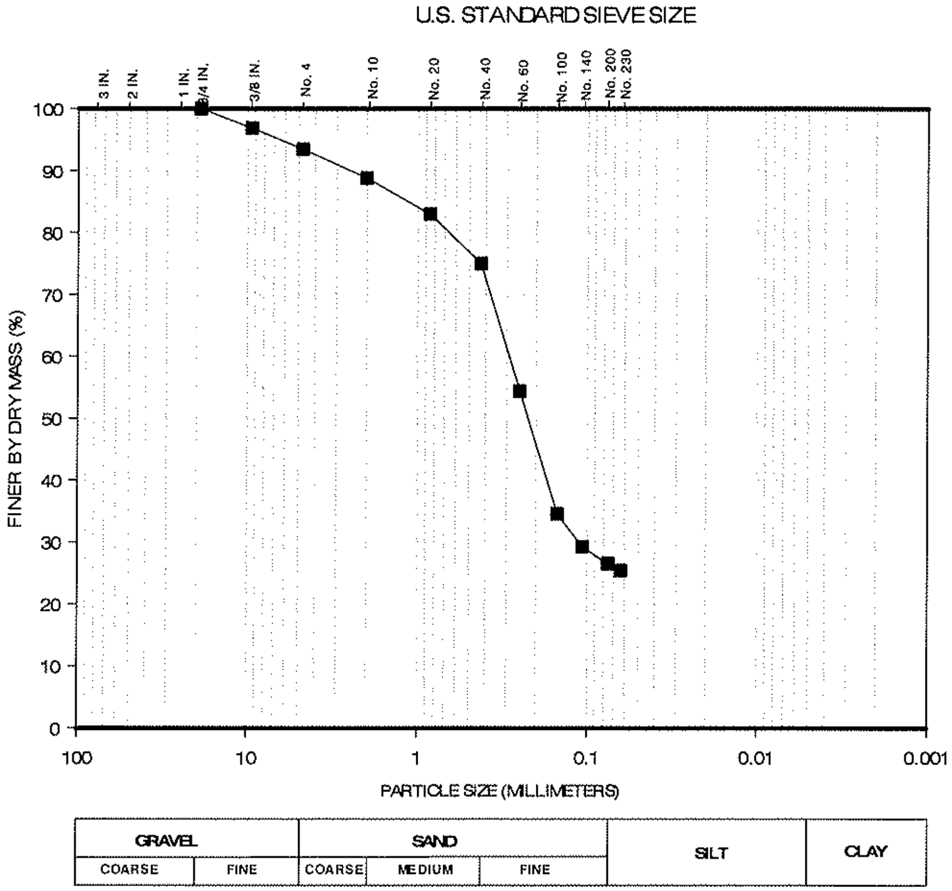
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 41.1
Mass Dry Solids (grams): 315.47

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 1.3
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	96.9	93.5	88.8	83.0	75.0	54.4	34.6	29.3	26.5	25.4	-	-	-

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Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R026**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R026
SAMPLE DESCRIPTION: Light brown to dark gray sand with silt and gravel and shell (SW-SM)
$C_u = 16$; $C_c = 1.6$

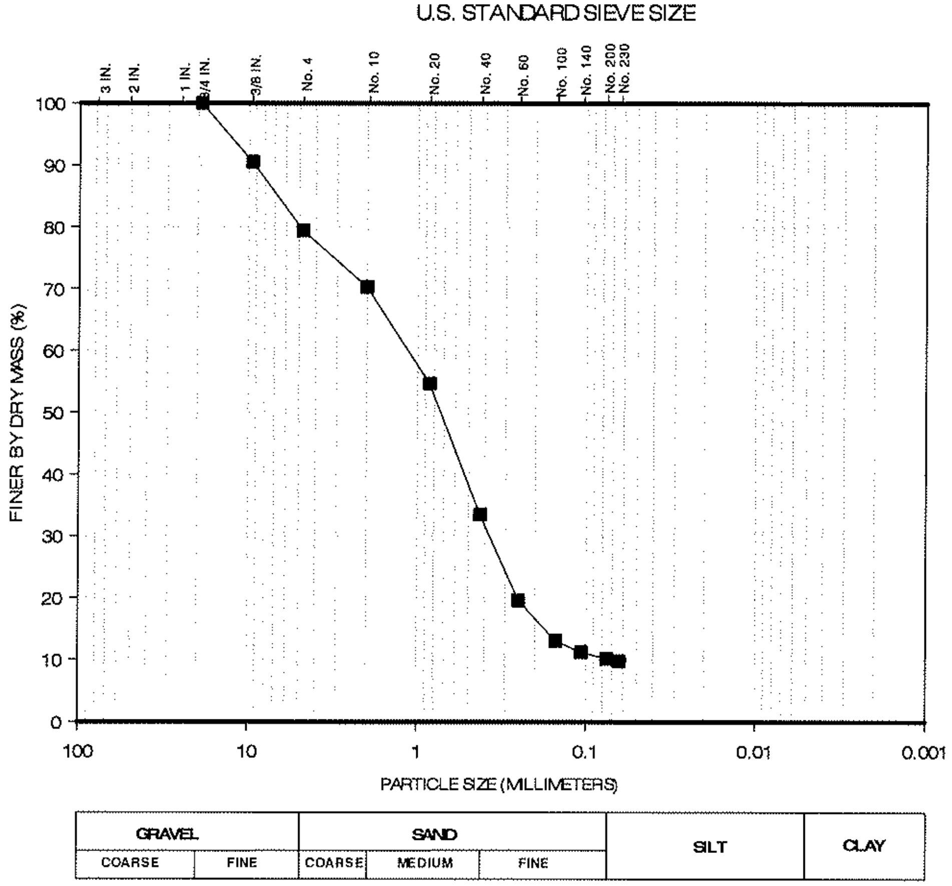
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other ____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 36.9
Mass Dry Solids (grams): 264.29
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.2
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	90.5	79.4	70.3	54.7	33.5	19.6	13.1	11.3	10.2	9.8	-	-	-

Checked By: ____ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R027**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R027
SAMPLE DESCRIPTION: Light brown to brown sand with clay and gravel and shell (SP-SC)
$C_u = 14; C_c = 0.7$

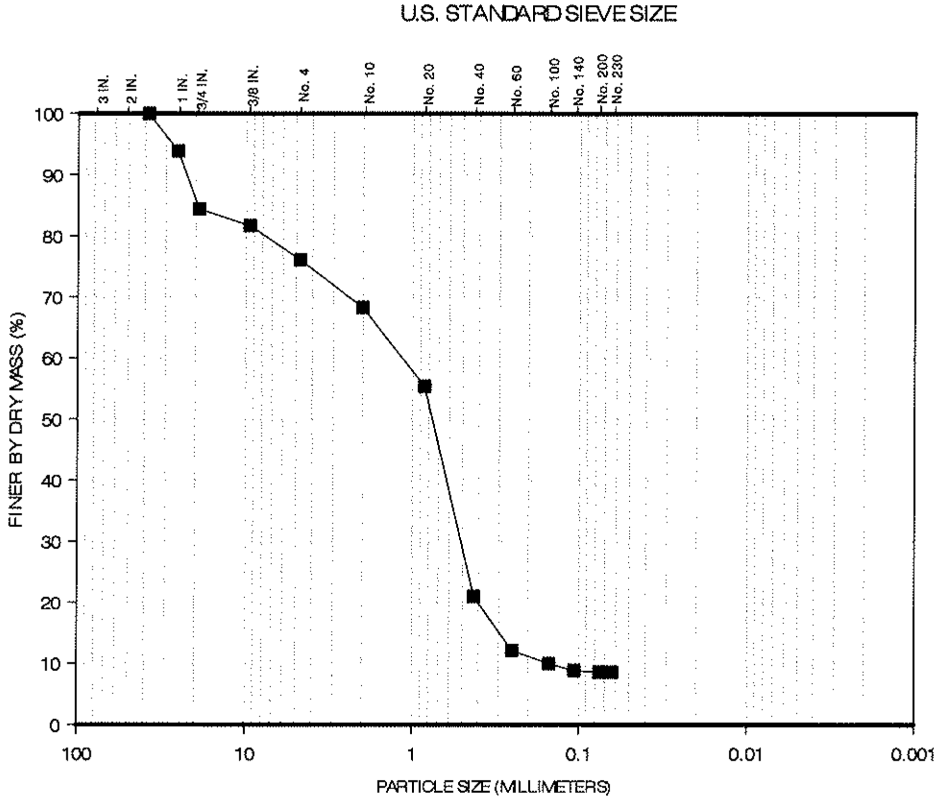
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 23.5
Mass Dry Solids (grams): 418.68
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.8
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

Percent Finer (dry mass basis)

Sieve Analysis													Hydrometer Analysis		
Gravel-Size					Sand-Size								Silt-Size	Clay-Size	
					Coarse	Medium		Fine							
1 1/2"	1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	93.9	84.4	81.7	76.1	68.3	55.4	21.0	12.2	10.0	8.9	8.6	8.6	-	-	-

Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R101**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R101
SAMPLE DESCRIPTION: Light brown to brown sand with clay, shell and trace roots (SP-SC)
$C_u = 4.8$; $C_c = 1.0$

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

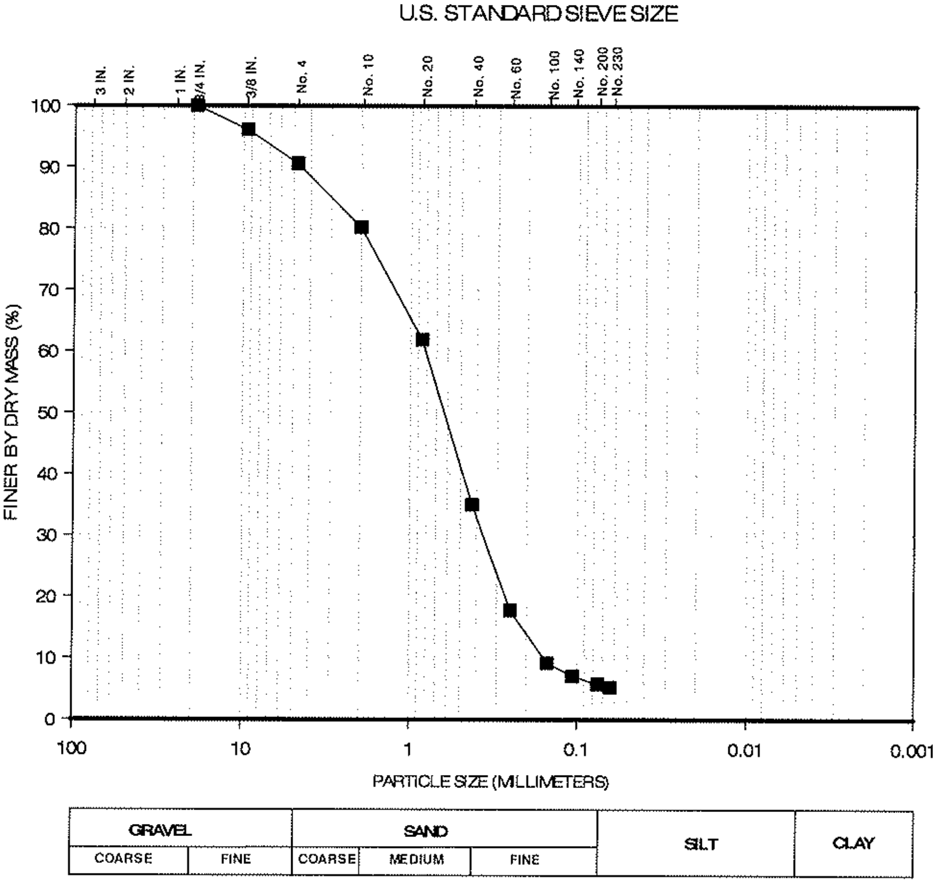
☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 19.6
Mass Dry Solids (grams): 464.91

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.5
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	96.1	90.6	80.2	61.9	35.0	17.8	9.2	7.1	5.8	5.3	-	-	-

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Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R102**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R102
SAMPLE DESCRIPTION: Brown sand with trace shell (SP)
$C_u = 1.9$; $C_c = 1.0$

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

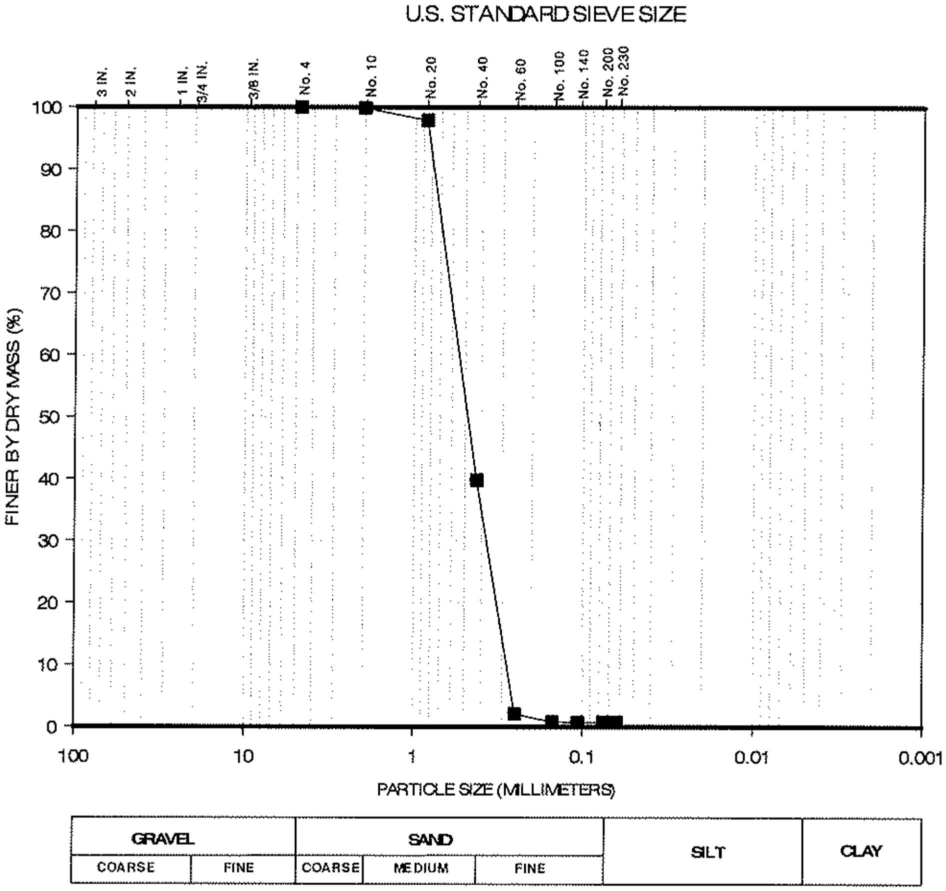
☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other____
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____

Water Content (%): 25.0
Mass Dry Solids (grams): 237.60

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.2
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	100	100	99.9	97.9	39.8	2.1	0.8	0.7	0.7	0.7	-	-	-

Checked By: ____ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R103**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R103
SAMPLE DESCRIPTION: Light brown to brown gravel with clay and sand and trace roots (GP-GC)
C_u = 130; C_c = 0.6

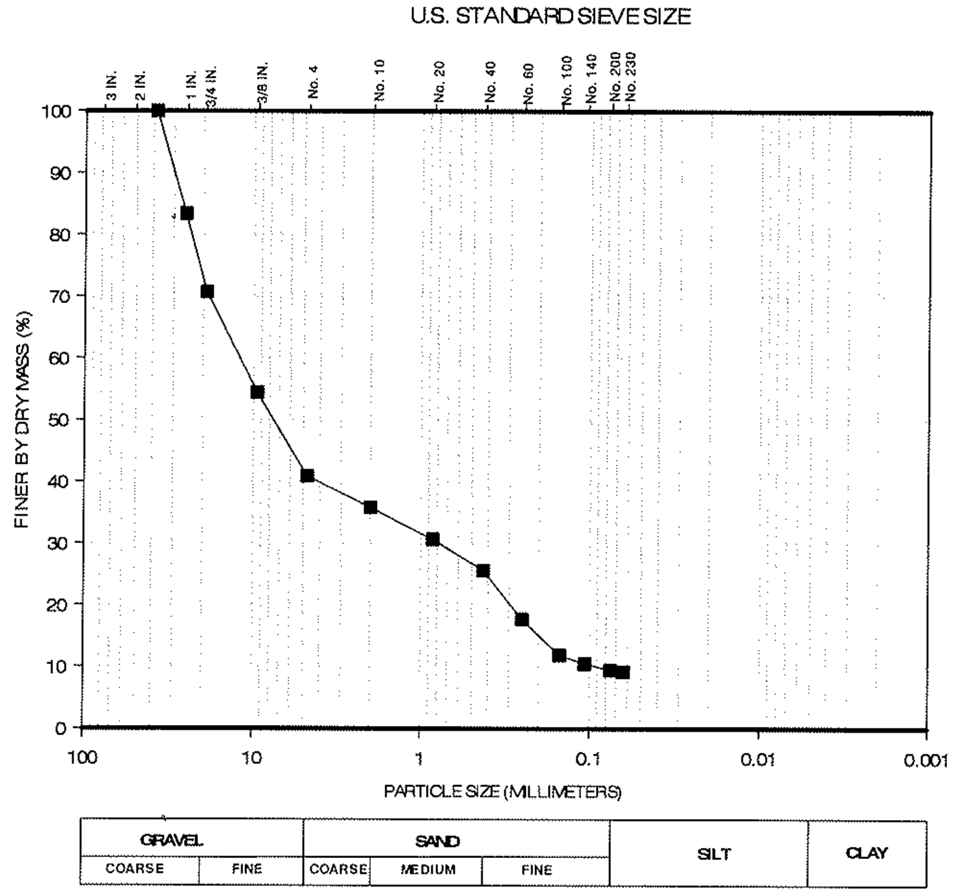
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 19.2
Mass Dry Solids (grams): 539.20
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.0
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis													Hydrometer Analysis		
Gravel-Size					Sand-Size								Silt-Size	Clay-Size	
					Coarse	Medium		Fine							
1½"	1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	83.4	70.7	54.4	40.9	35.8	30.7	25.6	17.7	11.9	10.5	9.5	9.2	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R105**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R105
SAMPLE DESCRIPTION: Light brown to brown clayey sand with shell (SC)

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

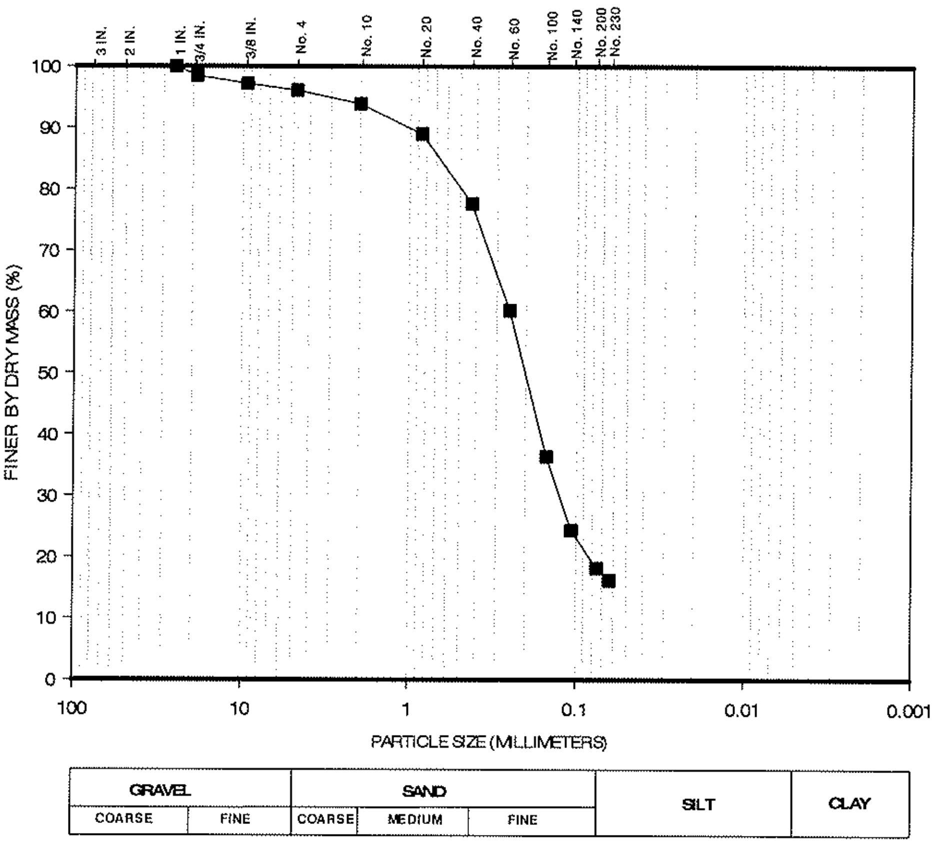
☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 42.8
Mass Dry Solids (grams): 287.89
G

G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.3
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]

U.S. STANDARD SIEVE SIZE



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	98.5	97.2	96.1	93.9	89.0	77.6	60.2	36.4	24.4	18.2	16.2	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R106**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R106
SAMPLE DESCRIPTION: Light brown to brown sand with silt and shell (SP-SM)
$C_u = 3.3$; $C_c = 0.9$

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate
☐ Other

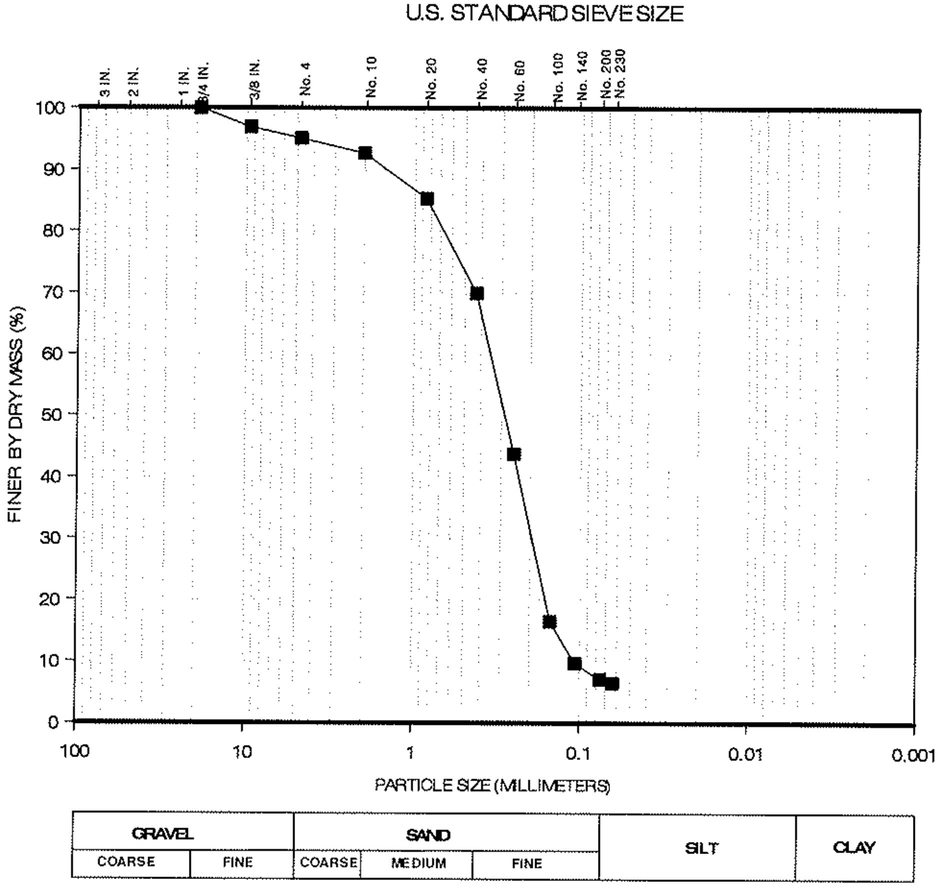
Dispersion Device: ☐ Apparatus A
☐ Apparatus B

Dispersion Period (hours):

Water Content (%): 34.2
Mass Dry Solids (grams): 388.06

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.7
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	96.9	95.1	92.7	85.3	69.9	43.8	16.5	9.7	7.1	6.5	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: R107
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R107
SAMPLE DESCRIPTION: Light brown to brown clayey sand with gravel and shell and trace roots (SC)

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ______

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other______

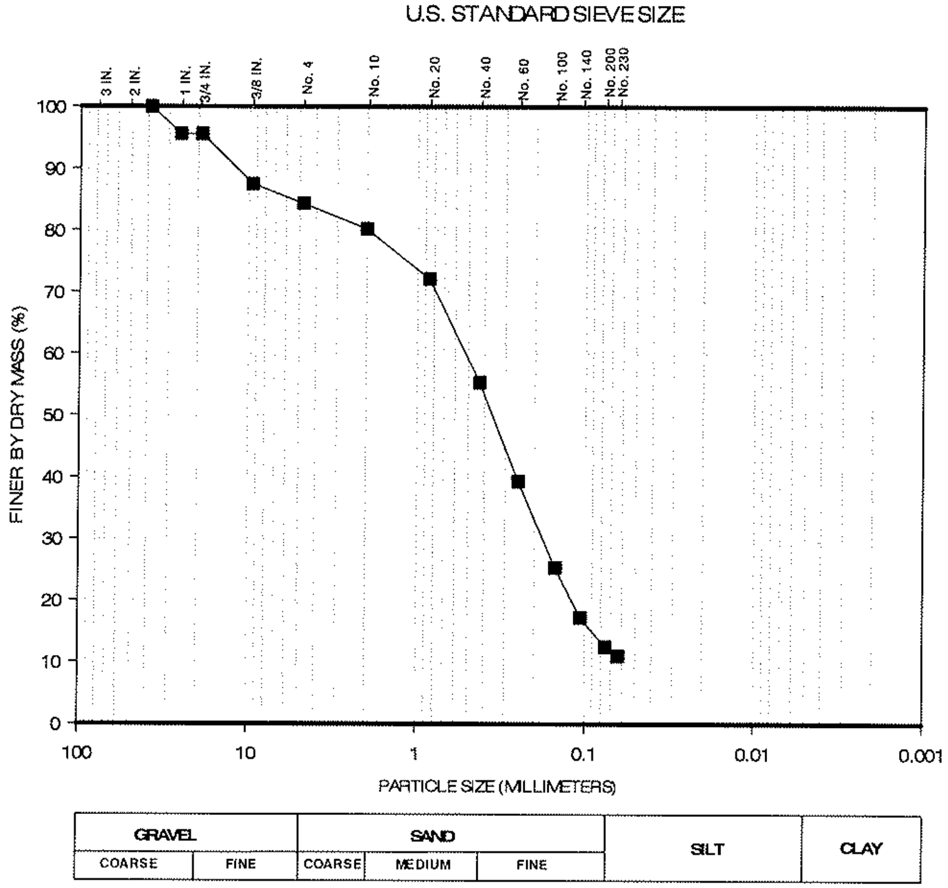
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours): ______

Water Content (%): 32.1
Mass Dry Solids (grams): 369.77

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 1.3
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis													Hydrometer Analysis		
Gravel-Size					Sand-Size								Silt-Size	Clay-Size	
					Coarse	Medium		Fine							
$1^1/_2$"	1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	95.6	95.6	87.5	84.3	80.2	72.1	55.3	39.3	25.3	17.2	12.5	11.0	-	-	-

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Checked By: JM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R108**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R108
SAMPLE DESCRIPTION: Light brown to brown clayey sand with shell (SC)

TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ______

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other______

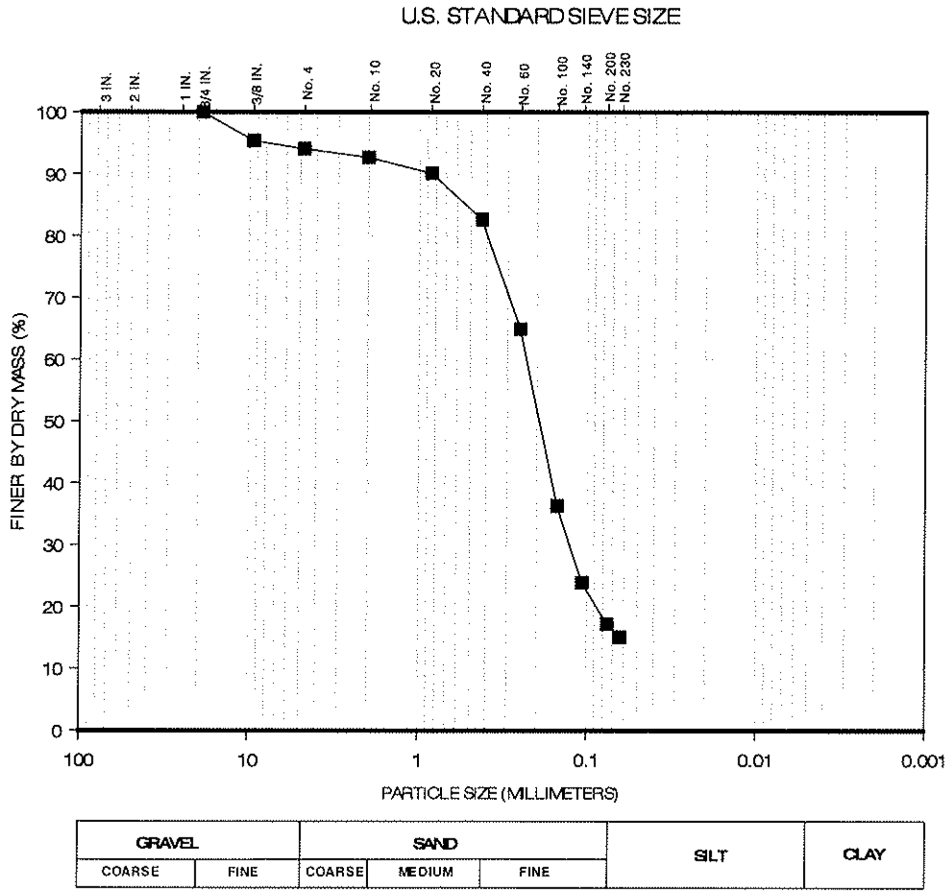
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours): ______

Water Content (%): 40.6
Mass Dry Solids (grams): 321.78

Gₛ: - ☐ Assumed ☐ Measured

Organic Content (%): 1.3
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	95.4	94.1	92.7	90.1	82.6	64.9	36.3	23.9	17.2	15.1	-	-	-

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Checked By: ______ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: R109
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R109
SAMPLE DESCRIPTION: Brown clayey sand with shell (SC)

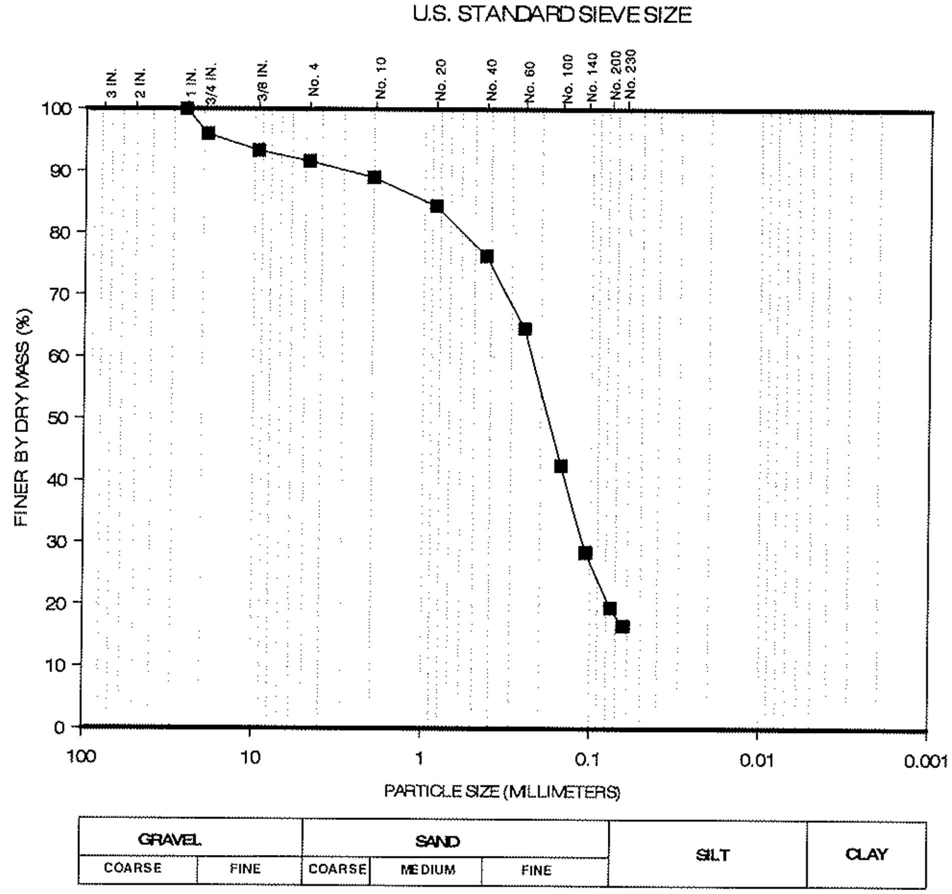
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 37.1
Mass Dry Solids (grams): 345.04
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.4
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	96.0	93.3	91.6	89.0	84.4	76.3	64.6	42.5	28.5	19.5	16.6	-	-	-

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Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R110**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R110
SAMPLE DESCRIPTION: Brown clayey sand with shell (SC)

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ________

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other________

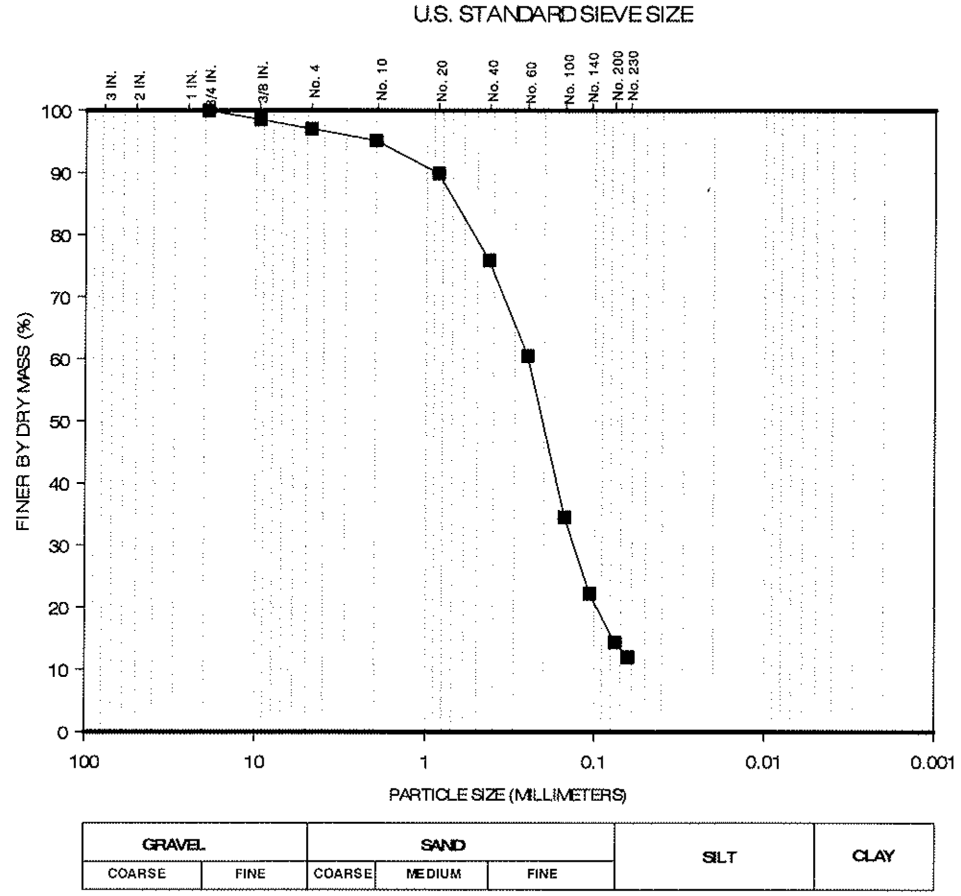
Dispersion Device: ☐ Apparatus A ☐ Apparatus B

Dispersion Period (hours): ________

Water Content (%): 32.8
Mass Dry Solids (grams): 396.57

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.9
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	98.6	97.1	95.2	89.9	75.9	60.5	34.5	22.2	14.4	12.0	-	-	-

Checked By: ____ Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R111**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R111
SAMPLE DESCRIPTION: Brown clayey sand with shell (SC)

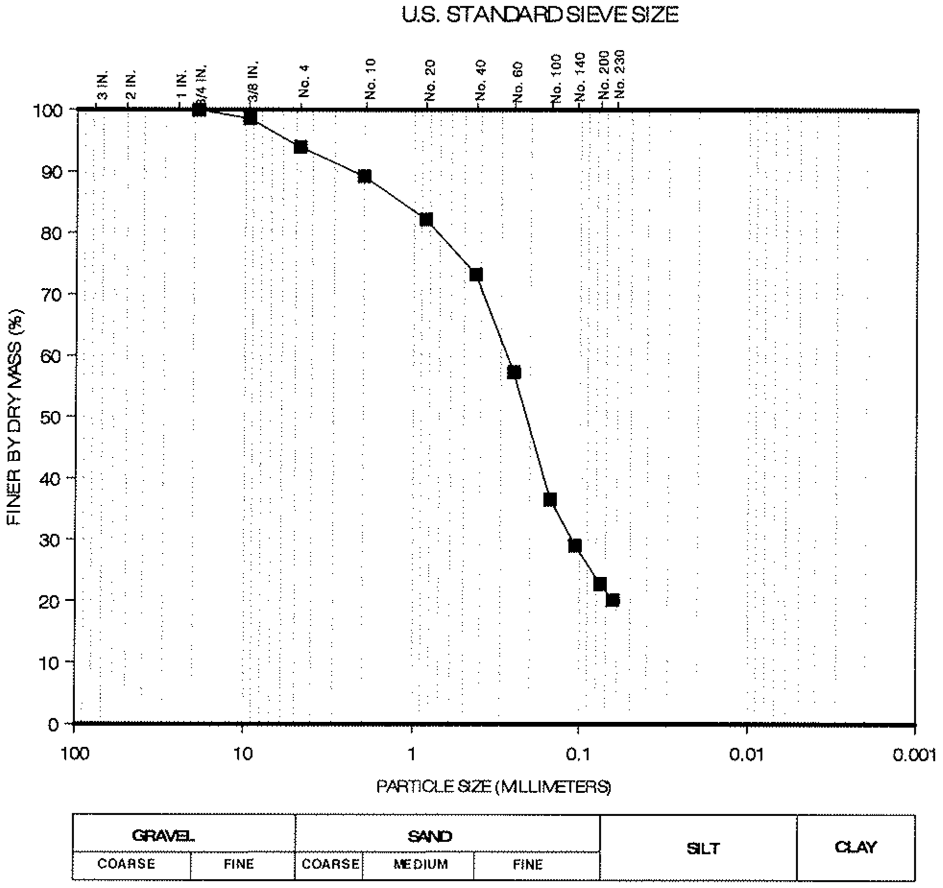
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other:

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours):

Water Content (%): 42.0
Mass Dry Solids (grams): 313.72
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 1.8
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	98.6	94.0	89.2	82.2	73.2	57.3	36.6	29.1	22.8	20.2	-	-	-

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Checked By: Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R112**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R112
SAMPLE DESCRIPTION: Light brown to brown sand with shell (SP)
$C_u = 2.0$; $C_c = 1.0$

TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____________

Dispersant Type: ☐ Sodium Hexametaphosphate
☐ Other____________

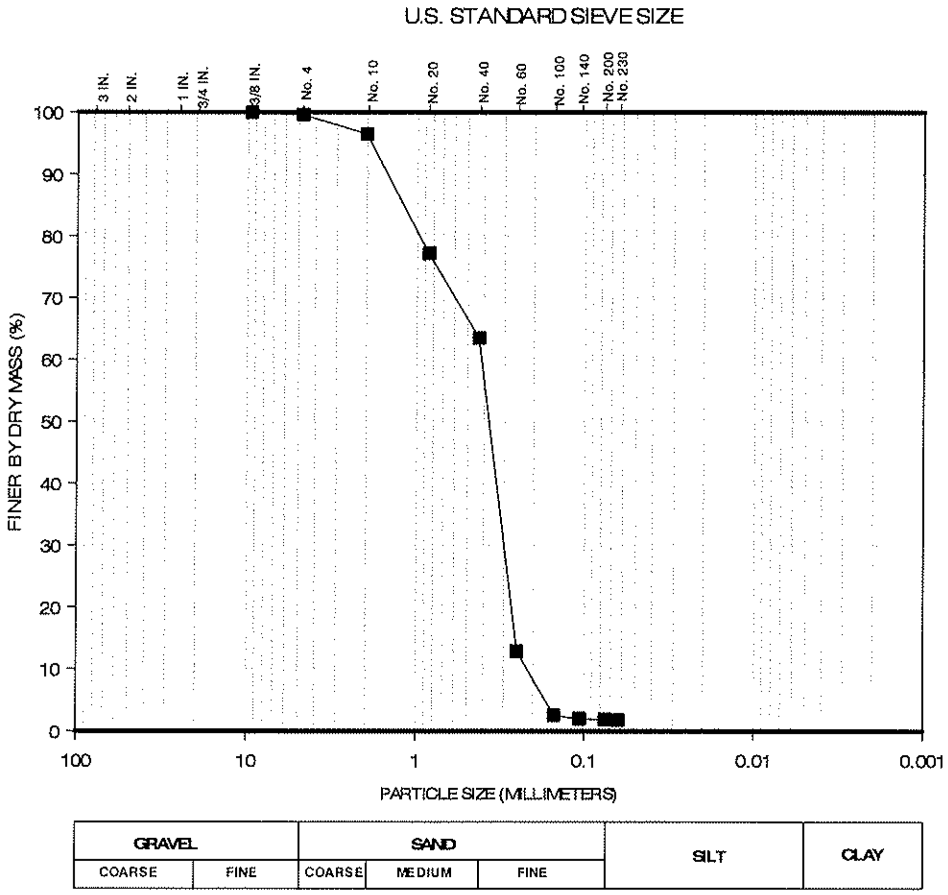
Dispersion Device: ☐ Apparatus A
☐ Apparatus B

Dispersion Period (hours): ____________

Water Content (%): 26.2
Mass Dry Solids (grams): 436.98

G_s: - ☐ Assumed ☐ Measured

Organic Content (%): 0.6
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	100	99.6	96.5	77.2	63.5	12.9	2.6	2.0	1.9	1.8	-	-	-

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: TM Date: 09/20/13

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R113**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R113
SAMPLE DESCRIPTION: Brown sand with silt and shell (SP-SM)
$C_u = 4.5$; $C_c = 0.6$

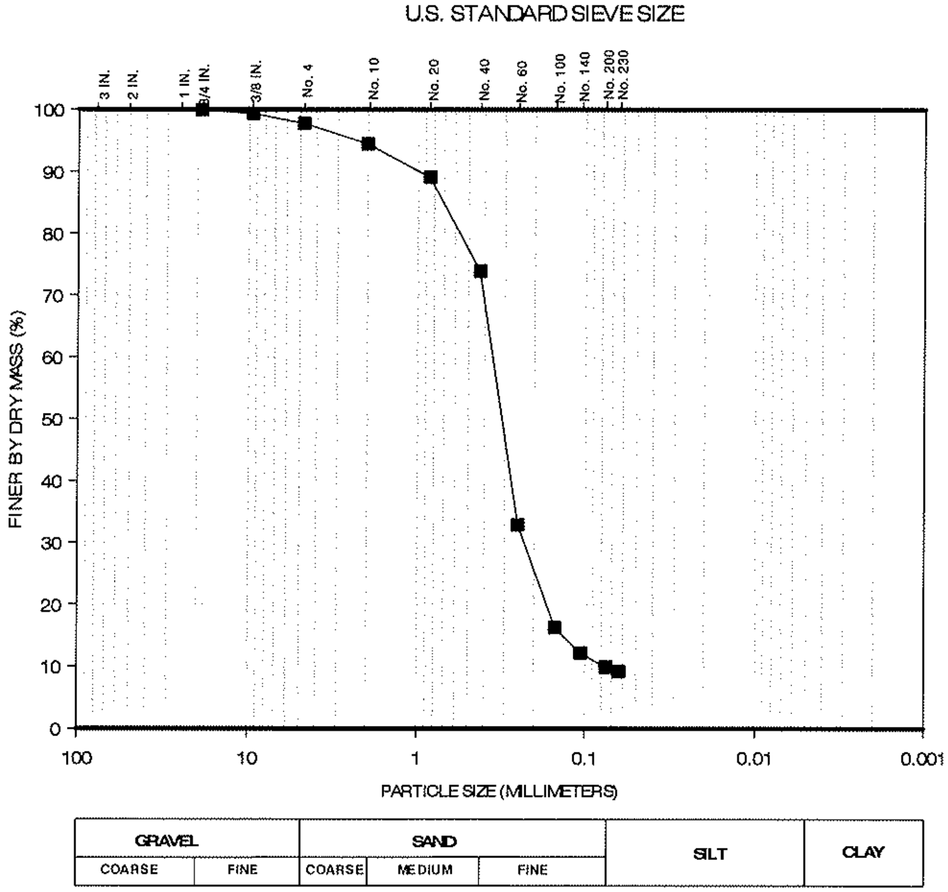
TEST PROCEDURES

ASTM Standard D422:
- ☒ Sieve Analysis
- ☐ Hydrometer Analysis
- ☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ____________________

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other ____________
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ____________

Water Content (%): 34.4
Mass Dry Solids (grams): 389.90
G_s: - ☐ Assumed ☐ Measured
Organic Content (%): 0.7
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	99.4	97.8	94.5	89.1	73.9	32.9	16.3	12.2	9.9	9.2	-	-	-

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: ______ Date: 09/20/13

S:\Projects\2013\13-13-008\Lab Test Results\Form SR-6T Rev 0(R).docx

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
PARTICLE-SIZE ANALYSIS TEST REPORT

CLIENT: Tetra Tech NUS
PROJECT: Eastern Long Island Sound
FILE NO.: 13-13-0083

DATE SAMPLE RECEIVED: 07/24/13
DATE TEST SET-UP: 07/26/13
DATE REPORTED: 09/20/13

INCOMING SAMPLE NO.: **R114**
BORING: - SAMPLE: -
DEPTH: - ☐ ft; ☐ m
LABORATORY IDENTIFICATION: 0083/R114
SAMPLE DESCRIPTION: Light brown to brown sand with clay and shell (SP-SC)
C_u = 5.1; C_c = 1.8

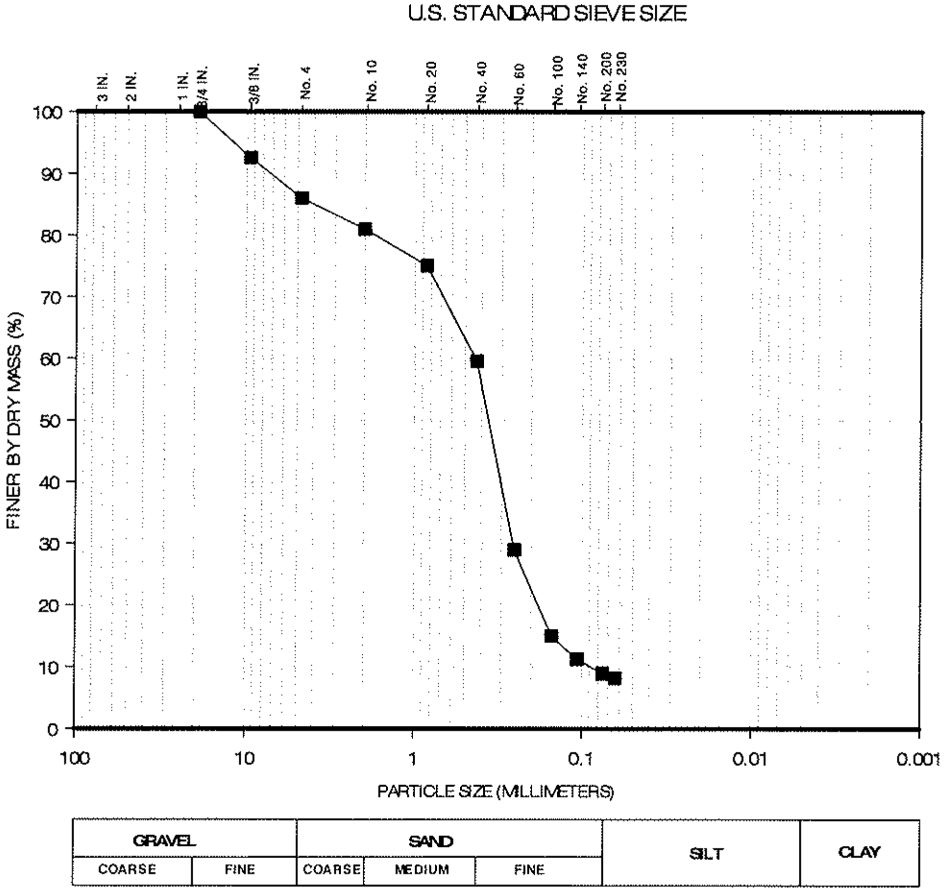
TEST PROCEDURES

ASTM Standard D422:
☒ Sieve Analysis
☐ Hydrometer Analysis
☐ Sieve and Hydrometer Analysis

☐ ASTM Standard D6913 Sieve Analysis
☐ Other: ______

Dispersant Type: ☐ Sodium Hexametaphosphate ☐ Other______
Dispersion Device: ☐ Apparatus A ☐ Apparatus B
Dispersion Period (hours): ______

Water Content (%): 30.7
Mass Dry Solids (grams): 325.54
G_s:______ ☐ Assumed ☐ Measured
Organic Content (%): 1.1
ASTM Standard D2974
Method C [Loss on Ignition at 440°C]



Percent Finer (dry mass basis)

Sieve Analysis												Hydrometer Analysis		
Gravel-Size				Sand-Size								Silt-Size	Clay-Size	
				Coarse	Medium		Fine							
1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.140	No.200	No. 230	0.005 mm	0.002 mm	0.001 mm
100	100	92.6	86.0	81.0	75.1	59.6	29.0	15.0	11.3	9.0	8.2	-	-	-

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: TM Date: 09/20/13

APPENDIX C – RAW LABORATORY DATA; SEDIMENT TOXICITY

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Results of 10 day Sediment Toxicity Tests with *Leptocheirus plumulosus* and *Americamysis bahia* for Long Island Sound Dredge Disposal Sites

Report #BRF/ETF13-024

Submitted to:
Mr. Brian Dresser
Tetra Tech, Inc.
889 Elm St.
Manchester, NH 03101
Phone: (603)-314-0756

Prepared by:
Tetra Tech, Inc.
400 Red Brook Boulevard, Suite 200
Owings Mills, Maryland 21117

September 30, 2013

SUMMARY

CLIENT: USEPA and NAVFAC

TEST FACILITY: Eastern Long Island Sound

TEST MATERIAL: Sediment from 4 sites, plus control

DATE(S) COLLECTED: July 16 - 18, 2013

DATE(S) RECEIVED: July 23, 2013

COLLECTED BY: Brian Dresser, Tetra Tech, Inc.

CONTROL/DILUTION WATER: Artificial Seawater

TYPE OF TEST(S): 10-Day Sediment Toxicity using *Leptocheirus plumulosus*
10-Day Sediment Toxicity using *Americamysis bahia*

TEST DATE(S):

Leptocheirus plumulosus:	August 27 – September 7, 2013 July 29 – August 9, 2013
Americamysis bahia:	September 9 – 20, 2013

TEST RESULTS:

TABLE 1. SUMMARY OF TEST RESULTS

Site	Species	**Mean % Survival**
Control	*L. plumulosus*	97
P003		98
P018		99
R024		94
P011		96
Control	*A. bahia*	90
P003		92
P018		92
R024		88
P011		82

MATERIALS AND METHODS

TEST MATERIAL

One gallon of sediment for each of 4 sites was collected by Tetra Tech personnel between July 16 and 18. Samples were held at <6° C from July 18 until shipping on July 22. The samples were transported in one gallon plastic ziploc bags on ice to Tetra Tech's Ecological Testing Facility. Upon arrival, the sample identification, collection date and time were recorded on the sample chain-of-custody sheet (see Appendix A Chain-of-Custody). Temperature of sediment was recorded upon arrival by measuring the temperature blank (water) packed with sediment. Temperature was < 6° C and was recorded on the chain-of-custody sheet.

CONTROL/DILUTION WATER

The control/dilution water used for the *Leptocheirus plumulosus* 10-day sediment toxicity test was artificial seawater with a salinity of 19.4 ppt. The control/dilution water used for the *Americamysis bahia* 10-day sediment toxicity test was artificial seawater with a salinity of 28.5 ppt.

TEST ORGANISMS/AGE

Leptocheirus plumlosus, 2 – 4 millimeters in length, were obtained from ABS (Aquatic BioSystems Inc.) and Chesapeake Cultures. *Americamysis bahia*, 1 day old, were obtained from Chesapeake Cultures. All organisms appeared healthy and disease free.

TEST METHODS

Samples were thoroughly homogenized in the lab in a stainless steel bowl with a Teflon spoon. During homogenization, the sediments were inspected for indigenous organisms. If any were found, they were removed.

USEPA. 1991. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Ed. EPA/600/4-90/027.

ASTM. 1994. E1367-92. Standard guide for conducting 10-day static sediment toxicity tests with marine and estuarine amphipods. Annual Book of ASTM Standards, Vol. 11.04. American Society for Testing and Materials, Philadelphia, PA.

Tetra Tech Standard Operating Procedure TT-BRF/TX-SOP-O-054. 10-day Sediment Toxicity Test Using *Leptocheirus plumulosus*. Created May 22, 2012. (Internal document prepared by Tetra Tech, Inc.)

TEST CONDITIONS

A summary of the test conditions for the *L. plumolsus* 10-day sediment toxicity test is on page 4 (Table 2) and *A. bahia* is on page 5 (Table 3).

AERATION OF TEST

As per the method, slow aeration was provided one day prior to test organisms being loaded into test chambers for both *L. plumulosus* and *A. bahia*. Dissolved oxygen levels were sufficient after the addition of aeration.

MODIFICATIONS TO PROTOCOLS

None.

COMMENTS CONCERNING TEST

Due to control mortality greater than 10%, the 10-day sediment toxicity testing with *L. plumulosus* was repeated with a new batch of organisms and different control sediment. Control survival in the subsequent round of testing was greater than 90%.

TABLE 2. Summary of Test Conditions for *Leptocheirus plumulosus* 10-day Whole Sediment Toxicity Test.

PARAMETER		CONDITIONS
1.	Test type	10-Day Survival
2.	Test duration	10 Days
3.	Temperature	25^{o}C ± 1^{0}C daily mean temperature, 25 ± 3^{0}C instantaneous temperature
4.	Light quality	Wide-spectrum fluorescent lights
5.	Light intensity	~ 100-1000 lux
6.	Photoperiod	24-h light
7.	Test chamber size	1000 mL high-form lipless beaker
8.	Sediment volume	175 mL
9.	Overlying water volume	800 mL
10.	Renewal of overlying water	None
11.	Length of test organisms:	2 – 4 mm (no mature males or females)
12.	No. organisms per test chamber	20
13.	No. replicate chambers per sample	5
14.	No. organisms per sample	100
15.	Feeding regime	None
16.	Test chamber cleaning	None
17.	Aeration	Slow aeration was provided as per USEPA guidelines.
18.	Overlying water	Artificial Seawater (19.4 ppt)
19.	Overlying water quality	Temperature and DO daily; ph, ammonia, salinity on Day 2 and Day 8
20.	Endpoint	Survival
21.	Sampling and sample holding requirements	Samples used within 8 weeks of receipt. Samples stored in the dark at 4^{0}C in sealed containers with no air space.
22.	Sample volume required	one gallon
23.	Test acceptability	Minimum mean control survival of 90%.

TABLE 3. Summary of Test Conditions for *Americamysis bahia* 10-day Whole Sediment Toxicity Test.

PARAMETER		CONDITIONS
1.	Test type	10-Day Survival
2.	Test duration	10 Days
3.	Temperature	$25^{o}C \pm 1^{0}C$ daily mean temperature, $25 \pm 3^{0}C$ instantaneous temperature
4.	Light quality	Wide-spectrum fluorescent lights
5.	Light intensity	~ 100-1000 lux
6.	Photoperiod	16-h light: 8-h dark
7.	Test chamber size	1000 mL high-form lipless beaker
8.	Sediment volume	175 mL
9.	Overlying water volume	800 mL
10.	Renewal of overlying water	None
11.	Age of test organisms:	1 – 5 days
12.	No. organisms per test chamber	10
13.	No. replicate chambers per sample	5
14.	No. organisms per sample	50
15.	Feeding regime	Fed <24-hour old *Artemia* nauplii daily
16.	Test chamber cleaning	None
17.	Aeration	Slow aeration was provided as per USEPA guidelines.
18.	Overlying water	Artificial Seawater (25-30‰)
19.	Overlying water quality	Temperature, pH and DO daily; ammonia, salinity on Day 1 and Day 9
20.	Endpoint	Survival
21.	Sampling and sample holding requirements	Samples used within 8 weeks of receipt. Samples stored in the dark at $4^{0}C$ in sealed containers with no air space.
22.	Sample volume required	one gallon
23.	Test acceptability	Minimum mean control survival of 90%.

RESULTS

OVERLYING WATER PHYSICAL/CHEMICAL RESULTS

The physical/chemical results of the overlying water including ammonia, dissolved oxygen, pH, temperature, and salinity, are summarized in Tables 4 and 5. See Appendix B Laboratory Bench Sheets for all physicochemical data.

LEPTOCHEIRUS PLUMULOSUS RESULTS

Leptocheirus plumulosus survival in site sediments ranged between 94% (R024) to 99% (P018). There was no significant difference in the survival of any site with respect to the controls. The results of the statistical analyses, along with significance levels, are included in Table C-1 in Appendix C Statistical Analyses.

AMERICAMYSIS BAHIA RESULTS

Americamysis bahia survival in site sediments ranged between 82% (P011) to 92% (P003 and P018). There was no significant difference in the survival of any site with respect to the controls. The results of the statistical analyses, along with significance levels, are included in Table C-2 in Appendix C Statistical Analyses.

COMMENTS CONCERNING TEST RESULTS

Test acceptability criteria were met for *L. plumulosus* and *A. bahia* for these tests as evidenced by >90% survival in the controls.

QUALITY ASSURANCE/QUALITY CONTROL

Reference toxicant test data are included in Appendix D Quality Assurance/Quality Control. Results indicate all organisms were responding appropriately.

TABLE 4. SUMMARY OF WATER QUALITY AND TEST DATA FOR *L. plumulosus* 10-DAY SEDIMENT TOXICITY TEST

Client: USEPA and NAVFAC		
Experiment ID: Tt01684, Tt01688 – Tt01691	Start Test	8-27-13
Sample Tested: Eastern Long Island Sound	End Test	9-7-13

RESULTS
(including water quality before organisms were loaded)

WATER CHEMISTRY ANALYSIS (RANGE)

Site	Salinity (ppt)	D.O. (mg/L)	pH	Temp. (°C) Instantaneous	Ammonia (mg/L)
Control	17.5 – 19.6	7.2 – 8.4	7.3 – 7.4	23.7 – 26.5	1.1 – 3.3
P003	19.9 – 22.7	7.6 – 8.8	7.8	23.7 – 26.5	0.3 – 0.7
P018	20.0 – 22.1	7.1 – 8.8	7.9 – 8.0	23.7 – 26.5	1.7 – 4.7
P011	20.3 – 22.4	7.7 – 9.0	8.0	23.7 – 26.5	0.1 – 0.4
R024	20.0 – 22.1	7.7 – 8.7	8.0	23.7 – 26.5	0.1 – 2.7

TABLE 5. SUMMARY OF WATER QUALITY AND TEST DATA FOR *A. bahia* 10-DAY SEDIMENT TOXICITY TEST

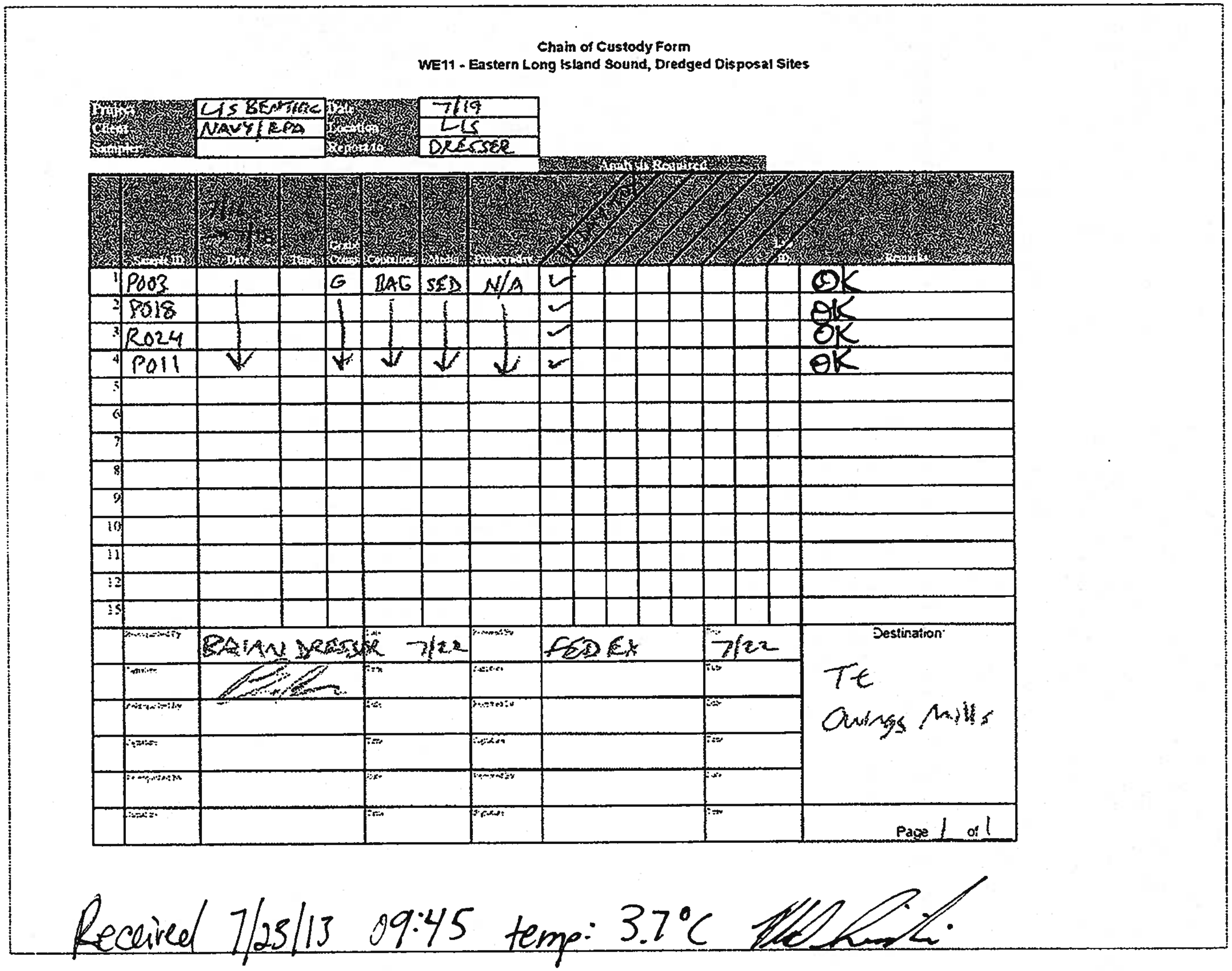
Client: USEPA and NAVFAC		
Experiment ID: Tt01711, Tt01713 - Tt01716	Start Test	9-09-13
Sample Tested: Eastern Long Island Sound	End Test	9-20-13

RESULTS
(including water quality before organisms were loaded)

WATER CHEMISTRY ANALYSIS (RANGE)

Site	Salinity (ppt)	D.O. (mg/L)	pH	Temp. (°C) Instantaneous	Ammonia (mg/L)
Control	28.5 – 30.3	7.1 – 8.5	7.6 – 8.1	23.9 – 26.1	0.5 – 4.4
P003	30.1 – 35.1	7.3 – 9.2	7.9 – 8.3	23.9 – 26.1	0.1 – 0.4
P018	30.8 – 34.5	7.3 – 9.3	7.9 – 8.2	23.9 – 26.1	0.5 – 2.1
P011	30.5 – 33.1	7.4 – 9.1	7.6 – 8.2	23.9 – 26.1	0.7 – 4.1
R024	30.5 – 33.0	6.9 – 9.3	7.7 – 8.1	23.9 – 26.1	1.0 – 1.7

A. CHAIN OF CUSTODY



Chain of Custody Form
WE11 - Eastern Long Island Sound, Dredged Disposal Sites

Project: LIS BENTHIC
Client: NAVY / EPA
Sampler:
Date: 7/19
Location: LIS
Report to: DRESSER

	Sample ID	Date	Time	Grab Comp	Container	Media	Preservative	Analysis Required								Remarks
		7/16 – 7/18						[illegible]							Lab ID	
1	P003	↓		G	BAG	SED	N/A	✓								OK
2	P018	↓		↓	↓	↓	↓	✓								OK
3	R024	↓		↓	↓	↓	↓	✓								OK
4	P011	↓		↓	↓	↓	↓	✓								OK
5																
6																
7																
8																
9																
10																
11																
12																
15																

BRIAN DRESSER	7/22	FEDEX	7/22	Destination: TE Owings Mills
				Page 1 of 1

Received 7/23/13 09:45 temp: 3.7°C

Figure 7: Chain of Custody Form

B. LABORATORY BENCH SHEETS

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01684

Test #: TT01684

Sample ID: Broad man River Contol

Organism Source: Chesapeake

Organism Batch #: 0026

Organism Size: 2-4mm

Laboratory ID: TT

Client/Project: LIS

Sediment Volume (mL): ~~80~~ BS 175

Water Volume (mL): ~~475~~ BS 800

Dilution Water (Batch #): 501

Sediment Load Date/Time: 8/27/13 1010

Organism Load Date/Time: 8/28/13 1230

Test End Date/Time: 9/7/13 0920

Corresponding Control Test #: TE01684

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH3 (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1230		23.9	7.5				BS	1020
1									23.8	8.3				BS	0910
2									23.9	8.6	17.5	1.1	7.4	BS	0950
3									23.7	8.4				BS	1050
4									23.7	7.7				PTS	1030
5									23.7	7.7				PTS	1155
6								26.1	~~23.7~~ BS 9/3/13	8.3				BS	1000
7									26.5	8.3				BS	0850
8									25.3	7.2	19.0	3.3	7.5	BS	1050
9									25.4	7.4				BS	0900
10	19	19	20	20	19	BS	0920		25.6	8.0				BS	1310

Final Mean Percent Survial: $\frac{\#\ \text{Surviving}}{\#\ \text{Exposed}}$ x100 = cb ~~94~~ 97 %

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01688

Test #: TT01688

Sample ID: P003

Organism Source: Chesapeake

Organism Batch #: 0026

Organism Size: 2-4mm

Laboratory ID: TT

Client/Project: LIS

Sediment Volume (mL): 175

Water Volume (mL): 600

Dilution Water (Batch #): 501

Sediment Load Date/Time: 8/27/13 1012

Organism Load Date/Time: 8/28/13 1310

Test End Date/Time: 9/7/13 1040

Corresponding Control Test #: TE01684

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1310		23.9	8.1				BS	1020
1									23.8	8.2				BS	0910
2									23.9	8.4	19.9	0.7	7.8	BS	0950
3									23.7	8.3				BS	1050
4									23.7	7.6				PTS	1030
5									23.7	8.2				PTS	1555
6								26.1	~~23.9~~ BS 9/3/13	8.1				BS	1000
7									26.5	7.9				BS	0850
8									25.3	8.5	22.7	0.3	7.8	BS	1250
9									25.4	7.8				BS	0900
10	20	20	18	20	20	PTS	1040		25.6	7.8				BS	1340

Final Mean Percent Survial: $\frac{\text{\# Surviving}}{\text{\# Exposed}}$ x100 = 98 %

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01689

Test #: TT01689

Sample ID: P018

Organism Source: Chesapeake

Organism Batch #: 0026

Organism Size: 2-4mm

Laboratory ID: TT

Client/Project: LIS

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #): 501

Sediment Load Date/Time: 8/27/13 1015

Organism Load Date/Time: 8/28/13 1345

Test End Date/Time: 09/07/13 1425

Corresponding Control Test #: TT01684

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1345		23.9	8.3				BS	1020
1									23.8	8.3				BS	0910
2									23.9	8.7	20.0	1.7	7.9	BS	0950
3									23.7	8.8				BS	1050
4									23.7	7.1				BTS	1030
5									23.7	7.8				BTS	1155
6								261	BS 9/3/13 ~~23.9~~	8.1				BS	1000
7									265	8.0				BS	0850
8									25.3	8.8	22.1	4.7	8.0	BS	1250
9									25.4	7.8				BS	0900
10	19	20	20	20	20	BS	1425		25.6	7.8				BS	1340

Final Mean Percent Survial: $\frac{\text{\# Surviving}}{\text{\# Exposed}}$ x100 = 99 %

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

Page 1 of 1

L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01690

Test #: TT01690
Sample ID: 8011
Organism Source: Chesapeake
Organism Batch #: 0026
Organism Size: 2-4 mm

Laboratory ID: TT
Client/Project: LIS
Sediment Volume (mL): 175
Water Volume (mL): 800
Dilution Water (Batch #): 501

Sediment Load Date/Time: 8/27/13 1018
Organism Load Date/Time: 8/28/13 1325
Test End Date/Time: 9/07/13 1000
Corresponding Control Test #: TT01684

Day	Replicate 1	2	3	4	5	Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
0	20	20	20	20	20	BS	1325		23.9	8.3				BS	1020
1									23.8	8.3				BS	0410
2									23.9	8.7	20.3	0.4	8.0	BS	0950
3									23.7	8.8				BS	1050
4									23.7	7.8				PTS	1030
5									23.7	8.3				PTS	1155
6								26.1	9/3/13 BS ~~23.9~~	8.0				BS	1000
7									26.5	8.1				BS	0850
8									25.3	9.0	22.4	0.1	8.0	PS	1250
9									25.4	7.7				BS	0900
10	20	20	19	19	18	PTS	1000		25.6	7.9				BS	1340

Final Mean Percent Survial: $\frac{\text{\# Surviving}}{\text{\# Exposed}}$ x100 = 96 %

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

Page 1 of 1

L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01691

Test #: TT01691

Sample ID: R024

Organism Source: Chesapeake

Organism Batch #: 0026

Organism Size: 2-4mm

Laboratory ID: TT

Client/Project: LIS

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #): 501

Sediment Load Date/Time: 8/27/13 1020

Organism Load Date/Time: 8/28/13 1345

Test End Date/Time: 9/7/13 1405

Corresponding Control Test #: TT01684

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH₃ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1345		23.9	8.3				BS	1020
1									23.8	8.4				BS	0910
2									23.9	8.6	20.0	2.7	8.0	BS	0950
3									23.7	8.7				BS	1050
4									23.7	8.0				BTS	1030
5									23.7	8.3				BS	1155
6								26.1	~~23.7~~ 9/3/13 BS	8.0				BS	1000
7									26.5	8.1				BS	0850
8									25.3	8.3	22.1	0.1	8.0	BS	1250
9									25.4	7.7				BS	0900
10	20	19	20	18	17	BS	1405		25.6	7.9				BS	1340

Final Mean Percent Survial: # Surviving / # Exposed x100 = 94 %

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Data Checked and Approved: SF

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01669

Test #: TT01669
Sample ID: Control
Organism Source: ABS
Organism Batch #: 0023
Organism Size: 2-4mm

Laboratory ID: TT
Client/Project: LIS
Sediment Volume (mL): 175
Water Volume (mL): 800
Dilution Water (Batch #): 493

Sediment Load Date/Time: 7/29/13 1225
Organism Load Date/Time: 7/30/13 1300
Test End Date/Time: 8/9/13 0910
Corresponding Control Test #: TT01669

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1300		24.7	7.9				BS	1000
1									24.4	7.3				BS	1100
2									24.6	8.2	21.6	5.0	8.0	BS	1350
3									24.9	7.7				BS	0915
4									25.0	8.6				BS	1015
5									25.5	7.9				BS	1510
6									25.0	7.6				BS	0935
7									25.0	8.2				BS	0925
8									25.0	8.2	23.0	7.0	7.5	BS	1240
9									24.9	8.5				BS	1330
10	12	12	15	14	15	BS	0910		24.9	8.6				BS	1600

Final Mean Percent Survial: # Surviving / # Exposed x100 = 68 %

-Test invalid due to control mortality > 10%.

Tetra Tech, Inc.
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Data Checked ~~and Approved~~: JF
JF 9/26/13
Data reviewed but not approved; invalid

2013

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01670

Test #: TT01670
Sample ID: P003
Organism Source: ABS
Organism Batch #: 0023
Organism Size: 2-4mm

Laboratory ID: TT
Client/Project:
Sediment Volume (mL): 175
Water Volume (mL): 800
Dilution Water (Batch #):

Sediment Load Date/Time: 7/29/13 1205
Organism Load Date/Time: 7/30/13 1100
Test End Date/Time: 8/9/13 1300
Corresponding Control Test #: TT01669

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1100		24.7	7.8				BS	1000
1									24.4	7.7				PS	1100
2									24.6	8.2	21.8	1.3	7.9	BS	1350
3									24.9	7.7				PS	0915
4									25.0	8.0				BS	1015
5									25.5	8.2				PS	1540
6									25.0	7.8				BS	0935
7									25.0	8.9				PS	0925
8									25.0	8.5	21.5	0.2	7.5	BS	1240
9									24.9	8.6				BS	1330
10	17	18	16	14	16	BS	1300		24.9	8.7				BS	1600

Final Mean Percent Survial: $\frac{\text{\# Surviving}}{\text{\# Exposed}}$ x100 = 81 %

– Test invalid due to control mortality > 10%.

Tetra Tech, Inc.
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Data Checked ~~and Approved:~~ JF
JF 9/26/13
Data reviewed but not approved; test invalid!

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01671

Test #: TT01671

Sample ID: P018

Organism Source: ABS

Organism Batch #: 0023

Organism Size: 2-4mm

Laboratory ID: TT

Client/Project:

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #):

Sediment Load Date/Time: 7/29/13 1100

Organism Load Date/Time: 7/30/13 1210

Test End Date/Time: 08/09/13 1100

Corresponding Control Test #: TT01669

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH₃ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1210		24.7	7.9				BS	1000
1									24.4	~~8.0~~ 7.5 BS 7/31/13				BS	1100
2									24.6	8.2	21.2	2.0	7.9	BS	1350
3									24.9	8.0				BS	0915
4									25.0	8.0				BS	1015
5									25.5	8.2				BS	1540
6									25.0	7.8				BS	0935
7									25.0	9.2				BS	0925
8									25.0	8.9	21.1	0.4	7.5	BS	1240
9									24.9	8.5				BS	1330
10	19	12	17	18	17	BS	1100		24.9	8.7				BS	1600

Final Mean Percent Survial: $\frac{\#\ \text{Surviving}}{\#\ \text{Exposed}}$ x100 = 83 %

Test invalid due to control mortality >10%.

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Data Checked ~~and Approved~~: JF 9/26/13 JF

reviewed but not approved; test invalid.

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01672

Test #: TT01672

Sample ID: R024

Organism Source: ABS

Organism Batch #: 0023

Organism Size: 2-4mm

Laboratory ID: TT

Client/Project:

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #):

Sediment Load Date/Time: 7/29/13 1200

Organism Load Date/Time: 7/30/13 1300

Test End Date/Time: 08/09/13 1055

Corresponding Control Test #: TT01669

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1300		24.7	8.0				BS	1000
1									24.9	7.8				BS	1100
2									24.6	8.2	21.4	2.0	7.9	BS	1350
3									24.9	7.7				BS	0915
4									25.0	7.9				BS	1015
5									25.5	8.6				BS	1540
6									25.0	7.9				BS	0935
7									25.0	8.3				BS	0925
8									25.0	8.7	22.1	0.4	7.7	BS	1240
9									24.9	8.3				BS	1330
10	BS 8/9/13 ~~14~~ 16	BS 8/9/13 14 ~~12~~	8/9/13 BS ~~15~~ 18	BS 8/9/13 ~~14~~ 11	BS 8/9/13 ~~15~~ 13	BS	~~0910~~ BS 8/9/13 1055		24.6	8.6				BS	1600

Final Mean Percent Survial: # Surviving / # Exposed x100 = 74 %

Test INVALID Due to Control Mortality >10%.

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Data Checked ~~and Approved~~: JF 9/26/13 JF
Data reviewed but not approved; invalid.

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L. PLUMULOSUS 10-DAY SEDIMENT TOXICITY BENCH SHEET

Test #: TT01673

Test #: TT01673

Sample ID: P011

Organism Source:. ABS

Organism Batch #: 0023

Organism Size: 2-4mm

Laboratory ID: TT

Client/Project:

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #):

Sediment Load Date/Time: 7/29/13 1215

Organism Load Date/Time: 7/30/13 1300

Test End Date/Time: 08/09/13 1410

Corresponding Control Test #: TT01669

Day	Replicate					Analyst	Time	Observations	Temp (°C)	DO (mg/L)	Salinity (‰)	NH_3 (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	20	20	20	20	20	BS	1300		24.7	7.8				BS	1000
1									24.4	8.4				BS	1100
2									24.6	8.3	21.4	2.2	7.9	BS	1350
3									24.9	7.7				BS	0915
4									25.0	7.8				BS	1015
5									25.5	8.6				BS	1540
6									25.0	8.1				BS	0935
7									25.0	8.0				BS	0925
8									25.0	8.4	23.0	0.4	7.8	BS	1240
9									24.9	8.5				BS	1330
10	17	BS 8/9/13 ~~19~~ 20	15	15	16	BS	1410		24.9	8.5				BS	1600

Final Mean Percent Survial: $\frac{\text{\# Surviving}}{\text{\# Exposed}}$ x100 = 83 %

TEST INVALID Due to CONTROL MORTALITY >10%

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked ~~and Approved~~: SF 9/26/13 SF

Data reviewed but not approved; test invalid.

2013

Weight Data for *L. plumulosus* Larval Survival and Growth

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Test ID: TT61669-TT01673
Start Date (MMDDYYY): 7/29/13
End Date (MMDDYYY): 7/30/13
Drying Temp: 60°C
Drying Time (HH:MM): 24hrs
Weighing Date (MMDDYYY): 7/31/13
Analyst: B
Client: LIS

Concentration	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
1669	1	[illegible] ~~1188.3~~ 1181.5	1186.7	5.2	12	0.43	
	2	1175.4	1180.4	5.0	12	0.42	Avg. = 0.482
	3	1186.2	1194.4	8.2	15	0.55	
	4	1188.3	1195.1	6.8	14	0.49	
	5	1171.1	1178.9	7.8	15	0.52	
1670	1	1175.2	1178.8	3.6	17	0.21	
	2	1179.8	1184.1	4.9	18	0.27	
	3	1172.4	1178.4	6.0	16	0.38	Avg. = 0.432
	4	1187.8	1197.9	10.1	14	0.72	
	5	1173.0	1182.3	9.3	16	0.58	
1671	1	1174.7	1185.4	10.7	19	0.56	
	2	117~~4.~~ 4.0	1180.5	6.5	12	0.54	
	3	1192.2	1202.9	10.7	17	0.63	Avg. = 0.544
	4	1173.6	1181.0	7.4	18	0.41	
	5	1169.1	1178.9	9.8	17	0.58	
1672	1	1165.9	1176.6	10.7	18	0.59	
	2	1163.2	1171.5	8.3	14	0.59	
	3	1176.8	1181.6	4.8	18	0.27	Avg. = 0.422
	4	1173.5	1177.4	3.9	11	0.35	
	5	1179.9	1184.0	4.1	13	0.31	
1673	1	1180.3	1185.2	4.9	17	0.29	
	2	1172.5	1177.8	5.3	20	0.27	
	3	1193.1	1197.3	4.2	15	0.28	Avg. = 0.314
	4	1188.0	1194.6	6.6	15	0.44	
	5	1171.6	1176.3	4.7	16	0.29	
Blanks	A						
	B						

TEST INVALID DUE TO CONTROL MORTALITY >10%

Tetra Tech, Inc.
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9/26/13 JF
Data Checked ~~and Approved~~ JF
Data reviewed but not approved; test invalid

2013

Test #: TT01711

Sample ID: Boardman Control

Species/Source: chesapeake A.bahia

Organism Batch #: 0031

Organism Age: 1 day

Laboratory ID: TE

Client/Project: LES

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #): 505

Sediment Load Date/Time: 9/9/13 1322

Organism Load Date/Time: 9/10/13 1410

Test End Date/Time: 9/20/13 0910

Corresponding Control Test #: TE01711

Day	Replicate					Analyst	Time	Comments	Temp (°C)	DO (mg/L)	Salinity (‰)	NH_3 (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	10	10	10	10	10	PS	1410		25.1	7.4	28.5	0.5	7.8	BS	1035
1									26.1	7.7	28.5	0.7	8.1	BS	0950
2									25.6	7.5		–	7.6	BS	0950
3									23.9	7.3		–	7.7	BS	1020
4									25.2	7.5		–	7.6	BS	1010
5									25.8	7.5		–	7.7	BS	1120
6									25.9	7.6		–	7.8	BS	0850
7									26.0	7.6		–	7.9	BS	1050
8									25.8	8.9		–	8.0	MS	0945
9									24.2	8.0	30.3	~~0~~ 4.4	8.1	MS	1300
10	10	9	8	9	9	PS	0910		24.1	8.5		–	7.9	MS	1410

Final Mean Percent Survial: $\frac{\text{\# Surviving}}{\text{\# Exposed}}$ x100 = 90 %

Data checked and QC'd: JF

1 of 1

Test #: TT01713

Sample ID: R024

Species/Source: Chesapeake Abbia

Organism Batch #: 0031

Organism Age: 1 day

Laboratory ID: TC

Client/Project: LIS

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #): 505

Sediment Load Date/Time: 9/9/13 1325

Organism Load Date/Time: 9/10/13 1412

Test End Date/Time: 9/20/13 1020

Corresponding Control Test #: ~~TC01712~~ TT01711 PS 9/27/13

Day	Replicate					Analyst	Time	Comments	Temp (°C)	DO (mg/L)	Salinity (‰)	NH_3 (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	10	10	10	10	10	PS	1412		25.1	7.9	31.4	1.7 ~~8.0~~ BS 9/10/13	8.0	BS	1035
1									26.1	7.8	30.5	1.0	8.1	BS	0950
2									25.6	7.6		-	7.7	BS	0950
3									23.9	7.4		-	7.8	BS	1020
4									25.2	7.7		-	7.8	BS	1010
5									25.8	7.9		-	7.9	BS	1020
6									25.9	6.9		-	7.9	BS	0850
7									26.0	7.2		-	7.7	BS	1050
8									25.8	7.2		-	7.9	PTS	0945
9									24.2	8.2	33.0	ND	8.1	PTS	1300
10	7	9	9	10	9	PS	1020		24.1	9.3		-	8.1	PTS	1410

Final Mean Percent Survial: $\frac{\text{\# Surviving}}{\text{\# Exposed}}$ x100 = 88 %

Data checked and QC'd: JF

1 of 1

Test #: TT01714

Sample ID: P003

Species/Source: Chesapeake A. bahia

Organism Batch #: 0031

Organism Age: 1 day

Laboratory ID: Tt

Client/Project: LIS

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #): 505

Sediment Load Date/Time: 9/9/13 1332

Organism Load Date/Time: 9/10/13 1412

Test End Date/Time: 9/20/13 1047

Corresponding Control Test #: ~~TT01712~~ TT01711 PS 9/27/13

Day	Replicate					Analyst	Time	Comments	Temp (°C)	DO (mg/L)	Salinity (‰)	NH_3 (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	10	10	10	10	10	BS	1412		25.1	8.3	31.3	0.1	8.1	BS	1035
1									26.1	7.7	30.1	0.4	8.2	BS	0950
2									25.6	7.6		–	7.9	BS	0950
3									23.9	7.4		–	8.0	BS	1020
4									25.2	7.3		–	8.0	BS	1010
5									25.8	7.9		–	7.9	BS	1120
6									25.9	7.0		–	7.9	BS	0850
7									26.0	7.3		–	8.0	BS	1050
8									25.8	8.6		–	8.3	BTS	0945
9									24.2	8.7	35.1	0.1	8.1	BTS	1300
10	9	10	8	9	10	BS	1047		24.1	9.2		–	8.1	BTS	1910

Final Mean Percent Survial: # Surviving / # Exposed x100 = 92 %

Data checked and QC'd: JF

1 of 1

Test #: TT01715

Sample ID: 8018

Species/Source: Chesapeake A.bahia

Organism Batch #: 0081

Organism Age: 1 day

Laboratory ID: TT

Client/Project: LIS

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #): 505

Sediment Load Date/Time: 9/9/13 1337

Organism Load Date/Time: 9/10/13 1325

Test End Date/Time: 9/20/13 1250

Corresponding Control Test #: ~~TE01712~~ TT01714 PS 9/27/13

Day	Replicate					Analyst	Time	Comments	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	10	10	10	10	10	PS	1325		25.1	8.6	31.8	2.1	8.1	BS	1035
1									26.1	7.8	30.9	0.7	8.2	BS	0930
2									25.6	7.8		–	8.0	BS	0950
3									23.9	7.4		–	8.1	BS	1020
4									25.2	7.3		–	8.0	BS	1010
5									25.8	7.9		–	8.1	BS	1120
6									25.9	7.4		–	8.1	BS	0850
7									26.0	7.6		–	8.0	BS	1050
8									25.8	7.3		–	8.0	BTS	0945
9									24.2	8.0	34.5	0.5	7.9	BTS	1300
10	9	9	9	9	10	PS	1250		24.1	9.3		–	8.2	BTS	1410

Final Mean Percent Survial: # Surviving / # Exposed x100 = 92 %

Data checked and QC'd: SP

1 of 1

Test #: TT01716

Sample ID: P011

Species/Source: Chesapeake A. bahia

Organism Batch #: 0031

Organism Age: 1 day

Laboratory ID: Tt

Client/Project: LIS

Sediment Volume (mL): 175

Water Volume (mL): 800

Dilution Water (Batch #): 505

Sediment Load Date/Time: 9/9/13 1340

Organism Load Date/Time: 9/10/13 1320

Test End Date/Time: 09/20/13 1226

Corresponding Control Test #: ~~Tt01712~~ Tt01711 PS 9/27/13

Day	Replicate					Analyst	Time	Comments	Temp (°C)	DO (mg/L)	Salinity (‰)	NH$_3$ (mg/L)	pH	Analyst	Time
	1	2	3	4	5										
0	10	10	10	10	10	PS	1300		25.1	8.6	31.1	0.7	8.1	BS	1035
1									26.1	7.9	30.5	2.3	8.1	BS	0930
2									25.6	7.9		–	8.0	BS	0950
3									23.9	7.4		–	8.1	BS	1020
4									25.2	7.5		–	8.1	BS	1010
5									25.8	7.7		–	8.1	BS	1120
6									25.9	7.4		–	8.1	BS	0850
7									26.0	7.8		–	8.1	BS	1050
8									25.8	8.1		–	8.2	RTS	0945
9									24.2	8.3	33.1	4.1	7.6	RTS	1300
10	10	7	8	8	8	PS	1226		24.1	9.1		–	8.2	RTS	1410

Final Mean Percent Survial: # Surviving / # Exposed x100 = 82 %

Data checked and QC'd: JF

1 of 1

C. STATISTICAL ANALYSIS

Table C-1. Summary of statistical analysis of survival for 10-Day Eastern Long Island Sound sediment test using *L. plumulosus*. Highlighted cells are significant at p<0.05.

Sample ID	Duncan test; Variable: Survival (Spreadsheet1) Marked differences are significant at p < .05000				
	Control (M=19.6)	P003 (M=19.6)	P011 (M=19.4)	P018 (M=19.4)	R024 (M=18.8)
Control		1.000000	0.747415	0.739414	0.212427
P003	1.000000		0.739414	0.724180	0.203659
P011	0.747415	0.739414		1.000000	0.295674
P018	0.739414	0.724180	1.000000		0.322202
R024	0.212427	0.203659	0.295674	0.322202	

Table C-2. Summary of statistical analysis of survival for 10-Day Eastern Long Island Sound sediment test using *A. bahia*. Highlighted cells are significant at p<0.05.

Sample ID	Duncan test; Variable: Ab Survival (LIS Survival Data) Marked differences are significant at p < .05000				
	Control (M=9.0)	P003 (M=9.2)	P011 (M=8.2)	P018 (M=9.2)	R024 (M=8.8)
Control		0.736141	0.184561	0.720736	0.720736
P003	0.736141		0.117574	1.000000	0.514881
P011	0.184561	0.117574		0.110576	0.289582
P018	0.720736	1.000000	0.110576		0.501576
R024	0.720736	0.514881	0.289582	0.501576	

D. QUALITY ASSURANCE/QUALITY CONTROL

CETIS Summary Report

Report Date:	03 Sep-13 13:54 (p 1 of 2)
Test Code:	Ref00497 | 03-7901-9299

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Batch ID:	16-6823-0670	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	29 Aug-13 13:25	**Protocol:**	EPA/821/R-02-012 (2002)	**Diluent:**	30 ppt Saltwater
Ending Date:	02 Sep-13 12:30	**Species:**	Americamysis bahia (Atlantic Mysid)	**Brine:**	Instant Ocean
Duration:	95h	**Source:**	Chesapeake	**Age:**	3d

Sample ID:	10-8651-8267	**Code:**	40C2F3FB	**Client:**	Tetra Tech
Sample Date:	29 Aug-13 13:25	**Material:**	Potassium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**			

Point Estimate Summary

Analysis ID	Endpoint	Level	gm/L	95% LCL	95% UCL	TU	Method
20-7721-9751	48h Survival Rate	EC5	0.5128	0.359	0.5323		Linear Interpolation (ICPIN)
		EC10	0.5385	0.4985	0.5569		
		EC15	0.5641	0.5264	0.5815		
		EC20	0.5897	0.5543	0.6062		
		EC25	0.6154	0.5821	0.6308		
		EC40	0.6923	0.6657	0.7046		
		EC50	0.7436	0.7214	0.7538		
17-9466-0514	96h Survival Rate	EC5	0.5128	0.359	0.5323		Linear Interpolation (ICPIN)
		EC10	0.5385	0.4985	0.5569		
		EC15	0.5641	0.5264	0.5815		
		EC20	0.5897	0.5543	0.6062		
		EC25	0.6154	0.5821	0.6308		
		EC40	0.6923	0.6657	0.7046		
		EC50	0.7436	0.7214	0.7538		

48h Survival Rate Summary

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
0.125		4	1	1	1	1	1	0	0	0.0%	0.0%
0.25		4	1	1	1	1	1	0	0	0.0%	0.0%
0.5		4	0.975	0.9563	0.9937	0.9	1	0.025	0.05	5.13%	2.5%
1		4	0	0	0	0	0	0	0		100.0%
2		4	0	0	0	0	0	0	0		100.0%

96h Survival Rate Summary

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
0.125		4	1	1	1	1	1	0	0	0.0%	0.0%
0.25		4	1	1	1	1	1	0	0	0.0%	0.0%
0.5		4	0.975	0.9563	0.9937	0.9	1	0.025	0.05	5.13%	2.5%
1		4	0	0	0	0	0	0	0		100.0%
2		4	0	0	0	0	0	0	0		100.0%

Analyst: PS QA: JF

48h Survival Rate Detail

Conc-gm/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
0.125		1	1	1	1
0.25		1	1	1	1
0.5		1	1	0.9	1
1		0	0	0	0
2		0	0	0	0

96h Survival Rate Detail

Conc-gm/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
0.125		1	1	1	1
0.25		1	1	1	1
0.5		1	1	0.9	1
1		0	0	0	0
2		0	0	0	0

Analyst:____ QA:____

CETIS Measurement Report

Report Date: 03 Sep-13 13:53 (p 1 of 4)
Test Code: Ref00497 | 03-7901-9299

Americamysis 96-h Acute Survival Test

Tetra Tech, Inc.

Batch ID: 16-6823-0670
Start Date: 29 Aug-13 13:25
Ending Date: 02 Sep-13 12:30
Duration: 95h

Test Type: Survival (96h)
Protocol: EPA/821/R-02-012 (2002)
Species: Americamysis bahia (Atlantic Mysid)
Source: Chesapeake

Analyst:
Diluent: 30 ppt Saltwater
Brine: Instant Ocean
Age: 3d

Sample ID: 10-8651-8267
Sample Date: 29 Aug-13 13:25
Receive Date:
Sample Age: N/A

Code: 40C2F3FB
Material: Potassium chloride
Source: Reference Toxicant
Station:

Client: Tetra Tech
Project: Reference Toxicant

Final Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	7.25	6.987	7.513	6.7	7.8	0.55	0.7778	10.73%	0
0.125		2	7.25	7.035	7.465	6.8	7.7	0.45	0.6364	8.78%	0
0.25		2	7.3	7.156	7.444	7	7.6	0.3	0.4243	5.81%	0
0.5		2	7.45	7.235	7.665	7	7.9	0.45	0.6364	8.54%	0
1		1	7.4			7.4	7.4	0	0	0.0%	0
2		1	7.5			7.5	7.5	0	0	0.0%	0
Overall		10	7.358			6.7	7.9				0 (0%)

Initial Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	7.4	7.209	7.591	7	7.8	0.4	0.5657	7.64%	0
0.125		2	7.45	7.235	7.665	7	7.9	0.45	0.6364	8.54%	0
0.25		2	7.55	7.335	7.765	7.1	8	0.45	0.6364	8.43%	0
0.5		2	7.65	7.435	7.865	7.2	8.1	0.45	0.6364	8.32%	0
1		1	8			8	8	0	0	0.0%	0
2		1	8			8	8	0	0	0.0%	0
Overall		10	7.675			7	8.1				0 (0%)

Final pH-Units

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	8	7.952	8.048	7.9	8.1	0.1	0.1414	1.77%	0
0.125		2	8.1	8.052	8.148	8	8.2	0.1	0.1414	1.75%	0
0.25		2	8.1	8.099	8.101	8.1	8.1	0	0	0.0%	0
0.5		2	8.05	8.026	8.074	8	8.1	0.05001	0.07073	0.88%	0
1		1	7.9			7.9	7.9	0	0	0.0%	0
2		1	7.9			7.9	7.9	0	0	0.0%	0
Overall		10	8.008			7.9	8.2				0 (0%)

Initial pH-Units

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	7.95	7.926	7.974	7.9	8	0.04999	0.0707	0.89%	0
0.125		2	8	8	8	8	8	0	0	0.0%	0
0.25		2	8.1	8.099	8.101	8.1	8.1	0	0	0.0%	0
0.5		2	8.1	8.099	8.101	8.1	8.1	0	0	0.0%	0
1		1	8.1			8.1	8.1	0	0	0.0%	0
2		1	8.2			8.2	8.2	0	0	0.0%	0
Overall		10	8.075			7.9	8.2				0 (0%)

Final Salinity-ppt

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	35.9	35.85	35.95	35.8	36	0.09987	0.1412	0.39%	0
0.125		2	37.35	37.33	37.37	37.3	37.4	0.04996	0.07065	0.19%	0
0.25		2	33.9	33.8	34	33.7	34.1	0.2001	0.2829	0.83%	0
0.5		2	35.55	35.29	35.81	35	36.1	0.55	0.7778	2.19%	0
1		1	32.6			32.6	32.6	0	0	0.0%	0
2		1	33.6			33.6	33.6	0	0	0.0%	0
Overall		10	34.82			32.6	37.4				0 (0%)

Analyst: PS QA: JP

CETIS Measurement Report

Report Date: 03 Sep-13 13:53 (p 2 of 4)
Test Code: Ref00497 | 03-7901-9299

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Initial Salinity-ppt

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	30.05	29.93	30.17	29.8	30.3	0.25	0.3536	1.18%	0
0.125		2	30.05	29.93	30.17	29.8	30.3	0.25	0.3536	1.18%	0
0.25		2	30.2	30.1	30.3	30	30.4	0.2	0.2828	0.94%	0
0.5		2	30.45	30.43	30.47	30.4	30.5	0.04998	0.07069	0.23%	0
1		1	30.9			30.9	30.9	0	0	0.0%	0
2		1	32			32	32	0	0	0.0%	0
Overall		10	30.61			29.8	32				0 (0%)

Final Temperature-°C

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	25.55	25.48	25.62	25.4	25.7	0.15	0.2121	0.83%	0
0.125		2	25.55	25.48	25.62	25.4	25.7	0.15	0.2121	0.83%	0
0.25		2	25.55	25.48	25.62	25.4	25.7	0.15	0.2121	0.83%	0
0.5		2	25.55	25.48	25.62	25.4	25.7	0.15	0.2121	0.83%	0
1		1	24.8			24.8	24.8	0	0	0.0%	0
2		1	24.8			24.8	24.8	0	0	0.0%	0
Overall		10	25.3			24.8	25.7				0 (0%)

Initial Temperature-°C

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	25.25	25.03	25.47	24.8	25.7	0.45	0.6364	2.52%	0
0.125		2	25.25	25.03	25.47	24.8	25.7	0.45	0.6364	2.52%	0
0.25		2	25.25	25.03	25.47	24.8	25.7	0.45	0.6364	2.52%	0
0.5		2	25.25	25.03	25.47	24.8	25.7	0.45	0.6364	2.52%	0
1		1	24.8			24.8	24.8	0	0	0.0%	0
2		1	24.8			24.8	24.8	0	0	0.0%	0
Overall		10	25.1			24.8	25.7				0 (0%)

Analyst: PS QA: JF

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Final Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	1	2
0	Dilution Water	6.7	7.8
0.125		6.8	7.7
0.25		7	7.6
0.5		7	7.9
1		7.4	
2		7.5	

Initial Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	1	2
0	Dilution Water	7.8	7
0.125		7.9	7
0.25		8	7.1
0.5		8.1	7.2
1		8	
2		8	

Final pH-Units

Conc-gm/L	Control Type	1	2
0	Dilution Water	7.9	8.1
0.125		8	8.2
0.25		8.1	8.1
0.5		8	8.1
1		7.9	
2		7.9	

Initial pH-Units

Conc-gm/L	Control Type	1	2
0	Dilution Water	7.9	8
0.125		8	8
0.25		8.1	8.1
0.5		8.1	8.1
1		8.1	
2		8.2	

Final Salinity-ppt

Conc-gm/L	Control Type	1	2
0	Dilution Water	35.8	36
0.125		37.3	37.4
0.25		34.1	33.7
0.5		36.1	35
1		32.6	
2		33.6	

Initial Salinity-ppt

Conc-gm/L	Control Type	1	2
0	Dilution Water	29.8	30.3
0.125		29.8	30.3
0.25		30	30.4
0.5		30.4	30.5
1		30.9	
2		32	

Analyst: PS QA: JF

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Final Temperature-°C

Conc-gm/L	Control Type	1	2
0	Dilution Water	25.7	25.4
0.125		25.7	25.4
0.25		25.7	25.4
0.5		25.7	25.4
1		24.8	
2		24.8	

Initial Temperature-°C

Conc-gm/L	Control Type	1	2
0	Dilution Water	24.8	25.7
0.125		24.8	25.7
0.25		24.8	25.7
0.5		24.8	25.7
1		24.8	
2		24.8	

Analyst: PS QA: JF

Page 1 of 3

ACUTE TOXICITY TEST BENCH SHEET

Test #: Re50497

START Date/Time (MMDDYYYY HH:MM): 8/29/13 1325

FINISH Date/Time (MMDDYYYY HH:MM): 9/2/13 1230

Dilution Water: ~~Lob00501~~ PS 8/29/13 Lob00502

Test Substance: KCl

Client/Project: Tetra Tech

Species/Source: A. bahia Chesapeake

Concentration & Replicate		Number alive/hour of test					# alive / # exposed (percent survival)	Comments
Units: ~~mg~~ RS 9/3/13 g/L		Start	24	48	72	96		
0	A	10	10	10	10	10	100	PS 9/3/13
	B	10	10	10	10	10		
	C	10	10	10	10	10		
	D	10	10	10	10	10		
0.125	A	10	10	10	10	10	100	
	B	10	10	10	10	10		
	C	10	10	10	10	10		
	D	10	10	10	10	10		
0.25	A	10	10	10	10	10	100	
	B	10	10	10	10	10		
	C	10	10	10	10	10		
	D	10	10	10	10	10		
0.5	A	10	10	10	10	10	97.5	
	B	10	10	~~8~~ 10 RS 9/3/13	~~9~~ 10 PTS 9/1/13	10		
	C	10	10	~~8~~ 9 RS 9/3/13	~~8~~ 9 PTS 9/1/13	9		
	D	10	10	10	10	10		
1	A	10	0	BS 8/30/13			0	
	B	10	0					
	C	10	0					
	D	10	0					
2	A	10	0				0	
	B	10	0					
	C	10	0					
	D	10	0					
ANALYST		PS	BS	BS	PTS	PTS		
TIME		1325	1057	1111	1105	1236		

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

Page 2 of 3 **ACUTE MARINE TOXICITY CHEMISTRY BENCH SHEET** Test #: RC800497

START Date/Time (MMDDYYYY HH:MM): 8/29/13 1825

FINISH Date/Time (MMDDYYYY HH:MM): 9/2/13 1230

Dilution Water: ~~Lab00501~~ BS 8/29/13 Lab00502

Test Substance: KCl

Client/Project: Tetra Tech

Species/Source: A.bahia Chesapeake

Test Conc.	Chemical Parameters	Hour of Test				Comments
Units: g/L		0	48 before	48 After	96	
0	Salinity (‰)	29.8	35.8	30.3	36.0	
	DO (mg/L)	7.8	6.7	7.0	7.8	
	pH (su)	7.9	7.9	8.0	8.1	
	Temp (°C)	24.8	25.7	25.7	25.4	
0.125	Salinity (‰)	298	37.3	30.3	37.4	
	DO (mg/L)	7.9	6.8	7.0	7.7	
	pH (su)	8.0	8.0	8.0	8.2	
	Temp (°C)	24.8	25.7	25.7	25.4	
0.25	Salinity (‰)	30.0	34.1	30.4	33.7	
	DO (mg/L)	8.0	7.0	7.1	7.6	
	pH (su)	8.1	8.1	8.1	8.1	
	Temp (°C)	24.8	25.7	25.7	25.4	
0.5	Salinity (‰)	30.4	36.1	30.5	35.0	
	DO (mg/L)	8.1	7.0	7.2	7.9	
	pH (su)	81	8.0	8.1	8.1	
	Temp (°C)	24.8	25.7	25.7	25.4	
1	Salinity (‰)	30.9	32.6 *			
	DO (mg/L)	8.0	7.4 *			
	pH (su)	8.1	7.9 *			
	Temp (°C)	24.8	24.8 *		BS 8/30/13	
2	Salinity (‰)	32.0	33.6 *			
	DO (mg/L)	8.0	7.5 *			
	pH (su)	8.2	7.9 *			PS
	Temp (°C)	24.8	24.8 *			9/3/13
Analyst		PS	BS | BS	BS	PTS	
Time Analyzed		1335	1100 | 1035	1115	1295	

* Taken at 24 hour 100% mortality

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

Toxicity Test Procedure Check Sheet

Date 8/29/13

Test ID Number Re500497

Type of Test Chamber plastic bowl

Number of replicates per concentration 4

Specify vessel type and volume used to measure and deliver effluent and dilutent to test chambers____

Graduated Cylinder(s)____ Pipet(s)____

Volumetric Flask(s) 2L, 1L Other____

Specify materials used to place the test organisms into the test chambers Mesh

Test ID Number	Loading QC Initials
Re500497	KS

Exposure Chamber

Total Vessel Capacity 500mL

Test Solution volume 250mL

Feeding Schedule

Not fed____

Fed Daily X

Other____

Type of food Artemia

Specify below the number of milliliters (mls) of diluent and effluent measured out per concentration in this test.

Treatment Concentration	Working Stock Solution	Diluent	Total Volume
0	0	1000	1000
0.125	1000	1000	2000
0.25	1000	1000	2000
0.5	1000	1000	2000
1	1000	1000	2000
2	2000	0	2000
			KS 8/29/13

Aeration

Yes or [✓ No]

Time Began:____

Screened Animal Enclosures

[✓ Not used]

Used

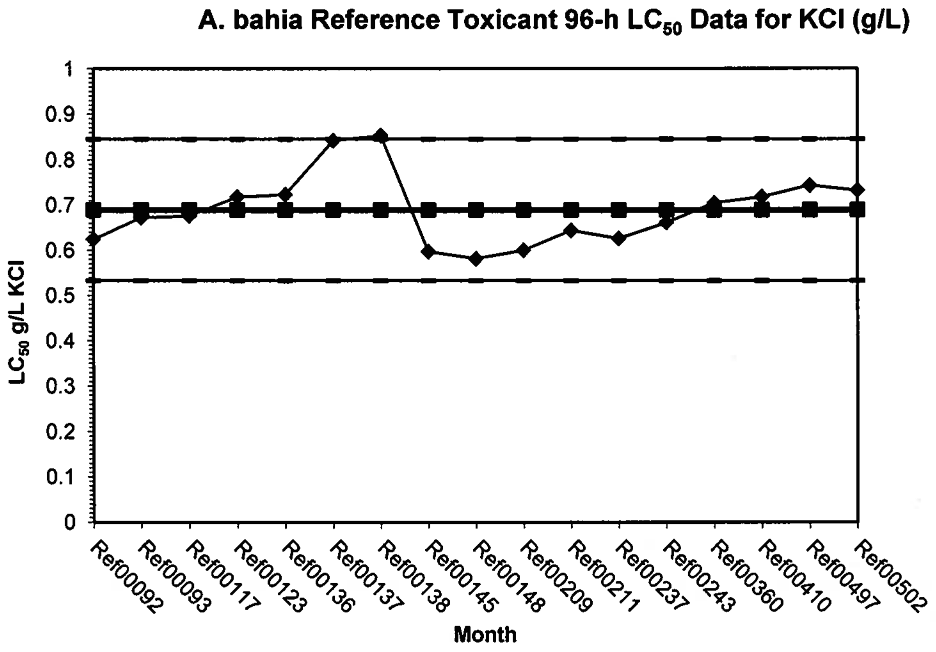
Photoperiod

[✓ dark 8 hr / light 16hr]

other____

Tetra Tech, Inc.
Ecological Testing Facility

2013



A. bahia Reference Toxicant 96-h LC_{50} Data for KCl (g/L)

Test Log #	Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD	
Ref00092	10/17/06	0.6240	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00093	10/24/06	0.6720	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00117	09/20/07	0.6760	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00123	10/22/07	0.7180	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00136	04/18/08	0.7230	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00137	04/22/08	0.8420	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00138	04/29/08	0.8530	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00145	07/08/08	0.5969	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00148	07/29/08	0.5813	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00209	01/21/10	0.6000	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00211	02/04/10	0.6440	0.6892	0.6110	0.5329	0.7673	0.8454	CONTROL FAILURE
Ref00237	06/16/10	0.6260	0.6892	0.6110	0.5329	0.7673	0.8454	CONTROL FAILURE
Ref00243	06/23/10	0.6610	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00360	08/23/11	0.7046	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00410	09/28/12	0.7183	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00497	08/29/13	0.7436	0.6892	0.6110	0.5329	0.7673	0.8454	
Ref00502	09/10/13	0.7321	0.6892	0.6110	0.5329	0.7673	0.8454	

Mean	0.6892
SD	0.0781
CV%	11.3380

CETIS Summary Report

Report Date: 26 Sep-13 08:41 (p 1 of 2)
Test Code: Ref00502 | 02-9960-5253

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Batch ID:	05-2573-1363	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	10 Sep-13 12:45	**Protocol:**	EPA/821/R-02-012 (2002)	**Diluent:**	30 ppt Saltwater
Ending Date:	14 Sep-13 12:05	**Species:**	Americamysis bahia (Atlantic Mysid)	**Brine:**	Instant Ocean
Duration:	95h	**Source:**	Chesapeake	**Age:**	2d

Sample ID:	02-4953-4677	**Code:**	EDF98D5	**Client:**	Tetra Tech
Sample Date:	10 Sep-13 12:45	**Material:**	Potassium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**			

Point Estimate Summary

Analysis ID	Endpoint	Level	gm/L	95% LCL	95% UCL	TU	Method
18-5009-6650	48h Survival Rate	EC5	0.1071	0.03571	0.7562		Linear Interpolation (ICPIN)
		EC10	0.5221	0.4867	0.5483		
		EC15	0.5487	0.5152	0.5734		
		EC20	0.5752	0.5438	0.5985		
		EC25	0.6018	0.5723	0.6236		
		EC40	0.6814	0.6578	0.6988		
		EC50	0.7345	0.7148	0.749		
20-7819-3006	96h Survival Rate	EC5	0.09375	0.04375	0.7507		Linear Interpolation (ICPIN)
		EC10	0.5179	0.4893	0.538		
		EC15	0.5446	0.5177	0.5636		
		EC20	0.5714	0.546	0.5893		
		EC25	0.5982	0.5744	0.615		
		EC40	0.6786	0.6595	0.692		
		EC50	0.7321	0.7163	0.7433		

48h Survival Rate Summary

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
0.125		4	0.925	0.8892	0.9608	0.8	1	0.04787	0.09574	10.35%	7.5%
0.25		4	0.95	0.9284	0.9716	0.9	1	0.02887	0.05774	6.08%	5.0%
0.5		4	0.95	0.9284	0.9716	0.9	1	0.02887	0.05774	6.08%	5.0%
1		4	0	0	0	0	0	0	0		100.0%
2		4	0	0	0	0	0	0	0		100.0%

96h Survival Rate Summary

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
0.125		4	0.925	0.8892	0.9608	0.8	1	0.04787	0.09574	10.35%	7.5%
0.25		4	0.925	0.9063	0.9437	0.9	1	0.025	0.05	5.41%	7.5%
0.5		4	0.95	0.9284	0.9716	0.9	1	0.02887	0.05774	6.08%	5.0%
1		4	0	0	0	0	0	0	0		100.0%
2		4	0	0	0	0	0	0	0		100.0%

Analyst: RS QA: JF

48h Survival Rate Detail

Conc-gm/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
0.125		0.8	0.9	1	1
0.25		1	0.9	0.9	1
0.5		1	1	0.9	0.9
1		0	0	0	0
2		0	0	0	0

96h Survival Rate Detail

Conc-gm/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
0.125		0.8	0.9	1	1
0.25		1	0.9	0.9	0.9
0.5		1	1	0.9	0.9
1		0	0	0	0
2		0	0	0	0

Analyst: tJ QA: JF

CETIS Measurement Report

Report Date: 26 Sep-13 08:41 (p 1 of 4)
Test Code: Ref00502 | 02-9960-5253

Americamysis 96-h Acute Survival Test | **Tetra Tech, Inc.**

Batch ID: 05-2573-1363
Start Date: 10 Sep-13 12:45
Ending Date: 14 Sep-13 12:05
Duration: 95h
Test Type: Survival (96h)
Protocol: EPA/821/R-02-012 (2002)
Species: Americamysis bahia (Atlantic Mysid)
Source: Chesapeake
Analyst:
Diluent: 30 ppt Saltwater
Brine: Instant Ocean
Age: 2d

Sample ID: 02-4953-4677
Sample Date: 10 Sep-13 12:45
Receive Date:
Sample Age: N/A
Code: EDF98D5
Material: Potassium chloride
Source: Reference Toxicant
Station:
Client: Tetra Tech
Project: Reference Toxicant

Final Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	7.2	7.152	7.248	7.1	7.3	0.1	0.1414	1.96%	0
0.125		2	7.25	7.178	7.322	7.1	7.4	0.15	0.2121	2.93%	0
0.25		2	7.35	7.326	7.374	7.3	7.4	0.04999	0.0707	0.96%	0
0.5		2	7.4	7.352	7.448	7.3	7.5	0.1	0.1414	1.91%	0
1		1	7.3			7.3	7.3	0	0	0.0%	0
2		1	7.5			7.5	7.5	0	0	0.0%	0
Overall		10	7.333			7.1	7.5				0 (0%)

Initial Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	7.9	7.756	8.044	7.6	8.2	0.3	0.4243	5.37%	0
0.125		2	8.15	8.03	8.27	7.9	8.4	0.25	0.3535	4.34%	0
0.25		2	8.1	8.004	8.196	7.9	8.3	0.2	0.2828	3.49%	0
0.5		2	8.05	8.026	8.074	8	8.1	0.05001	0.07073	0.88%	0
1		1	8.3			8.3	8.3	0	0	0.0%	0
2		1	8.2			8.2	8.2	0	0	0.0%	0
Overall		10	8.117			7.6	8.4				0 (0%)

Final pH-Units

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	7.85	7.826	7.874	7.8	7.9	0.05	0.07071	0.9%	0
0.125		2	7.95	7.926	7.974	7.9	8	0.04999	0.0707	0.89%	0
0.25		2	7.95	7.926	7.974	7.9	8	0.04999	0.0707	0.89%	0
0.5		2	8	8	8	8	8	0	0	0.0%	0
1		1	8.1			8.1	8.1	0	0	0.0%	0
2		1	8.2			8.2	8.2	0	0	0.0%	0
Overall		10	8.008			7.8	8.2				0 (0%)

Initial pH-Units

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	8.05	8.026	8.074	8	8.1	0.05001	0.07073	0.88%	0
0.125		2	8.15	8.126	8.174	8.1	8.2	0.05001	0.07073	0.87%	0
0.25		2	8.15	8.126	8.174	8.1	8.2	0.05001	0.07073	0.87%	0
0.5		2	8.2	8.2	8.2	8.2	8.2	0	0	0.0%	0
1		1	8.2			8.2	8.2	0	0	0.0%	0
2		1	8.2			8.2	8.2	0	0	0.0%	0
Overall		10	8.158			8	8.2				0 (0%)

Final Salinity-ppt

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	33.25	33.18	33.32	33.1	33.4	0.1499	0.2119	0.64%	0
0.125		2	32.85	32.68	33.02	32.5	33.2	0.35	0.4949	1.51%	0
0.25		2	32.25	31.89	32.61	31.5	33	0.75	1.061	3.29%	0
0.5		2	33	32.81	33.19	32.6	33.4	0.4	0.5656	1.71%	0
1		1	32.2			32.2	32.2	0	0	0.0%	0
2		1	32.3			32.3	32.3	0	0	0.0%	0
Overall		10	32.64			31.5	33.4				0 (0%)

Analyst: RJ QA: JF

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Initial Salinity-ppt

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	30.65	30.58	30.72	30.5	30.8	0.15	0.2121	0.69%	0
0.125		2	30.8	30.7	30.9	30.6	31	0.2	0.2829	0.92%	0
0.25		2	30.85	30.73	30.97	30.6	31.1	0.25	0.3536	1.15%	0
0.5		2	31.15	31.08	31.22	31	31.3	0.15	0.2121	0.68%	0
1		1	31.9			31.9	31.9	0	0	0.0%	0
2		1	32.8			32.8	32.8	0	0	0.0%	0
Overall		10	31.36			30.5	32.8				0 (0%)

Final Temperature-°C

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	25.4	25.3	25.5	25.2	25.6	0.2	0.2829	1.11%	0
0.125		2	25.4	25.3	25.5	25.2	25.6	0.2	0.2829	1.11%	0
0.25		2	25.4	25.3	25.5	25.2	25.6	0.2	0.2829	1.11%	0
0.5		2	25.4	25.3	25.5	25.2	25.6	0.2	0.2829	1.11%	0
1		1	26.1			26.1	26.1	0	0	0.0%	0
2		1	26.1			26.1	26.1	0	0	0.0%	0
Overall		10	25.63			25.2	26.1				0 (0%)

Initial Temperature-°C

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	2	25.35	25.23	25.47	25.1	25.6	0.25	0.3536	1.4%	0
0.125		2	25.35	25.23	25.47	25.1	25.6	0.25	0.3536	1.4%	0
0.25		2	25.35	25.23	25.47	25.1	25.6	0.25	0.3536	1.4%	0
0.5		2	25.35	25.23	25.47	25.1	25.6	0.25	0.3536	1.4%	0
1		1	25.1			25.1	25.1	0	0	0.0%	0
2		1	25.1			25.1	25.1	0	0	0.0%	0
Overall		10	25.27			25.1	25.6				0 (0%)

Analyst:______ QA: JP

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Final Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	1	2
0	Dilution Water	7.1	7.3
0.125		7.1	7.4
0.25		7.3	7.4
0.5		7.3	7.5
1		7.3	
2		7.5	

Initial Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	1	2
0	Dilution Water	8.2	7.6
0.125		8.4	7.9
0.25		8.3	7.9
0.5		8.1	8
1		8.3	
2		8.2	

Final pH-Units

Conc-gm/L	Control Type	1	2
0	Dilution Water	7.8	7.9
0.125		7.9	8
0.25		7.9	8
0.5		8	8
1		8.1	
2		8.2	

Initial pH-Units

Conc-gm/L	Control Type	1	2
0	Dilution Water	8.1	8
0.125		8.2	8.1
0.25		8.2	8.1
0.5		8.2	8.2
1		8.2	
2		8.2	

Final Salinity-ppt

Conc-gm/L	Control Type	1	2
0	Dilution Water	33.4	33.1
0.125		33.2	32.5
0.25		33	31.5
0.5		33.4	32.6
1		32.2	
2		32.3	

Initial Salinity-ppt

Conc-gm/L	Control Type	1	2
0	Dilution Water	30.8	30.5
0.125		31	30.6
0.25		31.1	30.6
0.5		31.3	31
1		31.9	
2		32.8	

Analyst:______ QA:______

Americamysis 96-h Acute Survival Test **Tetra Tech, Inc.**

Final Temperature-°C

Conc-gm/L	Control Type	1	2
0	Dilution Water	25.6	25.2
0.125		25.6	25.2
0.25		25.6	25.2
0.5		25.6	25.2
1		26.1	
2		26.1	

Initial Temperature-°C

Conc-gm/L	Control Type	1	2
0	Dilution Water	25.1	25.6
0.125		25.1	25.6
0.25		25.1	25.6
0.5		25.1	25.6
1		25.1	
2		25.1	

Analyst: RS QA: JF

Page 2 of 3

ACUTE MARINE TOXICITY CHEMISTRY BENCH SHEET

Test #: RRF00502

START Date/Time (MMDDYYYY HH:MM): 9/10/13 1245

FINISH Date/Time (MMDDYYYY HH:MM): 9/14/13 1205

Dilution Water: LAB 00505

Test Substance: KCl

Client/Project: Tetra Tech

Species/Source: A. bahia Chesapeake

Test Conc.	Chemical Parameters	Hour of Test				Comments
Units: g/L		0	48 Before	48 After	96	
0	Salinity (‰)	30.8	33.4	30.5	33.1	
	DO (mg/L)	8.2	7.1	7.6	7.3	
	pH (su)	8.1	7.8	8.0	7.9	
	Temp (°C)	25.1	25.6	25.6	25.2	
0.125	Salinity (‰)	31.0	33.2	30.6	32.5	
	DO (mg/L)	8.4	7.1	7.9	7.4	
	pH (su)	8.2	7.9	8.1	8.0	
	Temp (°C)	25.1	25.6	25.6	25.2	
0.25	Salinity (‰)	31.1	33.0	30.6	31.5	
	DO (mg/L)	8.3	7.3	7.9	7.4	
	pH (su)	8.2	7.9	8.1	8.0	
	Temp (°C)	25.1	25.6	25.6	25.2	
0.5	Salinity (‰)	31.3	33.4	31.0	32.6	
	DO (mg/L)	8.1	7.3	8.0	7.5	
	pH (su)	8.2	8.0	8.2	8.0	
	Temp (°C)	25.1	25.4	25.6	25.2	
1	Salinity (‰)	31.9	32.2 ϕ			
	DO (mg/L)	8.3	7.3 ϕ			
	pH (su)	8.2	8.1 ϕ			
	Temp (°C)	25.1	26.1 ϕ			
2	Salinity (‰)	32.8	32.3 ϕ			
	DO (mg/L)	8.2	7.5 ϕ			
	pH (su)	8.2	8.2 ϕ			
	Temp (°C)	25.1	26.1 ϕ			BS 9/12/13
Analyst		PS	BS | PS	PS	BS	
Time Analyzed		1100	0840 | 0840	0955	1210	

ϕ taken at 24 hour 100% mortality

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

Toxicity Test Procedure Check Sheet

Date 09/10/13

Test ID Number REF00502

Type of Test Chamber 1L beaker

Number of replicates per concentration 4

Specify vessel type and volume used to measure and deliver effluent and dilutent to test chambers 4

Graduated Cylinder(s)____ Pipet(s)____

Volumetric Flask(s) x Other____

Specify materials used to place the test organisms into the test chambers mesh

Test ID Number	Loading QC Initials
REF00502	PTS

Exposure Chamber

Total Vessel Capacity 1L

Test Solution volume 975

Feeding Schedule

Not fed____

Fed Daily x

Other____

Type of food____

Specify below the number of milliliters (mls) of diluent and effluent measured out per concentration in this test.

Treatment Concentration	Working Stock Solution	Diluent	Total Volume
0	0	1000	1000
0.125	1000	1000	2000
0.25	1000	1000	2000
0.5	1000	1000	2000
1	1000	1000	2000
2	2000	0	2000
			PS 9/20/13

Aeration

Yes or [✓ No]

Time Began:____

Screened Animal Enclosures

[✓ Not used]

Used

Photoperiod

[✓ dark 8 hr / light 16hr]

other____

Page 1 of 3

ACUTE TOXICITY TEST BENCH SHEET

Test #: Re600502

START Date/Time (MMDDYYYY HH:MM): 9/10/13 1245

FINISH Date/Time (MMDDYYYY HH:MM): 9/14/13 1205

Dilution Water: Lo600505

Test Substance: KCl

Client/Project: Tetra Tech

Species/Source: A. bahia Chesapeake

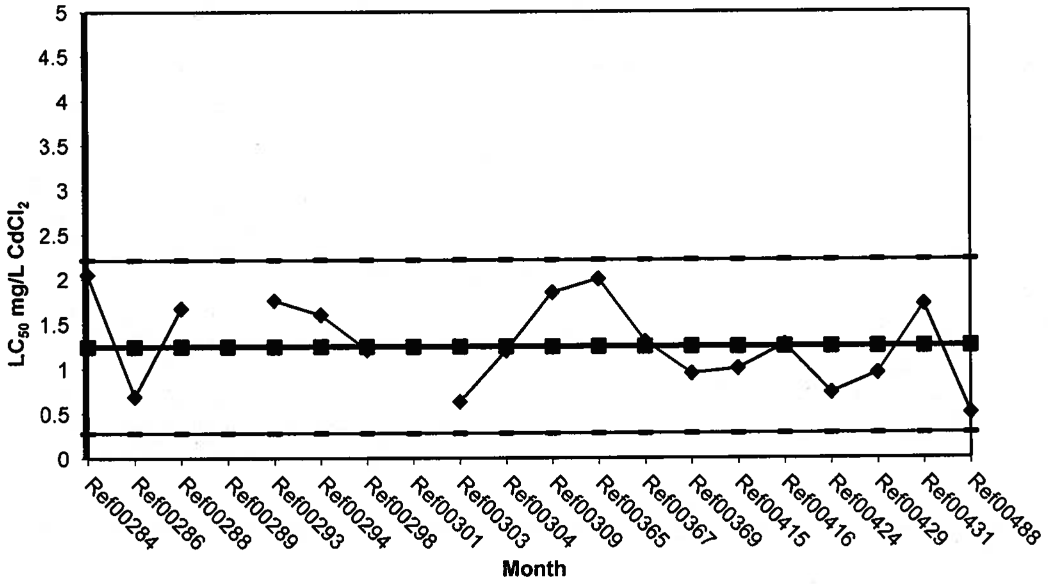
Concentration & Replicate		Number alive/hour of test					# alive / # exposed (percent survival)	Comments
Units: g/L		Start	24	48	72	96		
0	A	10	10	10	10	10	100	
	B	10	10	10	10	10		
	C	10	10	10	10	10		
	D	10	10	10	10	10		
0.125	A	10	10	8	8	8	92.5	
	B	10	10	9	9	9		
	C	10	10	10	10	10		
	D	10	10	10	10	10		
0.25	A	10	10	10	10	10	92.5	
	B	10	10	9	9	9		
	C	10	10	9	9	9		
	D	10	10	10	10	9		
0.5	A	10	10	10	10	10	95	
	B	10	10	10	10	10		
	C	10	9	9	9	9		
	D	10	10	9	9	9		
1	A	10	0	0	0	0	0	
	B	10	0	0	0	0		
	C	10	0	0	0	0		
	D	10	0	0	0	0		
2	A	10	0	0	0	0	0	
	B	10	0	0	0	0		
	C	10	0	0	0	0		BS 9/26/13
	D	10	0	0	0	6		
ANALYST		BS	bs	BS	bs	bs		
TIME		1245	0939	0940	1302	1205		

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

L. plumulosus Reference Toxicant 96-h LC_{50} Data for $CdCl_2$ (mg/L)



Test Log #	Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
Ref00284	09/22/10	2.0480	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00286	09/28/10	0.6888	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00288	10/06/10	1.6720	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00289	10/13/10	1.2080	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00293	10/20/10	1.7600	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00294	10/22/10	1.6000	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00298	10/27/10	1.2080	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00301	10/29/10	0.6792	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00303	11/05/10	0.6304	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00304	11/05/10	1.2000	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00309	11/12/10	1.8480	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00365	10/12/11	2.0000	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00367	10/18/11	1.3000	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00369	10/25/11	0.9440	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00415	10/09/12	1.0000	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00416	11/12/12	1.2660	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00424	11/07/12	0.7300	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00429	11/13/12	0.9484	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00431	11/20/12	1.7110	1.2471	0.7635	0.2799	1.7307	2.2143
Ref00488	07/30/13	0.5000	1.2471	0.7635	0.2799	1.7307	2.2143

Mean	1.2471
SD	0.4836
CV%	38.7777

CETIS Summary Report

Report Date: 13 Aug-13 08:44 (p 1 of 1)
Test Code: Ref00488 | 01-1959-2411

Leptocheirus 96-h Acute Survival Test

Tetra Tech, Inc.

Batch ID:	03-0842-1774	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	30 Jul-13 10:55	**Protocol:**	EPA/600/R-94/025 (1994)	**Diluent:**	20 ppt Saltwater
Ending Date:	03 Aug-13 10:07	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	95h	**Source:**	Aquatic Research Organisms, NH	**Age:**	

Sample ID:	12-6472-1588	**Code:**	4B621EB4	**Client:**	Tetra Tech
Sample Date:	30 Jul-13 10:55	**Material:**	Cadmium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**			

Batch Note: Organism size: 2-4mm

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
20-2250-9046	96h Survival Rate	EC5	0.25	N/A	0.375		Linear Interpolation (ICPIN)
		EC10	0.2778	0.1667	0.4167		
		EC15	0.3056	0.1833	0.4583		
		EC20	0.3333	0.2	0.5		
		EC25	0.3611	0.2167	0.5417		
		EC40	0.4444	0.2667	0.6667		
		EC50	0.5	0.3	1.167		

96h Survival Rate Summary

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	2	1	1	1	1	1	0	0	0.0%	0.0%
0.25		2	0.95	0.9236	0.9764	0.9	1	0.05	0.07071	7.44%	5.0%
0.5		2	0.5	0.4472	0.5528	0.4	0.6	0.1	0.1414	28.28%	50.0%
1		2	0.15	0.07079	0.2292	0	0.3	0.15	0.2121	141.4%	85.0%
2		2	0.1	0.1	0.1	0.1	0.1	0	0	0.0%	90.0%
4		2	0	0	0	0	0	0	0		100.0%

96h Survival Rate Detail

Conc-mg/L	Control Type	Rep 1	Rep 2
0	Dilution Water	1	1
0.25		1	0.9
0.5		0.4	0.6
1		0.3	0
2		0.1	0.1
4		0	0

Analyst: PS QA: JS

CETIS Measurement Report

Report Date: 13 Aug-13 08:43 (p 1 of 2)
Test Code: Ref00488 | 01-1959-2411

Leptocheirus 96-h Acute Survival Test

Tetra Tech, Inc.

Batch ID:	03-0842-1774	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	30 Jul-13 10:55	**Protocol:**	EPA/600/R-94/025 (1994)	**Diluent:**	20 ppt Saltwater
Ending Date:	03 Aug-13 10:07	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	95h	**Source:**	Aquatic Research Organisms, NH	**Age:**	

Sample ID:	12-6472-1588	**Code:**	4B621EB4	**Client:**	Tetra Tech
Sample Date:	30 Jul-13 10:55	**Material:**	Cadmium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**			

Batch Note: Organism size: 2-4mm

Dissolved Oxygen-mg/L

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	7.8	7.698	7.902	7.5	8.1	0.1732	0.3	3.85%	0
0.25		3	7.733	7.663	7.804	7.5	7.9	0.1202	0.2082	2.69%	0
0.5		3	7.833	7.748	7.918	7.6	8.1	0.1453	0.2517	3.21%	0
1		3	7.8	7.698	7.902	7.5	8.1	0.1732	0.3	3.85%	0
2		3	7.867	7.758	7.975	7.5	8.1	0.1856	0.3215	4.09%	0
4		3	7.9	7.753	8.047	7.4	8.2	0.2517	0.4359	5.52%	0
Overall		18	7.822			7.4	8.2				0 (0%)

pH-Units

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	7.467	7.389	7.545	7.2	7.6	0.1333	0.2309	3.09%	0
0.25		3	7.567	7.458	7.675	7.2	7.8	0.1856	0.3215	4.25%	0
0.5		3	7.667	7.558	7.775	7.3	7.9	0.1856	0.3215	4.19%	0
1		3	7.733	7.636	7.831	7.4	7.9	0.1667	0.2887	3.73%	0
2		3	7.767	7.689	7.845	7.5	7.9	0.1333	0.2309	2.97%	0
4		3	7.833	7.763	7.904	7.6	8	0.1202	0.2082	2.66%	0
Overall		18	7.672			7.2	8				0 (0%)

Salinity-ppt

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	20.6	20.22	20.98	19.3	21.4	0.6557	1.136	5.51%	0
0.25		3	20.47	20.12	20.81	19.3	21.2	0.5897	1.021	4.99%	0
0.5		3	20.1	19.86	20.34	19.3	20.7	0.4163	0.7211	3.59%	0
1		3	20.43	20.07	20.79	19.3	21.4	0.6119	1.06	5.19%	0
2		3	20.17	19.94	20.39	19.4	20.6	0.3844	0.6658	3.3%	0
4		3	20.2	20	20.4	19.6	20.8	0.3464	0.6	2.97%	0
Overall		18	20.33			19.3	21.4				0 (0%)

Temperature-°C

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	24.77	24.7	24.84	24.6	25	0.1202	0.2082	0.84%	0
0.25		3	24.77	24.7	24.84	24.6	25	0.1202	0.2082	0.84%	0
0.5		3	24.77	24.7	24.84	24.6	25	0.1202	0.2082	0.84%	0
1		3	24.77	24.7	24.84	24.6	25	0.1202	0.2082	0.84%	0
2		3	24.77	24.7	24.84	24.6	25	0.1202	0.2082	0.84%	0
4		3	24.77	24.7	24.84	24.6	25	0.1202	0.2082	0.84%	0
Overall		18	24.77			24.6	25				0 (0%)

Analyst: R3 QA: JF

Dissolved Oxygen-mg/L

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	7.8	8.1	7.5
0.25		7.9	7.8	7.5
0.5		8.1	7.8	7.6
1		8.1	7.8	7.5
2		8	8.1	7.5
4		8.1	8.2	7.4

pH-Units

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	7.2	7.6	7.6
0.25		7.2	7.7	7.8
0.5		7.3	7.8	7.9
1		7.4	7.9	7.9
2		7.5	7.9	7.9
4		7.6	8	7.9

Salinity-ppt

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	19.3	21.1	21.4
0.25		19.3	21.2	20.9
0.5		19.3	20.3	20.7
1		19.3	20.6	21.4
2		19.4	20.5	20.6
4		19.6	20.2	20.8

Temperature-°C

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	24.7	24.6	25
0.25		24.7	24.6	25
0.5		24.7	24.6	25
1		24.7	24.6	25
2		24.7	24.6	25
4		24.7	24.6	25

Analyst: PS QA: JF

Page 1 of 3 **ACUTE TOXICITY TEST BENCH SHEET** Test #: REF00488

START Date/Time (MMDDYYYY HH:MM): 7/30/13 1055

FINISH Date/Time (MMDDYYYY HH:MM): 8/3/13 1007

Dilution Water: 20 ppt Salt water

Test Substance: CdCl₂

Client/Project: TT

Species/Source: L. plumulosus

Concentration & Replicate		Number alive/hour of test					# alive / # exposed (percent survival)	Comments
Units: mg/L		Start	24	48	72	96		
0	A	10	10	10	10	10	100	
	B	10	10	10	10	10		
	C							
	D					BS 8/12/13		
0.25	A	10	10	10	10	10	95	
	B	10	10	9	9	9		
	C							
	D					BS 8/12/13		
0.5	A	10	10	8	5	4	50	
	B	10	10	9	7	6		
	C					BS 8/12/13		
	D							
1	A	10	10	10	7	3	15	
	B	10	10	9	8	0		
	C							
	D					BS 8/12/13		
2	A	10	9	7	4	1	10	
	B	10	10	9	4	BS 8/3/13 ~~0~~ 1		
	C							
	D					BS 8/12/13		
4	A	10	10	5	4	0	0	
	B	10	10	6	3	0		
	C							
	D					BS 8/12/13		BS 8/12/13
ANALYST		BS	BS	BS	BS	BS		
TIME		1055	1045	1249	0900	1007		

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

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ACUTE MARINE TOXICITY CHEMISTRY BENCH SHEET

Test #: REF00786

START Date/Time (MMDDYYYY HH:MM): 7/30/13 1055

FINISH Date/Time (MMDDYYYY HH:MM): 8/3/13 1007

Dilution Water: 20 ppt salt water

Test Substance: Cd Cl2

Client/Project: TT

Species/Source: L. plumulosus

Test Conc.	Chemical Parameters	Hour of Test				Comments
Units mg/L		0	48	96		
0	Salinity (‰)	19.3	21.1	21.4		
	DO (mg/L)	7.8	8.1	7.5		
	pH (su)	7.2	7.6	7.6		
	Temp (°C)	24.7	24.6	25.0		
0.25	Salinity (‰)	19.3	21.2	20.9		
	DO (mg/L)	7.9	7.8	7.5		
	pH (su)	7.2	7.7	7.8		
	Temp (°C)	24.7	24.6	25.0		
0.5	Salinity (‰)	19.3	20.3	20.7		
	DO (mg/L)	8.1	7.8	7.6		
	pH (su)	7.3	7.8	7.9		
	Temp (°C)	24.7	24.6	25.0		
1	Salinity (‰)	19.3	20.6	21.4		
	DO (mg/L)	8.1	7.8	7.5		
	pH (su)	7.4	7.9	7.9		
	Temp (°C)	24.7	24.8	25.0		
2	Salinity (‰)	19.4	20.5	20.6		
	DO (mg/L)	8.0	8.1	7.5		
	pH (su)	7.5	7.9	7.9		
	Temp (°C)	24.7	24.6	25.0		
4	Salinity (‰)	19.6	20.2	20.8		
	DO (mg/L)	8.1	8.2	7.4		
	pH (su)	7.6	8.0	7.9		BS
	Temp (°C)	24.7	24.6	25.0		8/2/13
Analyst		BS	BS	BS		
Time Analyzed		1320	1305	1015		

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

Toxicity Test Procedure Check Sheet

Page ___ of 3

Date 7/30/13

Test ID Number REF00488

Type of Test Chamber 1L beaker

Number of replicates per concentration 2

Specify vessel type and volume used to measure and deliver effluent and dilutent to test chambers ___

Graduated Cylinder(s) ___ Pipet(s) ___

Volumetric Flask(s) 4L, 2L Other ___

Specify materials used to place the test organisms into the test chambers disposable pipet

Test ID Number	Loading QC Initials
REF00488	PS

Exposure Chamber

Total Vessel Capacity 1L

Test Solution volume 1L

Feeding Schedule

Not fed X

Fed Daily ___

Other ___

Type of food ___

Specify below the number of milliliters (mls) of diluent and effluent measured out per concentration in this test.

Treatment Concentration	Working Stock Solution	Diluent	Total Volume
0	0	2000	2000
0.25	2000	2000	4000
05	2000	2000	4000
1	2000	2000	4000
2	2000	2000	4000
4	4000	0	4000
			PS 8/12/13

Aeration

[✓ Yes] or No

Time Began: ___

Screened Animal Enclosures

[✓ Not used]

Used

Photoperiod

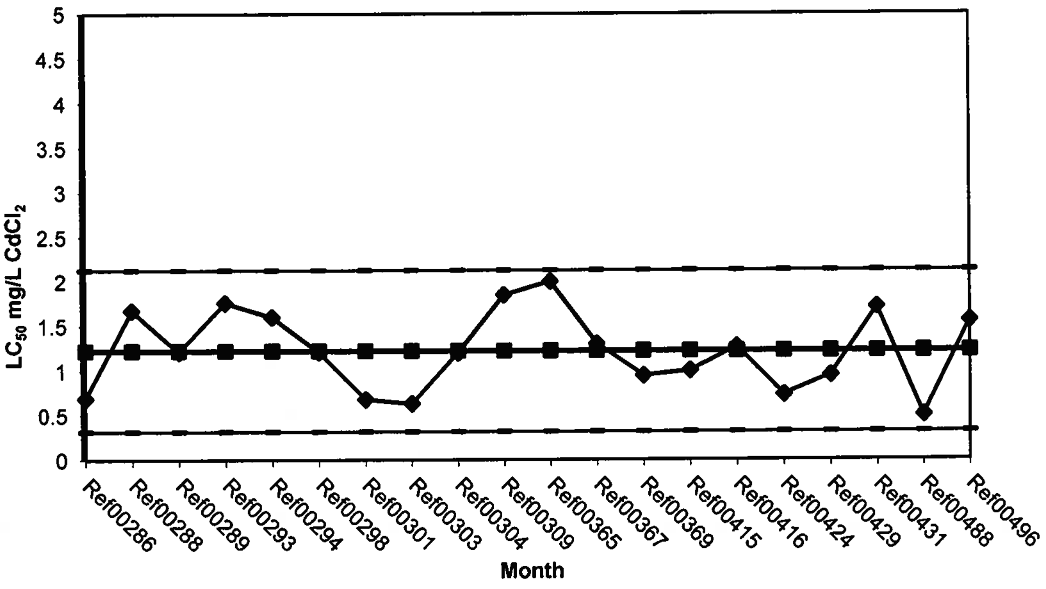
dark 8 hr / light 16hr

other 24h dark

Tetra Tech, Inc.
Ecological Testing Facility

2013

L. plumulosus Reference Toxicant 96-h LC_{50} Data for $CdCl_2$ (mg/L)



Test Log #	Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
Ref00286	09/28/10	0.6888	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00288	10/06/10	1.6720	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00289	10/13/10	1.2080	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00293	10/20/10	1.7600	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00294	10/22/10	1.6000	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00298	10/27/10	1.2080	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00301	10/29/10	0.6792	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00303	11/05/10	0.6304	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00304	11/05/10	1.2000	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00309	11/12/10	1.8480	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00365	10/12/11	2.0000	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00367	10/18/11	1.3000	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00369	10/25/11	0.9440	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00415	10/09/12	1.0000	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00416	11/12/12	1.2660	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00424	11/07/12	0.7300	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00429	11/13/12	0.9484	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00431	11/20/12	1.7110	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00488	07/30/13	0.5000	1.2225	0.7703	0.3181	1.6747	2.1269
Ref00496	08/28/13	1.5560	1.2225	0.7703	0.3181	1.6747	2.1269

Mean	1.2225
SD	0.4522
CV%	36.9903

CETIS Summary Report

Report Date: 03 Sep-13 14:40 (p 1 of 2)
Test Code: Ref00496 | 15-0629-2764

Leptocheirus 96-h Acute Survival Test — **Tetra Tech, Inc.**

Batch ID:	12-4776-5080	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	28 Aug-13 12:15	**Protocol:**	EPA/600/R-94/025 (1994)	**Diluent:**	20 ppt Saltwater
Ending Date:	01 Sep-13	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	84h	**Source:**	Chesapeake	**Age:**	

Sample ID:	03-2246-7032	**Code:**	133874D8	**Client:**	Tetra Tech
Sample Date:	28 Aug-13 12:15	**Material:**	Cadmium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**			

Batch Note: Organism size: 2-4mm

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
17-4464-0406	48h Survival Rate	EC5	2.4	1.8	4.8		Linear Interpolation (ICPIN)
		EC10	2.8	1.6	7.6		
		EC15	3.2	1.4	N/A		
		EC20	3.6	1.2	N/A		
		EC25	4	1	N/A		
		EC40	>4	N/A	N/A		
		EC50	>4	N/A	N/A		
09-4495-6127	96h Survival Rate	EC5	0.3	0.2429	0.4333		Linear Interpolation (ICPIN)
		EC10	0.35	0.2357	0.6167		
		EC15	0.4	0.2286	2.8		
		EC20	0.45	0.2214	3.031		
		EC25	1	N/A	1.762		
		EC40	1.333	0.8	2		
		EC50	1.556	0.9333	2.19		

48h Survival Rate Summary

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	2	1	1	1	1	1	0	0	0.0%	0.0%
0.25		2	1	1	1	1	1	0	0	0.0%	0.0%
0.5		2	1	1	1	1	1	0	0	0.0%	0.0%
1		2	1	1	1	1	1	0	0	0.0%	0.0%
2		2	1	1	1	1	1	0	0	0.0%	0.0%
4		2	0.75	0.6708	0.8292	0.6	0.9	0.15	0.2121	28.28%	25.0%

96h Survival Rate Summary

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	2	1	1	1	1	1	0	0	0.0%	0.0%
0.25		2	1	1	1	1	1	0	0	0.0%	0.0%
0.5		2	0.7	0.6472	0.7528	0.6	0.8	0.1	0.1414	20.2%	30.0%
1		2	0.8	0.7472	0.8528	0.7	0.9	0.1	0.1414	17.68%	20.0%
2		2	0.25	0.2236	0.2764	0.2	0.3	0.05	0.07071	28.28%	75.0%
4		2	0.35	0.2708	0.4292	0.2	0.5	0.15	0.2121	60.61%	65.0%

Analyst:______ QA:______

Leptocheirus 96-h Acute Survival Test **Tetra Tech, Inc.**

48h Survival Rate Detail

Conc-mg/L	Control Type	Rep 1	Rep 2
0	Dilution Water	1	1
0.25		1	1
0.5		1	1
1		1	1
2		1	1
4		0.6	0.9

96h Survival Rate Detail

Conc-mg/L	Control Type	Rep 1	Rep 2
0	Dilution Water	1	1
0.25		1	1
0.5		0.6	0.8
1		0.7	0.9
2		0.2	0.3
4		0.2	0.5

Analyst: PS QA: JF

CETIS Measurement Report

Report Date: 03 Sep-13 14:39 (p 1 of 2)
Test Code: Ref00496 | 15-0629-2764

Leptocheirus 96-h Acute Survival Test **Tetra Tech, Inc.**

Batch ID:	12-4776-5080	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	28 Aug-13 12:15	**Protocol:**	EPA/600/R-94/025 (1994)	**Diluent:**	20 ppt Saltwater
Ending Date:	01 Sep-13	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	84h	**Source:**	Chesapeake	**Age:**	

Sample ID:	03-2246-7032	**Code:**	133874D8	**Client:**	Tetra Tech
Sample Date:	28 Aug-13 12:15	**Material:**	Cadmium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**			

Batch Note: Organism size: 2-4mm

Dissolved Oxygen-mg/L

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	7.667	7.569	7.764	7.5	8	0.1667	0.2887	3.77%	0
0.25		3	7.833	7.755	7.911	7.7	8.1	0.1333	0.2309	2.95%	0
0.5		3	8	7.883	8.117	7.8	8.4	0.2	0.3464	4.33%	0
1		3	8	7.883	8.117	7.8	8.4	0.2	0.3464	4.33%	0
2		3	7.967	7.896	8.037	7.8	8.2	0.1202	0.2082	2.61%	0
4		3	7.9	7.899	7.901	7.9	7.9	0	0	0.0%	0
Overall		18	7.894			7.5	8.4				0 (0%)

pH-Units

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	7.833	7.725	7.942	7.6	8.2	0.1856	0.3215	4.1%	0
0.25		3	7.833	7.748	7.918	7.6	8.1	0.1453	0.2517	3.21%	0
0.5		3	7.767	7.747	7.786	7.7	7.8	0.03334	0.05774	0.74%	0
1		3	7.867	7.796	7.937	7.7	8.1	0.1202	0.2082	2.65%	0
2		3	7.867	7.796	7.937	7.7	8.1	0.1202	0.2082	2.65%	0
4		3	7.967	7.896	8.037	7.8	8.2	0.1202	0.2082	2.61%	0
Overall		18	7.856			7.6	8.2				0 (0%)

Salinity-ppt

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	19.5	19.09	19.91	18.2	20.6	0.7	1.212	6.22%	0
0.25		3	19.23	18.93	19.54	18.2	19.9	0.5239	0.9074	4.72%	0
0.5		3	19.37	19.07	19.66	18.4	20.1	0.5044	0.8737	4.51%	0
1		3	19.13	18.95	19.32	18.5	19.5	0.318	0.5508	2.88%	0
2		3	20	19.49	20.51	18.4	21.4	0.8718	1.51	7.55%	0
4		3	19.27	19.01	19.52	18.4	19.8	0.4372	0.7572	3.93%	0
Overall		18	19.42			18.2	21.4				0 (0%)

Temperature-°C

Conc-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	23.83	23.79	23.87	23.7	23.9	0.06665	0.1154	0.48%	0
0.25		3	23.83	23.79	23.87	23.7	23.9	0.06665	0.1154	0.48%	0
0.5		3	23.83	23.79	23.87	23.7	23.9	0.06665	0.1154	0.48%	0
1		3	23.83	23.79	23.87	23.7	23.9	0.06665	0.1154	0.48%	0
2		3	23.83	23.79	23.87	23.7	23.9	0.06665	0.1154	0.48%	0
4		3	23.83	23.79	23.87	23.7	23.9	0.06665	0.1154	0.48%	0
Overall		18	23.83			23.7	23.9				0 (0%)

Analyst: PS QA: JS

Leptocheirus 96-h Acute Survival Test **Tetra Tech, Inc.**

Dissolved Oxygen-mg/L

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	7.5	7.5	8
0.25		7.7	7.7	8.1
0.5		7.8	7.8	8.4
1		7.8	7.8	8.4
2		7.9	7.8	8.2
4		7.9	7.9	7.9

pH-Units

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	7.6	7.7	8.2
0.25		7.6	7.8	8.1
0.5		7.7	7.8	7.8
1		7.7	7.8	8.1
2		7.7	7.8	8.1
4		7.8	7.9	8.2

Salinity-ppt

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	18.2	19.7	20.6
0.25		18.2	19.6	19.9
0.5		18.4	19.6	20.1
1		18.5	19.4	19.5
2		18.4	20.2	21.4
4		18.4	19.6	19.8

Temperature-°C

Conc-mg/L	Control Type	1	2	3
0	Dilution Water	23.9	23.9	23.7
0.25		23.9	23.9	23.7
0.5		23.9	23.9	23.7
1		23.9	23.9	23.7
2		23.9	23.9	23.7
4		23.9	23.9	23.7

Analyst: PS QA: JF

Page 1 of 3

ACUTE TOXICITY TEST BENCH SHEET

Test #: Re500496

START Date/Time (MMDDYYYY HH:MM): 8/28/13 1215

FINISH Date/Time (MMDDYYYY HH:MM): 9/1/13 1130

Dilution Water: 20 ppt Saltwater

Test Substance: CdCl2

Client/Project: Tetra Tech

Species/Source: L. plumulosus Chesapeake

Concentration & Replicate		Number alive/hour of test					# alive / # exposed (percent survival)	Comments
Units: mg/L		Start	24	48	72	96		
0	A	10	10	10	10	10	100	
	B	10	10	10	10	10		
	C							
	D					BS 9/3/13		
0.25	A	10	10	10	10	10	100	
	B	10	10	10	10	10		
	C							
	D					BS 9/3/13		
0.5	A	10	10	10	10	6	70	
	B	10	10	10	8	8		
	C							
	D					BS 9/3/13		
1	A	10	10	10	9	7	80	
	B	10	10	10	9	9		
	C							
	D					BS 9/3/13		
2	A	10	10	10	5	2	25	
	B	10	10	10	6	3		
	C							
	D					BS 9/3/13		
4	A	10	10	6	2	2	35	BS 9/3/13
	B	10	10	9	6	5		
	C							
	D					BS 9/3/13		
ANALYST		BS	BS	BS	BS	BS		
TIME		1215	0920	1010	1020	~~1230~~ 1130 BS 9/1/13		

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF

2013

Page 2 of 3 ACUTE MARINE TOXICITY CHEMISTRY BENCH SHEET Test #: Re500496

START Date/Time (MMDDYYYY HH:MM): 8/25/13 1215

FINISH Date/Time (MMDDYYYY HH:MM): 9/1/13 1130

Dilution Water: 20ppt Saltwater

Test Substance: $CdCl_2$

Client/Project: Tetra Tech

Species/Source: L.plumulosus Chesapeake

Test Conc.	Chemical Parameters	Hour of Test				Comments
Units mg/L		0	48	96		
0	Salinity (‰)	18.2	19.7	20.6		
	DO (mg/L)	7.5	7.5	8.0		
	pH (su)	7.6	7.7	8.2		
	Temp (°C)	23.9	23.9	23.7		
0.25	Salinity (‰)	18.2	19.6	19.9		
	DO (mg/L)	7.7	7.7	8.1		
	pH (su)	7.6	7.8	8.1		
	Temp (°C)	23.9	23.9	23.7		
0.5	Salinity (‰)	18.4	19.6	20.1		
	DO (mg/L)	7.8	7.8	8.4		
	pH (su)	7.7	7.8	7.8		
	Temp (°C)	23.9	23.9	23.7		
1	Salinity (‰)	18.5	19.4	19.5		
	DO (mg/L)	7.8	7.8	8.4		
	pH (su)	7.7	7.8	8.1		
	Temp (°C)	23.9	23.9	23.7		
2	Salinity (‰)	18.4	20.2	21.4		
	DO (mg/L)	7.9	7.8	8.2		
	pH (su)	7.7	7.8	8.1		
	Temp (°C)	23.9	23.9	23.7		
4	Salinity (‰)	18.4	19.6	19.8		
	DO (mg/L)	7.9	7.9	7.9		BS
	pH (su)	7.8	7.9	8.2		9/3/13
	Temp (°C)	23.9	23.9	23.7		
Analyst		BS	BS	~~1215~~ MS		
Time Analyzed		1240	1010	1215		

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved: JF 9/1/13

2013

Toxicity Test Procedure Check Sheet

Date 8/28/13

Test ID Number Re600496

Type of Test Chamber 1L beaker

Number of replicates per concentration 2

Specify vessel type and volume used to measure and deliver effluent and dilutent to test chambers

Graduated Cylinder(s)

Pipet(s)

Volumetric Flask(s) 2L

Other

Specify materials used to place the test organisms into the test chambers transfer pipette

Test ID Number	Loading QC Initials
Re600496	BS

Exposure Chamber

Total Vessel Capacity 1L

Test Solution volume 1L

Feeding Schedule

Not fed X

Fed Daily

Other

Type of food

Specify below the number of milliliters (mls) of diluent and effluent measured out per concentration in this test.

Treatment Concentration	Working Stock Solution	Diluent	Total Volume
0	0L	2L	2L
0.25	2L	0L	2L
0.5	2L	0L	2L
1	2L	0L	2L
2	2L	0L	2L
4	2L	0L	2L
			BS 8/28/13

Aeration

Yes or [✓ No]

Time Began:

Screened Animal Enclosures

[✓ Not used]

Used

Photoperiod

dark 8 hr / light 16hr

other 24hr dark

APPENDIX D – RAW LABORATORY DATA; BENTHIC INFAUNA (Excel Spreadsheet; Provided as Electronic Copy Only)

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APPENDIX E – FIELD DATA SHEETS; TRAWL SAMPLING

Initials: Recorder: JB
Lab Check: LJ.
Data Entry: SH A
JS B

CONNECTICUT MARINE TRAWL SURVEY
TOW INFO DATA AND PHYSICAL DATA

SAMPLE #: AC2013 01
Other Sample #: AC2013 01
(Tow # of Day): 1
DATE: 06 / 10 / 2013
SITE (strata): 1740 (T2)

	PART A	PART B
TIME START (military):	8:54	
DURATION (minutes):	30	
NAV. DATA: START	8:54:18	
STOP	9:24:21	

METER YSI M30 ✓ CTD___ OTHER___
LAT 41 ° 17 55
LONG 72 ° 04 35
DEPTH ft: 40.7 m: 12.4

	@ 1m	@ 11.9m
TEMP (C)	15.0	13.1
SAL	27.6	30.8
COND	3466	3737

LENGTH OF WIRE 200'

	START A		**STOP A**
LAT	41 ° 17.56	**LAT**	___ ° ___.___
LONG	72 ° 04.31	**LONG**	___ ° ___.___

	START B		**STOP B**
LAT	41 ° 17.10	**LAT**	___ ° ___.___
LONG	72 ° 03.01	**LONG**	___ ° ___.___

WEATHER CONDITIONS/QC COMMENTS:

NET # C

QC CHECK FOR SALINITY **SCALE CAL. USING** ________ **kg STD. WT.**

Sal. Stan.	YSI	Diff	Pre-Cal. Wt.	Cal. Fit Values	Post-Cal. Wt.	Temp. Log. Deployed?: ______ Temp.:

FILL OUT IF SITE MOVED, TOW IS SHORT, OR IN PARTS:

Original Site:		Why moved:		(P, H, U)
Original Strata:		Gear Interaction:		(PV, PE, RI)
Attempts:		Pots:		(A, I, U)
Parts:		Number of Pots:		(P#, T#)

CREW: (list if first tow of day): Deb, Rodney, Jacque, Wes, John, Eric, Martha Sara H (volunteer)

P: Pots, H: Hangs, U: Unknown
PV: pots visible, PE: pots entangled, RI: recently informed
A: Active, I: Inactive, U: Unknown
P1, P2, etc. for pots; T1, T2, etc, for trawls

COMMENTS: ACOE/EPA tows

Recorder:
Lab check: E.W.
Data entry: ____
13:55

SPRING SURVEY-TOTAL COUNT / WEIGHT

SAMPLE #: AC2013 01 (tow # of day: 1) DATE: 6/10/13 SITE #: 17-40

Species	# Counted / Meas / to Lab / Scales	Total	Weights	Total
BKF	1m	1	1.8	1.8
BLF				
PGY	(15-18 cm) [198+180+99+53m]+ m=10.0 (9-14 cm) [78+52m]+ 16m m=2.5	676 ✓	18.1+11.3+12.6+19.7-0.1 BUT	61.6 ✓
SFL				
STB				
WKF				
WFL	13m	13	3.6	3.6
ALW				
ASD				
BUT	3m	3	0.1	0.1
FSF				
LSK	10m	10	5.2	5.2
NSR				
RCK				
RED				
SMD				
SPH				
SSR				
WHI				
WPF				
WSK				

TO LAB / COMMENTS: ____

Recorder:
Lab check: T.W.
Data entry: ___

INVERTEBRATE / ALGAE COUNTS AND WEIGHTS

SAMPLE#: AC2013 01 (tow # of day: 1) DATE: 6/10/13 SITE#: 17-40 13.55

SPECIES	COUNT	TOT CNT	WEIGHT	TOT WT
ALGAE, MIXED (ALG)	no count		0.7	0.7
KELP (KLP)	no count		0.6	0.6
ULVA (ULV)	no count		0.1	0.1
BUSHY BRYOZOA (BBI)	no count			
CRABS, ROCK (RCR)	no count			
BLUE (BCR)				
LADY (LCR)	no count			
F.C. HERMIT (HER)	no count			
SPIDER (SPI)	no count		5.9	5.9
HORSESHOE (HOR)				
MUD (BMC)	no count			
LION'S MANE (JEL)				
LOBSTER (LOB)	5m	5	1.2	1.2
MANTIS SHRIMP (MAN)				
N. MOON SHELL (NMS)	no count m=10.56			
SQUID, LONG-FINNED (SQI)	391+1+41m	433✓	22.3	22.3
STARFISH (STF)	no count			
WHELK, CHANNEL (CHW)				
KNOBBED (KNW)				
HSA (fresh)		—	8.8	8.8

TO LAB, COMMENTS: ___

Recorder: JS
Error check: LW
Data Entry:
B, JS

SAMPLE #: AC201301 (Tow # of day: 1) DATE: 6/10/13 SITE: 17-40

m=10.56

LEN	WFL	LSK	BKF	SQI
1				
2				
3				
4				1
5				
6				
7				1
8				3
9				2
10				8
11				7
12				6
13				3
14				3
15				1
16	1			
17	1			1
18				1
19	1			1
20				2
21				
22	3			1
23	1			
24				
25				
26				
27				
28				
29				
30	4			
31				
32				
33				
34	1			
35		1		
36	1			
37		2		
38				
39				
40		1		
41				
42				
43				
44				
45		1	1	
46		4		
47		1		
48				
49				
50				
	13	10	1	41

m=10.56

Recorder: MD
Error check: G.V.
Data Entry:

SAMPLE #: AC201301 (Tow # of day: 1) **DATE:** 6/10/13 **SITE:** 17-40 B; JS

LEN	PGY	LEN	BUT	LEN
1		1		1
2		2		2
3		3		3
4		4		4
5		5		5
6		6		6
7		7		7
8		8		8
9	1	9		9
10	9	10	1	10
11	26	11		11
12	11	12	2	12
13	4	13		13
14	1	14		14
15	5	15		15
16	15	16		16
17	23	17		17
18	10	18		18
19	11	19		19
20		20		20
21		21		21
22	1	22		22
23		23		23
24	4	24		24
25		25		25
26		26		26
27		27		27
28		28		28
29		29		29
30		30		30
31		31		31
32		32		32
33		33		33
34		34		34
35		35		35
36		36		36
37		37		37
38		38		38
39		39		39
40		40		40
41		41		41
42		42		42
43		43		43
44		44		44
45		45		45
46		46		46
47		47		47
48		48		48
49		49		49
50		50		50

subsample 9-14

52

M=2.5

subsample 15-18cm

53

M=10.0

16

M= 1.0

10

3

Recorder:
Lab check: ___
Data entry: ___

LISTS Lobster Measurement Data Sheet

Sample: AC2013-001 Date: 6/10/13 Site: 1740

Measured: 5 # Counted: 0 Total: 5

	V-notch	Sex	Length	Egg Bearing		Shell Disease	Shell Condition	Cull Status		Con-dition
	V/R Females Only	Male / Female	(mm)	Color G B T	Comp 0 - 4	0 - 3	Hardness H N S R	Crusher P M B S	Pincher P M B S	Alive Dead
1		M	72.7					B		
2		F	58.8					S		
3		F	70.7				N			
4		M	67.4			2				
5		M	69.7							
6										
7										
8										
9										
10										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Page ___ of ___

Initials: Recorder: Deb
Lab Check: GV
Data Entry: A SH
B JS

CONNECTICUT MARINE TRAWL SURVEY
TOW INFO DATA AND PHYSICAL DATA

SAMPLE #: AC2013-002
Other Sample #: AC2013-002
(Tow # of Day): 2
DATE: 06/10/2013
SITE (strata): 18-40 (T1)

	PART A	PART B
TIME START (military):	10:48	11:34
DURATION (minutes):	~4 1/2	25 1/2
NAV. DATA: START	10:47:45	11:34:02
STOP	10:52 *	11:59:21

30 min total

METER YSI M30 X CTD___ OTHER___
LAT 41° 19 .65
LONG 72° 05 .10
DEPTH ft: 28.3 m: 8.63

	@ 1m	@ 08.1m
TEMP (C)	15.9	14.3
SAL	18.3	30.0
COND	24.90	36.73

LENGTH OF WIRE 150'

	START A		STOP A
LAT	41° 19.27	**LAT**	41° 18.57
LONG	72° 05.04	**LONG**	72° 05.25
	START B		**STOP B**
LAT	__° __.__	**LAT**	__° __.__
LONG	__° __.__	**LONG**	__° __.__

WEATHER CONDITIONS/QC COMMENTS:

NET #

QC CHECK FOR SALINITY **SCALE CAL. USING** ________ **kg STD. WT.**

Sal. Stan.	YSI	Diff	Pre-Cal. Wt.	Cal. Fit Values	Post-Cal. Wt.	Temp. Log. Deployed?: ______ Temp.:

FILL OUT IF SITE MOVED, TOW IS SHORT, OR IN PARTS:

Original Site:		Why moved:		(P, H, U)
Original Strata:		Gear Interaction:	PE	(PV, PE, RI)
Attempts:		Pots:		(A, I, U)
Parts:		Number of Pots:		(P#, T#)

CREW: (list if first tow of day):

P: Pots, H: Hangs, U: Unknown
PV: pots visible, PE: pots entangled, RI: recently informed
A: Active, I: Inactive, U: Unknown
P1, P2, etc. for pots; T1, T2, etc, for trawls

COMMENTS: Project O trawled close by ^they were more in channel^ just before us.
LOST GPS data feed for NavLogfile ~ Reconnected @ ~10:49:45
* Conch pots set blind — ^No buoy lines^ on both doors & line across
also one ghost lob. pot : slipped lines off both doors
but then it cinched around codend & we had to cut ! lots of drama.

→ Popped a float on net reel due to excessive torsion, 11:50; had to mend couple holes in net.

Recorder: JB
Lab check: ____
Data entry: ____

B:55

SPRING SURVEY-TOTAL COUNT / WEIGHT

SAMPLE #: AC2013-002 (tow # of day: 2) **DATE:** 6/10/13 **SITE #:** 18-40

Species	# Counted / Meas / to Lab / Scales	Total	Weights	Total
BKF				
BLF				
PGY	15-19cm $(70^{c} + 52^{m}) + 43^{m}$ all m=2.35	165	16.0	16.0
SFL	6	6	3.4	3.4
STB	1	1	8.7	8.7
WKF				
WFL	3	3	1.4	1.4
ALW				
ASD				
BUT	3	3	0.1	0.1
FSF				
LSK	2	2	1.3	1.3
NSR				
RCK				
RED				
SMD				
SPH				
SSR	1	1	0.5	0.5
WHI				
WPF	1	1	0.4	0.4
WSK				
BSB	3	3	0.5	0.5
ATH	1	1	0.1	0.1
BAY	9	9	0.1	0.1

TO LAB / COMMENTS: ____________________

Recorder: JB
Lab check: Z.W.
Data entry: ____

INVERTEBRATE / ALGAE COUNTS AND WEIGHTS

SAMPLE#: AC2013-002 (tow # of day: 3) DATE: 6/10/13 SITE#: 18-40 B; 35

SPECIES	COUNT	TOT CNT	WEIGHT	TOT WT
ALGAE, MIXED (ALG)	no count		0.4 + 0.4	0.8
KELP (KLP)	no count		2.3	2.3
ULVA (ULV)	no count		0.2	0.2
BUSHY BRYOZOA (BBI)	no count			
CRABS, ROCK (RCR)	no count			
BLUE (BCR)	8	8	1.4	1.4
LADY (LCR)	no count			
F.C. HERMIT (HER)	no count			
SPIDER (SPI)	no count		2.0	2.0
HORSESHOE (HOR)				
MUD (BMC)	no count			
LION'S MANE (JEL)	4	4	0.2	0.2
LOBSTER (LOB)	2	2	0.6	0.6
MANTIS SHRIMP (MAN)	4.74			
N. MOON SHELL (NMS)	no count m=4.74	✓		
SQUID, LONG-FINNED (SQI)	$116^c + 31^m$	147	6.0	6.0
STARFISH (STF)	no count			
WHELK, CHANNEL (CHW)				
KNOBBED (KNW)				
CSL	—	—	0.1	0.1
HSA	—	—	1.0 + 6.8	7.8

TO LAB, COMMENTS: UnK ALG incl. Gracilaria??)
Algae < 0.1 kg

Recorder: MD
Error check: LW.
Data Entry: BJS

SAMPLE #: AC2013-002 (Tow # of day: 2) **DATE:** 6/10/13 **SITE:** 18-40

LEN	PGY	ATH	SSR	LSK	WPF
1					
2					
3					
4					
5		1			
6	m=1.0				
7		①			
8					
9	1				
10	9				
11	21 (40)				
12	8				
13	1				
14					
15	6				
16	13				
17	22 (52)				
18	9				
19	2				
20	1				
21					
22	m=1.0				
23	③				
24					
25	1				1
26	1				
27			1		
28					
29					①
30			①		
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43				1	
44				1	
45					
46				②	
47					
48					
49					
50					

subsample 15-19
=2.35

Recorder: MD.
Error check: I.U.
Data Entry: ______

SAMPLE #: AC2013-002 (Tow # of day: 2) **DATE:** 6/10/13 **SITE:** 18-4B B'53

LEN	BSB				LEN				LEN
1					1				1
2					2				2
3					3				3
4					4				4
5					5				5
6					6				6
7					7				7
8					8				8
9					9				9
10					10				10
11					11				11
12					12				12
13					13				13
14					14				14
15					15				15
16					16				16
17	1				17				17
18					18				18
19	1				19				19
20					20				20
21	1				21				21
22					22				22
23					23				23
24	③				24				24
25					25				25
26					26				26
27					27				27
28					28				28
29					29				29
30					30				30
31					31				31
32					32				32
33					33				33
34					34				34
35					35				35
36					36				36
37					37				37
38					38				38
39					39				39
40					40				40
41					41				41
42					42				42
43					43				43
44					44				44
45					45				45
46					46				46
47					47				47
48					48				48
49					49				49
50					50				50

Recorder: JS
Error check:
Data Entry:

SAMPLE #: AC2013-002 (Tow # of day: 2) **DATE:** 6/10/13 **SITE:** 18-40

LEN	STB+50	SFL	WFL	Bay	LEN	BUT	SAI		LEN
1					1				1
2					2				2
3					3		2		3
4					4		2		4
5				4	5	2	5		5
6				3	6				6
7				2	7		2		7
8					8				8
9					9		1		9
10					10		2		10
11					11		2		11
12					12	1	3		12
13					13		3		13
14					14		3		14
15					15		1		15
16			1		16		1		16
17					17		2		17
18					18				18
19					19		1		19
20					20				20
21					21				21
22					22		1		22
23					23				23
24					24				24
25					25				25
26					26				26
27					27				27
28					28				28
29					29				29
30					30				30
31					31				31
32					32				32
33			2		33				33
34					34				34
35		2			35				35
36					36				36
37		1			37				37
38					38				38
39		1			39				39
40	1	2			40				40
41					41				41
42					42				42
43					43				43
44					44				44
45					45				45
46					46				46
47					47				47
48					48				48
49					49				49
50					50				50
	①	⑥	③	⑨		③	(31)		

Recorder: JB
Lab check: ____
Data entry: ____

LISTS Lobster Measurement Data Sheet

Sample: AC2013-002 Date: 6/10/13 Site: 1178-40

Measured: 2 # Counted: 0 Total: 2
(Jacque)

	V-notch	Sex	Length	Egg Bearing		Shell Disease	Shell Condition	Cull Status		Con-dition
	V/R Females Only	Male / Female	(mm)	Color G B T	Comp 0 - 4	0 - 3	Hardness H N S R	Crusher P M B S	Pincher P M B S	Alive Dead
1		F	70.3							
2		M	54.4							
3										
4										
5										
6										
7										
8										
9										
10										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Initials: Recorder: JB
Lab Check: E.W.
Data Entry: A SH
B JJ

CONNECTICUT MARINE TRAWL SURVEY
TOW INFO DATA AND PHYSICAL DATA

SAMPLE #: AC2013-003
Other Sample #: AC2013-003
(Tow # of Day): 3
DATE: 06/10/2013
SITE (strata): 17-38 (T2)

	PART A	PART B
TIME START (military):	12:58	
DURATION (minutes):	30	
NAV. DATA: START	12:58:29	
STOP	13:28:32	

METER YSI M30 ✓ CTD___ OTHER___

LAT	41° 17 .11	
LONG	72° 09 .04	
DEPTH	ft: 38.4	m: 11.7

	@ 1m	@ 11.2m
TEMP (C)	15.2	14.2
SAL	27.7	30.0
COND	34.26	36.63

LENGTH OF WIRE 200'

	START A		**STOP A**
LAT	41° 17.21	**LAT**	__° __.__
LONG	72° 09.40	**LONG**	__° __.__
	START B		**STOP B**
LAT	41° 17.39	**LAT**	__° __.__
LONG	72° 11.10	**LONG**	__° __.__

WEATHER CONDITIONS/QC COMMENTS:
Overcast
<1' chop <10 KTS E

NET # C

QC CHECK FOR SALINITY **SCALE CAL. USING ______ kg STD. WT.**

Sal. Stan.	YSI	Diff	Pre-Cal. Wt.	Cal. Fit Values	Post-Cal. Wt.	Temp. Log. Deployed?: ______ Temp.:
			1	19	22.68	

FILL OUT IF SITE MOVED, TOW IS SHORT, OR IN PARTS:

Original Site:		Why moved:		(P, H, U)
Original Strata:		Gear Interaction:	PV	(PV, PE, RI)
Attempts:		Pots:		(A, I, U)
Parts:		Number of Pots:		(P#, T#)

CREW: (list if first tow of day):

P: Pots, H: Hangs, U: Unknown
PV: pots visible, PE: pots entangled, RI: recently informed
A: Active, I: Inactive, U: Unknown
P1, P2, etc. for pots; T1, T2, etc, for trawls

COMMENTS: Pots visible along our tow path; had to tow a tad South.

Recorder:
Lab check: E.V.
Data entry: ____
8:55

SPRING SURVEY-TOTAL COUNT / WEIGHT

SAMPLE #: AC2013-003 (tow # of day: 3) DATE: 6/10/13 SITE #: 17-38

Species	# Counted / Meas / to Lab / Scales	Total	Weights	Total
BKF	2m	2	2.4	2.4
BLF				
PGY (15-19 cm)	m=4.42 [76+78+1+48+26+24+74m]+ m=1.0 m=1.0 18m + 99m	444 ✓	14.1+14.4+12.5+15.5+ 8.9+11.0	76.4
SFL	1m	1	0.9	0.9
STB	1m	1	3.2	3.2
WKF				
WFL	2m	2	0.4	0.4
ALW				
ASD				
BUT	1m	1	0.1	0.1
FSF				
LSK	1m	1	0.4	0.4
NSR				
RCK				
RED				
SMD				
SPH				
SSR				
WHI				
WPF				
WSK				
BAY	1m	1	0.1	0.1

TO LAB / COMMENTS: ____

Recorder: dck
Lab check: ____
Data entry: ____

INVERTEBRATE / ALGAE COUNTS AND WEIGHTS

SAMPLE#: AC2013-003 (tow # of day: 3) **DATE:** 6/10/13 **SITE#:** 17-38 B!J5

SPECIES	COUNT	TOT CNT?	WEIGHT	TOT WT
ALGAE, MIXED (ALG) *	no count	gracilaria pics	0.2 +0.3+2.4	2.9
KELP (KLP)	no count		3.5+3.3 +0.2	7.0
ULVA (ULV)	no count		0.7	0.7
BUSHY BRYOZOA (BBI)	no count			
CRABS, ROCK (RCR)	no count		0.1	0.1
BLUE (BCR)				
LADY (LCR)	no count			
F.C. HERMIT (HER)	no count			
SPIDER (SPI)	no count		2.1 +1.3	3.4
HORSESHOE (HOR)				
MUD (BMC)	no count			
LION'S MANE (JEL)				
LOBSTER (LOB)				
MANTIS SHRIMP (MAN)				
N. MOON SHELL (NMS)	no count			
SQUID, LONG-FINNED (SQI)	60+70m m=1.86	130	4.9	4.9
STARFISH (STF)	no count			
WHELK, CHANNEL (CHW)				
KNOBBED (KNW)				
(fresh) HSA		—	14.0 +1.0 +6.5+2.4	23.9
BOR		—	1.5	1.5
Sq. EGG		—	0.1	0.1

TO LAB, COMMENTS: * Took pics & samples

Recorder: SH+J
Error check: L.W.
Data Entry:

SAMPLE #: AC2013-003 (Tow # of day: 3) **DATE:** 6/10/13 **SITE:** 17-38 B/JS

LEN	STB+SU	SFL	BKF	WFL	LEN	LSK	BUT	~~S~~	LEN
1					1				1
2					2				2
3					3				3
4					4				4
5					5				5
6					6				6
7					7				7
8					8				8
9					9				9
10					10				10
11					11				11
12					12				12
13					13				13
14					14		/ 1		14
15					15				15
16	\ 1				16				16
17					17				17
18				/ 1	18				18
19					19				19
20					20				20
21	①				21				21
22					22				22
23					23				23
24					24				24
25					25				25
26					26				26
27				\ 1	27				27
28					28				28
29					29				29
30					30				30
31					31				31
32			\ 1		32				32
33					33				33
34					34				34
35					35				35
36					36				36
37					37	/ 1			37
38					38				38
39					39				39
40					40				40
41					41				41
42					42				42
43					43				43
44		/ 1	/ 1		44				44
45					45				45
46					46				46
47					47				47
48					48				48
49					49				49
50					50				50
		①	②	②		①	①		

Recorder: Sarah
Error check: G.V.
Data Entry: ________

SAMPLE #: AC2013-003 (Tow # of day: 3) DATE: 6/10/13 SITE: 17-38 11:55

LEN	SQI	
1		
2		
3	2	
4		11
5	5	
6	6	
7	3	
8	3	
9	3	
10	6	
11		11
12	7	
13	3	
14	2	
15	4	
16	2	
17		
18	1	
19		
20		
21		
22	1	
23		
24		
25		
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37		
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m=1.86

70

Recorder: JB
Error check: L.W.
Data Entry:

SAMPLE #: AC2013-003 (Tow # of day: 3) **DATE:** 6/10/13 **SITE:** 17-38 13:55

LEN	PGY		LEN	BAY	LEN
1			1		1
2			2		2
3			3		3
4			4		4
5			5		5
6			6	1	6
7			7		7
8			8		8
9	1	m=1.0	9		9
10	2		10		10
11	6	18	11		11
12	6		12	1	12
13	3		13		13
14			14		14
15	5		15		15
16	10		16		16
17	26	74	17		17
18	27		18		18
19	6	m=4.42	19		19
20	3		20		20
21	4		21		21
22	24		22		22
23	22		23		23
24	8		24		24
25	8		25		25
26	8		26		26
27	7	99	27		27
28	6		28		28
29	3		29		29
30	2		30		30
31	2	m=1.0	31		31
32	1		32		32
33	1		33		33
34			34		34
35			35		35
36	117	117	36		36
37			37		37
38			38		38
39			39		39
40			40		40
41			41		41
42			42		42
43			43		43
44			44		44
45			45		45
46			46		46
47			47		47
48			48		48
49			49		49
50			50		50

\|||

sub sample

||

Initials: Recorder: E.U.
Lab Check: E.M.
Data Entry: A:JTS
A:54

SP2013-81

CONNECTICUT MARINE TRAWL SURVEY
TA AND PHYSICAL DATA

AC2013-004
(Tow # of Day): 4

DATE: 06 / 10 / 2013

SITE (strata): 14-37 (T4)

	PART A	PART B
TIME START (military):	14:37	
DURATION (minutes):	30	
NAV. DATA: START	14:37:03	
STOP	15:07:05	

METER YSI M30 ✓ CTD____ OTHER____

LAT	41°	14	.70
LONG	72°	12	.74

DEPTH ft: 123.4 m: 37.6

	@ 1m	@ 37.1m
TEMP (C)	14.6	13.9
SAL	29.7	30.6
COND	36.73	37.05

LENGTH OF WIRE 650 ft.

	START A		**STOP A**
LAT	41° 14.64	**LAT**	___° __.__
LONG	72° 13.26	**LONG**	___° __.__

	START B		**STOP B**
LAT	41° 14 31	**LAT**	___° __.__
LONG	72° 14 74	**LONG**	___° __.__

WEATHER CONDITIONS/QC COMMENTS:

NET #

QC CHECK FOR SALINITY **SCALE CAL. USING ________kg STD. WT.**

Sal. Stan.	YSI	Diff	Pre-Cal. Wt.	Cal. Fit Values	Post-Cal. Wt.	Temp. Log. Deployed?: _______ Temp.:
	26.9			7	22.68	

FILL OUT IF SITE MOVED, TOW IS SHORT, OR IN PARTS:

Original Site:		Why moved:		(P, H, U)
Original Strata:		Gear Interaction:		(PV, PE, RI)
Attempts:		Pots:		(A, I, U)
Parts:		Number of Pots:		(P#, T#)

CREW: (list if first tow of day):

P: Pots, H: Hangs, U: Unknown
PV: pots visible, PE: pots entangled, RI: recently informed
A: Active, I: Inactive, U: Unknown
P1, P2, etc. for pots; T1, T2, etc, for trawls

COMMENTS:

Recorder: JB
Lab check: LV.
Data entry: A SH
B JJ

SPRING SURVEY-TOTAL COUNT / WEIGHT

SAMPLE #: SP2013-081 (tow # of day: 4) DATE: 06/10/13 SITE #: 14-37

Species	# Counted / Meas / to Lab / Scales	Total	Weights	Total
BKF				
~~BLF~~	(15-20cm)			
PGY	(158c + 69m+6sc] sc + 46m + 13sc m=3.11	292 ✓	14.5+18.4	32.9
SFL	1	1	0.8	0.8
STB				
WKF				
WFL	10	10	3.2	3.2
ALW				
ASD				
BUT				
FSF	11	11	1.8	1.8
LSK	36	36	19.7	19.7
NSR	65c + 108c + 41m m=5.22	214	10.7+4.5-0.6 (SSR) JB	~~15.8~~ 14.
RCK				
RED	2	2	0.1	0.1
SMD	6	6	16.8	16.8
SPH	4	4	0.2	0.2
SSR	1c + 3m M=1.33	4	0.6 + 0.2 est (for 1c) (+)	~~0.6~~ 0.8
WHI	10	10	0.7	0.7
WPF	14	14	3.0	3.0
WSK	10	10	11.9	11.9
SPD	1	1	No weight 3.9 est L/W *	? 3.9
SSB	14	14	2.0	2.0

TO LAB / COMMENTS: 19 PGY scales ✓ L.V.

* est wt from NMFS-NE-171 length wt relationship for SPD
[illegible]

(+) ave Kg/SSR ≅ 0.2
also, L/W (wilk) was same

Recorder: JB
Lab check: S.W.
Data entry: A B 55

INVERTEBRATE / ALGAE COUNTS AND WEIGHTS

SAMPLE#: SP2013-081 (tow # of day: 4) **DATE:** 06/10/13 **SITE#:** 14-37

SPECIES	COUNT	TOT CNT	WEIGHT	TOT WT
ALGAE, MIXED (ALG)	no count			
KELP (KLP)	no count		0.3	0.3
ULVA (ULV)	no count		0.3	0.3
BUSHY BRYOZOA (BBI)	no count			
CRABS, ROCK (RCR)	no count		0.1	0.1
BLUE (BCR)				
LADY (LCR)	no count			
F.C. HERMIT (HER)	no count		0.1	0.1
SPIDER (SPI)	no count		0.7	0.7
HORSESHOE (HOR)				
MUD (BMC)	no count			
LION'S MANE (JEL)				
LOBSTER (LOB)				
MANTIS SHRIMP (MAN)				
N. MOON SHELL (NMS)	no count m=369			
SQUID, LONG-FINNED (SQI)	$43^c + 16^m$	59	4.3	4.3
STARFISH (STF)	no count			
WHELK, CHANNEL (CHW)				
KNOBBED (KNW)				
HSA	—		5.0	5.0

TO LAB, COMMENTS: * HYDROID ON POLY PRO STRANDS (PIC)

Recorder: JJ
Error check: G.V.
Data Entry: A
B JS

SAMPLE #: SP2013-081 (Tow # of day: 4) **DATE:** 06/10/13 **SITE:** 14-37

LEN	SSR	WPF	WFL	~~SFL~~	LEN	LSK		~~WSKt~~	LEN
1					1				1
2					2				2
3					3				3
4					4				4
5					5				5
6					6				6
7					7				7
8					8				8
9					9				9
10					10				10
11					11				11
12					12				12
13					13				13
14					14				14
15			1		15				15
16					16				16
17	m=1.33				17				17
18		1			18				18
19					19				19
20					20				20
21			2		21				21
22	1				22				22
23	1				23				23
24		5	1		24				24
25	1	1	2		25				25
26		1	1		26	1			26
27		3			27	1			27
28		2			28	1			28
29					29	1			29
30					30				30
31					31				31
32		1			32				32
33					33				33
34			1		34	1			34
35					35				35
36			1		36				36
37					37				37
38					38				38
39			1		39				39
40					40				40
41					41	1			41
42					42	4			42
43					43	3			43
44					44	10			44
45					45	2			45
46					46	4			46
47					47	4			47
48					48	3			48
49					49				49
50					50				50
	③	⑭	⑩			㊱			

Recorder: TS
Error check: L.L.
Data Entry:
B 75

SAMPLE #: SP2013-081 (Tow # of day: 4) **DATE:** 06/10/13 **SITE:** 14-37

LEN	WHT	FSF	PGY		LEN				LEN
1					1				1
2					2				2
3					3				3
4					4				4
5					5				5
6					6				6
7					7				7
8					8				8
9					9		m=1.0		9
10					10	12			10
11					11	20			11
12					12	8 (43)			12
13					13	1			13
14	1				14	2			14
15					15	5	Sub	m=3.11	15
16					16	21	Sample		16
17	1				17	20		(69)	17
18					18	15			18
19	3				19	5	15-20cm		19
20	1				20	3			20
21	1	1			21	1			21
22	2				22				22
23		2			23	2			23
24	1				24				24
25		2			25	(3)			25
26		2			26		m=1.0		26
27		3			27				27
28					28				28
29					29				29
30					30				30
31					31				31
32		1			32				32
33					33				33
34					34				34
35					35				35
36					36				36
37					37				37
38					38				38
39					39				39
40					40				40
41					41				41
42					42				42
43					43				43
44					44				44
45					45				45
46					46				46
47					47				47
48					48				48
49					49				49
50					50				50
	(10)	(11)							

Recorder: mcr
Error check: T.W.
Data Entry: A
B SJ

SAMPLE #: SP2013-081 (Tow # of day: 4) **DATE:** 06/10/13 **SITE:** 14-37

LEN	SFL	SPH	BSB		NSR →	RED
1						
2						
3						
4						
5						
6						
7						
8						
9					1	
10						
11						
12					2	
13					3	
14		1			2	
15					3	
16		1				
17			1			
18		1	1			1
19		1				
20			4		4	1
21			1		4	
22			2		9	
23		④	2		1	
24			1		2	
25			2			
26					6	②
27					2	
28			(14)			
29					2	
30						
31						
32						
33					(41)	
34						
35						
36					m=5.22	
37						
38						
39						
40						
41						
42						
43						
44						
45						
46	1					
47						
48						
49						
50	①					

Recorder:
Error check: G.W.
Data Entry:

SAMPLE #: SP2013-081 (Tow # of day: 4) DATE: 6/10/13 SITE: 14-37 BTS

LEN	SQ1
1	
2	
3	
4	
5	
6	
7	
8	
9	1
10	
11	4
12	3
13	1
14	
15	1
16	1
17	
18	1
19	1
20	2
21	
22	
23	1
24	
25	
26	
27	
28	1/6
29	
30	
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32	
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m=3.69

SPP: SPD

LIS TRAWL SURVEY
DOGFISH MEASUREMENT SHEET

Recorder:
Error Check: S.V.
Data Entry: A
B TS

SAMPLE #: SP2013-081 (Tow # of day: 4) **DATE:** 6/10/13 **SITE:** 14-37

MALE | **FEMALE**

LEN		LEN		LEN		LEN		LEN		LEN	
1		51		101		1		51		101	
2		52		102		2		52		102	
3		53		103		3		53		103	
4		54		104		4		54		104	
5		55		105		5		55		105	
6		56		106		6		56		106	
7		57		107		7		57		107	
8		58		108		8		58		108	
9		59		109		9		59		109	
10		60		110		10		60		110	
11		61		111		11		61		111	
12		62		112		12		62		112	
13		63		113		13		63		113	
14		64		114		14		64		114	
15		65		115		15		65		115	
16		66		116		16		66		116	
17		67		117		17		67		117	
18		68		118		18		68		118	
19		69		119		19		69		119	
20		70		120		20		70		120	
21		71		121		21		71		121	
22		72		122		22		72		122	
23		73		123		23		73		123	
24		74		124		24		74		124	
25		75		125		25		75		125	
26		76		126		26		76		126	
27		77		127		27		77		127	
28		78		128		28		78		128	
29		79		129		29		79		129	
30		80		130		30		80		130	
31		81		131		31		81		131	
32		82		132		32		82		132	
33		83		133		33		83		133	
34		84		134		34		84		134	
35		85		135		35		85		135	
36		86		136		36		86		136	
37		87		137		37		87		137	
38		88		138		38		88		138	
39		89		139		39		89		139	
40		90		140		40		90		140	
41		91		141		41		91		141	
42		92		142		42		92		142	
43		93		143		43		93		143	
44		94		144		44		94		144	
45		95		145		45		95	\ |	145	
46		96		146		46		96		146	
47		97		147		47		97		147	
48		98		148		48		98		148	
49		99		149		49		99		149	
50		100		150		50		100		150	

①

SPP: SMD

Recorder: [illegible]
Error Check:
Data Entry:

LIS TRAWL SURVEY
DOGFISH MEASUREMENT SHEET

SAMPLE #: S?2013-081 (Tow # of day: 4) DATE: 6/10/13 SITE: 14-37

LEN	MALE	FEMALE
1		
2		
3		
4		
5		
6		
7		
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82		
83		\ |
84		
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91	\ |	
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106		
107		\ |
108		
109		
110		\ |
111		
112		
113		
114		
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116		
117		
118		
119		
120		
121		
122		
123		
124		
125		
126		
127		
128		
129		
130		
131		
132		
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137		
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139		
140		
141		
142		
143		
144		
145		
146		
147		
148		
149		
150		

Recorder:
Error Check: L.W.
Data Entry: A BJS

LIS TRAWL SURVEY
LARGE FISH MEASUREMENT SHEET

SAMPLE #: SP2013-081 (Tow # of day: 4) **DATE:** 6/10/13 **SITE:** 14-37

SPECIES: WSK (10)

1						51						101					
2						52						102					
3						53						103					
4						54						104					
5						55	\				/	105					
6						56	\				/	106					
7						57						107					
8						58						108					
9						59						109					
10						60						110					
11						61						111					
12						62	\				/	112					
13						63						113					
14						64						114					
15						65	\				/	115					
16						66						116					
17						67	\				/	117					
18						68						118					
19						69						119					
20						70						120					
21						71						121					
22						72						122					
23						73						123					
24						74						124					
25						75						125					
26						76						126					
27						77						127					
28						78						128					
29						79						129					
30						80						130					
31						81						131					
32						82						132					
33						83						133					
34						84						134					
35						85						135					
36						86						136					
37	\				/	87						137					
38						88						138					
39						89						139					
40						90						140					
41						91						141					
42	\				/	92						142					
43						93						143					
44	\				/	94						144					
45	\				/	95						145					
46	\				/	96						146					
47						97						147					
48						98						148					
49						99						149					
50						100						150					

SPECIES:

1						51						101					
2						52						102					
3						53						103					
4						54						104					
5						55						105					
6						56						106					
7						57						107					
8						58						108					
9						59						109					
10						60						110					
11						61						111					
12						62						112					
13						63						113					
14						64						114					
15						65						115					
16						66						116					
17						67						117					
18						68						118					
19						69						119					
20						70						120					
21						71						121					
22						72						122					
23						73						123					
24						74						124					
25						75						125					
26						76						126					
27						77						127					
28						78						128					
29						79						129					
30						80						130					
31						81						131					
32						82						132					
33						83						133					
34						84						134					
35						85						135					
36						86						136					
37						87						137					
38						88						138					
39						89						139					
40						90						140					
41						91						141					
42						92						142					
43						93						143					
44						94						144					
45						95						145					
46						96						146					
47						97						147					
48						98						148					
49						99						149					
50						100						150					

SP2013082

Initials: Recorder: KV
Lab Check: J.L.
Data Entry: ________

B 5.5

MARINE TRAWL SURVEY
TA AND PHYSICAL DATA

SAMPLE #: Sp2013-082
Other Sample #: AC2013005
(Tow # of Day): 1
DATE: 06 / 12 / 2013
SITE (strata): 14-36 (T4)

	PART A	PART B
TIME START (military):	07:31	
DURATION (minutes):	30 min	
NAV. DATA: START	07:31:10	
STOP	08:01:13	

METER YSI M30 ✓ CTD___ OTHER___
LAT 41° 14 .80
LONG 72° 13 .72
DEPTH ft: 116.5' m: 35.5

	@ 1m	@ 35.0m
TEMP (C)	14.7	14.1
SAL	26.0	30.3
COND	31.13	36.85

LENGTH OF WIRE 600'

	START A		**STOP A**
LAT	41° 14.75	**LAT**	41° 14.48
LONG	72° 14.00	**LONG**	72° 15.70
	START B		**STOP B**
LAT	__° __.__	**LAT**	__° __.__
LONG	__° __.__	**LONG**	__° __.__

WEATHER CONDITIONS/QC COMMENTS:

NET # "C"

QC CHECK FOR SALINITY **SCALE CAL. USING ________kg STD. WT.**

Sal. Stan.	YSI	Diff	Pre-Cal. Wt.	Cal. Fit Values	Post-Cal. Wt.	Temp. Log. Deployed?: ____ Temp.:
	26.8			212.3	22.68	

FILL OUT IF SITE MOVED, TOW IS SHORT, OR IN PARTS:

Original Site:		Why moved:		(P, H, U)
Original Strata:		Gear Interaction:		(PV, PE, RI)
Attempts:		Pots:		(A, I, U)
Parts:		Number of Pots:		(P#, T#)

CREW: (list if first tow of day):

P: Pots, H: Hangs, U: Unknown
PV: pots visible, PE: pots entangled, RI: recently informed
A: Active, I: Inactive, U: Unknown
P1, P2, etc. for pots; T1, T2, etc, for trawls

COMMENTS:

Recorder: JTB
Lab check: T.W.
Data entry: ____

B:35 S4
115,2

SPRING SURVEY-TOTAL COUNT / WEIGHT

SAMPLE #: Sp2013-082 (tow # of day: 1) DATE: 6/12/13 SITE #: 14-36

Species	# Counted / Meas / to Lab / Scales	Total	Weights	Total
BKF				
BLF				
PGY	<15 m=2.1 $(44^{c}+5^{sc}+35^{M})$ 15-20 m=1.67 $(46^{c}+6^{sc}+63^{M})$ >20 $(4^{m}+6\,sc)$	209 ✓	20.5	20.5
SFL	$1^{sc}+2^{m}$	3	5.9	5.9
STB				
WKF				
WFL	13	13	3.7	3.7
ALW				
ASD				
BUT				
FSF	6	6	0.9	0.9
LSK	35	35	16.8	16.8
NSR	$257^{c}+54^{c}+40m$ m=8.78	351 ✓	12.4+13.9	26.3
RCK				
RED	1	1	0.1	0.1
SMD	16	16	19.7+20.2+9.6	49.5
SPH	14	14	0.6	0.6
SSR	1	1	0.3	0.3
WHI	9	9	0.7	0.7
WPF	62	62	12.7	12.7
WSK	5	5	5.1	5.1
SPD	5	5	21.4	21.4
CNS	1	1	1.9	1.9
BSB	~~14~~ 15 m	~~14~~ 15	2.4	2.4
SPT	20	20	1.4	1.4

TO LAB / COMMENTS: 1 SFL scale
17 PGY scale

Recorder: JB
Lab check: ____
Data entry: ____

INVERTEBRATE / ALGAE COUNTS AND WEIGHTS

SAMPLE#: Sp2013-082 (tow # of day: 1) DATE: 6/12/2013 SITE#: 14-36B

SPECIES	COUNT	TOT CNT	WEIGHT	TOT WT
ALGAE, MIXED (ALG)	no count		0.2	0.2
KELP (KLP)	no count		0.1	0.1
ULVA (ULV)	no count		0.1	0.1
BUSHY BRYOZOA (BBI)	no count			
CRABS, ROCK (RCR)	no count			
BLUE (BCR)				
LADY (LCR)	no count			
F.C. HERMIT (HER)	no count		0.2	0.2
SPIDER (SPI)	no count			
HORSESHOE (HOR)				
MUD (BMC)	no count			
LION'S MANE (JEL)				
LOBSTER (LOB)				
MANTIS SHRIMP (MAN)				
N. MOON SHELL (NMS)	no count			
SQUID, LONG-FINNED (SQI)	78	78	4.8	4.8
STARFISH (STF)	no count			
WHELK, CHANNEL (CHW)				
KNOBBED (KNW)				
MSE	~~0.1~~		0.1	0.1
HSA	~~1.2~~		1.2	1.2

LAB, COMMENTS: ____

Recorder: JS
Error check: GV
Data Entry: B; 55

SAMPLE #: Sp2013-092 (Tow # of day: 1) **DATE:** 6/12/13 **SITE:** 14-36

LEN	WSK	+SC	LSK	BSB
1				
2				
3				
4				
5		1		
6				
7				
8				
9				
10				
11				
12				
13		1		
14				
15				1
16				
17				1
18				1
19				3
20				3
21				5
22				
23				
24				
25			1	
26			3	1
27			1	
28				
29			1	
30				
31				
32			1	
33				
34			1	
35				
36				
37			1	
38				
39	1			
40				
41			2	
42			2	
43			6	
44	1		5	
45			3	
46			5	
47	1		1	
48				
49			2	
50				
	5		34	15

LEN	SFL	+SU	RED
1			
2			
3			
4			
5		1	
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			1
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42	1		
43			
44			
45			
46			
47			
48			
49			
50			
	1	2	1

Recorder: ______
Error check: ______
Data Entry: ______

SAMPLE #: SP2013-082 (Tow # of day: 1) **DATE:** 6/12/2013 **SITE:** 14-36 HS

LEN	SPH	WHI	SQI	
1				
2				
3				
4				1
5				1
6				2
7				2
8				
9				7
10				14
11				9
12				14
13	1			5
14	2			7
15	2			
16	1			5
17		1		
18	2	2		6
19	4	1		1
20	2	1		
21		2		2
22		1		
23				
24		1		2
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36			78 ✓	
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
	(14)	(9)		

Recorder: S.W
Error check: L.V.
Data Entry: ________

SAMPLE #: SP2013-082 (Tow # of day: 1) DATE: 6/12/2013 SITE: 14-36 B/55

LEN	WFL	CNS	WPF		LEN	FSF	SSR		LEN
1					1				1
2					2				2
3					3				3
4					4				4
5		68 cm			5				5
6					6				6
7					7				7
8					8				8
9		~~1~~			9				9
10					10				10
11					11				11
12					12				12
13				1	13				13
14					14				14
15					15				15
16	2				16				16
17					17				17
18	1			1	18				18
19	2			1	19				19
20				1	20	1			20
21					21				21
22	1				22				22
23				7	23				23
24	2			5	24	1	1		24
25	1			8	25	1			25
26				12	26				26
27	1			6	27		~~1~~		27
28				4	28	1			28
29				5	29				29
30				4	30				30
31				5	31	1			31
32				2	32	1			32
33					33				33
34					34				34
35					35				35
36	1				36				36
37					37	~~6~~			37
38	1			~~62~~	38				38
39					39				39
40	1				40				40
41					41				41
42					42				42
43					43				43
44					44				44
45					45				45
46	~~13~~				46				46
47					47				47
48					48				48
49					49				49
50					50				50

Recorder: S.L
Error check: LV
Data Entry:

SAMPLE #: SP2013-082 (Tow # of day: 1) **DATE:** 6/12/13 **SITE:** 14-36 B.JS

LEN	NSR	SPT	PGY
1			
2			
3			
4			
5			
6			
7			
8			
9			3
10			13
11			16
12	3		3
13	12		
14	4		35
15	2	9	5
16		6	15
17	1	4	19
18		1	15
19			8
20			1
21	4	20	63
22	6		
23	5		
24	1		
25	1		
26	1		1
27			
28			2
29			1
30	40		4
31			
32			
33			
34	m=8.78		m=1.0
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

Sub sample < 14 cm
m=2.1

sub sample 15-20 cm
m=1.67

Recorder: E.W.
Error Check: G.V.
Data Entry: ________

SPP: SMD

LIS TRAWL SURVEY
DOGFISH MEASUREMENT SHEET

SAMPLE #: Sp2013-082 (Tow # of day: 1) DATE: 6/12/13 SITE: 14-36 B; JS

MALE						FEMALE					
LEN		LEN		LEN		LEN		LEN		LEN	
1		51		101		1		51	\ ✓ 1	101	
2		52		102	X ✓ 2	2		52		102	
3		53		103	\ ✓ 1	3		53		103	
4		54		104		4		54		104	
5		55		105		5		55		105	
6		56		106		6		56		106	
7		57		107		7		57		107	
8		58		108		8		58		108	\ ✓ 1
9		59		109		9		59		109	\ ✓ 1
10		60		110		10		60		110	
11		61		111		11		61		111	
12		62	\ ✓ 1	112		12		62		112	
13		63		113		13		63		113	
14		64		114		14		64		114	
15		65		115		15		65		115	
16		66		116		16		66	\ ✓ 1	116	
17		67		117		17		67		117	
18		68		118		18		68		118	
19		69		119		19		69		119	
20		70		120		20		70		120	
21		71		121		21		71		121	
22		72		122		22		72		122	\ 1
23		73		123		23		73		123	
24		74		124		24		74		124	
25		75		125		25		75		125	
26		76		126		26		76		126	
27		77		127		27		77		127	
28		78		128		28		78		128	
29		79		129		29		79		129	
30		80		130		30		80		130	
31		81		131		31		81		131	
32		82		132		32		82		132	
33		83		133		33		83		133	
34		84		134		34		84		134	
35		85		135		35		85		135	
36		86		136		36		86		136	
37		87		137		37		87		137	
38		88		138		38		88		138	
39		89		139		39		89		139	
40		90		140		40		90		140	
41		91		141		41		91		141	
42		92		142		42		92		142	
43		93	\ ✓ 1	143		43		93		143	
44		94	\ ✓ 1	144		44		94		144	
45		95	\ ✓ 1	145		45		95		145	
46		96	\ ✓ 1	146		46		96		146	
47		97	\ ✓ 1	147		47		97		147	
48		98		148		48		98		148	
49		99		149		49		99		149	
50		100	X ✓ 2	150		50		100		150	

16

Recorder: E.W
Error Check: C.V.
Data Entry:

SPP: SPD

LIS TRAWL SURVEY
DOGFISH MEASUREMENT SHEET

SAMPLE #: SP2013-082 (Tow # of day: 1) **DATE:** 6/12/13 **SITE:** 14-36

MALE

LEN		LEN		LEN	
1		51		101	
2		52		102	
3		53		103	
4		54		104	
5		55		105	
6		56		106	
7		57		107	
8		58		108	
9		59		109	
10		60		110	
11		61		111	
12		62		112	
13		63		113	
14		64		114	
15		65		115	
16		66		116	
17		67		117	
18		68		118	
19		69		119	
20		70		120	
21		71		121	
22		72		122	
23		73		123	
24		74		124	
25		75		125	
26		76		126	
27		77		127	
28		78		128	
29		79		129	
30		80		130	
31		81		131	
32		82		132	
33		83		133	
34		84		134	
35		85		135	
36		86		136	
37		87		137	
38		88		138	
39		89		139	
40		90		140	
41		91		141	
42		92		142	
43		93		143	
44		94		144	
45		95		145	
46		96		146	
47		97		147	
48		98		148	
49		99		149	
50		100		150	

FEMALE

LEN		LEN		LEN	
1		51		101	
2		52		102	
3		53		103	
4		54		104	
5		55		105	
6		56		106	
7		57		107	
8		58		108	
9		59		109	
10		60		110	
11		61		111	
12		62		112	
13		63		113	
14		64		114	
15		65		115	
16		66		116	
17		67		117	
18		68		118	
19		69		119	
20		70		120	
21		71		121	
22		72		122	
23		73		123	
24		74		124	
25		75		125	
26		76		126	
27		77		127	
28		78		128	
29		79		129	
30		80		130	
31		81		131	
32		82		132	
33		83		133	
34		84		134	
35		85		135	
36		86		136	
37		87		137	
38		88	\ 1	138	
39		89		139	
40		90		140	
41		91		141	
42		92		142	
43		93		143	
44		94		144	
45		95	X 2	145	
46		96	X 2	146	
47		97		147	
48		98		148	
49		99	⑤	149	
50		100		150	

Initials: Recorder: MD
Lab Check: KU
Data Entry: A: KU
B: JS

SP2013083

T MARINE TRAWL SURVEY
ATA AND PHYSICAL DATA

Also: AC2013006

Other Sample #: ____________

(Tow # of Day): 1

DATE: 06/13/2013

SITE (strata): 1133 (S4) *

	PART A	PART B
TIME START (military):	~~0733~~	08:06
DURATION (minutes):	~~5~~	30
NAV. DATA: B START	~~07:33:58~~	08:06:40
STOP	~~07:38:53~~	08:37:07

METER YSI M30 ✓ CTD___ OTHER___

LAT 41° 11 .41

LONG 72° 23 .77

DEPTH ft: 111 m: 33.8

	@ 1m	@ 33.3 m
TEMP (C)	15.5	14.2
SAL	27.7	29.7
COND	35.23	36.43

LENGTH OF WIRE 600' / "B" @ 500'

	START A		STOP A
LAT	~~__° __.__~~	LAT	~~__° __.__~~
LONG	~~__° __.__~~	LONG	~~__° __.__~~

	START B		STOP B
LAT	41° 11.75	LAT	41° 11.45
LONG	72° 23.29	LONG	72° 23.55

WEATHER CONDITIONS/QC COMMENTS:

NET # "C"

QC CHECK FOR SALINITY

SCALE CAL. USING ________ kg STD. WT.

Sal. Stan.	YSI	Diff	Pre-Cal. Wt.	Cal. Fit Values	Post-Cal. Wt.	Temp. Log. Deployed?: ______ Temp.:
30.88	26.8			14	22.68	

FILL OUT IF SITE MOVED, TOW IS SHORT, OR IN PARTS:

Original Site:	0830	Why moved:	EPA Tow duplicate	(P, H, U)
Original Strata:	S4	Gear Interaction:		(PV, PE, RI)
Attempts:		Pots:		(A, I, U)
Parts:		Number of Pots:		(P#, T#)

CREW: (list if first tow of day):
Kurt, Rodney, Wes, Eric, Martha, John

P: Pots, H: Hangs, U: Unknown
PV: pots visible, PE: pots entangled, RI: recently informed
A: Active, I: Inactive, U: Unknown
P1, P2, etc. for pots; T1, T2, etc, for trawls

COMMENTS: Site 0830 moved from selected site list
to 1133 for cooperative EPA / LIS Dumpsites
Study - See AC2013001 - AC2013006
0738 - stopped tow - caught on dunes
→ new towlog "083b" - This is our 4th attempt (2 yesterday) Hitting Dum 2/ESW To
Scrap part "A" - No Time (5min)
Rename Tow file to SP2013083_scrap

Recorder: KV
Lab check: L.W.
Data entry: A.C.

SPRING SURVEY-TOTAL COUNT / WEIGHT

SAMPLE #: SP2013083 AC2013006 (tow # of day: 1) **DATE:** 6/13/13 **SITE #:** 11 33

B JS

Species	# Counted / Meas / to Lab / Scales	Total	Weights	Total
BKF				
BLF	1 lab	1	1.85	1.9
PGY	4m + 13lab	17	4.31 +0.1 +0.1	4.5
SFL				
STB	1m	1	3.35	3.4
WKF				
WFL	1m	1	0.28	0.3
ALW				
ASD				
BUT				
FSF	2m	2	0.40	0.4
LSK	19m	19	11.99	12.0
NSR	15m	15	2.18	2.2
RCK				
RED				
SMD	2m	2	5.6	5.6
SPH				
SSR	2m	2	0.71	0.7
WHI				
WPF	11m	11	2.24	2.2
WSK	17m	17	19.0	19.0

TO LAB / COMMENTS: 1 BLF
13 PGY ✓L.W.

Recorder: KG
Lab check: SW
Data entry: A:SW

INVERTEBRATE / ALGAE COUNTS AND WEIGHTS

SAMPLE#: SP2013083 (tow # of day: 1) DATE: 6/13/13 SITE#: 1133 BT

SPECIES	COUNT	TOT CNT	WEIGHT	TOT WT
ALGAE, MIXED (ALG)	no count		0.1	0.1
KELP (KLP)	no count			
ULVA (ULV)	no count		0.1	0.1
BUSHY BRYOZOA (BBI)	no count			
CRABS, ROCK (RCR)	no count			
BLUE (BCR)				
LADY (LCR)	no count			
F.C. HERMIT (HER)	no count		0.1	0.1
SPIDER (SPI)	no count		0.23	0.2
HORSESHOE (HOR)				
MUD (BMC)	no count			
LION'S MANE (JEL)				
LOBSTER (LOB)				
MANTIS SHRIMP (MAN)				
N. MOON SHELL (NMS)	no count			
SQUID, LONG-FINNED (SQI)	5 m	5	0.29	0.3
STARFISH (STF)	no count			
WHELK, CHANNEL (CHW)				
KNOBBED (KNW)				
HSA			0.2	0.2
FUC			0.1	0.1

TO LAB, COMMENTS:

Recorder: JS
Error check: E.W.
Data Entry: A: E.W.
B: JS

SAMPLE #: SP2013-083 (Tow # of day: 1) **DATE:** 6/13/13 **SITE:** 11-33

97M 65cm

96M

LEN	✓ SMD	✓ STB	✓ PGY	✓ LSK	LEN	✓ WFL	✓ SQI	✓ FSF	LEN
1					1				1
2					2				2
3					3				3
4					4				4
5					5				5
6					6				6
7					7				7
8					8				8
9					9				9
10					10				10
11					11				11
12					12		4		12
13					13				13
14					14				14
15					15				15
16					16				16
17			1		17				17
18			1		18				18
19					19				19
20			1		20				20
21					21				21
22					22				22
23					23				23
24					24				24
25					25				25
26					26			1	26
27			1		27	1			27
28					28				28
29					29				29
30					30				30
31					31			1	31
32					32				32
33					33				33
34					34				34
35					35				35
36					36				36
37					37				37
38					38				38
39					39				39
40					40				40
41				2	41				41
42					42				42
43				2	43				43
44				5	44				44
45				5	45				45
46				2	46				46
47					47				47
48				1	48				48
49				2	49				49
50					50				50
	②	①	④	⑲		①	⑤	②	

→

Recorder:
Error check: T.U
Data Entry: A:[illegible]

SAMPLE #: SP2013-083 (Tow # of day: 1) **DATE:** 6/13/13 **SITE:** 11-33 [illegible]

SSR

LEN		LEN		LEN
1		1		1
2		2		2
3		3		3
4		4		4
5		5		5
6		6		6
7		7		7
8		8		8
9		9		9
10		10		10
11		11		11
12		12		12
13		13		13
14		14		14
15		15		15
16		16		16
17		17		17
18		18		18
19		19		19
20		20		20
21		21		21
22		22		22
23		23		23
24		24		24
25		25		25
26		26		26
27		27		27
28	\ 1	28		28
29	\	29		29
30		30		30
31		31		31
32		32		32
33		33		33
34		34		34
35		35		35
36		36		36
37		37		37
38		38		38
39		39		39
40		40		40
41		41		41
42		42		42
43		43		43
44		44		44
45		45		45
46		46		46
47		47		47
48		48		48
49		49		49
50		50		50

②

Recorder: MD
Error check: L.W.
Data Entry: A: LW
B: JS

SAMPLE #: SP2013-083 (Tow # of day: 1) **DATE:** 6/13/13 **SITE:** 11-33

LEN	NSK		>50		NPF		NSR		LEN					LEN
1			\	1					1					1
2									2					2
3			\	1					3					3
4			\	1					4					4
5									5					5
6									6					6
7			\	1					7					7
8									8					8
9							\	1	9					9
10			\	1					10					10
11			\	1			X	2	11					11
12									12					12
13									13					13
14							\	1	14					14
15									15					15
16									16					16
17									17					17
18									18					18
19			\	1					19					19
20									20					20
21							X	2	21					21
22			\	1	\	1			22					22
23					\	1			23					23
24					\	1	\	1	24					24
25					\	1	\	1	25					25
26							\	1	26					26
27					XX	4	\	1	27					27
28					X\	3	X	2	28					28
29							\	1	29					29
30							\	1	30					30
31									31					31
32							\	1	32					32
33									33					33
34									34					34
35	X	2							35					35
36	\	1							36					36
37									37					37
38									38					38
39									39					39
40	\	1							40					40
41									41					41
42	\	1							42					42
43	X	2							43					43
44									44					44
45									45					45
46									46					46
47									47					47
48	X	2							48					48
49									49					49
50									50					50

11

15

17

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APPENDIX F – FISHING ACTIVITY SURVEY

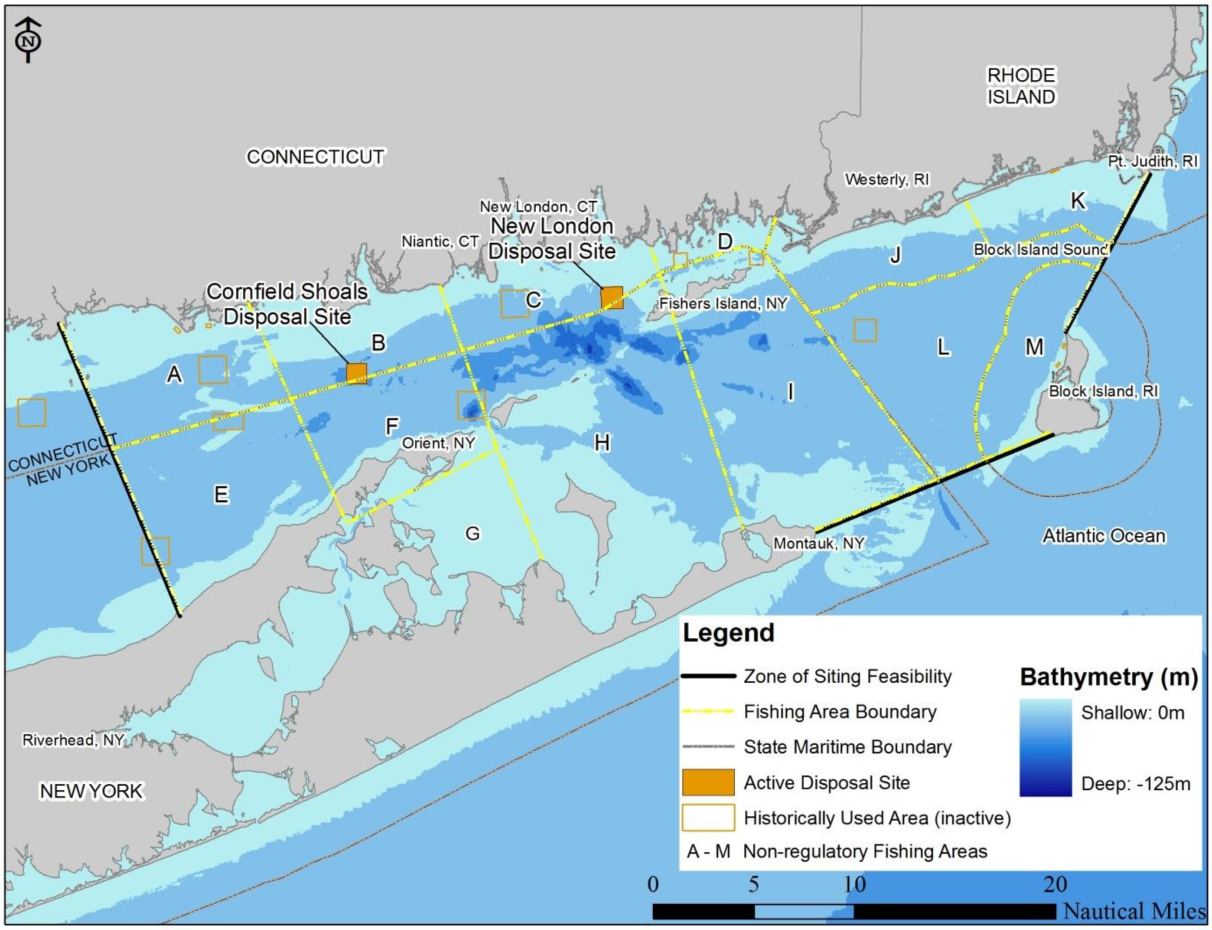
Eastern Long Island Sound Fishing Activities Survey

Fall/Winter 2013

Tetra Tech, Inc. is requesting your assistance to help us investigate the locations and activities of commercial and recreational fishing in eastern Long Island, Block Island, and Rhode Island Sounds. Your **anonymous** answers, along with other fisheries and biological data, will be used to evaluate fishery use in these areas. This data will be used to characterize fisheries and lobster habitat in support of the U.S. Environmental Protection Agency's (EPA's) preparation of a Supplemental Environmental Impact Statement (SEIS) for the potential designation of one or more dredged material disposal sites in eastern Long Island Sound. Any information we receive will remain confidential (i.e., not associated with specific fishermen or vessel names). We appreciate hearing about your experiences whether you are currently fishing or not. **Thank you** in advance for your time and for your candid responses.

Questions:

1. What is your occupation or relationship to the fishing industry?
    a. Commercial fisherman or lobsterman
    b. Recreational fisherman
    c. Charter boat operator
    d. Other (Please specify): ____
2. How long have you been fishing in Long Island Sound? (Choose one.)
    a. 0–5 years
    b. 5–15 years
    c. 15–30 years
    d. 30+ years
3. Have you actively fished during 2013?
    a. Yes
    b. No; the last year I actively fished was: ____________
4. Which species do you (or did you) primarily target?
    a. Lobster
    b. Scup
    c. Flounder
    d. Tautog
    e. Mollusks (e.g., clams, scallops, mussels, conch)
    f. Other (Please specify): ____
5. Throughout your career, have you shifted your target species?
    a. No.
    b. Yes.
        i. From what species to what species?:____
        ii. Why (e.g., market demand, decreased catch/quality)?: ___________________________
        iii. When did you make this shift?: ____
6. Please refer to the map on the following page to answer part a and b. Note that the grey lines represent the boundaries of state waters. The areas delineated by dashed yellow lines (labeled with the letters A–M) have been generated for the sole purpose of identifying locations, and do not represent official fishing areas.



a. In the following table, please indicate what gear you use in each area during each season. Please write in **Active** (e.g., trawl, dredge, purse seine), **Passive** (e.g., gillnets, longline), **Pots/traps**, or **specify** a different gear type in each relevant box. (Fill in all that apply.)

Area	**Spring**	**Summer**	**Fall**	**Winter**
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				

b. In which areas do you expend less than 25 percent of your overall fishing effort? (Choose all that apply.)
   - i. A
   - ii. B
   - iii. C
   - iv. D
   - v. E
   - vi. F
   - vii. G
   - viii. H
   - ix. I
   - x. J
   - xi. K
   - xii. L
   - xiii. M

7. When do you fish? (Indicate the percent of your fishing effort applied by month.)

Month	**Percent Effort**
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

8. During which months do you **not** have gear in the water?

Month	**Select**
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	
I fish year-round	

9. How many other fishermen actively fish in the area where you spend the majority of your time fishing? (Choose one.)
    a. 0–3
    b. 3–10
    c. 10+
10. If you use **active** gear, how long do you fish your gear before emptying your net?
    a. <30 minutes
    b. 30-90 minutes
    c. >90 minutes
11. Has this trawl time changed over your fishing career?
    a. No, the trawl time has not changed.
    b. Yes, trawl time has increased.
    c. Yes, trawl time has decreased.
12. If you use **passive** gear, in a typical set, how long does the gear remain in the water? (Choose one.)
    a. <1 day
    b. 1–3 days
    c. 4–7 days
    d. 7–14 days
    e. 14+ days
13. If you use **pots** or **traps**, do you use warp (lines connecting pots) to haul out your gear? (Choose one.)
    a. Yes
    b. No
    c. Sometimes
14. Throughout your career, have you noticed any of the following changes in catches of your *target species* (as identified in question 4)?
    a. Quantity: (Choose one.)
        i. No change.
        ii. Yes – increase.
        iii. Yes – decrease.
    b. Size: (Choose one.)
        i. No change.
        ii. Yes – increase.
        iii. Yes – decrease.
    c. Location: (Provide detail if applicable.)
        i. No change.
        ii. Fishing effort has diminished in this area (specify): ________________________________
        iii. Fishing effort has increased in this area (specify): ________________________________
    d. Change in gender composition of catch: (Choose one.)
        i. No change
        ii. Proportion of females has increased
        iii. Proportion of males has increased
    e. Health of catch: (Choose one.)
        i. No change
        ii. Health has improved
        iii. Health is poorer
15. What species do you see in your bycatch, and in what percentage? (Please specify. For example, 60% butterfish, 25% spider crabs, 15% scup)____

16. What changes have you noticed in the composition of your bycatch (e.g., changes in quantity, quality, and/or size of various species)? (Choose one and provide detail if applicable.)
    a. No change.
    b. Bycatch composition has changed in the following ways (specify):
    ____
17. If you have experienced gear fouling, how and when (seasonally or annually) has it occurred? (Choose one and provide detail if applicable.)
    a. I have not had any gear fouling.
    b. Fouling has occurred in the following ways: ____
18. Have you noticed any changes in the frequency of needing to clean your gear?
    a. No change.
    b. Yes – increase.
    c. Yes – decrease.
19. Do you fish within 0.5 nautical miles (nm) of the center of an existing dredged material disposal site? (Choose one.)
    a. Yes, regularly, near (specify site name): ____
    b. Yes, occasionally, near (specify site name): ____
    c. No.
    d. I don't know.
20. What have you noticed about species diversity in your catch within 0.5 nm of the center of a dredged material disposal site?
    a. I do not fish near disposal sites.
    b. I have not noticed a difference in fishing near dredged material disposal sites.
    c. Other (specify): ____
21. Please provide any additional information or suggestions that you think might be helpful:

    ____

    ____

    ____

    ____

    ____

22. **Optional.** If you would like to speak with us further regarding fishing activity in eastern Long Island Sound or regarding our findings, please call Deena Anderson, a Tetra Tech biologist, at **(603) 314-0760** between 9:00 a.m. and 5:00 p.m. Monday through Friday or by email: **Deena.Anderson@tetratech.com**. If you prefer to be contacted, include your contact information (phone or email) below:

    ____

APPENDIX G – FISHING ACTIVITY SURVEY RESULTS

(Excel Spreadsheet; Provided as Electronic Copy Only)

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