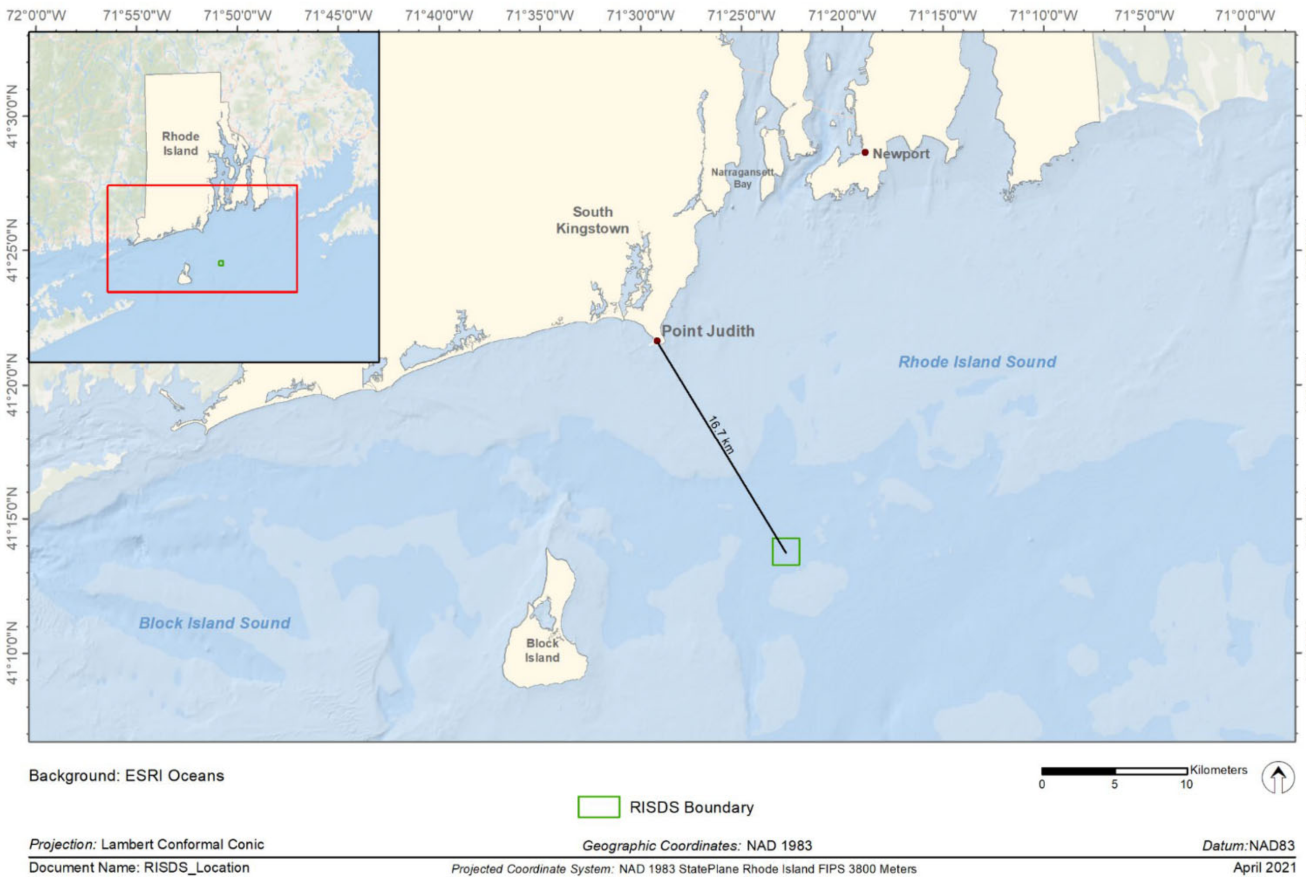
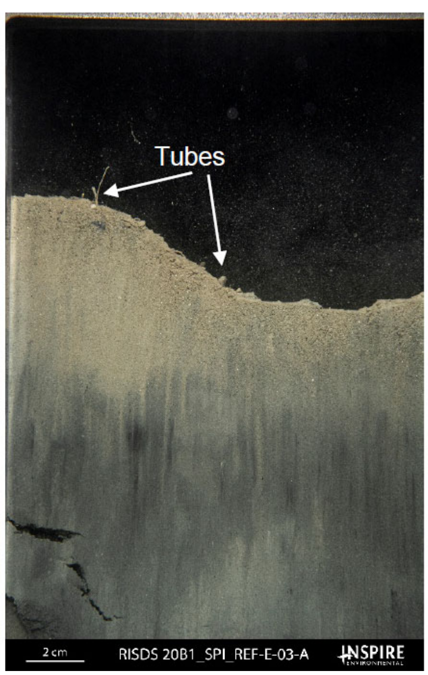
Monitoring Survey at the Rhode Island Sound Disposal Site May/June 2020

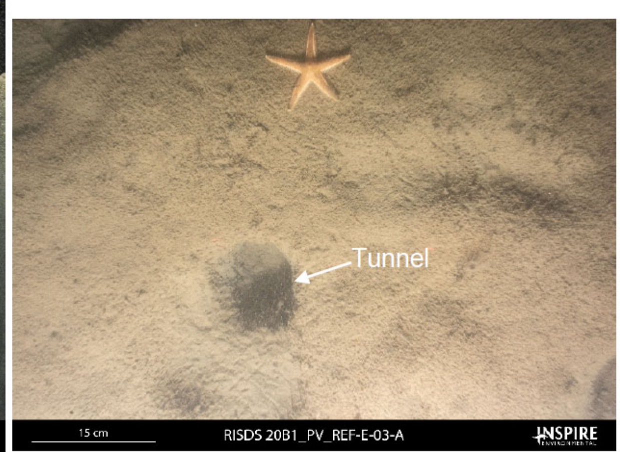
Disposal Area Monitoring System - DAMOS



US Army Corps of Engineers
New England District

DAMOS
DISPOSAL AREA MONITORING SYSTEM





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13. ABSTRACT

Since the most recent Disposal Area Monitoring System (DAMOS) survey in 2015, approximately 366,000 m^3 (479,000 yd^3) of dredged material was placed at Rhode Island Sound Disposal Site (RISDS). The overall objective of the 2020 RISDS survey was to conduct a combined confirmatory and focused baseline survey in preparation for increased use of RISDS for the anticipated Providence Harbor maintenance dredging project. The survey was designed to characterize the seafloor topography and large-scale surficial features, assess surficial sediments and benthic recolonization status, and to characterize surficial sediment quality and benthic community status.

The 2020 RISDS survey included collection of high-resolution acoustic bathymetric data, sediment profile and plan view imaging (SPI/PV), and sediment grab sampling. The acoustic survey covered the entire RISDS, three reference areas, and a previously established U.S. Environmental Protection Agency (EPA) reference point. SPI/PV imagery was collected at 21 stations within RISDS and five stations in each of the three reference areas. Stations within RISDS were distributed across seven areas, including five historical disposal areas (RISDS-A, -B, -C, -D, and -E), a recent disposal area (RISDS-N), and an area that has experienced limited disposal in the past (RISDS-NW). Sediment grab samples collected at a subset of the SPI/PV stations including at RISDS-N, -B, and -E, and the three reference areas were analyzed for grain size, sediment chemistry, and benthic community analysis (BCA).

The bathymetric data revealed prominent topographic features at RISDS including a berm along the western boundary leading to a high-relief northern mound, consistent with previous survey results. Overall, seafloor elevation increases were observed at reported disposal locations based on disposal event records indicating that most dredged material was placed at targeted locations. This included two new small low-relief mounds in the northeast corner and a broad oval-shaped area to the southwest of northern mound RISDS-N. Backscatter data confirmed the presence of dredged material at reported disposal locations and revealed numerous thin trails distinct from the ambient seafloor throughout RISDS, particularly through the central region. These features are believed to be derived from the release of small amounts of dredged material from transiting scows following the primary disposal operation. Similar trails were observed during the 2013 survey and appear to be acoustically ephemeral. These linear features do not appear in the bathymetric data, indicating a lack of measurable relief associated with the discharge.

Benthic recolonization as informed by SPI/PV imagery was observed to be progressing along an expected trajectory. Maximum infaunal successional stage at RISDS stations was found to be statistically equivalent to that measured at the reference areas. Hard bottom habitat was observed at RISDS-N and RISDS-C, consisting of cobble encrusted primarily with bryozoa and hydroids. Coastal bivalve shells including oyster and bay scallop shells were observed at several stations indicating non-native material.

Measured aRPD depths at all RISDS sampling areas were shallow, and significantly lower than those measured at the reference areas. The 2020 aRPD depths were similar to those measured in 2013, suggesting continued high benthic respiration rates in combination with limited infaunal bioturbation activity, likely resulting from high organic matter and physical disturbance. The evident lack of improvement in aRPD over time, particularly in the southern and central areas where no recent disposals were targeted, may suggest effects of the inadvertent widespread release of small amounts of dredged material in this area. This likely depressed aRPD depths but allowed some Stage 3 infauna, although patchy, to persist.

Benthic community analysis of sediments showed overall lower abundances of infauna at RISDS stations compared with the reference areas, but similar species diversity. Infaunal species composition appeared dependent primarily on sediment type and secondarily on whether the sample was collected at RISDS or a reference area.

Concentrations of measured chemical analytes in the sediments were generally similar at RISDS and the reference areas and were generally below ER-L national guidance values. Given the low values measured across RISDS and that values were similar between RISDS and reference areas, chemical contaminants are not likely influencing the benthic recolonization process.

The results of the 2020 survey at RISDS led to the following recommendations:

R1: Future dredged material placement should avoid the large, high-relief RISDS-N mound peak area to avoid the potential for hydrodynamic transport of dredged materials.

R2: Future dredged material placement should be limited to specific target areas to limit the potential for benthic impacts in other portions of RISDS.

R3: Expansion of the berm along the northeast and eastern boundary of RISDS should be continued for future containment of larger dredged material projects in the center of the site.

R4: All three of the current reference areas are deeper than RISDS and consist of soft sediments. Large areas of hard bottom habitat are present within RISDS and are not comparable to existing reference sites. New reference areas that are more similar in depth and sediment type to RISDS should be identified and monitored.

14. SUBJECT TERMS DAMOS, dredged material, RISDS, Rhode Island Sound, acoustic, multibeam, SPI, PV, benthic, infauna

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__Note on units of this report__: As a scientific data summary, information and data are presented in the metric system. However, given the prevalence of English units in the dredging industry of the United States, conversions to English units are provided for general information in Section 1.0. A table of common conversions can be found in Appendix A.

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LIST OF ACRONYMS

aRPD	Apparent redox potential discontinuity
ASCII	American Standard Code for Information Interchange
BCA	Benthic Community Analysis
CI	Confidence interval
CLT	Central Limit Theorem
CMECS	Coastal and Marine Ecological Classification Standard
DAMOS	Disposal Area Monitoring System
dB	Decibels
DGPS	Differential Global Positioning System
EGN	Empirical Gain Normalization
ER-L	Effects range low
ER-M	Effects range median
FGDC	Federal Geographic Data Committee
GIS	Geographic information system
GPS	Global Positioning System
GRD	Gridded data
LPIL	lowest practicable taxonomic level
MBES	Multibeam echosounder
MDL	Method detection limit
MLLW	Mean Lower Low Water
MRU	Motion reference unit
NAD83	North American Datum of 1983
NAE	USACE, New England Division
NEF	Nikon Electronic Format
nMDS	non-metric multidimensional scaling
NOAA	National Oceanic and Atmospheric Association
NOAA CO-OPS	NOAA’s Center for Operational Oceanographic Products

NOAA CCOM/JHC	NOAA's Center for Coastal and Ocean Mapping Joint Hydrographic Center
NOAA NCEI	NOAA's National Centers for Environmental Information
NOS	National Ocean Service
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PRHMDP	Providence River and Harbor Maintenance Dredging Project
PSD	Photoshop Document
PV	plan View
QAPP	Quality Assurance Project Plan
RISDS	Rhode Island Sound Disposal Site
RTK	Real time kinematic
R/V	Research vessel
SD	Standard deviation
SMMP	Site Management and Monitoring Plan
SOP	Standard Operating Procedures
SPI	Sediment Profile Imaging
SQG	Sediment quality guideline
TIF	Tagged image file
TOC	Total organic carbon
TZM	Tide Zoning Model
USACE	U.S. Army Corps of Engineers
USEPA/EPA	U.S. Environmental Protection Agency
VDATUM	Vertical Datum Transformation

EXECUTIVE SUMMARY

Since the most recent Disposal Area Monitoring System (DAMOS) survey in 2015, approximately 366,000 m^3 (479,000 yd^3) of dredged material was placed at Rhode Island Sound Disposal Site (RISDS). The overall objective of the 2020 RISDS survey was to conduct a combined confirmatory and focused baseline survey in preparation for increased use of RISDS for the anticipated Providence Harbor maintenance dredging project. The survey was designed to characterize the seafloor topography and large-scale surficial features, assess surficial sediments and benthic recolonization status, and to characterize surficial sediment quality and benthic community status.

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The bathymetric data revealed prominent topographic features at RISDS including a berm along the western boundary leading to a high-relief northern mound, consistent with previous survey results. Overall, seafloor elevation increases were observed at reported disposal locations based on disposal event records indicating that most dredged material was placed at targeted locations. This included two new small low-relief mounds in the northeast corner and a broad oval-shaped area to the southwest of northern mound RISDS-N. Backscatter data confirmed the presence of dredged material at reported disposal locations and revealed numerous thin trails distinct from the ambient seafloor throughout RISDS, particularly through the central region. These features are believed to be derived from the release of small amounts of dredged material from transiting scows following the primary disposal operation. Similar trails were observed during the 2013 survey and appear to be acoustically ephemeral. These linear features do not appear in the bathymetric data, indicating a lack of measurable relief associated with the discharge.

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1.0 INTRODUCTION

INSPIRE Environmental (INSPIRE) conducted a monitoring survey at the Rhode Island Sound Disposal Site (RISDS) in May and June 2020 as part of the U.S. Army Corps of Engineers (USACE) New England District (NAE) Disposal Area Monitoring System (DAMOS) Program. DAMOS is a comprehensive monitoring and management program designed and conducted to address environmental concerns surrounding the placement of dredged material at aquatic disposal sites throughout the New England region. An introduction to the DAMOS Program and RISDS, including brief descriptions of previous dredged material disposal and site monitoring activities, is provided below.

1.1 Overview of the DAMOS Program

The DAMOS Program features a tiered management protocol designed to ensure that any potential adverse environmental impacts associated with dredged material disposal are promptly identified and addressed (Germano et al. 1994). For over 40 years, the DAMOS Program has collected and evaluated dredged material disposal site data throughout New England. Based on these data, patterns of physical, chemical, and biological responses of seafloor environments to dredged material disposal activity have been documented (Fredette and French 2004).

DAMOS monitoring surveys fall into two general categories: confirmatory studies and focused studies. The data collected and evaluated during these studies provide answers to strategic questions in determining next steps in the disposal site management process. DAMOS monitoring results guide the management of disposal activities at existing sites, support planning for use of future sites, and evaluate the long-term status of historical sites (Wolf et al. 2012).

Confirmatory studies are designed to test hypotheses related to expected physical and ecological response patterns following placement of dredged material on the seafloor at established, active disposal sites. Two primary goals of DAMOS confirmatory monitoring surveys are to document the physical location and stability of dredged material placed into the aquatic environment and to evaluate the biological recovery of the benthic community following placement of dredged material. Several survey techniques are employed in order to characterize these responses to dredged material placement. Sequential acoustic monitoring surveys (including bathymetric, acoustic backscatter, and side-scan sonar data collection) are performed to characterize the height and spread of discrete dredged material deposits or mounds created at open water sites as well as the accumulation/consolidation of dredged material into confined aquatic disposal cells. Sediment Profile and Plan View Imaging (SPI/PV) surveys are performed in confirmatory studies to provide further physical characterization of the material and to support evaluation of seafloor (benthic) habitat conditions and recovery over time. Each type of data collection activity is conducted periodically at disposal sites, and the conditions found after a defined period of disposal activity are compared with the long-term data set at specific sites to determine the next step in the disposal site management process (Germano et al. 1994).

Focused studies are periodically undertaken within the DAMOS Program to evaluate candidate sites, as baseline surveys at new sites, to evaluate inactive or historical disposal sites, and to contribute to the development of dredged material management and monitoring techniques. Focused DAMOS monitoring surveys may also feature additional types of data collection activities as deemed appropriate to achieve specific survey objectives, such as grab or core sampling of sediment for physical/chemical/biological analyses, sub-bottom profiling, or video imaging.

The 2020 RISDS survey contained elements of both confirmatory and focused surveys to support the update of the Site Management and Monitoring Plan (SMMP) (USEPA 2004). The survey featured confirmatory monitoring of areas that had recently received dredged material and focused collection of sediment samples for physical, chemical, and biological analyses.

1.2 Introduction to the Rhode Island Sound Disposal Site

The Rhode Island Sound Disposal Site (RISDS) is located south of Narragansett Bay and approximately 16.7 km (10.4 mi) south of Point Judith, Rhode Island (Figure 1-1). The site is defined as an 1800 × 1800 m (5900 × 5900 ft) area on the seafloor centered at 41°13.850' N, 71°22.817' W (NAD 83). RISDS was identified as an open-water disposal site in 1997 (USACE 2001a), began receiving dredged material from the Providence River and Harbor Maintenance Dredging Project (PRHMDP) in 2003 (Carey et al. 2015), and was formally designated as an open-water disposal site for dredged material from Rhode Island and other surrounding harbors in Massachusetts and Connecticut in 2004 (40 CFR Part 228).

The underlying topography of RISDS features a broad topographic depression with water depths ranging from 34 to 39 m (111 to 128 ft; Figure 1-2). Native sediments at RISDS have been observed to range from glacially derived till to soft, silty sand (USEPA

2004). RISDS features a berm rising 1 to 4 m above the seafloor along the western side, a mound in the northern area (within the RISDS-N sampling area) rising up to 12 m (~40.0 ft) above the seafloor and several smaller low-relief areas rising 1 to 2 m (~3.0 - 6.5 ft) above the seafloor located throughout the site. The berm and low-relief areas were formed by dredged material placement activities conducted between 2003 and 2013, as described below.

1.3 Historical Dredged Material Disposal Activity

Recorded placement of dredged material at RISDS began from 2003 through 2005 with the placement of 4 million m^3 (5 million yd^3) of dredged material from the PRHMDP (yellow points in Figure 1-3; Table 1-1). This total dredged material volume was composed primarily of two different types of material; (1) maintenance material from the navigation channel and (2) underlying native material generated from the excavation of confined aquatic disposal (CAD) cells beneath Providence River. The underlying native material was composed primarily of glacial sediments and was placed mainly along the western boundary of RISDS to create a continuous ridge or berm of sediment (SAIC 2004). This berm was created to enhance the capacity of the natural bottom depression located in the southeastern quadrant of the disposal site and to limit the lateral spread of disposed unconsolidated sediment. The maintenance material dredged from the channel and additional material from non-federal projects was directed to a series of disposal points across the site, including target disposal areas RISDS-A through -E, to create a relatively even deposit.

From 2008 through 2015, a total of 866,100 m^3 (1,123,800 yd^3) of dredged material was reportedly placed at and near the northern mound area of RISDS from three projects (Figure 1-3; Table 1-1). Most of this dredged material (76%) came from the New Bedford Harbor CAD cell construction project and consisted primarily of glacial till and clay. In addition, dredged material from the Port of Davisville that consisted of primarily fine sand was placed at RISDS along with a relatively small amount of material from Great Harbor in Woods Hole, MA.

1.4 Previous RISDS Monitoring Events

Numerous acoustic, SPI/PV and other surveys were conducted prior to, during and immediately following the major Providence River dredging project (1997-2005; Carey et al. 2015; Table 1-2). Three additional RISDS monitoring surveys were conducted in 2009, 2013, and 2015. In 2009, a SPI/PV survey was conducted to continue assessment of the benthic recolonization status following placement of sediment from Providence River.

In 2013, an acoustic survey and a combined SPI/PV and sediment grab sampling survey was conducted to assess the benthic recolonization status of recent dredged material placement and to support the RISDS SMMP. The acoustic survey confirmed the persistence of the western berm created previously through dredged material disposal activity and found evidence of limited sediment transport since the 2009 survey. Stage 3 successional stage was present at all RISDS stations in 2013, although abundances of deep deposit-feeding infauna were lower at the disposal site compared to the reference areas. This likely attributed to the significantly shallower aRPD depths measured at the disposal site compared to the reference areas; a finding that was consistent with results from previous survey years.

In 2015, an acoustic-only survey was conducted over the north-central portion of the site to characterize the seafloor topography after recent dredged material placement and to aid in planning the next season's placement of dredged material. The survey confirmed targeted placement of dredged material to the northeast of the existing disposal berm along the western boundary. The 2015 survey found up to 11 m of material accumulation on the northern mound since the 2013 survey. The 2015 survey report recommended that future material be spread more widely to increase the spatial extent of the berm (Sturdivant and Carey 2017).

1.5 Recent Dredged Material Disposal Activity

Since the most recent monitoring survey in October 2015, approximately 366,000 m^3 (479,000 yd^3) of dredged material was placed at RISDS from four projects (Figure 1-4; Table 1-1). The projects were the Town of Harwich, Quonset, Port of Davisville, and New Bedford Lower Harbor. Dredged material placement locations were reported at sampling area RISDS-N, to the southwest of RISDS-N, and at two new locations in the northeast corner of RISDS.

A detailed record of dredged material disposal activity at RISDS for the period from November 2017 to June 2020, including the origin and volume of dredged material, and the disposal location, is provided in Appendix B. No material was placed at the site in 2016.

1.6 2020 Survey Objectives

The overall objective of the 2020 RISDS survey was to conduct a combined confirmatory and focused baseline survey in preparation for increased use of RISDS as part of the upcoming Providence Harbor dredging project and to support the update of the SMMP. This survey objective is consistent with the recommendations of the RISDS 2013 survey report (Carey et al. 2015). Specifically, the 2020 survey was designed to address the following three objectives:

- To characterize the seafloor topography and surficial features throughout the site and reference areas by completing a high-resolution acoustic survey.
- To assess surficial sediments and benthic colonization status by completing a SPI/PV imaging survey at active disposal and reference areas.
- To characterize the surficial sediment quality and benthic community status of the site and associated reference areas through the collection of sediment for chemical and biological (benthic community) analyses.

In the 2020 survey sampling design, there were ten distinct sampling areas, three of which were categorized as reference locations (REF-E, REF-NE, REF-SW) and seven were within the RISDS boundary (RISDS-A, -B, -C, -D, -E, -N, and -NW) (Figure 1-5).

Table 1-1.

Estimated Volume of Dredged Material Placed at RISDS
from April 2003 to June 2020

Project	Disposal Dates	Volume (m^3)	Volume (yd^3)
Providence River and Harbor Maintenance Dredging	04/2003 to 01/2005	4,062,000	5,312,000
National Marine Fisheries Service at Great Harbor, Woods Hole, MA - Maintenance Dredging	11/2008 to 01/2009	23,200	30,400
Port of Davisville, Quonset Point, RI - Improvement Dredging	01/2012 to 01/2013	196,000	257,000
New Bedford Harbor CAD Cell Construction Material	05/20/2013 to 08/25/2013*	163,000	213,200
New Bedford Harbor CAD Cell Construction Material	08/28/2013 to 07/19/2015*	483,900	632,900
Quonset Business Park, Port of Davisville, New Bedford Harbor, Town of Harwich	11/2017 to 6/2020	366,000	479,000
Total		**5,294,000**	**6,924,000**

*Acoustic surveys performed 08/27/2013 and 10/14/2015

Table 1-2.

Overview of DAMOS Survey Activities in Rhode Island Sound since 1997

Date	Purpose of Survey	Acoustic Surveys	SPI Stations	Additional Studies	Reference
June 1997	Evaluation of potential disposal sites		18		SAIC 1997[a]
Nov 1999	Characterize benthic resources and sediment at potential dredged material disposal sites		35		SAIC 2000[b]
Sept 2001	Rhode Island regional long-term dredged material disposal site evaluation		RISDS - 9 REF Areas - 9		Battelle 2002
Feb 2003	Baseline bathymetry survey in support of PRHMDP	Multibeam 4000 x 3800 m			SAIC 2004
July 2003	First post-disposal monitoring survey	Single-beam 1900 x 1900 m			SAIC 2004
Sept 2003	Second post-disposal monitoring survey	Single-beam 1900 x 1900 m Towed Side-scan sonar 2900 x 2900 m[c]			SAIC 2004
Oct 2003	Assessment of surface sediment composition within RISDS and surrounding Area W		11	Towed video 8 transects	SAIC 2004
Apr 2004 Sept 2004	Track and assess suspended sediment plume			ADCP OBS drogues, water analysis	SAIC 2005a SAIC 2005b

Date	Purpose of Survey	Acoustic Surveys	SPI Stations	Additional Studies	Reference
Feb 2004 May 2004 Sept 2004 Aug 2005	Post-disposal monitoring in support of PRHMDP	Single-beam 1900 x 1900 m			Unpublished DAMOS data ENSR 2008
July 2005	Assess benthic recolonization status		RISDS – 30 (RISDS-A thru -E, BE[d]) Ref Areas - 15	Infauna Analysis	ENSR 2007
Aug 2005 Sept 2005 Nov 2005	Assess post-disposal lobster abundance			Lobster trapping	Valente et al. 2007
Oct 2009	Assess benthic recolonization status		RISDS – 30 (RISDS-A thru -E, BE[d]) Ref Areas - 15		ENSR 2007
Aug 2013	Assess full-site seafloor topography Assess benthic recolonization status	Multibeam 2000 x 2000 m	RISDS – 15 (RISDS-B, -C and -D) Ref Areas - 15	Infauna Analysis	Carey et al. 2015
Oct 2015	Post-disposal monitoring in support of New Bedford Harbor CAD Cell Construction	Multibeam 600 x 1000 m			Sturdivant and Carey 2017
May/June 2020	Assess full-site seafloor topography Assess benthic recolonization status Support SMMP update	Multibeam 2000 x 2000 m RISDS 600 x 600 m Ref areas	RISDS – 21 (RISDS-A, -B, -C, -D, -E, -N, -NW) Ref Areas - 15	Infaunal Analysis Grain Size PCBs, PAHs, Metals, TOC	Current study

Notes:
a - Dimensions of site 69b and 69a were different from current configuration.
b - Dimensions of site 69b and 69a were consistent with current boundaries.
c - Area W was 2900 x 2900 m with RISDS included in the southeast quadrant.
d - BE refers to the berm area.

2.0 METHODS

Due to health and safety restrictions associated with the SARS COVID-19 pandemic, the 2020 RISDS survey data collection was conducted as two separate survey efforts. The Sediment Profile and Plan View Imaging (SPI/PV) survey was conducted by INSPIRE Environmental onboard the 92-foot *R/V Northstar Challenger* on 6 May 2020. The acoustic data collection and sediment grab sampling survey was conducted by CR Environmental onboard the 55-foot *R/V Jamie Hanna* on 12-14 June 2020.

2.1 Navigation and Onboard Data Acquisition

For the acoustic and sediment grab sampling surveys, to ensure field team social distancing associated with COVID-19 protocols, a Conex Box laboratory van was installed on the *R/V Jamie Hanna*. The Conex Box created separate workspaces for the scientific team and the vessel crew. Navigation and other system components were installed in the van. Power was supplied from the vessel's generator. The survey crew was restricted to the Conex Box laboratory van while the vessel crew was restricted to the pilothouse.

Navigation onboard the *R/V Jamie Hanna* was accomplished using a Hemisphere VS-330 Real Time Kinematics (RTK) Global Positioning System (GPS) which received base station corrections through the Keynet NTRIP broadcast. Horizontal position accuracy in fixed RTK mode was approximately 2 cm, enabling use for tide corrections in some circumstances. A spare Hemisphere VS-330 was available as a backup. The differential GPS (DGPS) system was serially interfaced to a laptop computer running HYPACK hydrographic survey software. HYPACK continually recorded vessel position and GPS satellite quality and provided a steering display for the vessel captain allowing him to accurately maintain the position of the vessel along pre-established acoustic survey transects. Vessel heading measurements were provided by an IxBlue Octans III fiber optic gyrocompass. The Hemisphere VS-330 served as a backup source for heading corrections.

The SPI/PV survey was conducted aboard the multi-purpose offshore utility vessel *Northstar Challenger*. Sample positioning was carried out by INSPIRE using a Hemisphere V102 GPS compass to accurately record vessel heading as well as a differential position accuracy of the sampling equipment to within a meter. During mobilization, the navigator conducted a positional accuracy check on the system, by placing the antenna on a known GPS point and ensuring the antenna's position fell within one meter of the known coordinates. During operations HYPACK Ultralite software was used to receive positional data from the antenna and direct the vessel to sampling stations. Once the vessel was within a 7.5 meters of the target location, the SPI/PV camera system was deployed to the seafloor. As soon as the camera system made contact with the seafloor, the navigator recorded the time and position of the camera electronically in HYPACK and the written field log. This process was repeated for four SPI/PV replicate "drops" of the SPI/PV camera system at each sampling station. After all stations were surveyed the navigator exported all recorded positional data into an Excel sheet.

2.2 Acoustic Survey

The acoustic survey included bathymetric, backscatter, and side-scan sonar data collection and processing. The bathymetric data provided measurements of water depth that, when processed, were used to map the seafloor topography. The processed data were also compared with previous surveys to track changes in the size and location of seafloor features. This technique is the primary tool of the DAMOS Program for mapping the distribution of dredged material at disposal sites. The methodology for acoustic data acquisition is described in detail in the Project Quality Assurance Project Plan (QAPP; INSPIRE 2020a) and INSPIRE acoustic standard operating procedures (SOP; INSPIRE 2020b).

Multibeam backscatter and side-scan sonar data provided images that supported characterization of surficial topography, sediment texture, and roughness. Backscatter data are processed into a seamless image with corrections for topography (depth-normalized) while side-scan sonar data retains a higher resolution image without correction for topography. Comparison of synoptic acoustic data types is very useful for assessing dredged material placed on the seafloor.

2.2.1 Acoustic Survey Planning

A certified hydrographer obtained site coordinates from USACE NAE, imported them to HYPACK and ArcView GIS software, and created maps to guide survey activities. The proposed RISDS survey design was then reviewed and approved by NAE scientists.

The acoustic survey covered the entire RISDS and three reference areas. A 2000 × 2000 m acoustic survey was selected to ensure MBES coverage extended beyond the borders of RISDS (1800 × 1800 m). The acoustic survey also included 600 x 600 m survey areas over each of the three reference areas as well as an expansion area near the REF-NE that encompassed an area previously used as a U.S. Environmental Protection Agency (EPA) reference point (Figure 2-1). Survey lines were spaced 70 m apart and cross lines were spaced 250 - 350 m apart, which provided greater than 100-percent coverage of the RISDS seafloor (Figure 2-1).

2.2.2 Acoustic Data Collection

The 2020 multibeam bathymetric survey of RISDS was conducted on 12-14 June 2020. The survey was initiated on 11 June but was suspended due to adverse weather conditions. Although the weather had improved on 12 June, conditions were still somewhat unfavorable, and the resulting high seas affected acoustic data collection. Bathymetric, acoustic backscatter, and side-scan sonar data were collected using a R2Sonic 2022 broadband multibeam echosounder (MBES). This 200-400 kHz system formed 256 1-2° beams (frequency dependent) distributed equiangularly or equidistantly across a 160° swath. The system was operated using a frequency of 229 kHz and a 0.07 millisecond pulse to optimize bathymetric and backscatter data quality. The MBES transducer was mounted amidships to the port rail of the survey vessel using a high strength adjustable boom. Offsets between the primary GPS antenna and the sonar were precisely measured and entered into HYPACK. The transducer depth below the water surface (draft) was checked and recorded at the beginning and end of data acquisition and confirmed using the “bar check” method.

An IxBlue Octans III motion reference unit (MRU) was interfaced to the MBES topside processor and to the acquisition computer. Precise linear offsets between the MRU and MBES were recorded and applied during acquisition. Depth and backscatter data were synchronized using pulse per second timing and transmitted to the HYPACK MAX® acquisition computer via Ethernet communications. Several patch tests were conducted during the survey to allow computation of angular offsets between the MBES system components.

An AML Minos-X sound velocity profiler system was used to collect sound velocity profiles (SVP) casts at frequent intervals throughout each survey day to determine the speed of sound in the local water mass for use in calibrating the MBES system. A total of 20 SVP casts were acquired during the survey. Additional confirmations of proper calibration, including static draft, were obtained using the “bar check” method, in which a metal plate was lowered beneath the MBES transducer to a known depth (e.g., 5.0 m) below the water surface. “Bar-check” calibrations were accurate to within 0.01 m in tests conducted at the beginning and end of each survey day.

Surveys of the three reference areas and a pair of transit transects across RISDS were conducted on 12 June, and the full survey of RISDS was conducted on 13 June. Preliminary processing immediately following the 12 June survey confirmed the acquisition of useable bathymetric, backscatter and side-scan records. During the latter portion of the 12 June survey, the team noticed electrical interference thought to be associated with wiring in the Conex Box laboratory van. On 13 June, the team ran extension cords from the pilothouse of the *R/V Jamie Hanna* to the van in an effort to eliminate the interference. Despite observing side-scan and backscatter data in real time on 13 June, the raw HYPACK data files did not contain “RSS” side-scan records, and backscatter records were limited to “beam average” values. Because all system and software settings were identical on 12 and 13 June, it is likely that electrical interference associated with the Conex Box laboratory van was responsible for the side-scan data loss on 13 June.

2.2.3 Bathymetric Data Processing

Bathymetric data were processed using HYPACK HYSWEEP® software. Processing components are described below and included:

- Conversion of RTK GPS tide data from NAVD88 elevations to Mean Lower Low Water (MLLW) elevations using the National Oceanic and Atmospheric Association’s (NOAA) VDatum model
- Adjustment of data for tide fluctuations
- Correction of ray bending (refraction) due to density variation in the water column
- Removal of spurious points associated with water column interference or system errors
- Development of a grid surface representing depth solutions
- Statistical estimation of sounding solution uncertainty
- Generation of data visualization products

Tide corrections were provided by the RTK GPS. NOAA’s Center for Operational Oceanographic Products and Services (CO-OPS) provided a Tide Zoning Model (TZM) calculated specifically for this survey area. The model applied a time correction of -6 minutes and a range correction of 0.87 to the six-minute NAVD88 data series acquired at NOAA's Newport Tide Station (#8452660). Comparisons between RTK GPS tide corrections and NOAA's TZM adjusted data showed average deviations of 0.07 m for both survey dates.

Correction of sounding depth and position (range and azimuth) for refraction due to water column stratification was conducted using a series of twenty sound velocity profiles acquired by the survey team. The water column was stratified during the survey, with an approximately 20 – 25 m gradient between the surface and bottom. Stratification resulted in data artifacts associated with refraction that remained in the bathymetric surface model at a relatively fine scale (generally less than 5 to 10 cm) relative to the survey depth.

Bathymetric data were filtered to accept only beams falling within an angular limit of 60° to minimize refraction artifacts. Spurious sounding solutions were flagged or rejected based on the careful examination of data in sweep and profile views.

The R2Sonics 2022 MBES system was operated at 229 kHz. At this frequency, the system has a published beam width of 1.85°. Assuming an average depth of 37.4 m and a maximum beam angle of 60°, the mid-swath diameter of the beam footprint was calculated at approximately 4.8 × 2.4 m (11.4 m^2). Data were reduced to a cell (grid) size of 5.0 × 5.0 m, acknowledging the system's fine range resolution while accommodating beam position uncertainty. This data reduction was accomplished by calculating and exporting the average elevation for each cell in accordance with USACE recommendations (USACE 2013a).

The combined uncertainties associated with all system elements, including calibrations, tide corrections and refraction caused by water column stratification were quantified by comparing primary survey transects with perpendicular "cross-line" transects. Data for primary transects were exported at a cell resolution of 25 m^2 using the average elevation within each cell. Data for cross-line transects were compared to the pseudo "reference surface" created using the primary transects.

Comparisons were made between cross-line and mainstay swaths to +/- 60-degrees from nadir using 5.0-m x 5.0-m cell average elevations and 5-degree beam-angle increments. The mean difference between the mainstay reference surface and cross-line data was 0.01 m. The average standard deviation between cross-lines and primary lines was 0.08 m, with a mean 95% RMS confidence limit uncertainty of 0.15 m (maximum 0.24 m at 60 degrees from nadir). Mean elevation differences were consistent across the swaths from 0° to 60°

(-0.06 to 0.03 m), documenting negligible tide bias. This analysis shows compliance with USACE accuracy recommendations and National Ocean Service (NOS) standards. Note that the NOS standard for this project depth (Special Order 1A) would call for a 95th percentile confidence interval (95% CI) of 0.39 m at the maximum site depth (40.7 m) and 0.38 m at the mean site depth (37.4 m).

Reduced data were exported in ASCII text format with fields for Easting, Northing, and MLLW elevation (meters). All data were projected to the Rhode Island State Plane, NAD83 (metric). A variety of data visualizations were generated using a combination of IVS3D Fledermaus (V.7), ESRI ArcMap (V.10.1), and Golden Software Surfer (V. 17). Visualizations and data products included:

- ASCII data files of all processed soundings including MLLW depths and elevations,
- Contours of seabed elevation (5-cm, 50-cm, and 1.0-m intervals) in shapefile (SHP) format suitable for plotting using GIS and computer-aided design software,
- 3-dimensional surface maps of the seabed created using 2× vertical exaggeration and artificial illumination to highlight fine-scale features not visible on contour layers (delivered in grid and TIF formats), and,
- An acoustic relief map of the survey area created using 2× vertical exaggeration, delivered in georeferenced TIF format.

2.2.4 Backscatter Data Processing

MBES backscatter data were processed using HYPACK®'s implementation of GeoCoder software developed by NOAA's Center for Coastal and Ocean Mapping Joint Hydrographic Center (CCOM/JHC). GeoCoder was used to create a mosaic best suited for substratum characterization through the use of innovative beam-angle correction algorithms. Data acquired on 12 June (including transects across RISDS) were processed using R2Sonics' TruePix beam time series data. Data acquired on 13 June were processed using beam average backscatter records. Backscatter data (in decibels [dB]) acquired on 13 June were normalized to beam time series data using transects across RISDS recorded on 12 June. A trend-adaptive angle-varying gain function in Geocoder was applied to normalized data to minimize artifacts associated with substrate variation within survey transects.

Further processing was conducted to improve resolution and enable comparison of 2020 backscatter results to those of the 2013 RISDS survey. The trend-normalized backscatter data was capable of identifying potential disposal track lines observed at RISDS. Backscatter data for RISDS were next exported in ASCII format with fields for Easting, Northing, and backscatter (in dB units) using a 0.5-m x 0.5-m resolution. Data were converted to grid format using Golden Software Surfer V17 software. This grid was used to generate a seamless mosaic of backscatter in GeoTIF format. A Gaussian filter was next applied to backscatter data to minimize nadir artifacts and the filtered data were used to develop a backscatter model using a 3.0-m x 3.0-m grid. The grid was exported to an ESRI binary GRD format to facilitate comparison with other data layers.

2.2.5 Side-Scan Sonar Data Processing

As noted in Section 2.2.2, multibeam side-scan records were only acquired in the reference areas (on 12 June) and not in RISDS, likely due to interference associated with the Conex Box laboratory wiring. These side-scan sonar data were processed using Chesapeake Technology, Inc. SonarWiz software. Time-varied gain adjustments were applied to data and a mosaic was constructed using the root-mean squared intensity value to represent overlapping pixels. Empirical Gain Normalization (EGN) was not used as side-scan was intended to show finer features (e.g., targets, fine bedforms) without the loss of resolution associated with EGN. This mosaic was exported in GeoTIF format using a resolution of 0.2 m per pixel. Because fine details are partially obscured in side-scan mosaics data, individual GeoTIF images of each sonar file with resolutions of 0.2 m/pixel were also produced and delivered.

2.2.6 Acoustic Data Analysis

The processed bathymetric grids were converted to rasters, and bathymetric contour lines and acoustic relief models were generated and displayed using GIS. The backscatter mosaics and filtered backscatter grid were combined with acoustic relief models in GIS to facilitate visualization of relationships between acoustic datasets. This was done by rendering images and color-coded grids with sufficient transparency to allow the three-dimensional acoustic relief model to be visible underneath.

Depth difference analysis was conducted to characterize changes in seafloor elevation from measurements made in 2013 and 2015 to those measured in 2020. QPS Fledermaus software was used to calculate elevation difference grids between the 2020 bathymetric dataset and the DAMOS surveys conducted in 2013 and 2015. Elevation difference grids were calculated by subtracting the earlier survey depth estimates from the 2020 survey depth estimates at each point throughout the grid. The resulting elevation differences were contoured and displayed using GIS.

2.3 Sediment Profile and Plan View Imaging Survey

SPI and PV imaging are monitoring techniques used to provide data on the physical characteristics of the seafloor and the status of the benthic biological community.

2.3.1 SPI and PV Survey Planning

The RISDS SPI/PV survey featured 36-stations, including 21 stations within RISDS and five stations in each of three reference areas (REF-NE, REF-E, and REF-SW; Figure 2-2). Stations within RISDS were distributed across seven areas, including five historical disposal areas (RISDS-A, -B, -C, -D, and -E), a recent disposal area (RISDS-N), and an area that has experienced limited disposal in the past (RISDS-NW). Three stations were randomly located within each of these seven areas within RISDS. Additionally, five stations were randomly located within each of the three reference areas. Planned SPI/PV station locations are provided in Table 2-1 and actual SPI/PV station replicate locations sampled are provided in Appendix C. The methodology for data acquisition and analysis for these images was consistent with the sampling methods described in detail in the Project QAPP (INSPIRE 2020a) and INSPIRE SPI/PV SOP (INSPIRE 2019a).

2.3.2 Sediment Profile Imaging

The SPI technique involves deploying an underwater camera system to photograph a cross-section of the sediment–water interface. In the 2020 survey at RISDS, high-resolution SPI images were acquired using a Nikon® D7100 digital single-lens reflex camera mounted inside an Ocean Imaging® Model 3731 pressure housing system. The pressure housing sat atop a wedge-shaped steel prism with a plexiglass front faceplate and a back mirror. The mirror was mounted at a 45° angle to reflect the profile of the sediment–water interface. The camera lens looked down at the mirror, which reflected the image from the faceplate. The prism had an internal strobe mounted inside at the back of the wedge to provide illumination for the image; this chamber was filled with distilled water, so the camera always had an optically clear path. The descent of the prism into the sediment was controlled by a hydraulic piston. As the prism penetrated the seafloor, a trigger activated a time-delay circuit that fired an internal strobe to obtain a cross-sectional image of the upper 15–20 cm of the sediment column (Figure 2-3). The camera remained on the seafloor for approximately 20 seconds to ensure that a successful image had been obtained.

Test exposures of a Color Calibration Target were made on deck at the beginning and end of the 2020 survey to verify that all internal electronic systems consistently met design specifications and to provide a color standard against which final images could be checked to ensure proper color balance. Details of the camera settings for each digital image are available in the associated parameters file embedded in each electronic image file. For this survey, the ISO-equivalent was set at 640, shutter speed was 1/250, f-stop was f9, and storage was in compressed raw Nikon Electronic Format (NEF) files (approximately 30 MB each). All camera settings and any setting changes were recorded in the field log (INSPIRE 2020c).

Each time the camera system was brought onboard, the frame counter was checked to ensure that the requisite number of replicates had been obtained. In addition, a prism penetration depth indicator on the camera frame was checked to verify that the optical prism had actually penetrated the bottom to a sufficient depth. If images were missed or the penetration depth was insufficient, the camera frame stop collars were adjusted and/or weights were added or removed, and additional replicate images were taken. Frame counts, time of image acquisition, frame stop-collar position, and the number of weights used were recorded in the field log for each replicate image.

Each image was assigned a unique time stamp in the digital file attributes by the camera's data logger and cross-checked with the time stamp in the navigational system's computer data file. In addition, the field crew kept redundant written sample logs. Images were downloaded periodically to verify successful sample acquisition and/or to assess what type of sediment/depositional layer was present at a particular station. Digital image files were renamed with the appropriate station names after downloading as a further quality assurance step.

2.3.3 Plan View Imaging

An Ocean Imaging® Model DSC24000 PV underwater camera system with two Ocean Imaging® Model 400-37 Deep Sea Scaling lasers was attached to the sediment profile camera frame and used to collect plan view images of the seafloor surface. Both SPI and PV images were collected during each "drop" of the system. The PV system consisted of a

Nikon D-7100 encased in an aluminum housing, a 24 VDC autonomous power pack, a 500 W strobe, and a bounce trigger. A weight was attached to the bounce trigger with a stainless-steel cable so that the weight hung below the camera frame; the scaling lasers projected two red dots that are separated by a constant distance (26 cm) regardless of the field-of-view of the PV system. The field-of-view can be varied by increasing or decreasing the length of the trigger wire and, thereby, the camera height above the bottom when the picture is taken. As the SPI/PV camera system was lowered to the seafloor, the weight attached to the bounce trigger contacted the seafloor prior to the camera frame reaching the seafloor and triggered the PV camera (Figure 2-3).

During set-up and testing of the PV camera, the positions of lasers on the PV camera were checked and calibrated to ensure separation of 26 cm. Test images were also captured to confirm proper camera settings for site conditions. Details of the camera settings for each digital image are available in the associated parameters file embedded in each electronic image file; for this survey, the ISO-equivalent was set at 640. The additional camera settings used were as follows: shutter speed 1/15, f18, white balance set to flash, color mode set to Adobe RGB, sharpening set to none, noise reduction off, and storage in compressed raw NEF files (approximately 30 MB each). Images were checked periodically throughout the survey to confirm that the initial camera settings were still resulting in the highest quality images possible. All camera settings and any setting changes were recorded in the field log.

Prior to field operations, the internal clock in the digital PV system was synchronized with the GPS navigation system and the SPI camera. For each PV image, a time stamp was recorded in the digital file and redundant time notes were made in the field and navigation logs. Throughout the survey, PV images were downloaded at the same time as the SPI images and evaluated to confirm image acquisition and image clarity.

The ability of the PV system to collect usable images was dependent on the clarity of the water column. Water conditions at RISDS allowed use of a 0.8-m trigger wire, resulting in a mean image width of 0.7 m and a mean field-of-view of 0.4 m^2.

2.3.4 SPI and PV Data Collection

The SPI/PV survey was conducted at RISDS and reference areas on 6 May 2020 onboard the *Northstar Challenger*. At each station, the vessel was positioned at the target coordinates and the camera was deployed within a defined station tolerance of 15 m. At least four replicate SPI and PV images were collected at each station. The three replicate images with the best quality (adequate prism penetration, no or minimal sampling artifacts) at each station were selected for analysis (Appendices D and E).

The DGPS described above was interfaced to HYPACK® software via laptop serial ports to provide a method to locate target coordinates and record actual sampling locations. Throughout the survey, the HYPACK® data acquisition system received DGPS data. The incoming data stream was digitally integrated and stored on the PC's hard drive. Actual SPI/PV sampling locations were recorded using this system.

2.3.5 Image Conversion and Calibration

Following completion of field operations, quality control checks were conducted of filenames, date/time stamps, and the field log. After these procedures, the NEF raw image files were color calibrated in Adobe Camera Raw® by synchronizing the raw color profiles to the Color Calibration Target that was photographed prior to field operations with the SPI camera. The raw SPI and PV images were then converted to high-resolution Photoshop Document (PSD) format files, using a lossless conversion file process and maintaining an Adobe RGB (1998) color profile. The PSD images were then calibrated and analyzed in Adobe Photoshop®. Length and area measurements were recorded as number of pixels and converted to scientific units using the calibration information. Detailed results of all SPI and PV image analyses are presented in Appendices D and E.

2.3.6 SPI and PV Data Analysis

Computer-aided analysis of the resulting images provided a set of standard measurements to allow comparisons between different locations and different surveys. The DAMOS Program has successfully used this technique for over 30 years to map the distribution of disposed dredged material and to monitor benthic recolonization at disposal sites (Germano et al. 2011).

Measured parameters for SPI and PV images were recorded in Microsoft Excel© spreadsheets. These data were subsequently checked by one of INSPIRE's senior scientists as an independent quality assurance/quality control review before final interpretation was performed. Spatial distributions of SPI and PV parameters were mapped using ESRI ArcGIS 10.5. Map backgrounds use regional bathymetric mosaics obtained from NOAA's National Centers for Environmental Information (NOAA NCEI 2020a, 2020b).

2.3.6.1 Sediment Profile Image Analysis Parameters

The parameters discussed below were assessed and/or measured and recorded for each replicate SPI image selected for analysis (Appendix D). Descriptive comments were also recorded for each. Many variables can be seen and annotated in context in SPI images from soft bottom coastal and estuarine environments (Figure 2-4).

Sediment Type–The sediment grain size major mode and range were estimated visually from the images using a grain size comparator at a similar scale. Results were reported using the phi scale. Conversion to other grain size scales is provided in Appendix F. The presence and thickness of disposed dredged material were also assessed as described below.

Penetration Depth–The depth to which the camera penetrated into the seafloor was measured to provide an indication of the sediment density and bearing capacity. The penetration depth can range from a minimum of 0 cm (i.e., no penetration on hard substrata) to a maximum of 20 cm (full penetration on very soft substrata).

Surface Boundary Roughness–Surface boundary roughness is a measure of the vertical relief of features at the sediment–water interface in the sediment profile image. Surface boundary roughness was determined by measuring the vertical distance between the highest and lowest points of the sediment–water interface. The surface boundary roughness (sediment surface relief) measured over the width of sediment profile images typically ranges from 0 to 4 cm, and may be related to physical structures (e.g., ripples, rip-up structures, mud clasts) or biogenic features (e.g., burrow openings, fecal mounds, foraging depressions). Biogenic roughness typically changes seasonally and is related to the interaction of bottom turbulence and bioturbation activities.

Apparent Redox Potential Discontinuity (aRPD) Depth–The aRPD depth provides a measure of the integrated time history of the balance between near-surface oxygen conditions and biological reworking of sediments. Sediment particles exposed to oxygenated waters oxidize and lighten in color to brown or light gray. As the particles are buried or moved down by biological activity, they are exposed to reduced oxygen concentrations in subsurface pore waters and their oxic coating slowly reduces, changing color to dark gray or black. When biological activity is high, the aRPD depth increases; when it is low or absent, the aRPD depth decreases. The aRPD depth was measured by assessing color and reflectance boundaries within the images.

Mud Clasts – When fine-grained, cohesive sediments are disturbed, either by physical bottom scour or faunal activity (e.g., decapod foraging) intact clumps of sediment are often scattered across the seafloor. The number of clasts observed at the sediment–water interface was counted and their oxidation state assessed. The detection of reduced mud clasts in an obviously aerobic setting suggests a recent origin (Germano 1983). Mud clasts that are artifacts of SPI sampling (mud clots can fall off the back of the prism or wiper blade) are not recorded in the analysis sheet but may be noted in the “Comments” field.

Dredge Material Layer Depth and Thickness– The depth below the sediment–water interface of dredge material layer was measured. Additionally, the thickness of the dredged material layer, from 1 mm to 20 cm (the height of the SPI optical window) was measured. If the layer extended below the depth of prism penetration this was noted.

Biological Mixing– The depth to which sediments are bioturbated, or the biological mixing depth, can be an important parameter for studying nutrient or contaminant flux, as well as organic enrichment, in sediments. In this study, the minimum and maximum linear distances from the sediment surface to subsurface voids were measured. The latter parameter represents the maximum observed particle mixing depth of head-down feeders, mainly polychaetes. The number of subsurface voids were counted for each SPI replicate.

Infaunal Successional Stage–Infaunal successional stage is a measure of the biological community inhabiting the seafloor. Current theory holds that organism–sediment interactions in fine-grained sediments follow a predictable sequence of development after a major disturbance (e.g., dredged material disposal) (Pearson and Rosenberg 1978; Rhoads and Germano 1982; Rhoads and Boyer 1982). This continuum has been divided subjectively into four stages: Stage 0, indicative of a sediment column that is largely devoid of macrofauna, occurs immediately following a physical disturbance or in close proximity to an organic enrichment source; Stage 1 is the initial recolonizing tiny, densely populated polychaete assemblages; Stage 2 is the start of the transition to head-down deposit feeders; and Stage 3 is the mature, equilibrium community of deep-dwelling, head-down deposit feeders (Figure 2-5). Successional stage was assigned by assessing the types of species and related activities (e.g., feeding voids) apparent in the images. Biogenic particle mixing depths can be estimated by measuring the maximum and minimum depths of imaged fauna, burrows, or feeding voids in the sediment column. Successional stage was mapped by image replicate to provide a comprehensive depiction of the within-station variability. The data were summarized by the maximum successional stage observed at each station, values which were used during the statistical comparison between reference areas and RISDS, as described below.

Additional components of the SPI analysis included calculation of means and ranges for the parameters listed above and mapping of means of replicate values from each station. Station means were calculated from three replicates from each station and used in statistical analysis.

2.3.6.2 Plan View Image Analysis Parameters

The PV images provided a much larger field-of-view than the SPI images and provided valuable information about the landscape ecology and sediment topography in the area where the pinpoint "optical core" of the sediment profile was taken (Figure 2-6). Unusual surface sediment layers, textures, or structures detected in any of the sediment profile images can be interpreted in light of the larger context of surface sediment features, i.e., is a surface layer or topographic feature a regularly occurring feature and typical of the bottom in this general vicinity or just an isolated anomaly. The scale information provided by the underwater lasers allows for accurate density counts (number per square meter) of attached epifaunal colonies, sediment burrow openings, or larger macrofauna or fish which may have been missed in the sediment profile cross-section. Information on sediment transport dynamics and bedform wavelength were also available from PV image analysis.

For each replicate PV image selected for analysis, analysts calculated the image size and field-of-view and the following were recorded: sediment type; oxidation state of the surface sediment; presence and type of bedforms; presence of *Beggiatoa* and estimates of cover extent; dredged material presence; presence of burrows, tubes, tracks/trails, and debris; types of epifauna and flora; number of fish; and descriptive comments (Appendix E).

At stations where gravel and/or large shell fragments were observed on the sediment surface, further plan view image analysis was conducted to fully characterize the physical and biological features associated with the hard bottom. This additional analysis made use of the Coastal and Marine Ecological Classification Standard (CMECS) (Federal Geographic Data Committee [FGDC] 2012). CMECS is a framework that enables a comprehensive characterization of any environment using standardized parameters and definitions. The PV images collected at hard bottom stations were analyzed for CMECS Substrate Group, CMECS Substrate Subgroup, percent cover of attached epifauna and flora, presence and type of biogenic structure, degree of sediment sorting (diversity of gravel sizes), and size measurements of the maximum grain size observed. CMECS Substrate Group and Subgroup are conceptually explained in Figure 2-7. CMECS Substrate Group is determined by the proportion of gravel present (Folk 1954), and if >80% is gravel, the size of the gravel (Figure 2-7). CMECS Substrate Subgroup further refines Substrate Group by incorporating the proportion of sand to mud (silt/clay) and the grain size major mode (Wentworth 1922) as determined through SPI (Figure 2-7).

2.4 Sediment Grab Sampling Survey

Sediment samples were collected for chemical analyses, benthic community analysis (BCA), and grain size to characterize the sediment quality at three disposal areas within RISDS and the three reference areas. The methodology for sediment data acquisition and analysis was consistent with the sampling methods described in detail in the Project QAPP (INSPIRE 2020a) and INSPIRE sediment grab sampling SOP (INSPIRE 2019b).

2.4.1 Sediment Grab Sample Collection

An 18-station sediment grab sampling survey was performed on 16 June 2020 onboard the R/V *Jamie Hanna,* including nine stations located within the boundary of the disposal site and three stations in each of the three reference areas (Figure 2-2). The sediment grab sampling stations were co-located with a subset of the SPI/PV stations that were sampled on 6 May 2020, with the exception of Station 03, which was moved about 100 m south of the SPI/PV station because the results from the SPI/PV imagery indicated the substrate at this station was predominantly cobble (Table 2-1). At each station, the vessel was positioned at the target coordinates and grab samples were collected within a defined station tolerance of 15 m. Two sediment grab samples were collected at each station using a 0.04-m^2 Ted Young-modified Van Veen grab sampler: one for analytical chemistry and grain size analysis and the other for BCA. The samples were checked for penetration depth (10 cm was the maximum and 6 cm was the minimum acceptable penetration depth), sediment texture, odor, and observed biota. The grab samples for analytical chemistry and grain size analysis were subsampled to include the top 2 cm of sediment, homogenized in the field, and were placed in appropriate containers, and chilled. The grab samples for analytical chemistry were hand delivered to Battelle's Norwell, MA facility for later delivery to the appropriate laboratories for analyses (Table 2-2).

The sediment grab samples for BCA were washed into clean 10-liter plastic buckets and sieved through a 0.5 mm mesh screen. The material retained on the sieve was then placed in an appropriate sample container (1 liter or 500 ml) and preserved with 10% formalin and half a tablespoon of borax to buffer the solution. The samples were hand-delivered to INSPIRE (Newport, RI) for shipment to the benthic analysis lab, Barry Vittor and Associates (Mobile, AL).

Sediment grab sampling station locations and coordinates are provided in Table 2-1, Figure 2-2, and Appendix C. All sediment sample collection and subsequent analyses were conducted in accordance with the sediment grab sampling SOP and Project QAPP (INSPIRE 2020a, INSPIRE 2019b).

2.4.2 Analytical and Biological Analyses

2.4.2.1 Chemical Analyses

Surficial sediment samples were collected from all 18 stations for analysis of grain size, total organic carbon (TOC), metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn), polycyclic aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs) (Table 2-2). Additional details of the analytical and quality control methods are provided in the Project QAPP (INSPIRE 2020a).

Total PAH was calculated as the sum of the 18 PAH compounds analyzed (naphthalene, 2-methylnaphthalene, 1-methylnaphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene). Total PCB was estimated as the sum of the 18 NOAA National Status and Trends congeners multiplied by two. Total DDx was calculated as the sum of 4,4'DDT, 4,4'DDD and 4,4'DDE. Total chlordane was estimated as the sum of alpha and gamma chlordane, cis and trans nonachlor and heptachlor. Non-detected compounds were summed using ½ the method detection limit (MDL).

There are no site-specific sediment quality guidelines (SQGs) directly applicable to the environment in Rhode Island Sound. Therefore, the presentation and discussion of the sediment chemistry results make use of national guidelines that define sediment contaminant concentrations at which toxic effects are expected (Long and Morgan 1990; Long et al. 1995). These SQGs were derived using a database compiled from many studies across numerous marine sediment environments where paired sediment chemistry and bioassay data were reported. For each chemical of concern, the concentrations at which adverse effects were reported were compiled. The 10th and 50th percentile of the effects values was calculated and designated as effects range low (ER-L) and effects range median (ER-M), respectively, where adverse effects were rarely observed below ER-L concentrations, and adverse effects frequently occurred above ER-M concentrations. These national guidelines, although useful, should be considered with caution as they were not derived directly from sediments and biological communities collected from Rhode Island Sound. Although, the sediment chemistry results are presented here relative to these analyte-specific established national standards (ER-L and ER-M), it should be noted that these values are not thresholds but rather guidelines that may aid in interpreting sediment chemical concentrations.

2.4.2.2 Benthic Community Analysis

Benthic community samples were processed using a 0.5 mm sieve and infauna were identified and enumerated to the lowest practicable taxonomic level (LPIL). Biomass (wet weight) was measured for all individuals aggregated by phylum (Annelida, Mollusca, Arthropoda, Echinodermata) for each sample.

2.5 Statistical Methods

2.5.1 SPI/PV Statistical Methods

One of the objectives of the 2020 SPI/PV survey at RISDS was to assess the benthic colonization status over the site and associated reference areas. Statistical analyses were conducted to compare key SPI parameter values between sampled disposal areas and reference areas. The aRPD depth and successional stage measured in each image are the best indicators of infaunal activity measured by SPI and were, therefore, used in this comparative analysis. Standard boxplots were generated for visual assessment of the central tendency and variation in each of these parameters within the disposal areas and the reference areas. Inequivalence tests between the reference and disposal areas were conducted, as described in detail below.

Traditionally, the objective of this study would be addressed using point null hypotheses of the form “There is no difference in benthic conditions between the reference area and the disposal areas.” However, in this instance, an approach using bioequivalence or interval testing was considered to be more informative than the point null hypothesis test of “no difference” (Germano 1999). One reason is that there is always some small difference, and the statistical significance of this difference may or may not be ecologically meaningful.

Without an associated power analysis, the results of traditional point null hypothesis testing often provide an inadequate ecological assessment.

In this application of bioequivalence (interval) testing the null hypothesis is chosen as one that presumes the difference is great, i.e., an inequivalence hypothesis (e.g., McBride 1999). This is recognized as a "proof of safety" approach because rejection of this inequivalence null hypothesis requires sufficient proof that the difference is actually small. The null and alternative hypotheses to be tested were:

H_0: $d \leq -\delta$ or $d \geq \delta$ (presumes the difference is great)

H_A: $-\delta < d < \delta$ (requires proof that the difference is small)

where d is the difference between a reference mean and a site mean. If the null hypothesis is rejected, then it can be concluded that the two means are equivalent to one another within $\pm\delta$ units. The size of δ should be determined from historical data and/or best professional judgment to identify a maximum difference that is within background variability/noise and is therefore not ecologically meaningful.

The δ value for aRPD depth was established using data collected at the three reference areas associated with RISDS over four surveys (2005, 2009, 2013, and 2020). Within each survey year, the differences between the mean aRPD depths of each of the three reference areas were calculated, providing three 'delta' values for each surveyed year. The distribution of these values was used to establish a tolerance interval, which was calculated as the upper confidence level which contained 90% of the calculated differences with 90% confidence (i.e., the 90/90 upper tolerance limit). Using this previously collected data the δ value for aRPD depth was found to be 2.2 cm.

Previously established δ value 0.5 for successional stage rank on the 0–3 scale was used. A successional stage rank variable was applied to each image to evaluate successional stages numerically. A value of 3 was assigned to Stage 3, 2 on 3, and 1 on 3 designations, a value of 2 was applied to Stage 2 and 1 on 2, a value of 1 was applied to Stage 1, intermediate ranks were assigned to the transitional assemblages (2.5 for Stage 2 transitioning to Stage 3, and 1.5 for Stage 1 transitioning to Stage 2), and images from which the stage could not be determined were excluded from calculations. The maximum successional stage rank among replicates was used to represent the station value.

The test of this interval hypothesis can be broken down into two one-sided tests (TOST) (McBride 1999 after Schuirmann 1987) which are based on the normal distribution, or on Student's *t*-distribution when sample sizes are small and variances must be estimated from the data (the typical case in the majority of environmental monitoring projects). The statistics used to test the interval hypotheses shown here are based on such statistical foundations as the Central Limit Theorem (CLT) and basic statistical properties of random variables. A simplification of the CLT says that the mean of any random variable is normally distributed. Linear combinations of normal random variables are also normal so a linear function of means is also normally distributed. When a linear function of means is divided by its standard error the ratio follows a *t*-distribution with degrees of freedom associated with the variance estimate. Hence, the *t*-distribution can be used to construct a confidence interval around any linear function of means.

In this 2020 survey sampling design, there were ten distinct areas, three of which were categorized as reference locations (REF-E, REF-NE, REF-SW) and seven were disposal locations (RISDS-A, -B, -C, -D, -E, -N, and -NW). The difference equation, $\hat{d}$, for the comparison of interest was the linear contrast of the mean of the three reference means minus the mean of the seven disposal area means, or

$$\hat{d} = \tfrac{1}{3}\,(\mathrm{Mean}_{REF\text{-}E} + \mathrm{Mean}_{REF\text{-}NE} + \mathrm{Mean}_{REF\text{-}SW}) -$$

$$\tfrac{1}{7}\,(\mathrm{Mean}_{RISDS\text{-}A} + \mathrm{Mean}_{RISDS\text{-}B} + \mathrm{Mean}_{RISDS\text{-}C} + \mathrm{Mean}_{RISDS\text{-}D} + \mathrm{Mean}_{RISDS\text{-}E} + \mathrm{Mean}_{RISDS\text{-}N} + \mathrm{Mean}_{RISDS\text{-}NW}) \quad \text{[Eq. 1]}$$

The three reference areas collectively represented ambient conditions, but if the means were different among these three areas, then pooling them into a single reference group would inflate the variance estimate because it would include the variability between areas, rather than only the variability between stations within each single homogeneous area. The effect of keeping the three reference areas separate had no effect on the reference mean when sample size was equal among these areas, but it ensured that the variance is truly the residual variance within a single population with a constant mean.

The standard error of each difference equation was calculated using Equation 2, where the variance of a sum is the sum of the variances for independent variables, or

$$se(\hat{d}) = \sqrt{\sum_j \left(S_j^2 c_j^2 / n_j\right)} \qquad \text{[Eq. 2]}$$

Where:

$se(\hat{d})$ standard error of the difference equation

$\hat{d}$ observed difference in means between the reference and the disposal area

c_j coefficients for the j means in the difference equation, $\hat{d}$ (i.e., for [Eq. 1] shown above, the coefficients were ⅓ for each of the three reference locations, and $-^1/_7$ for each of the seven disposal areas

S_j^2 variance for the j^{th} area. If we can assume equal variances, a single pooled residual variance estimate can be substituted for each group, equal to the mean square error from an ANOVA.

n_j number of stations for the j^{th} area

The inequivalence null hypothesis was rejected (and equivalence was concluded) if the confidence interval on the difference of means, $\hat{d}$, was fully contained within the interval [–δ, +δ].

Thus, the decision rule was to reject H_0 if

$$D_L = \hat{d} - t_{\alpha,\upsilon} se(\hat{d}) > -\delta \quad \text{and} \quad D_U = \hat{d} + t_{\alpha,\upsilon} se(\hat{d}) < \delta \qquad \text{[Eq. 3]}$$

where:

$t_{\alpha,\upsilon}$ upper $(1-\alpha)*100^{\text{th}}$ percentile of a Student's t-distribution with υ degrees of freedom ($\alpha = 0.05$)

$se(\hat{d})$ standard error of the difference ([Eq. 2])

υ degrees of freedom for the standard error. If a pooled residual variance estimate was used, it was the residual degrees of freedom from an ANOVA on all groups (total number of samples minus the number of groups); if separate variance estimates were used,

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degrees of freedom were calculated based on the Welch-Satterthwaite estimation (Satterthwaite 1946).

Validity of the normality and equal variance assumptions was tested using Shapiro-Wilk's test for normality on the area residuals (α=0.05) and Levene's test for equality of variances among the ten areas (α =0.05). If normality was not rejected but equality of variances was, then the variance for the difference equation was based on separate variances for each group. If systematic deviations from normality were identified, then a nonparametric bootstrapped interval were used (Appendix G). Bootstrapping is a statistical resampling procedure that uses the sample data to represent the entire population to construct confidence limits around population parameters. Bootstrapping does not make assumptions about the distribution of the data; it assumes only that the sample data are representative of the underlying population, so random sampling is a prerequisite for appropriate application of this method. Bootstrapping procedures entail resampling, with replacement, from the observed sample of size n. Each time the sample is resampled, a summary statistic (e.g., mean or standard deviation [SD]) of the bootstrapped sample is computed and stored. After repeating this procedure many times, a summary of the bootstrapped statistics is used to construct the confidence limit.

2.5.2 Sediment Chemistry

The objective of the chemical analyses of the sediment grab samples was to characterize the surficial sediment quality of the disposal site and associated reference areas. Summary statistics were calculated within each of the six areas sampled (i.e., RISDS-B, -D, and -N, and the three reference areas) and across the two groups (reference areas and disposal site areas) using *dplyr* package (v1.0.1) within the RStudio statistical software Version 4.0.2 (2020-06-22) (RStudio Team 2020).

The sediment chemistry data are presented as box and whisker plots grouped by the six areas where sediment grab samples were collected, including the three reference areas and the three disposal site areas (RISDS-B, -D, and -N). There are no site-specific sediment quality guidelines (SQGs) for use in Rhode Island Sound. Therefore, ER-L and ER-M values (Long and Morgan 1990; Long et al. 1995) are plotted or noted alongside the data for context.

2.5.3 Benthic Community Analysis Statistical Methods

The objective of the benthic community analysis of sediment grab samples was to characterize the benthic community status of the site and associated reference areas. Summary statistics that characterized benthic infaunal samples included overall density/m^2 and species richness by area (REF-E, REF-NE, REF-SW, RISDS-B, -D, and -N) and by group (disposal site and reference). The infaunal community composition across areas was explored using visualizations including a stacked bar-plot and non-metric multidimensional scaling (nMDS) ordination plot as described in detail below; these were conducted using the packages *phyloseq* (v1.32.0) and *vegan* (v2.5.6) within the RStudio statistical software Version 4.0.2 (2020-06-22) (RStudio Team 2020).

To examine taxonomic composition of the benthic infaunal assemblages across sampled areas, first, the abundance data were aggregated at the family level. Family level aggregation is used because species within families share similar functional roles, therefore, data aggregation permits an examination of community similarity that may reflect biological functions (e.g., prey resource, filtration, bioturbation). Data aggregation also reduces the influence of individual species distributions and eliminates false distinctions that may result if a taxon is identified both at a LPIL and species level. Next, taxonomic assemblages were visualized using a stacked bar plot, with the data grouped by sampling area (three reference areas, and RISDS-B, -D, and -N).

To further examine the infaunal assemblages across areas and determine relationships across areas in terms of taxonomic composition, the data were visualized using an ordination. First, the abundance data were log(x+1) transformed to reduce the influence of abundant taxa and permit taxa with low or rare occurrences to contribute. Next, Bray-Curtis similarity distances were calculated and ranks of the Bray-Curtis similarity metric were used to describe relationships among samples based on their infaunal assemblages. These ranks were visualized using nMDS ordination. This approach illustrates the relative similarity/dissimilarity in assemblage composition among samples in each area. On the nMDS plots, symbols representing samples with similar infaunal assemblages are positioned more closely to each other than samples with dissimilar assemblage composition. This ordination was found by maximizing the correlation between observed dissimilarities and the dissimilarities in this 2-dimensional plot using monotonic regression. The stress values associated with the nMDS plots indicate the goodness-of-fit of the two-dimensional representations. A smaller stress value (e.g., <10%) indicates that the nMDS ordination is a good representation of the original pairwise relationships between samples. The smaller the stress, the better the representation. Generally, stress values under 10% are considered "good" and values over 15% are considered "poor".

Table 2-1.

RISDS 2020 Survey Target SPI/PV and Sediment Grab Station Locations

Station ID	Station Type	Latitude (NAD 1983)	Longitude (NAD 1983)	X (NAD 1983 State Plane RI meters)	Y (NAD 1983 State Plane RI meters)
1	SPI/PV and Grab Station	41.237349	-71.379268	110121.2	17111.5
2	SPI/PV and Grab Station	41.237704	-71.383468	109769.0	17150.4
3*	SPI/PV and Grab Station	41.236017	-71.381238	109956.3	16963.3
4	SPI/PV and Grab Station	41.230246	-71.380570	110013.1	16322.5
5	SPI/PV and Grab Station	41.230294	-71.379971	110063.4	16327.9
6	SPI/PV and Grab Station	41.229924	-71.380540	110015.7	16286.7
7	SPI/PV and Grab Station	41.226769	-71.385455	109604.1	15935.7
8	SPI/PV and Grab Station	41.227308	-71.386116	109548.6	15995.5
9	SPI/PV and Grab Station	41.227040	-71.384809	109658.2	15965.9
10	SPI/PV Station	41.237757	-71.389225	109286.4	17155.6
11	SPI/PV Station	41.237839	-71.388699	109330.5	17164.9
12	SPI/PV Station	41.237851	-71.389856	109233.6	17166.0
13	SPI/PV Station	41.234768	-71.375277	110456.2	16825.3
14	SPI/PV Station	41.234794	-71.374543	110517.7	16828.2
15	SPI/PV Station	41.234378	-71.375203	110462.5	16782.0
16	SPI/PV Station	41.229718	-71.375833	110410.4	16264.4
17	SPI/PV Station	41.230160	-71.375832	110410.4	16313.4
18	SPI/PV Station	41.229939	-71.376320	110369.5	16288.9
19	SPI/PV Station	41.225739	-71.375198	110464.2	15822.5
20	SPI/PV Station	41.225796	-71.374749	110501.9	15829.0
21	SPI/PV Station	41.225331	-71.375181	110465.8	15777.2
REF-E-01	SPI/PV and Grab Station	41.234057	-71.321809	114938.9	16754.2
REF-E-02	SPI/PV and Grab Station	41.233955	-71.324453	114717.2	16742.4
REF-E-03	SPI/PV and Grab Station	41.234504	-71.326706	114528.3	16802.9
REF-E-04	SPI/PV Station	41.235863	-71.323618	114786.8	16954.3
REF-E-05	SPI/PV Station	41.232012	-71.324975	114673.9	16526.5
REF-NE-01	SPI/PV and Grab Station	41.254963	-71.333216	113978.1	19074.0
REF-NE-02	SPI/PV and Grab Station	41.253911	-71.330336	114219.7	18957.7
REF-NE-03	SPI/PV and Grab Station	41.250727	-71.333978	113915.1	18603.4
REF-NE-04	SPI/PV Station	41.251733	-71.331022	114162.7	18715.6
REF-NE-05	SPI/PV Station	41.252947	-71.334369	113881.9	18849.9
REF-SW-01	SPI/PV and Grab Station	41.215659	-71.413813	107227.6	14699.1
REF-SW-02	SPI/PV and Grab Station	41.214084	-71.417944	106881.3	14523.9
REF-SW-03	SPI/PV and Grab Station	41.212504	-71.413625	107243.7	14348.7
REF-SW-04	SPI/PV Station	41.212505	-71.416425	107008.9	14348.7
REF-SW-05	SPI/PV Station	41.214225	-71.415222	107109.7	14539.7

*Grab Station 3 was moved 100 m south of SPI/PV Target

Table 2-2.

Sample Containers, Sample Sizes and Preservative Requirements for RISDS and Reference Area Sediment Samples

Container	Analysis	Min Amount	Additional for QC	Preservative/ Storage	Lab	Number of stations
			Sediment			
8 oz Plastic	Particle Size/Bulk Density	200 g (at least ¾ full)	1 additional container for Analytical Dup	Chill 4º±2ºC	Alpha	15 Plus 1 Field Dup
4 oz glass	TOC/moisture	~ 15 g (~1/2 full)	Fill existing jar for MS/MSD and Analytical Dup	Chill 4º±2ºC	Alpha	15 Plus 1 Field Dup
8oz Glass	PAHs/PCBs/Pest	20 g (fill jar 1/3)	Fill existing jar to ¾ for MS/MSD and Analytical Dup	Chill 4º±2ºC	Battelle	15 Plus 1 Field Dup
8oz Glass	Metals	10 g (fill jar ¼)	Fill existing jar full for MS/MSD and Analytical Dup	Chill 4º±2ºC	Alpha	15 Plus 1 Field Dup
8 oz Glass	Archive	Fill w/ remaining sediment no more than ¾ full.	n/a	Chill 4º±2ºC	Battelle	15 Plus 1 Field Dup
Water (equipment blanks)						
1 L Glass Amber x2	PAHs	1 L	n/a	Chill 4º±2ºC	Battelle	1
250 mL Plastic	Metals	100 mL	n/a	HNO_3 : 4°±2°C	Alpha	1

3.0 RESULTS

3.1 Acoustic Survey

3.1.1 Existing Bathymetry

The 2020 multibeam bathymetric data were rendered as an acoustic relief model (color scale with hillshading) to provide a detailed representation of the surface of the seafloor at RISDS and three reference areas (Figure 3-1). The ambient seafloor at RISDS was approximately 37 m deep. A berm was observed along the western side of the site, curling northeast to connect to a large mound centered along the northern edge of the site. The berm was approximately 1.6 km in length, varied in width, and rose 1 to 2 m above the seafloor. The mound at the northern end of the berm (within sampling area RISDS-N) was observed to be approximately 10 m above the seafloor to a depth of 27 m. Several relatively small mounds observed around the site included historical disposal areas RISDS-A, -B, and -E and two mound features in the northeast corner of the site. These two northeast mound features had not been observed in the previous 2015 survey and were approximately 200 m in diameter and rose approximately 1 m above the seafloor.

RISDS seafloor features, including the berm and individual mounds were formed by dredged material placement. There was evidence of disposal activity throughout the site in the form of impact craters and mounds. For example, impact craters were visible surrounding RISDS-N, especially to the southwest and at RISDS-C (Figure 3-1).

The three reference areas were characterized by relatively flat bottoms with distinct large-scale linear topographic features (Figure 3-1). There was little depth variability within each of the three reference areas. REF-NE, including the EPA reference point, was the shallowest at approximately 37 to 38 m, followed by REF-SW at approximately 38 m, and REF-E was the deepest at approximately 38 to 39 m.

3.1.2 Acoustic Backscatter and Side-Scan Sonar

Acoustic backscatter provides an indication of the nature of surficial sediment present in the survey area. Unfiltered backscatter imagery of RISDS revealed extensive patterns of dredged material disposal throughout the site (Figure 3-2). Filtered backscatter over acoustic hillshaded relief presents a quantitative assessment of surficial sediment characteristics independent of slope effects and provides a more readily interpreted map (Figure 3-3).

Stronger backscatter returns are indicative of coarser-grained, rougher, or harder sediment relative to surrounding sediments and are shown in orange and yellow on the map (Figure 3-3).

Coarser-grained, rougher, or harder ambient sediments (stronger backscatter returns) were apparent along the southern and eastern margins of the site and finer-grained ambient sediments (weaker returns) were found in the central depression of RISDS. Coarser, rougher, or harder sediments were observed along the western berm and at several large nearly circular areas, including at RISDS-C and RISDS-N, where dredged material had been placed (Figure 3-3). Stronger backscatter return patterns were co-located with craters and small mounds seen in bathymetric relief data throughout RISDS, providing additional support of the association of these features with dredged material placement.

Numerous narrow curved lines of relatively coarser, rougher, or harder material were also observed in the filtered backscatter distributed throughout RISDS (appearing as curved light blue or yellow lines in Figure 3-3). These curved lines often included a series of distinct coarser material clumps, for example, the curving line northeast of RISDS-C. These linear features appear to be dredged material disposal trails. Disposal trails are created when dredged material is released while a disposal scow is underway and results in a line of dredged material on the seafloor consistent with the route of the scow. Clumps along disposal trails are created when discrete amounts of dredged material are released intermittently from the transiting disposal scow.

At reference areas, filtered backscatter imagery suggested coarser-grained, rougher, or harder ambient sediments (stronger backscatter returns) at REF-NE relative to the other two reference areas (Figure 3-3). At REF-E, the filtered backscatter imagery suggested finer-grained, smoother, or softer ambient sediments (weaker backscatter returns) relative to the other two reference areas. Intermediate backscatter returns were observed at REF-SW. Variability in backscatter returns observed at REF-NE and in the northeast portion of REF-E may be indicative of sand waves and ripples.

Side-scan sonar imagery derived from MBES was obtained at the three reference areas (Figure 3-4). Similar to the backscatter returns, the side-scan sonar imagery indicated a relatively uniform seafloor in most of the refence areas. The exceptions were a central portion of REF-NE and in an eastern portion of REF-E where evidence of sand waves and ripples were observed. Due to technical difficulties, side-scan sonar imagery was not collected at RISDS during the 2020 acoustic survey. Supplemental backscatter data analysis and interpretation was conducted (Section 4.0) to enhance the RISDS seafloor characterization.

3.1.3 Comparison with Previous Bathymetry

The 2020 bathymetry data were quantitatively compared to 2015 bathymetry data to assess elevation changes since 2015 (Figure 3-5). The 2015 acoustic survey was conducted over the north-central portion of the site (blue outline in Figure 3-5). Bottom depths measured during the 2015 survey were subtracted from those measured during the 2020 survey to obtain an elevation difference map of each survey point throughout the combined study area (Figure 3-5A). Positive values (represented as shades of yellow and orange in the elevation difference maps) computed between surveys indicated elevations have increased (i.e., sediment accumulation). Negative elevation change (represented in shades of blue) computed between surveys indicated areas that elevation has decreased (i.e., compaction, redistribution, smoothing).

Between 2015 and 2020, dredged material was reportedly placed at two distinct locations in the northeast corner of RISDS and the seafloor elevation increased by as much as 2.0 m at these two locations (Table 1-1; Figures 1-4 and 3-5B). In addition, the seafloor elevation increased in an oval-shaped area southwest of RISDS-N by as much as 1.4 m where dredged material placement primarily from the Port of Davisville and Quonset Business Park project was reportedly placed.

On the northern mound peak within the sampling area RISDS-N, there was no measurable increase in seafloor elevation observed. On the contrary, a reduction in the height of RISDS-N above the seafloor of approximately 1.4 m was observed based on the 2015 vs 2020 depth difference analysis. The reduction in elevation of RISDS-N was likely due to consolidation of the relatively large volume of material (846,100 yd^3) placed there during the 2013 to 2015 timeframe (Table 1-1).

Since the 2015 acoustic survey included only the northern region of RISDS, a depth comparison was conducted between 2013 and 2020 to capture a more comprehensive depiction of the change in elevation over time throughout RISDS. Bottom depths measured during the 2013 survey were subtracted from those measured during the 2020 survey to obtain an elevation difference map (Figure 3-6). Additional material placed between the 2013 and 2015 surveys included 846,000 yd^3 of dredged material from New Bedford CAD cells. This material was placed on the northern mound (within RISDS-N). The peak of

RISDS-N was observed to increase by as much as 9.7 m from 2013 to 2020 and two new small northeast mounds appeared (Figure 3-6). Between 2013 and 2020, no substantial measurable changes in seafloor elevation were observed throughout RISDS, except in the northern areas described above.

3.2 Sediment Profile and Plan View Imaging

The primary purpose of the SPI/PV survey at RISDS was to characterize the physical features of surficial sediments and assess the status of benthic colonization at the selected disposal areas and compare results with conditions at the three reference areas. Station summaries of selected physical and biological parameters from the SPI/PV images can be found in Tables 3-1, 3-2, 3-3, and 3-4 and a complete set of SPI/PV results are provided in Appendices D and E. Table 3-5 provides a summary of hard bottom-specific PV image results from stations where gravel was observed.

3.2.1 Reference Area Stations

In May 2020, a total of 15 SPI/PV stations were sampled across the three reference areas. This included paired SPI and PV image collection in triplicate at five stations within each of the three reference areas, REF-NE, REF-E, and REF-SW (Figure 3-7). These reference areas were used to represent ambient sediment conditions of the region relative to RISDS.

Physical Sediment Characteristics: Measured water depth during SPI/PV sampling across the surveyed reference areas ranged from a minimum of 37.5 m at REF-NE-04 to a maximum of 41.5 m at two stations at REF-E (Table 3-1). Sediment grain size major mode at the reference areas ranged from silt/clay at several stations at REF-E to medium sand at several stations at REF-NE (Figures 3-8 and 3-9). However, the majority of stations across the reference areas were characterized as predominantly very fine to fine sand (Figure 3-9).

The differences in sediment compaction across the reference areas were evident in the camera prism penetration depths and camera system weights used during image collection. The spatial patterns of prism penetration corroborated the backscatter data, with shallower prism penetration associated with stronger backscatter returns (Figures 3-3, 3-8, and 3-10). Prism penetration ranged across the three reference areas from a minimum of 3.9 cm at Station REF-NE-02 to a maximum of 18.9 cm at Station REF-E-05, with an overall reference area average of 10.0 cm (Table 3-1; Figure 3-10). Prism penetration was generally deepest at

REF-E, followed by REF-SW, and shallowest at REF-NE (Figure 3-10). Ten weights were used at REF-NE, while only eight weights were needed at REF-E and REF-SW (Appendix D). Compared to the other reference areas, REF-NE had the shallowest penetration depths despite the additional weight, averaging 5.1 cm (Table 3-1; Figure 3-10). REF-E had the deepest penetration depths across the reference areas, which averaged 16.8 cm (Table 3-1; Figure 3-10).

Small scale boundary roughness values across the three reference areas ranged from 0.7 to 2.4 cm, with an overall mean of 1.4 cm (Table 3-1; Figure 3-11). At REF-E and REF-SW, most of these small-scale roughness elements were biogenic in origin (e.g., burrow openings, fecal mounds, fecal stacks, foraging depressions) (Table 3-1; Figure 3-12). Two stations at REF-E had high boundary roughness as a result of large biogenic tunnels on the sediment surface (Figure 3-12). Small-scale bedforms (e.g., small ripples) were evident at REF-NE, although boundary roughness here was generally comparable to the other reference areas, despite these physically derived sand ripples (Table 3-1; Figures 3-11 and 3-12).

Biological Conditions and Benthic Recolonization: In general, there were distinctive biological characteristics observed at each of the three reference areas (Table 3-2). REF-E, which had the deepest penetration depths and finest sediments, had more frequent occurrences of subsurface feeding voids and Stage 3 deep burrowing polychaetes relative to the other reference areas. REF-SW had high densities of epifaunal amphipods that construct and climb stalks on the surface of soft sediments. REF-NE, which had slightly coarser sediments relative to the other reference areas, had prevalent tracks and small burrows visible on the sediment surface in PV images.

Mean aRPD depths were generally similar across the three reference areas. Mean aRPD depth ranged from a minimum of 2.8 cm at Station REF-SW-02 to a maximum of 6.3 cm at Station REF-NE-01, with an overall reference area mean of 4.4 cm (Table 3-2; Figure 3-13). The vast majority of stations across all three reference areas had aRPD depths that measured between 3.1 and 5.0 cm (Figure 3-13). There was no evidence of low dissolved oxygen in the overlying water or signs of methane in the subsurface sediments at any of the reference area stations (Appendix D).

Evidence of mature, deposit-feeding infaunal (Stage 3) assemblages was found at all reference areas, manifested as subsurface feeding voids in SPI replicates, large burrows visible in PV replicates, and/or deep-burrowing polychaetes in SPI replicates (Table 3-2; Figures 3-14 and 3-15). Assemblages of Stage 2 tubicolous surface fauna, including both polychaetes and amphipods were common at all three reference areas. Stage 2 on 3 was the predominant successional stage at REF-E, where large deep burrowing polychaetes and/or subsurface feeding voids were frequently observed in combination with small tubes at the sediment water interface (Table 3-2; Figures 3-14 and 3-15). At both REF-NE and REF-SW, Stage 2 -> 3 was the most frequently observed successional stage across replicates, generally as inferred by tubicolous surface fauna (polychaetes and/or amphipods) in SPI images and large burrows visible in the PV images, which are an indication of Stage 3 assemblages (Figure 3-14). Subsurface feeding voids in SPI were more prevalent at REF-E compared to the other reference areas, with generally 1 to 2 voids observed per image (Table 3-2; Figure 3-16). The maximum depth of these voids below the sediment water interface at REF-E extended to 16.7 cm but were most often between 10.1 and 15.0 cm depth (Figure 3-17; Appendix D).

The widespread presence of Stage 3 infauna detected in the sediment profile images was further supported in the corresponding plan view images from the reference areas. All of the plan view images from the reference areas showed burrow openings at the sediment surface, with the exception of two images from REF-NE (Appendix E). There also was abundant evidence of epifauna in the form of tracks, pits, amphipod fecal stacks, and organisms, including sea stars, crabs, and shrimp (Table 3-2; Figure 3-15). There was no indication of any severe disturbance to the reference area benthic communities from trawling or other anthropogenic impacts.

3.2.2 Disposal Site Stations

SPI and PV images were collected across seven areas within RISDS, including five historical disposal areas (RISDS-A, -B, -C, -D, and -E), an active disposal area (RISDS-N), and an area where disposal activity has been limited (RISDS-NW) (Figure 3-7).

<u>Physical Sediment Characteristics:</u> Measured water depth during SPI/PV sampling across the RISDS surveyed area ranged from a minimum of 29.9 m at Station 03 at RISDS-N to a maximum of 39.6 m at all three stations at RISDS-C (Table 3-3). Surface sediments at the RISDS stations varied from silt/clay to small gravels and cobble (Table 3-3; Figure 3-9; Appendix D). The predominant grain size major mode observed at the majority of disposal areas (i.e., RISDS-A, -B, -D, and -E) was a surficial few centimeters of very fine to fine sand overlying silt/clay (Figure 3-9). A large fraction of cobble was observed at the peak of the northern mound within RISDS-N (Station 03) and at RISDS-C (Figures 3-18 and 3-19).

Dredged material was documented at all stations within RISDS with the exception of Station 01 (Table 3-3), where shallow prism penetration may have inhibited detection of buried disposal material. At soft-sediment stations, evidence of dredged material was manifested as a silt/clay layer underlying a fine to very fine sand surface layer. This subsurface silt/clay layer was often highly reduced material (i.e., dark gray to black) and was generally poorly sorted in grain sizes (e.g., light gray and black clay mottled with silt) indicating dredged material (Figure 3-20). Across RISDS stations, dredged material occurred on average at 1.3 cm below the sediment water interface and averaged 7.9 cm in thickness; although generally, the dredged material extended below that of the SPI prism penetration (Table 3-3; Figure 3-21) so the thickness was greater than that measured. RISDS-D was the only disposal area where dredged material did not consistently extend below the depth of SPI prism penetration. At RISDS-D, the dredged material thickness was between 6 and 10 cm (Figure 3-21).

In addition to subsurface layers of mottled and poorly sorted sediments, the presence of small gravels and cobble on soft sediment provided evidence of dredged material at RISDS. This was documented at both RISDS-N and RISDS-C (Figures 3-9, 3-18, and 3-19). In these two areas, large gravels were observed and limited or inhibited SPI prism penetration (Table 3-3; Figure 3-10). Large shell fragments of coastal, shallow-water bivalves (i.e., oyster and bay scallops) were observed at several stations at RISDS-A, RISDS-B, and RISDS-E and provided another indication of dredged material (Figure 3-20C).

Similar to the reference area, camera prism penetration depths varied relative to sediment grain size and density, ranging from no penetration at areas where hard substrate inhibited penetration (i.e., RISDS-N and RISDS-C) to deep penetration (e.g., 14.0 cm) at RISDS-NW (Table 3-3; Figure 3-10). Prism penetration averaged 7.7 cm across RISDS (Table 3-3). However, only two weights were used at RISDS compared to the eight and ten weights at the reference areas because the mixture of ambient and dredged sediments at RISDS were generally not as dense as consolidated ambient sediments at the reference areas (Appendix D). The camera stop setting was also lower (12) than the settings used (14 or 16) at the reference areas (Appendix D). As a result, penetration depths between the reference area and RISDS were not directly comparable.

Boundary roughness values at RISDS stations were very similar to the reference areas, ranging from 0.8 cm to 3.0 cm, with an overall mean across RISDS of 1.3 cm (Table 3-3; Figure 3-11). Boundary roughness at RISDS stations was generally attributed to biogenic processes, with the exception of a few stations that had cobbles or small-scale sand ripples influencing the boundary roughness (Table 3-3; Figure 3-11).

Plan view images confirmed the presence of gravel at fourteen total stations, all of which were located at RISDS; no gravel was observed at any of the reference area stations (Table 3-5; Figure 3-18). Additional image analysis was conducted on PV image replicates collected at these stations to capture hard bottom-specific features. Across these stations maximum particle size ranged from granule/pebble (2-64 mm) to cobble size (64-256 mm); cobble was observed at ten stations, while granule/pebble was documented at the remaining four stations (Table 3-5; Figure 3-18). CMECS Substrate Subgroup, which broadly describes the proportion of gravel and sand observed in the PV images, was mapped by replicate (Figure 3-22). RISDS-C and the pinnacle of the mound located in the RISDS-N area had >80% cover of gravel (CMECS Substrate Subgroups Cobble and Pebble/Granule), while at RISDS-A and RISDS-E gravel was patchier and made up generally <30% cover (CMECS Substrate Subgroups Gravelly Sand and Sand or finer) (Table 3-5; Figure 3-22).

Biological Conditions and Benthic Recolonization: Mean station aRPD depths at RISDS ranged from a minimum of 0.0 cm at two stations at RISDS-D and one station at RISDS-E to a maximum of 2.2 cm, which was measured at a station at RISDS-NW. The overall RISDS mean aRPD depth was 0.7 cm (Table 3-4; Figures 3-13 and 3-23). At several stations at RISDS, the aRPD depth was indeterminant due to limited prism penetration as a result of hard bottom (e.g., Stations 03, 18, and 16) or due to coarser material being dragged down into the sediment by the camera prism obstructing the surficial aRPD depth (Figure 3-13). Although several stations had highly reduced sediments either at the sediment water interface or at depth, there were no locations sampled at RISDS that showed any evidence of low oxygen in the overlying waters or methane formation from excess organic enrichment in the subsurface sediments. Overall aRPD depths were lower at RISDS than at the reference areas. Results of the statistical comparison between the aRPD depths at RISDS with those measured at the reference areas are detailed in Section 3.2.3.

Similar to the reference stations, evidence of mature, Stage 3 deposit-feeding assemblages were found at the majority of stations sampled within RISDS boundary; 16 out of 18 stations where successional stage was determinate and had at least one replicate SPI/PV pair with evidence of Stage 3 taxa (Figure 3-14). This included direct observations of deep burrowing polychaetes, presence of subsurface feeding voids, and/or occurrences of large burrow openings on the sediment surface observed in plan view images (Figure 3-24).

The maximum depth of feeding void structures, when present, ranged from 4.1 to 9.4 cm with an overall RISDS average of 7.4 cm (Table 3-4; Figure 3-17).

Several stations at RISDS were classified predominantly as Stage 2 or included only Stage 1 organisms (Figure 3-14). Three replicate images across three separate stations were classified as Successional Stage 1, including two at RISDS-E and one at RISDS-D. These replicate images were co-located with image replicates where Stage 3 and Stage 2 -> 3 were observed, indicating presence but low abundance of Stage 3 taxa at these stations. At several stations, all within RISDS, hard substrata inhibited SPI prism penetration, limiting infaunal successional stage classification (i.e., Stations 03, 16, and 18), and infaunal successional stage was indeterminate (Figure 3-14).

The epifaunal communities observed in PV images varied based on the predominant grain size at each station. Hermit crabs, amphipods, and shrimp, as well as extensive crustacean tracks were common at soft-sediment stations within RISDS (Table 3-4). Evidence of biological activity in the form of burrow openings, shell fragments, and crustacean tracks was documented in the plan view images across RISDS (Appendix E). Tracks and burrows were observed at most stations (Table 3-4). At stations characterized by hard bottom, epifaunal communities consisted of bryozoa, hydroids, barnacles, and sea stars (Table 3-4; Figure 3-19). The percent coverage of attached epifauna was highest at RISDS-C where larger particle sizes (cobbles) and more continuous gravel (>80 % cover of gravel) were observed compared to the other disposal areas (Table 3-5; Figures 3-18, 3-22, and 3-25).

3.2.3 Statistical Comparisons

Mean aRPD Depths: The three 2020 reference areas were similar in their distribution of aRPD values (Table 3-6, Figure 3-26); average aRPD depth values ranged from a mean of 4.11 (± 0.85 SD) cm at REF-SW to a mean of 4.95 (± 0.79 SD) cm at REF-NE, with an intermediate mean of 4.27 (± 0.77 SD) cm at REF-E (Table 3-6). At RISDS, the deepest aRPD depth was at RISDS-C, where only one image had a measurable aRPD (1.84 cm), and the shallowest aRPD depths occurred at RISDS-D and RISDS-E. The mean aRPD at RISDS-D averaged 0.01 (n=2), while RISDS-E only measurable aRPD depth was 0.01, the remaining aRPD depths were indeterminant at this area (Table 3-6).

An inequivalence test was performed to determine whether the difference observed between the mean aRPD values of the three reference areas (4.44 cm ± 0.83 SD) and the seven disposal areas (0.74 cm ± 0.72 SD) was statistically significant (Table 3-6). Using the data from these ten locations, the results for the normality test indicated that the area residuals (i.e., each observation minus the area mean) were not significantly different from a normal distribution (Shapiro-Wilk's test p-value = 0.32). Levene's test for equality of variances was not rejected (p = 0.19). The confidence interval for this aRPD difference equation was constructed using a normal theory equation and pooled variance estimates.

The confidence region for the difference between the 2020 reference versus disposal means was not contained within the interval [-δ, +δ], which, based on historical data collected at the reference areas, was determined to be [-2.2, +2.2 cm], as described in the statistical methods (Section 2.5.1) (Table 3-7). The conclusion was that the reference areas had significantly higher aRPD values than at RISDS, with a difference in means of approximately 3.71 cm. This suggests higher sediment respiration rates and/or less bioturbation activity at RISDS compared to the reference areas.

Successional Stage Ranks: Similar to the aRPD depth analysis, a statistical comparison was conducted to examine the difference between successional stages measured in reference areas and at RISDS in 2020. The mean successional stage rank among reference areas was 2.83; the mean among RISDS was also 2.83 (Table 3-6). Despite the difference in means being equal to zero, an inequivalence test was still performed to account for possible differences in the variability across groups that may influence the confidence region for the difference in means. The results for the normality test indicated that the area residuals were significantly different from a normal distribution (Shapiro-Wilk's test p-value = 0.002). Levene's test for equality of variances was not rejected (p = 0.141). Consequently, a nonparametric confidence interval was constructed using the bootstrap-*t* interval (Lunneborg 2000; Manly 1997; see methods in Appendix G).

The confidence region for the difference between the 2020 reference versus disposal means was fully contained within the interval [-0.5, +0.5] (Table 3-7). The conclusion was that the three reference and seven disposal areas had similar maximum successional rank values in the 2020 survey, suggesting benthic recolonization is underway at RISDS.

3.3 Sediment Grab Sampling

Sediment grab samples were collected and analyzed for grain size, sediment chemical analyses, and benthic community structure. Three grab samples were collected from each of the three reference areas and at each of three disposal areas: RISDS-N, RISDS-B, and

RISDS-E (Figure 3-7). One replicate per sample was processed and analyzed for grain size and chemical analyses and one replicate was processed and analyzed for benthic community structure. Results for sediment analyses (grain size, TOC, total PCBs, total PAHs, selected pesticides, and metals) and for benthic community analysis are provided below. Summary statistics for sediment chemistry results are presented using the same classification system as for SPI/PV results. Sediment data are also presented using standard boxplots by area relative to reference, as well as the associated ER-L and ER-M values (Long et al. 1995). Full results for all parameters are provided in Appendices H (sediment grain size and chemistry) and I (benthic community analysis).

3.3.1 Grain Size and Total Organic Carbon

Grain size results for the 18 sampling stations are summarized in Table 3-8 and presented in Figures 3-27 and 3-28. Grain size distributions varied across the surveyed area. In general, the stations at RISDS were characterized by poorly sorted sediments with a wide range of grain sizes, while the sediments at the reference areas were more homogenous within each station and area.

The grain size distributions across the three reference areas averaged 66% fine sand, 18% silt, and 10% medium sand, with, on average, smaller contributions of clay, coarse sand, and gravel (Table 3-8; Figures 3-27 and 3-28). REF-SW and REF-NE were predominantly composed of fine sand, which made up between 78 and 91% at REF-SW and between 66 and 81% at REF-NE (Table 3-8; Figures 3-27 and 3-28). The remaining fraction at REF-SW was silt (6-15%) with minor contributions of medium sand and clay. While at REF-NE the remaining fraction was a mix of medium sand and silt with smaller contributions of clay, gravel, and coarse sand. REF-NE was the only reference area where gravel occurred in any substantial amounts (1-6%). REF-E was composed of a mixture of silt (29-40%) and fine sand (31-45%), with clay, medium sand, and coarse sand also contributing to the mix.

Within RISDS, the grain size distributions varied across the three disposal areas but on average was composed mainly of fine sand (averaged 51%), medium sand (averaged 19%), and silt (averaged 17%) (Table 3-8; Figure 3-27 and 3-28). RISDS-N was composed mainly of fine sand (50-83%) and silt (12-39%) with minor fractions of medium sand and clay (Figures 3-27 and 3-28). RISDS-B had a wide variety of grain sizes with significant contributions of gravel (7-13%), coarse sand (4-12%), medium sand (16-27%), fine sand (29-50%), and silt (14-23%). RISDS-E was mainly composed of fine sand (34-51%) and medium sand (22-49%), with small amounts of clay, silt, and gravel (Table 3-8).

Total organic carbon results are summarized in Table 3-8 and presented in Figures 3-29 and 3-30. In general, TOC was low across all reference and RISDS stations sampled, averaging 0.6% and 0.8%, respectively (Table 3-8; Figure 3-29). The range of TOC at the reference areas was relatively narrow, ranging from 0.2% at REF-SW-03 to 1.3% at REF-E-02. Similarly, at RISDS, TOC ranged from 0.2% at RISDS-N-01 to 1.5% at RISDS-B-04 (Table 3-8). In general, RISDS-B had higher TOC relative to the other RISDS stations but values here were comparable to those measured at REF-E (Figures 3-29 and 3-30). TOC values were significantly correlated with the contribution of fines (silt/clay) in a sample (Figure 3-30). Generally, sediments at RISDS-B had higher percent TOC relative to percent fines compared with the other stations sampled. REF-E had similar TOC content to RISDS-B but a higher contribution of total fines (Figure 3-30).

3.3.2 Sediment Chemistry

A summary of total PAHs, total PCBs, total chlordane, and total DD_x are provided by area in Table 3-9 and Figure 3-31. In general, analyte concentrations in sediment grab samples were low relative to published ER-Ms and ER-Ls across all stations. The sediment chemical concentrations measured in this study were consistently below the ER-M for all measured analytes and often below the ER-L.

Overall, total PAHs averaged 555.3 and 57.1 µg/kg at RISDS and the reference areas, respectively (Table 3-9). Total PAHs measurements were well below the ER-L across all stations (Table 3-9; Figure 3-31). The highest concentrations of total PAHs were observed at RISDS-B (1,212 µg/kg), while the lowest average total PAHs occurred at REF-NE (25.6 µg/kg) (Table 3-9).

Total PCBs followed similar trends as total PAHs. Overall, total PCBs averaged 35.3 and 2.8 µg/kg at RISDS and the reference areas, respectively (Table 3-9). Total PCBs measurements were well below the ER-M across all stations (Figure 3-31). Total PCBs were below the ER-L at all stations with the exception of stations at RISDS-B and RISDS-E. In general, total PCBs were higher at RISDS-B and RISDS-E stations compared to the reference areas (Figure 3-31). On average, between 74 and 94% of the 18 PCB congeners analyzed were detected across the RISDS stations (Table 3-9, Mean % Detected). In contrast, at REF-NE none of the 18 congeners analyzed were detected and at the other two reference areas only on average about 30-40% of the congeners were detected, and at low concentrations (Table 3-9).

Chlorinated pesticides detected in sediments from disposal locations and the reference areas are summarized in Table 3-10; total DDx and total chlordane are summarized in Table 3-9 and shown in Figure 3-31. Of the 22 pesticides analyzed only four were detected in at least one sample across the three reference areas (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin). While at RISDS, in addition to those four pesticides detected at the reference areas, alpha-chlordane, cis-nonachlor, endosulfan sulfate, and gamma-chlordane, were detected in at least one sediment sample (Table 3-10). However, often these pesticides were only detected in one or two samples, generally collected from RISDS-B (Table 3-10). Total DDx values (the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were well below ER-M and below ER-L across all areas, with the exception of RISDS-B. At RISDS-B, total DDx exceeded ER-L (Table 3-9; Figure 3-31). Similarly, total chlordane was well below ER-M and below ER-L across all areas, with the exception of RISDS-B which was similar to ER-L, averaging 0.4 µg/kg (Table 3-9; Figure 3-31).

Results of the nine metals analyzed – arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, and Zn) – are summarized in Table 3-11 and presented in Figure 3-32. In general, all metal concentrations were far below ER-M and ER-L values across all areas. However, the copper ER-L was exceeded in all three samples from RISDS-B, averaging 61.8 mg/kg, and one sample at RISDS-E, although the site average (26.6 mg/kg) was below the ER-L. Mercury levels at RISDS-B exceeded ER-L, averaging 0.18 mg/kg. In general, RISDS-B had higher concentrations of all the metals relative to the other areas. REF-E had higher concentrations of arsenic, nickel, and zinc relative to the other reference areas.

3.3.3 Benthic Community Analysis

Benthic community analyses results are reported in Tables 3-12, 3-13, 3-14, and 3-15, and presented in Figures 3-33, 3-34, 3-35, and 3-36. The complete results of benthic community analysis are provided in Appendix I. A combined total of 113 benthic taxa were reported from analysis of grab sample results from the 18 stations (Table 3-12; Appendix I). The number of species per grab (0.04 m^2) ranged from a low of 23 taxa to a high of 57 taxa (Table 3-12; Figure 3-33). Numbers of individuals ranged from a low of 132 individuals per 0.04 m^2 to a high of 1,434 individuals per 0.04 m^2 (Table 3-12; Figure 3-34).

The nine samples across the three reference areas had a total of 92 taxa and 7,542 individuals with an average of 43 taxa per station and 838 individuals per 0.04 m^2 at each station (Table 3-12). The diversity of species, as measured by Shannon's Diversity Index H′, at the stations ranged from 1.95 at REF-E-03 to 2.85 at REF-NE-03. Pielou's J′, which is a measure of species evenness within a community derived from H′, ranged from 0.54 to 0.74, with an average of 0.62 (Table 3-12). Total biomass averaged 5.9 g across the reference stations with arthropods accounting for the majority of the biomass (Table 3-13).

Several species were numerically dominant across the three reference areas. At REF-E, which was dominated by well-sorted very fine sand or silt/clay, a subsurface deposit feeder, the nut clam (*Nucula proxima* [Nuculidae]), and a tube-building polychaete, *Owenia fusiformis* (Oweniidae), were the two most abundant species, making up on average, across the three stations, 42% and 14% of the total communities, respectively (Tables 3-14 and 3-15; Figure 3-35). Similarly, at REF-SW, *Nucula proxima* was an important component of the benthic assemblage, making up on average 24.4% of the total community, as well as *Leptocheirus pinguis* (Aoridae), a surface burrowing amphipod, that averaged 25.2% of the total community at REF-SW (Tables 3-14 and 3-15; Figure 3-35). At REF-NE, the suspension feeding amphipod *Byblis serrata* (Ampeliscidae) was the most common species (24.4%), followed by *Leptocheirus pinguis* (Aoridae) (17%) and *Nucula proxima* (Nuculidae) (15.8%) (Tables 3-14 and 3-15; Figure 3-35).

The nine samples across the three RISDS disposal areas (RISDS-B, -D, and -N) had a total of 86 unique taxa and 2,231 individuals with an average of 33 taxa per station and 248 individuals per 0.04 m^2 at each station (Table 3-12). The diversity of species, as measured by Shannon's Diversity Index H′, at the stations ranged from 1.86 at RISDS-B-04 to 2.98 at RISDS-E-09. Pielou's J′, which is a measure of species evenness within a community derived from H′, ranged from 0.58 to 0.86, with an average of 0.77 (Table 3-12). Total biomass averaged 1.5 g across the RISDS stations with Annelida and Arthropoda accounting for the majority of the biomass (Table 3-13).

Several species were numerically dominant across the three RISDS areas. At RISDS-N, the top three most abundant taxa were all amphipods (Class Malacostraca), with the most abundant being the suspension feeding amphipod *Byblis serrata* (Ampeliscidae), which averaged 15.4% across the three stations (Tables 3-14 and 3-15; Figure 3-35). At RISDS-B, the most abundant taxa included *Nucula proxima* (Nuculidae) (27.8%), and the two polychaetes *Cossura soyeri* (Cossuridae) (12.0%) and *Ninoe nigripes* (Lumbrineridae) (11.3%) (Tables 3-14 and 3-15; Figure 3-35). At RISDS-E the most abundant taxa included three polycheates: *Polygordius* (Polygordiidae) (15.2%), *Ninoe nigribes* (Lumbrineridae) (12.4%), and *Chone* (Sabellidae) (10.4%) (Tables 3-14 and 3-15; Figure 3-35).

3.3.4 Comparison to the Reference Areas

The reference areas and RISDS areas had similar species diversity and evenness as reflected in the number of species and the diversity metrics (Table 3-12). However, on average, more than triple the number of individual organisms was found at the reference stations compared to RISDS stations (Figures 3-34 and 3-35). This was also reflected in the generally lower total biomass at RISDS compared with reference stations (Table 3-13). This difference was mainly due to high abundances of one or two taxa at the reference areas; for example, high abundances of *Nucula proxima* and *Owenia fusiformis* at REF-E and high abundances of *Leptocheirus pinguis* and *Nucula proxima* at REF-SW (Figure 3-35). Several species that ranked in the top 10 most abundant at RISDS also occurred in the top ten for the reference area (Table 3-15).

The benthic assemblages at each of the 18 stations were compared by calculating Bray-Curtis Dissimilarity, conducting non-metric multidimensional scaling (nMDS), and plotting as an ordination to visualize the degree of similarities and differences across the stations. The nMDS plot, with symbology that depicts whether the sample was from a reference area or RISDS area and the specific area that sample was collected, shows the relative similarity of benthic infaunal assemblages (Figure 3-36). The nMDS stress was 0.11. There was a clear separation between the samples collected at the reference areas compared to those collected within RISDS. In general, the stations within each of the six surveyed areas clustered together within the two-dimensional ordination.

The infaunal community assemblages were generally related to the sediment type and dredged material presence or absence (Figure 3-36). In the ordination, the samples generally arranged along the primary axis (NMDS1) based on sediment type and organic carbon content and secondarily by disposal versus reference area (NMDS2) (Figure 3-36). RISDS-B and REF-E had high contribution of fines and correspondingly high TOC and tended to cluster on the right side of the ordination plot (Figures 3-30 and 3-36). While RISDS-N, REF-NE, and REF-SW which had the lowest percent fines and relatively low TOC, arranged towards the left side of the ordination plot (Figures 3-30 and 3-36). Polychaetes were relatively more abundant at the areas with higher percent fines and relatively higher TOC (RISDS-B, RISDS-E, and REF-E) (Figure 3-35). In contrast, Malacostraca were numerically more prevalent at the areas with lower TOC and less percent fines (RISDS-N, REF-NE, and REF-SW) (Figure 3-35). At these areas, the physical conditions are generally less suitable for deep burrowing polychaetes and more amenable to suspension feeders and surface deposit feeders, such as members of the Malacostraca class. Podocerid amphipods were visible in high numbers in both the SPI and PV imagery collected from REF-SW and REF-E (Table 3-2). Podocerid amphipods are easily recognizable in SPI/PV imagery as they build narrow stacks on the sediment surface, which they climb to improve access to the water column during suspension feeding (Figure 3-8D). Despite the prevalence of podocerid amphipods in SPI/PV imagery, they were not a large component of the community assemblages as determined through sediment grab sampling (Table 3-14; Figure 3-35). These organisms are very quick and known to be able to evade the grab sampler, highlighting the potential bias associated with assessing benthic community composition through sediment grab sampling.

Table 3-1.

Summary of RISDS Reference Area Sediment Profile and Plan View Imaging Physical Results

Station ID	SPI Replicate (n)	Water Depth (m)	Mean Prism Penetration Depth (cm)	Mean Boundary Roughness (cm)	Predominant Boundary Roughness Type	SPI Predominant Grain Size Major Mode (phi)	Mean Mud Clast Number	SPI Dredged Material Presence	Mean Dredged Material Thickness (cm)	Dredged Material > Penetration	Buried Dredged Material Presence	Mean Dredged Material Depth (cm)	PV Replicate (n)	Predominant Bedform Type
REF-E-01	3	41.5	13.6	0.8	Biological	>4	0.0	No	N/A	No	N/A	N/A	2	None
REF-E-02	3	41.5	18.1	0.7	Biological	4 to 3	0.0	No	N/A	No	N/A	N/A	3	None
REF-E-03	3	41.1	16.4	2.4	Biological	4 to 3	0.0	No	N/A	No	N/A	N/A	2	None
REF-E-04	3	41.1	16.8	2.1	Biological	4 to 3	0.0	No	N/A	No	N/A	N/A	1	None
REF-E-05	3	41.5	18.9	1.5	Biological	>4	0.0	No	N/A	No	N/A	N/A	1	None
REF-NE-01	3	38.4	6.3	1.3	Physical	2 to 1	0.0	No	N/A	No	N/A	N/A	3	None
REF-NE-02	3	38.1	3.9	1.4	Physical	3 to 2	0.0	No	N/A	No	N/A	N/A	3	Small ripples
REF-NE-03	3	38.1	6.6	1.1	Physical	3 to 2	0.0	No	N/A	No	N/A	N/A	2	Small ripples
REF-NE-04	3	37.5	4.7	1.5	Physical	3 to 2	0.0	No	N/A	No	N/A	N/A	3	Small ripples
REF-NE-05	3	38.1	4.1	2.0	Physical	3 to 2	0.0	No	N/A	No	N/A	N/A	3	Small ripples
REF-SW-01	3	39.0	6.8	1.6	Biological	4 to 3	0.0	No	N/A	No	N/A	N/A	2	None
REF-SW-02	3	39.6	11.5	1.3	Biological	4 to 3	1.7	No	N/A	No	N/A	N/A	2	None
REF-SW-03	3	38.1	4.6	1.4	Physical	3 to 2	0.7	No	N/A	No	N/A	N/A	3	None
REF-SW-04	3	39.9	11.2	1.2	Biological	4 to 3	0.0	No	N/A	No	N/A	N/A	2	None
REF-SW-05	3	39.0	6.6	0.7	Biological	3 to 2	0.0	No	N/A	No	N/A	N/A	3	None
n = 15														
Max		41.5	18.9	2.4			1.7							
Min		37.5	3.9	0.7			0.0							
Mean		39.5	10.0	1.4			0.2							
Standard Deviation		1.5	5.5	0.5			0.5							

N/A=Not Applicable

Table 3-2.

Summary of RISDS Reference Area Sediment Profile and Plan View Imaging Biological Results

Station ID	SPI Replicate (n)	Mean aRPD Depth (cm)	Sediment Oxygen Demand Level	Mean Subsurface Feeding Voids	Mean Minimum Void Depth (cm)	Mean Maximum Void Depth (cm)	Highest Successional Stage[1]	PV Replicate (n)	Tubes Presence	Burrow Presence	Tracks Presence	Epifauna Present	Mean Fish Present
REF-E-01	3	4.0	Low	1.0	8.2	14.3	2 on 3	2	Yes	Yes	Yes	Crab, Podocerid Amphipod(s), Shrimp	0.0
REF-E-02	3	4.5	Low	1.0	9.7	11.2	2 on 3	3	Yes	Yes	Yes	Sea Star(s)	0.0
REF-E-03	3	3.5	Low	1.7	8.1	10.2	2 on 3	2	Yes	Yes	No	Sea Star(s)	0.0
REF-E-04	3	3.8	Low	1.3	9.9	14.5	2 on 3	1	Yes	Yes	Yes	Podocerid Amphipod(s)	0.0
REF-E-05	3	5.5	Low	2.0	3.9	15.3	2 on 3	1	Yes	Yes	Yes	Sea Star(s)	0.0
REF-NE-01	3	6.3	Low	0.7	6.3	6.7	1 on 3	3	Yes	Yes	Yes	Bryozoa, Sea Star(s), Shrimp	0.0
REF-NE-02	3	4.7	Low	0.0	N/A	N/A	2 -> 3	3	Yes	Yes	Yes	Shrimp	0.0
REF-NE-03	3	4.9	Low	0.0	N/A	N/A	2 -> 3	2	Yes	Yes	Yes	None	0.0
REF-NE-04	3	4.7	Low	0.0	N/A	N/A	2 -> 3	3	Yes	Yes	Yes	Ampelisca Amphipod(s), Shrimp	0.0
REF-NE-05	3	4.1	Low	0.0	N/A	N/A	2 -> 3	3	Yes	Yes	Yes	Bryozoa	0.0
REF-SW-01	3	4.8	Low	0.0	N/A	N/A	2 -> 3	2	Yes	Yes	Yes	Crab, Podocerid Amphipod(s), Shrimp(s)	0.0
REF-SW-02	3	2.8	Low	0.3	5.5	6.6	2 on 3	2	Yes	Yes	Yes	Ampelisca Amphipod(s), Podocerid Amphipod(s), Shrimp(s)	0.0
REF-SW-03	3	4.6	Low	0.3	4.4	4.7	2 on 3	3	Yes	Yes	No	Podocerid Amphipod(s), Shrimp(s)	0.0
REF-SW-04	3	3.7	Low	0.3	3.6	3.8	2 on 3	2	Yes	Yes	Yes	Podocerid Amphipod(s)	0.0
REF-SW-05	3	4.7	Low	0.0	N/A	N/A	2 on 3	3	Yes	Yes	Yes	Podocerid Amphipod(s), Shrimp(s)	0.0
n = 15													
Max		6.3		2.0	9.9	15.3							0.0
Min		2.8		0.0	3.6	3.8							0.0
Mean		4.4		0.6	6.6	9.7							0.0
Standard Deviation		0.8		0.7	2.4	4.4							0.0

N/A=Not Applicable

[1] Successional Stage: “on” indicates one Stage is found on top of another Stage (i.e., 1 on 3); “->” indicates one Stage is progressing to another Stage (i.e., 2 -> 3).

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Table 3-3.

Summary of RISDS Disposal Area Sediment Profile and Plan View Imaging Physical Results

RISDS Area	Station ID	SPI Replicate (n)	Water Depth (m)	Mean Prism Penetration Depth (cm)	Mean Boundary Roughness (cm)	Predominant Boundary Roughness Type	SPI Predominant Grain Size Major Mode (phi)[1]	Mean Mud Clast Number	Dredged Material Presence	Mean Dredged Material Thickness (cm)	Dredged Material > Penetration	Buried Dredged Material Presence	Mean Dredged Material Depth (cm)	PV Replicate (n)	Predominant Bedform Type
RISDS-N	01	3	38.1	3.0	3.0	Physical	Varies	0.0	No	N/A	No	N/A	N/A	3	Ripples
	02	3	36.6	7.9	1.2	Biological	4 to 3/>4	0.0	Yes	10.4	Yes	Yes	1.0	3	Small ripples
	03	3	29.9	0.0	IND	Physical	-4 to -5	0.0	Yes	IND	No	No	IND	3	None
RISDS-B	04	3	38.7	6.7	1.0	Physical	3 to 2/>4	0.0	Yes	4.8	Yes	Yes	1.8	3	Small ripples
	05	3	38.4	9.6	1.2	Biological	3 to 2/>4	0.0	Yes	7.6	Yes	Yes	2.1	3	Small ripples
	06	3	38.5	9.3	1.3	Biological	3 to 2/>4	0.0	Yes	8.1	Yes	Yes	1.2	3	Small ripples
RISDS-E	07	3	37.8	7.1	1.4	Biological	3 to 2/>4	0.0	Yes	4.5	Yes	Yes	2.7	3	Small ripples
	08	3	38.4	9.0	1.3	Biological	3 to 2/>4	0.0	Yes	7.3	Yes	Yes	1.7	2	Ripples
	09	3	37.8	10.5	0.9	Biological	>4	1.7	Yes	10.1	Yes	Yes	0.4	2	None
RISDS-NW	10	3	39.0	14.0	1.0	Biological	>4	0.0	Yes	10.3	Yes	Yes	2.3	2	None
	11	3	39.0	13.5	0.9	Biological	>4	0.0	Yes	12.1	Yes	Yes	0.7	3	None
	12	3	38.7	11.0	1.9	Biological	4 to 3/>4	0.0	Yes	4.1	No	Yes	3.3	2	None
RISDS-A	13	3	39.0	9.5	1.3	Biological	3 to 2/>4	0.0	Yes	8.7	Yes	Yes	0.8	3	Small ripples
	14	3	38.4	10.0	0.9	Biological	3 to 2/>4	0.0	Yes	9.3	Yes	Yes	1.2	3	Small ripples
	15	3	39.0	8.6	0.8	Biological	3 to 2/>4	0.0	Yes	8.2	Yes	Yes	0.4	3	None
RISDS-C	16	3	39.6	0.0	IND	Physical	-5 to -6	0.0	Yes	IND	No	No	IND	3	Small ripples
	17	3	39.6	4.8	1.1	Physical	-3 to -4/>4	0.0	Yes	3.6	Yes	Yes	1.2	3	None

RISDS Area	Station ID	SPI Replicate (n)	Water Depth (m)	Mean Prism Penetration Depth (cm)	Mean Boundary Roughness (cm)	Predominant Boundary Roughness Type	SPI Predominant Grain Size Major Mode (phi)[1]	Mean Mud Clast Number	Dredged Material Presence	Mean Dredged Material Thickness (cm)	Dredged Material > Penetration	Buried Dredged Material Presence	Mean Dredged Material Depth (cm)	PV Replicate (n)	Predominant Bedform Type
	18	3	39.6	0.0	IND	Physical	-3 to -4	0.0	Yes	IND	No	No	IND	3	None
RISDS-D	19	3	38.4	9.3	1.1	Biological	>4	0.0	Yes	9.3	No	No	0.0	3	None
	20	3	38.1	9.0	1.1	Biological	3 to 2/>4	0.0	Yes	7.7	No	Yes	1.3	3	Small ripples
	21	3	38.1	9.7	1.3	Biological	3 to 2/>4	0.0	Yes	8.9	No	Yes	0.8	3	Small ripples
n = 21															
Max			39.6	14.0	3.0			1.7		12.1			3.3		
Min			29.9	0.0	0.8			0.0		3.6			0.0		
Mean			38.1	7.7	1.3			0.1		7.9			1.3		
Standard Deviation			2.0	4.0	0.5			0.4		2.4			0.9		

IND=Indeterminate

[1] Grain Size Major Mode: "/" indicates layer of one phi size range over another.

Table 3-4.

Summary of RISDS Disposal Area Sediment Profile and Plan View Imaging Biological Results

RISDS Area	Station ID	SPI Replicate (n)	Mean aRPD Depth (cm)	Sediment Oxygen Demand Level	Mean Subsurface Feeding Voids	Mean Minimum Void Depth (cm)	Mean Maximum Void Depth (cm)	Highest Successional Stage[1]	PV Replicate (n)	Tubes Presence	Burrow Presence	Tracks Presence	Epifauna Present	Mean Fish Present
RISDS-N	01	3	IND	Low	0.0	N/A	N/A	2	3	Yes	No	Yes	Hermit Crab(s), Snail(s)	0.0
	02	3	1.2	Medium	1.3	1.0	9.3	2 on 3	3	No	Yes	Yes	Podocerid Amphipod(s), Shrimp(s)	0.0
	03	3	IND	IND	IND	IND	IND	IND	3	No	No	No	Barnacle(s), Bryozoa, Hydroids, Sea Star(s)	0.7
RISDS-B	04	3	1.0	Medium	0.3	2.8	5.5	2 on 3	3	Yes	Yes	Yes	Bryozoa, Shrimp	0.0
	05	3	0.5	Medium	0.0	N/A	N/A	2 -> 3	3	Yes	Yes	Yes	Bryozoa, Podocerid Amphipod(s)	0.0
	06	3	IND	High	1.0	6.5	8.9	2 on 3	3	Yes	Yes	Yes	Ampelisca Amphipod(s), Bryozoa, Shrimp	0.0
RISDS-E	07	3	IND	Medium	1.0	3.9	8.6	1 on 3	3	Yes	Yes	Yes	None	0.0
	08	3	IND	Medium	0.7	7.8	8.3	1 on 3	2	No	Yes	Yes	Hermit Crab(s), Shrimp	0.0
	09	3	0.0	High	0.0	N/A	N/A	2 -> 3	2	Yes	Yes	Yes	Barnacle(s), Shrimp	0.0
RISDS-NW	10	3	2.2	Medium	1.0	2.6	4.4	2 on 3	2	Yes	Yes	Yes	Sea Star(s)	0.0
	11	3	0.6	High	3.0	3.9	8.6	2 on 3	3	Yes	Yes	Yes	Crab(s), Podocerid Amphipod(s), Shrimp	0.0
	12	3	0.5	Medium	0.7	4.3	7.0	2 on 3	2	Yes	Yes	Yes	Podocerid Amphipod(s)	0.0

RISDS Area	Station ID	SPI Replicate (n)	Mean aRPD Depth (cm)	Sediment Oxygen Demand Level	Mean Subsurface Feeding Voids	Mean Minimum Void Depth (cm)	Mean Maximum Void Depth (cm)	Highest Successional Stage[1]	PV Replicate (n)	Tubes Presence	Burrow Presence	Tracks Presence	Epifauna Present	Mean Fish Present
RISDS-A	13	3	IND	High	1.0	3.9	8.3	1 on 3	3	Yes	No	Yes	Barnacle(s), Bryozoa, Hermit Crab(s), Shrimp	0.0
	14	3	0.4	High	0.3	1.9	4.1	1 on 3	3	Yes	Yes	Yes	Bryozoa, Podocerid Amphipod(s), Shrimp	0.0
	15	3	0.3	High	1.3	4.5	7.3	2 on 3	3	No	No	No	Barnacle(s), Bryozoa, Hermit Crab(s)	0.0
RISDS-C	16	3	IND	IND	0.0	IND	IND	IND	3	No	No	Yes	Barnacle(s), Bryozoa, Crab(s), Podocerid Amphipod(s), Shrimp	0.0
	17	3	1.8	Medium	0.0	N/A	N/A	2	3	Yes	No	Yes	Barnacle(s), Bryozoa, Podocerid Amphipod(s), Shrimp	0.0
	18	3	IND	IND	0.0	IND	IND	IND	3	No	No	No	Anemone(s), Barnacle(s), Bryozoa, Crab(s), Sponge	0.0
RISDS-D	19	3	0.0	High	0.3	2.4	9.4	1 on 3	3	Yes	Yes	Yes	Barnacle(s), Bryozoa, Podocerid Amphipod(s)	0.0
	20	3	0.0	High	0.7	5.4	7.3	2 on 3	3	Yes	Yes	Yes	Barnacle(s), Bryozoa, Hermit Crab(s)	0.0
	21	3	IND	High	0.7	5.2	6.6	1 on 3	3	Yes	Yes	Yes	Ampelisca Amphipod(s), Podocerid Amphipod(s)	0.0
		n = 21												
		Max	2.2		3.0	7.8	9.4							0.7

RISDS Area	Station ID	SPI Replicate (n)	Mean aRPD Depth (cm)	Sediment Oxygen Demand Level	Mean Subsurface Feeding Voids	Mean Minimum Void Depth (cm)	Mean Maximum Void Depth (cm)	Highest Successional Stage[1]	PV Replicate (n)	Tubes Presence	Burrow Presence	Tracks Presence	Epifauna Present	Mean Fish Present
		Min	0.0		0.0	1.0	4.1							0.0
		Mean	0.7		0.7	4.0	7.4							0.0
		Standard Deviation	0.7		0.7	1.8	1.7							0.1

IND=Indeterminate
N/A=Not Applicable
[1] Successional Stage: “on” indicates one Stage is found on top of another Stage (i.e., 1 on 3); “->” indicates one Stage is progressing to another Stage (i.e., 2 -> 3).

Table 3-5.

Summary of RISDS Disposal Area Plan View Imaging Results Where Hard Bottom was Documented

RISDS Area	Station ID	PV Replicate (n)	Maximum Attached Fauna Percent Cover (CMECS Percent Cover Modifier)	CMECS Substrate Subgroup (by replicate)			Maximum CMECS Gravel Size Category
RISDS-N	01	3	Trace (<1%)	Sand	Sand	Sand	Pebble/Granule
	03	3	Moderate (30 to <70%)	Cobble	Cobble	Pebble/Granule	Cobble
RISDS-B	04	3	Sparse (1 to <30%)	Mixed Sediment	Gravelly Sand	Sand	Cobble
	05	3	Trace (<1%)	Sand	Sand	IND	Pebble/Granule
	06	3	Trace (<1%)	Sand	Sand	Sand	Cobble
RISDS-E	09	2	Trace (<1%)	Gravelly Sand	Sand	-	Cobble
RISDS-A	13	3	Trace (<1%)	Gravelly Sand	Gravelly Sand	Sand	Cobble
	14	3	Trace (<1%)	Sand	Sand	Sand	Cobble
	15	3	Trace (<1%)	Gravelly Sand	Sand	Sand	Pebble/Granule
RISDS-C	16	3	Dense (70 to <90%)	Cobble	Pebble/Granule	Gravelly Sand	Cobble
	17	3	Moderate (30 to <70%)	Pebble/Granule	Pebble/Granule	Gravelly Sand	Cobble
	18	3	Dense (70 to <90%)	Pebble/Granule	Pebble/Granule	Pebble/Granule	Cobble
RISDS-D	19	3	Sparse (1 to <30%)	Sand	Sand	IND	Cobble
	20	3	Sparse (1 to <30%)	Gravelly Sand	Sand	Sand	Pebble/Granule

Table 3-6.

Summary of Station Mean aRPD depth and Maximum Successional Stage Rank by Sampling Location

	aRPD Depth (cm)			Maximum Successional Stage (Numeric Rank)		
Area	**N**	**Mean**	**Standard Deviation**	**N**	**Mean**	**Standard Deviation**
Reference areas						
REF-E	5	4.27	0.77	5	3.00	0
REF-NE	5	4.95	0.79	5	2.60	0.22
REF-SW	5	4.11	0.85	5	2.90	0.22
Mean:		4.44			2.83	
RISDS areas						
A	2	0.31	0.08	3	3.00	0
B	2	0.72	0.33	3	2.83	0.29
C	1	1.84	NA	1	2.00	NA
D	2	0.01	0.01	3	3.00	0
E	1	0.02	NA	3	2.83	0.29
North	1	1.17	NA	2	2.50	0.71
NW	3	1.09	0.99	3	3.00	0
Mean:		0.74		31	2.83	

Table 3-7.

Summary Statistics and Results of Parametric Confidence Bounds for aRPD Depth and or Bootstrap-t Confidence Bounds for Successional Stage Values

Difference Equation[1]	**Observed Difference** ($\hat{d}$)	**SE($\hat{d}$)**	**df for SE($\hat{d}$)**	**Confidence Bounds (D_L to D_U)**[2]	**Method**[3]	**Results**[4]
aRPD: (mean of REF-E, REF-SW, REF-NE) – (mean of RISDS -A, -B, -C, -D, -E, -N, -NW)	3.71	0.31	17	3.17 to 4.24	Np	d
Max SS: (mean of REF-E, REF-SW, REF-NE) – (mean of RISDS -A, -B, -C, -D, -E, -N, -NW)	0.0	0.10	31	-0.29 to 0.16	B	s

[1] Reference and RISDS grouping in [Eq. 1]
[2] D_L and D_U as defined in [Eq. 3]
[3] Np = Normal parametric confidence bounds, using pooled variance estimates
B = bootstrap-*t* non-parametric confidence bounds
[4] s = Reject the null hypothesis of inequivalence: the two group means are significantly equivalent.
d = Fail to reject the null hypothesis of inequivalence between the two group means, the two group means are different.

Table 3-8.

Grab Sampling Results of Grain Size Analysis and Percent Total Organic Carbon

Location	Sample ID	Clay (%)	Silt (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Gravel (%)	Total Organic Carbon (%)
Reference Stations								
	REF-E-01	5.2	29.0	43.5	15.8	6.1	0.4	0.91
REF-E	REF-E-02	8.9	39.9	30.7	15.4	5.1	0.1 U	1.29
	REF-E-03	8.3	35.4	44.5	9.0	2.8	0.1 U	0.89
	REF-NE-01	1.4	10.3	67.5	12.9	2.5	5.4	0.36
REF-NE	REF-NE-02	0.9	7.0	81.1	9.4	0.7	0.9	0.29
	REF-NE-03	1.4	10.5	66.1	13.8	2.2	6.0	0.30
	REF-SW-01	1.2	8.5	87.0	3.1	0.1	0.1	0.30
REF-SW	REF-SW-02	2.4	15.0	78.1	4.1	0.4	0.1 U	0.43
	REF-SW-03	0.8	6.0	90.8	2.2	0.2	0.1 U	0.23
	Average	**3.4**	**18.0**	**65.5**	**9.5**	**2.2**	**1.5**	**0.6**
	Minimum	**0.8**	**6.0**	**30.7**	**2.2**	**0.1**	**0.1 U**	**0.2**
	Maximum	**8.9**	**39.9**	**90.8**	**15.8**	**6.1**	**6.0**	**1.3**
RISDS Stations								
	01	1.6	12.0	82.6	3.7	0.1	0.1 U	0.23
RISDS-N	02	6.6	38.7	50.3	4.0	0.4	0.1 U	0.73
	03	2.8	20.1	72.2	4.6	0.3	0.1 U	0.40
	04	3.1	16.0	29.0	26.7	12.4	12.8	1.49
RISDS-B	05	2.2	13.9	50.1	22.3	4.4	7.1	0.97
	06	2.8	23.0	42.3	15.9	5.0	11.0	1.30
	07	0.8	8.6	44.3	21.7	8.7	15.9	0.44
RISDS-E	08	1.1	9.2	34.0	48.5	6.2	1.0	0.98
	09	1.2	10.7	50.6	23.5	6.0	8.0	0.41
	Average	**2.5**	**16.9**	**50.6**	**19.0**	**4.8**	**6.2**	**0.8**
	Minimum	**0.8**	**8.6**	**29.0**	**3.7**	**0.1**	**0.1 U**	**0.2**
	Maximum	**6.6**	**38.7**	**82.6**	**48.5**	**12.4**	**15.9**	**1.5**

U=Non-detect

Table 3-9.

Summary Statistics of total PAHs, Including Total High and Low Molecular Weight PAHs, Total PCBs, Total Chlordanes, and Total DDx in Sediment Grab Samples

Analyte[1,2] (µg/kg DW)	Summary Statistics	REF-E	REF-NE	REF-SW	RISDS-B	RISDS-E	RISDS-N	Reference Areas	All RISDS
Total PAHs[3] (ER-L = 4,022 ER-M = 44,792)	Maximum	136.41	32.17	51.23	2170.91	340.46	544.10	136.41	2170.91
	Minimum	95.85	18.37	20.96	530.83	118.84	85.41	18.37	85.41
	Average	111.21	25.56	34.67	1211.87	212.27	241.81	57.15	555.32
	Standard Deviation	22.00	6.92	15.34	854.65	114.82	261.84	43.03	667.59
	Mean % Detected	98.0	79.3	90.7	100	100	100	89.3	100
Total Low Molecular Weight PAHs[4]	Maximum	21.44	5.26	9.17	445.54	44.95	85.14	21.44	445.54
	Minimum	14.74	3.15	4.10	79.47	14.52	16.25	3.15	14.52
	Average	17.22	4.53	6.63	217.91	28.86	39.31	9.46	95.36
	Standard Deviation	3.68	1.19	2.54	198.66	15.29	39.69	6.33	137.07
	Mean % Detected	96.0	54.7	79.3	100	100	100	76.7	100
Total High Molecular Weight PAHs[5]	Maximum	114.97	26.99	42.06	1725.37	295.51	458.96	114.97	1725.37
	Minimum	81.11	15.22	16.86	451.36	104.32	69.16	15.22	69.16
	Average	93.99	21.03	28.04	993.96	183.41	202.50	47.69	459.96
	Standard Deviation	18.32	5.89	12.84	657.66	99.78	222.16	36.73	532.38
	Mean % Detected	100	100	100	100	100	100	100	100
Total PCBs[6] (ER-L = 22.7 ER-M = 180)	Maximum	3.41	1.30	10.62	97.68	41.40	8.76	10.62	97.68
	Minimum	1.81	1.25	1.26	55.34	9.04	2.26	1.25	2.26
	Average	2.80	1.28	4.40	75.92	23.54	6.55	2.83	35.33
	Standard Deviation	0.86	0.03	5.39	21.19	16.44	3.71	3.04	34.12
	Mean % Detected	40.7	0.0	29.7	94.3	90.7	74.0	23.4	86.3

Analyte[1,2] (µg/kg DW)	Summary Statistics	REF-E	REF-NE	REF-SW	RISDS-B	RISDS-E	RISDS-N	Reference Areas	All RISDS
Total Chlordanes[7] (ER-L = 0.5 ER-M = 6.0)	Maximum	0.26	0.17	0.18	1.61	0.72	0.18	0.26	1.61
	Minimum	0.21	0.16	0.17	0.49	0.17	0.16	0.16	0.16
	Average	0.23	0.16	0.17	0.86	0.38	0.17	0.19	0.47
	Standard Deviation	0.03	0.00	0.01	0.64	0.30	0.01	0.03	0.47
	Mean % Detected	0.0	0.0	0.0	33.3	20.0	0.0	0.0	17.8
Total DDx[8] (ER-L = 1.58 ER-M = 46.1)	Maximum	0.53	0.31	0.30	4.82	1.84	1.16	0.53	4.82
	Minimum	0.39	0.15	0.26	2.57	0.50	0.37	0.15	0.37
	Average	0.44	0.23	0.28	3.41	1.08	0.64	0.32	1.71
	Standard Deviation	0.08	0.08	0.02	1.23	0.69	0.45	0.11	1.49
	Mean % Detected	89.0	44.7	67.0	89.0	78.0	78.0	66.9	81.7

1 - Duplicates are averaged.
2 - Non-detected compounds were summed using ½ the MDL.
3 - Total PAH is the sum of the 18 PAH compounds analyzed (naphthalene, 2-methylnaphthalene, 1-methylnaphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene).
4 - Total LMW PAH is the sum of the 8 PAH compounds analyzed (1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene).
5 - Total HMW PAH is the sum of the 10 PAH compounds analyzed (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene.
6 - Total PCB is the sum of the NOAA 18 congeners multiplied by 2.
7 - Total Chlordane is the sum of the five isomers (i.e., alpha-chlordane (cis), gamma-chlordane (trans), cis-nonachlor, trans-nonachlor, and heptachlor).
8 - Total DDX is the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'DDT.

Table 3-10.

Summary Statistics of Chlorinated Pesticides in Sediment Grab Samples

Pesticide (µg/kg DW)	Summary Statistic	RISDS-B	RISDS-E	RISDS-N	REF-E	REF-NE	REF-SW	Reference Areas	All RISDS
4,4'-DDD	Maximum	1.29	0.48	0.30 J	0.14 J	0.12 J	0.09 U	0.14 J	1.29
	Minimum	0.77	0.16 J	0.11 J	0.10 J	0.08 U	0.08 J	0.08 U	0.11 J
	Average	0.98	0.29	0.18	0.12	0.09	0.09	0.10	0.48
	Standard Deviation	0.28	0.17	0.10	0.02	0.02	0.01	0.02	0.41
4,4'-DDE	Maximum	3.16	1.25	0.77	0.32 J	0.13 J	0.18 J	0.32 J	3.16
	Minimum	1.64	0.27 J	0.17 J	0.17 J	0.08 U	0.14 J	0.08 U	0.17 J
	Average	2.23	0.71	0.39	0.24	0.10	0.15	0.17	1.11
	Standard Deviation	0.82	0.50	0.33	0.08	0.03	0.02	0.08	0.99
4,4'-DDT	Maximum	0.37 J	0.13 U	0.13 U	0.16 U	0.13 U	0.13 U	0.16	0.37
	Minimum	0.14 U	0.11 J	0.09 J	0.07 J	0.12 U	0.03 J	0.03	0.09
	Average	0.22	0.12	0.11	0.10	0.13	0.10	0.11	0.15
	Standard Deviation	0.13	0.01	0.02	0.05	0.01	0.06	0.04	0.08
alpha-chlordane	Maximum	0.08 U	0.07 U	0.07 U	0.10 U	0.06 U	0.07 U	0.10 U	0.08 U
	Minimum	0.04 J	0.06 U	0.06 U	0.08 U	0.06 U	0.06 U	0.06 U	0.04 J
	Average	0.06	0.06	0.06	0.09	0.06	0.06	0.07	0.06
	Standard Deviation	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.01
cis-nonachlor	Maximum	0.44	0.28 J	0.05 U	0.07 U	0.05 U	0.05 U	0.07 U	0.44
	Minimum	0.31 J	0.05 U	0.05 U	0.06 U	0.05 U	0.05 U	0.05 U	0.05 U
	Average	0.36	0.15	0.05	0.06	0.05	0.05	0.05	0.19
	Standard Deviation	0.07	0.12	0.00	0.01	0.00	0.00	0.01	0.16
dieldrin	Maximum	1.96	0.82	0.22 J	0.09 J	0.06 U	0.06 U	0.09 J	1.96
	Minimum	0.89	0.17 J	0.06 U	0.08 U	0.06 U	0.06 U	0.06 U	0.06 U
	Average	1.34	0.44	0.11	0.09	0.06	0.06	0.07	0.63
	Standard Deviation	0.56	0.34	0.09	0.01	0.00	0.00	0.01	0.64

Pesticide (µg/kg DW)	Summary Statistic	RISDS-B	RISDS-E	RISDS-N	REF-E	REF-NE	REF-SW	Reference Areas	All RISDS
endosulfan sulfate	Maximum	1.22	0.53	0.09 U	0.13 U	0.08 U	0.09 U	0.13 U	1.22
	Minimum	0.09 U	0.08 U	0.08 U	0.11 U	0.08 U	0.08 U	0.08 U	0.08 U
	Average	0.47	0.29	0.08	0.12	0.08	0.09	0.09	0.28
	Standard Deviation	0.65	0.23	0.01	0.01	0.00	0.01	0.02	0.38
gamma-chlordane	Maximum	1.02	0.32	0.06 U	0.09 U	0.06 U	0.06 U	0.09 U	1.02
	Minimum	0.06 U	0.05 U	0.05 U	0.07 U	0.05 U	0.06 U	0.05 U	0.05 U
	Average	0.38	0.14	0.06	0.08	0.06	0.06	0.06	0.19
	Standard Deviation	0.55	0.15	0.01	0.01	0.01	0.00	0.01	0.32

U = Non-detect
J = Estimated

The following pesticides were not included in the summary table as there were no detections in any of the sediment samples: aldrin, alpha-BHC, beta-BHC, delta-BHC, endosulfan I, endosulfan II, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane, methoxychlor, oxychlordane, toxaphene, trans-nonachlor.

Table 3-11.

Summary Statistics of the Nine Metals Determined in Sediment Grab Samples

Metal (mg/kg DW)	Summary Statistic	RISDS-B	RISDS-E	RISDS-N	REF-E	REF-NE	REF-SW	Reference Areas	All RISDS
Arsenic	Maximum	6.81	4.38	2.82	6.52	4.65	3.34	6.52	6.81
	Minimum	3.60	3.28	1.74	4.87	3.41	2.55	2.55	1.74
	Average	5.54	3.89	2.24	5.84	4.06	2.98	4.30	3.89
	Standard Deviation	1.70	0.56	0.54	0.86	0.62	0.40	1.37	1.71
Cadmium	Maximum	0.58	0.30	0.27 U	0.07 J	0.25 U	0.25 U	0.25 U	0.58
	Minimum	0.29	0.07 J	0.06 J	0.05 J	0.18 U	0.19 U	0.05 J	0.064 J
	Average	0.39	0.16	0.17	0.06	0.20	0.22	0.16	0.24
	Standard Deviation	0.16	0.12	0.10	0.01	0.04	0.03	0.08	0.16
Chromium	Maximum	46.50	26.10	14.20	21.30	8.32	11.10	21.30	46.50
	Minimum	24.10	9.41	6.83	16.30	7.33	6.48	6.48	6.83
	Average	34.83	15.74	9.79	19.03	7.68	8.57	11.76	20.12
	Standard Deviation	11.23	9.05	3.89	2.53	0.56	2.34	5.74	13.57
Copper	Maximum	92.80	51.00	19.70	10.00	3.34	4.25	10.00	92.80
	Minimum	46.30	12.00	7.48	7.27	2.35	2.05	2.05	7.48
	Average	61.83	26.60	11.90	8.65	2.83	3.00	4.83	33.44
	Standard Deviation	26.82	21.27	6.77	1.37	0.50	1.13	3.02	28.25
Lead	Maximum	43.20	24.90	13.80	14.50	7.54	7.83	14.50	43.20
	Minimum	23.50	8.11	5.54	10.80	6.96	6.05	6.05	5.54
	Average	31.03	14.05	8.35	12.80	7.26	6.72	8.93	17.81
	Standard Deviation	10.64	9.41	4.72	1.87	0.29	0.97	3.10	12.66
Mercury	Maximum	0.26	0.15	0.06	0.03	0.01 J	0.01 J	0.03	0.26
	Minimum	0.13	0.02	0.01 J	0.02 J	0.00 J	0.00 J	0.00 J	0.01 J
	Average	0.18	0.07	0.03	0.03	0.00	0.01	0.01	0.09
	Standard Deviation	0.07	0.07	0.03	0.01	0.00	0.00	0.01	0.08
Nickel	Maximum	13.50	9.58	7.43	13.30	5.06	5.38	13.30	13.50

Metal (mg/kg DW)	Summary Statistic	RISDS-B	RISDS-E	RISDS-N	REF-E	REF-NE	REF-SW	Reference Areas	All RISDS
	Minimum	8.16	5.05	4.73	10.30	3.93	3.75	3.75	4.73
	Average	11.25	6.69	5.79	11.93	4.45	4.34	6.91	7.91
	Standard Deviation	2.77	2.51	1.44	1.52	0.57	0.90	3.88	3.23
Silver	Maximum	1.84	0.95	0.28 J	0.70 U	0.63 U	0.62 U	0.70	1.84
	Minimum	0.81	0.15 J	0.07 J	0.08 J	0.44 U	0.47 U	0.08 J	0.07 J
	Average	1.18	0.46	0.14	0.29	0.51	0.55	0.45	0.59
	Standard Deviation	0.57	0.43	0.12	0.35	0.11	0.08	0.22	0.59
Zinc	Maximum	87.40	53.10	42.50	44.60	20.20	24.20	44.60	87.40
	Minimum	50.80	24.40	17.20	34.80	16.90	16.30	16.30	17.20
	Average	67.33	34.10	27.27	40.43	18.43	19.83	26.23	42.90
	Standard Deviation	18.55	16.46	13.42	5.06	1.66	4.02	11.18	23.31

U = Non-detect
J = Estimated

Table 3-12.

Summary Statistics Describing Benthic Infauna Density, Species Richness, and Evenness in Each Sediment Grab Sample

Location	Station Name	No. of Individuals (per 0.04 m^2)	No. of Species	Density (No. of individuals/m^2)	Shannon's Diversity (H')	Pielou's Evenness (J')
Reference Stations						
REF-E	E-01-A	1230	57	30750	2.28	0.56
	E-02-A	562	35	14050	2.29	0.65
	E-03-A	1434	38	35850	1.95	0.54
REF-NE	NE-01-A	626	42	15650	2.60	0.69
	NE-02-A	426	30	10650	2.15	0.63
	NE-03-A	524	46	13100	2.85	0.74
REF-SW	SW-01-A	1095	52	27375	2.39	0.60
	SW-02-A	781	47	19525	2.21	0.57
	SW-03-A	864	40	21600	2.04	0.55
Average		**838**	**43**	**20950**	**2.30**	**0.62**
Minimum		**426**	**30**	**10650**	**1.95**	**0.54**
Maximum		**1434**	**57**	**35850**	**2.85**	**0.74**
Total		**7542**	**92[2]**			
RISDS Stations						
RISDS-N	001-A	388	29	9700	2.18	0.65
	002-A	199	31	4975	2.85	0.83
	003-A	132	23	3300	2.71	0.86
RISDS-B	004-A	278	25	6950	1.86	0.58
	005[1]-A	264	38	6600	2.93	0.81
	006-A	207	40	5175	2.97	0.80
RISDS-E	007-A	180	30	4500	2.89	0.85
	008-A	298	39	7450	2.62	0.72
	009-A	285	41	7125	2.98	0.80
Average		**248**	**33**	**6197**	**2.67**	**0.77**
Minimum		**132**	**23**	**3300**	**1.86**	**0.58**
Maximum		**388**	**41**	**9700**	**2.98**	**0.86**
Total		**2231**	**86[2]**			
All Stations Total		**9773**	**113**			

[1]A 600 µm sieve was used on sample 005-A instead of the correct 500 µm sieve; [2]Total number of unique species

Table 3-13.

Total Biomass (grams) for Annelids, Molluscs, Arthropods, Echinoderms, Miscellaneous, and Total Biomass in Each Sample

Location	Sample ID	Annelida (g)	Mollusca (g)	Arthropoda (g)	Echinodermata (g)	Miscellaneous (g)	Diptera (g)	Sample Total (g)
Reference Stations								
REF-E	E-01-A	1.19	2.42	0.42	0.00	0.00	0.00	4.04
	E-02-A	0.84	1.79	0.22	0.00	0.00	0.00	2.86
	E-03-A	4.92	2.64	0.12	5.53	0.00	0.00	13.21
REF-NE	NE-01-A	1.64	0.46	3.17	0.00	0.00	0.00	5.26
	NE-02-A	1.91	0.12	2.99	0.00	0.00	0.00	5.01
	NE-03-A	2.17	0.51	2.60	0.00	0.09	0.00	5.38
REF-SW	SW-01-A	1.27	0.42	3.42	0.00	0.09	0.00	5.19
	SW-02-A	0.92	1.03	1.06	0.00	0.00	0.00	3.01
	SW-03-A	0.96	0.60	7.53	0.00	0.06	0.00	9.15
Average		**1.76**	**1.11**	**2.39**	**0.61**	**0.03**	**0.00**	**5.90**
Minimum		**0.84**	**0.12**	**0.12**	**0.00**	**0.00**	**0.00**	**2.86**
Maximum		**4.92**	**2.64**	**7.53**	**5.53**	**0.09**	**0.00**	**13.21**
RISDS Stations								
RISDS-N	001-A	0.89	0.11	1.65	0.00	0.00	0.00	2.65
	002-A	0.25	0.21	1.25	0.00	0.01	0.00	1.71
	003-A	0.22	0.13	0.71	0.00	0.12	0.00	1.18
RISDS-B	004-A	0.24	0.15	0.06	0.00	0.01	0.00	0.46
	005-A[1]	0.90	0.20	0.28	0.00	0.14	0.00	1.51
	006-A	0.98	0.37	0.30	0.00	0.07	0.00	1.72
RISDS-E	007-A	0.54	0.14	0.45	0.00	0.00	0.00	1.14
	008-A	0.90	0.35	0.30	0.00	0.00	0.00	1.55
	009-A	1.08	0.14	0.57	0.00	0.02	0.00	1.81
Average		**0.67**	**0.20**	**0.62**	**0.00**	**0.04**	**0.00**	**1.53**
Minimum		**0.22**	**0.11**	**0.06**	**0.00**	**0.00**	**0.00**	**0.46**
Maximum		**1.08**	**0.37**	**1.65**	**0.00**	**0.14**	**0.00**	**2.65**

[1] A 600 µm sieve was used on sample 005-A instead of the correct 500 µm sieve

Table 3-14.

Average Abundances (individuals per sample) of Benthic Infauna by Family at Each of the Six Areas Sampled (n=3)

Class and Family	RISDS-B	RISDS-E	RISDS-N	REF-E	REF-NE	REF-SW
Anopla						
Lineidae	1.00	0.33	0.67	0.33	1.00	1.00
Tubulanidae	0.00	0.33	0.00	0.00	0.00	0.00
Anthozoa						
Actiniaria	1.00	0.33	1.33	1.33	0.33	0.33
Ascidiacea						
Ascidiacea (LPIL)	0.00	0.00	0.00	0.67	0.00	0.33
Asteroidea						
Astropectinidae	0.00	0.00	0.00	0.33	0.00	0.00
Bivalvia						
Astartidae	0.00	0.33	0.67	1.00	4.67	0.67
Bivalvia (LPIL)	0.33	0.00	0.00	0.00	0.00	0.00
Cardiidae	0.00	0.33	0.67	0.67	0.33	1.00
Lucinidae	0.33	0.67	0.00	4.67	0.00	0.33
Lyonsiidae	0.00	1.33	0.00	1.33	1.00	0.33
Mytilidae	0.00	0.00	0.00	0.67	13.67	9.33
Nuculidae	72.00	5.00	11.33	440.67	90.67	213.33
Pectinidae	0.00	0.00	0.00	1.00	0.00	0.00
Periplomatidae	5.67	4.00	1.00	45.67	2.00	6.67
Solenidae	0.00	0.33	9.67	0.00	0.00	0.00
Thyasiridae	0.33	0.33	0.00	5.67	0.00	0.00
Veneridae	11.33	7.00	8.67	24.00	6.67	25.00
Yoldiidae	4.67	0.33	0.00	10.00	1.00	4.33
Echinodermata (LPIL)						
Echinodermata (LPIL)	0.00	0.00	0.00	0.00	0.00	0.67
Enopla						
Amphiporidae	0.00	0.00	0.33	0.33	0.00	0.00
Gastropoda						
Acteonidae	0.00	0.00	0.00	0.33	0.00	0.33
Calyptraeidae	0.33	0.00	0.00	0.00	0.00	0.00
Haminoeidae	0.00	0.00	0.00	0.67	0.00	0.00
Nudibranchia (LPIL)	3.00	0.00	0.00	0.00	0.00	0.00
Pyramidellidae	0.00	0.00	0.00	0.00	0.00	0.33
Rissoidae	0.00	0.00	0.00	7.33	0.00	0.33
Insecta						
Ceratopogonidae	0.00	0.00	0.00	0.00	0.33	0.00
Malacostraca						
Ampeliscidae	9.00	6.00	67.67	9.00	123.33	111.67
Ampithoidae	0.00	0.00	3.33	0.00	0.00	0.00
Amphipoda (LPIL)	0.00	0.00	0.00	0.33	0.00	0.00
Anthuridae	0.00	0.00	0.00	0.00	0.00	0.33

Class and Family	RISDS-B	RISDS-E	RISDS-N	REF-E	REF-NE	REF-SW
Aoridae	5.00	18.00	37.00	0.00	103.00	263.00
Argissidae	0.33	0.00	0.67	0.00	0.00	0.00
Axiidae	0.00	0.33	0.00	0.00	0.33	0.33
Bodotriidae	0.33	0.67	0.00	0.00	0.00	0.33
Caprellidae	0.33	0.33	0.33	0.00	0.33	0.67
Cirolanidae	0.00	0.00	0.33	0.00	0.00	0.33
Crangonidae	0.00	0.33	0.33	0.00	0.00	0.00
Diastylidae	2.00	3.00	11.67	5.00	9.00	7.00
Isaeidae	1.00	4.67	22.00	10.00	13.33	69.33
Ischyroceridae	0.33	1.00	0.00	6.67	4.00	5.67
Leuconidae	1.67	0.33	2.67	7.33	5.67	9.33
Lysianassidae	0.67	0.00	6.33	0.00	8.33	3.67
Oedicerotidae	0.00	0.67	0.33	0.00	0.33	0.00
Paguridae	0.67	0.00	0.00	0.00	0.00	0.00
Phoxocephalidae	0.00	1.00	0.00	0.00	0.67	8.67
Pleustidae	0.00	0.00	0.33	1.67	0.00	2.00
Podoceridae	0.67	1.33	1.00	3.00	0.00	5.67
Nemertea (LPIL)						
Nemertea (LPIL)	0.00	0.00	0.33	0.00	0.00	0.00
Oligochaeta						
Naididae	0.33	1.33	0.00	19.67	1.67	4.33
Polychaeta						
Ampharetidae	5.33	2.33	0.33	7.67	2.00	1.33
Capitellidae	1.00	0.67	4.33	2.67	0.00	0.00
Chaetopteridae	0.33	0.33	0.00	0.67	0.00	0.33
Cirratulidae	4.33	16.67	0.33	6.67	15.33	6.67
Cossuridae	30.33	7.33	0.00	9.00	0.00	1.67
Dorvilleidae	0.00	0.00	0.00	0.33	0.00	0.33
Flabelligeridae	0.67	0.33	1.33	3.33	0.00	3.00
Glyceridae	0.00	0.67	0.00	0.00	2.33	0.33
Goniadidae	0.67	0.33	0.00	0.00	0.33	0.00
Lumbrineridae	28.00	45.67	8.67	40.00	22.67	7.33
Maldanidae	2.00	3.33	0.00	6.00	2.33	21.33
Nephtyidae	6.67	3.33	4.33	11.33	5.67	15.67
Oenonidae	0.00	0.00	0.00	0.33	0.33	0.00
Opheliidae	0.33	0.33	0.67	0.67	3.33	2.67
Orbiniidae	0.00	0.67	0.00	0.00	2.33	1.00
Oweniidae	1.00	1.00	0.00	233.00	0.00	1.33
Paraonidae	13.33	14.00	4.00	31.33	4.33	31.67
Pholoidae	0.00	0.00	0.00	0.33	0.00	0.00
Phyllodocidae	0.00	0.00	0.00	0.33	0.00	0.33
Pilargidae	0.33	0.00	0.00	0.00	0.00	0.00
Polygordiidae	0.00	41.67	3.33	0.67	25.00	3.00
Polynoidae	1.67	0.67	0.67	1.00	0.00	1.00
Sabellariidae	9.33	6.33	0.00	0.00	0.00	0.00
Sabellidae	13.33	26.33	0.67	79.33	9.67	4.00
Scalibregmatidae	1.00	9.33	16.67	18.67	29.67	48.00

Class and Family	RISDS-B	RISDS-E	RISDS-N	REF-E	REF-NE	REF-SW
Sigalionidae	0.00	0.33	0.00	0.00	1.67	0.33
Sphaerodoridae	0.33	0.00	0.00	0.33	0.00	0.00
Spionidae	6.67	13.00	5.00	1.00	0.00	1.67
Sternaspidae	0.00	0.00	0.00	5.00	0.00	0.00
Syllidae	0.33	0.00	0.67	0.00	6.33	2.67
Terebellidae	0.00	0.00	0.00	1.00	0.33	0.00
Trichobranchidae	0.00	0.00	0.00	5.33	0.00	1.00
Phoronida (Phylum)						
Phoronidae	0.33	0.00	0.00	0.00	0.00	0.00

n = 3 for each area

Table 3-15.

Average Percent Relative Abundances and Standard Deviations (SD) of the Top 10 Taxa by Area (n = 3)

RISDS-B			RISDS-E			RISDS-N		
Average	SD	LPIL	Average	SD	LPIL	Average	SD	LPIL
27.8	23.1	*Nucula proxima*	15.2	15.8	*Polygordius (LPIL)*	15.4	26.2	*Byblis serrata*
12.0	5.7	*Cossura soyeri*	12.4	2.8	*Ninoe nigripes*	12.6	9.3	*Photis (LPIL)*
11.3	1.9	*Ninoe nigripes*	10.4	10.9	*Chone (LPIL)*	12.3	6.1	*Leptocheirus pinguis*
5.6	3.3	*Chone (LPIL)*	5.3	5.0	*Lumbrineridae (LPIL)*	6.0	3.9	*Scalibregma inflatum*
5.1	1.8	*Levinsenia gracilis*	4.9	0.4	*Spiophanes bombyx*	4.9	1.0	*Nucula proxima*
4.2	1.7	*Veneridae (LPIL)*	4.6	3.8	*Levinsenia gracilis*	4.6	1.5	*Solen viridis*
3.8	4.0	*Sabellaria vulgaris*	4.5	2.3	*Cirratulidae (LPIL)*	4.5	2.7	*Ampelisca agassizi*
3.6	1.6	*Ampelisca agassizi*	3.8	1.6	*Scalibregma inflatum*	4.3	2.2	*Unciola irrorata*
2.6	1.7	*Spiophanes bombyx*	3.7	2.6	*Unciola irrorata*	3.6	2.7	*Orchomenella minuta*
2.2	0.8	*Periploma papyratium*	3.6	3.9	*Leptocheirus pinguis*	3.4	2.9	*Diastylis quadrispinosa*

REF-E			REF-NE			REF-SW		
Average	SD	LPIL	Average	SD	LPIL	Average	SD	LPIL
41.9	10.9	*Nucula proxima*	24.4	12.7	*Byblis serrata*	25.2	22.8	*Leptocheirus pinguis*
13.7	17.3	*Owenia fusiformis*	17.1	3.2	*Leptocheirus pinguis*	24.4	23.3	*Nucula proxima*
8.5	4.6	*Chone (LPIL)*	15.8	12.0	*Nucula proxima*	6.8	6.6	*Photis (LPIL)*
4.2	1.3	*Periploma papyratium*	5.9	1.7	*Scalibregma inflatum*	6.8	5.1	*Ampelisca agassizi*
4.0	6.5	*Galathowenia oculata*	5.2	3.4	*Polygordius (LPIL)*	5.8	9.6	*Byblis serrata*
3.0	0.9	*Levinsenia gracilis*	2.6	0.9	*Unciola irrorata*	5.0	4.2	*Scalibregma inflatum*
3.0	1.5	*Ninoe nigripes*	2.5	1.1	*Crenella decussata*	3.1	2.6	*Levinsenia gracilis*
2.5	1.7	*Veneridae (LPIL)*	2.4	1.1	*Photis (LPIL)*	2.6	0.8	*Unciola irrorata*
2.2	1.3	*Naididae (LPIL)*	2.1	1.3	*Scoletoma (LPIL)*	2.1	2.6	*Veneridae (LPIL)*
1.5	2.5	*Scalibregma inflatum*	2.1	0.9	*Tharyx acutus*	1.6	1.7	*Nephtyidae (LPIL)*

Species names are color coded to facilitate comparisons across areas. Only those that occurred in at least three areas were color coded. Colors coordinate with Figure 3-35; orange/red shades represent bivalves, blue shades represent Malacostraca, and shades of green represent polychaetes.

4.0 DISCUSSION

The overall objective of the 2020 RISDS survey was to conduct a combined confirmatory and focused baseline study in preparation for increased use of the site as part of the upcoming Providence Harbor dredging project and to support the update of the SMMP. The seafloor topography and surficial features of the entire RISDS, three reference areas, and the USEPA reference location were characterized using high-resolution acoustic data of the seafloor. Finer-scale physical characteristics of the surficial sediments and the benthic recolonization status were assessed using SPI/PV imagery collected across seven distinct areas within RISDS and compared with the three reference areas. Further characterization of benthic status was provided by benthic community analysis from grab samples. Surficial sediment samples were collected at RISDS and reference areas and analyzed for grain size and chemical analytes. This suite of analyses provided a comprehensive characterization of the seafloor topography, the surficial features, and the benthic recolonization status at RISDS.

4.1 Seafloor Topography

Bathymetric measurements confirmed the persistence of the berm along the western portion of RISDS, a high-relief mound in the sampling area RISDS-N, and small low-relief features in sampling areas RISDS-A, -B, and -E. The 2020 RISDS survey confirmed recent placement of dredged material southwest of the peak of RISDS-N and at two new small areas in the northeast corner of the site (Figures 3-1 and 3-5).

A relatively large volume of dredged material was placed at RISDS-N during the period of 2013 to 2015 with limited amounts of additional material placed after 2015 (Figures 1-3 and 1-4). RISDS-N elevation changes are illustrated in profile view in Figure 4-1, which shows the depths along an east-west transect line passing though the northern mound peak. From 2013 to 2015, the peak at RISDS-N increased in elevation by as much as 11 m (Sturdivant and Carey 2017). However, from 2015 to 2020, this location decreased in elevation by as much as 1.4 m (Figure 3-5) indicating that material on the peak at RISDS-N settled over the last five years after completion of the majority of dredged material placement. This decrease in elevation is likely a result of self-weight consolidation, given the coarse nature of the disposal material (New Bedford Harbor CAD Cell construction). However, some winnowing of any finer material from this region through hydrodynamic forcing is possible, leaving behind the lag deposit of coarser material.

Stronger backscatter returns were observed at disposal mound areas (e.g., RISDS-N, -C, and two new northeast mounds), the berm, and along disposal trails throughout the site. These backscatter observations are consistent with those of the previous survey (Sturdivant and Carey 2017) and are indicative of coarser-grained, rougher, or harder material (Figure 3-3).

At the three reference areas, the seafloor was gently sloped and showed evidence of sediment transport, particularly at shallower locations. The spatial variability of physical sediment characteristics corresponded with differences in depths and backscatter returns documented across these areas. As is common in Rhode Island Sound, shallower areas had stronger backscatter indicative of coarser, rougher, or harder material (REF-NE) compared with deeper areas that were characterized by weaker backscatter return and generally finer or softer sediments (REF-E) (Figure 3-3).

4.2 Distribution of Dredged Material

Ample evidence of dredged material was found throughout RISDS. Dredged material placement resulted in characteristic features on the seafloor revealed in acoustic imagery including crater features, low relief and high relief mounds, and distinct linear patterns in the backscatter data. Since the last acoustic survey, dredged material placement occurred in the southwest portion of RISDS-N and at two new areas in the northeast corner of RISDS (Figure 1-4).

Four dredging projects placed dredged material at RISDS since the last acoustic survey was conducted in 2015. During the 2019-2020 season, dredged material sourced from the Port of Davisville and Quonset Business Park was placed in an oval-shaped area southwest of RISDS-N (Figures 3-5 and 3-6) resulting in a seafloor elevation increase by as much as 1.4 m. Also, during the 2019-2020 season, dredged material from New Bedford Lower Harbor was placed in two areas in the northeast corner and resulted in elevation increases of up to 2.0 m since the 2015 survey (Figure 4-1). These two new small northeast mounds were characterized by hummocky deposits distinct in backscatter signature from the native sediments (Figure 3-3). Overall, seafloor elevation increases were observed at expected locations based on disposal event records indicating that dredged material was placed at targeted locations.

Numerous distinct linear anomalies in backscatter were observed throughout the central region of RISDS (Figure 3-3, bottom panels of Figure 4-2). Distinct lines of coarser, rougher, or harder surficial sediments were observed in the 2020 backscatter data traversing the northwest and central region of the site, as highlighted by the hand-drawn annotations overlaid on the 2020 backscatter map (bottom panels of Figure 4-2). These linear features are indicative of trails of dredged material disposal, resulting from the slow release of material from an actively transiting scow and suggest unintentional broader distribution of dredged material within RISDS. Similar features were documented in the 2013 backscatter data (Carey et al. 2015), although notably in different locations than the 2020 trails (top panels of Figure 4-2) due to different disposal targets and scow headings during those time periods. No disposal trails were identified crossing out of the RISDS boundary.

The 2013 backscatter map was annotated with black lines to highlight dredged material trails made prior to the 2013 acoustic survey (top right panel of Figure 4-2). These hand-drawn annotations are not actual navigation data from transiting scows but rather serve to highlight where backscatter linear anomalies were observed. Similarly, the 2020 backscatter map was annotated to highlight disposal trails created prior to the 2020 acoustic survey (bottom left panel of Figure 4-2). By directly comparing these annotated observations, it is clear that different sets of trails were observed in the 2013 and 2020 surveys. This suggests that the observed features are relatively ephemeral acoustically and that the dredged material forming the trails conforms with, and begins to resemble, the acoustic signature of native sediments over time. These linear features do not appear in the bathymetric data, signifying little measurable relief associated with the material placement.

4.3 Benthic Recolonization and Community Composition

The primary purpose of the RISDS SPI/PV survey was to characterize the physical features of the surface sediments and assess the status of benthic recolonization at RISDS. Benthic recolonization assessment was based on recovery predictions described in Rhoads and Germano (1982). Infaunal benthic community composition was further characterized by sediment grab sampling, which provided a taxonomic assessment of the community assemblages. Given no dredged material placement was logged at RISDS areas RISDS-A, -B, -D, and -E since 2005 and at RISDS-C since 2009 (Figure 1-4), benthic conditions were expected to have improved, with more Stage 3 organisms and deeper aRPDs compared with previous SPI/PV surveys in 2009 and 2013. At RISDS-NW it was expected that limited dredged material would be present and the benthic conditions would be similar to ambient reference areas. More recent disposal events occurred at RISDS-N (Figures 1-3 and 1-4), therefore, RISDS-N was expected to be characterized by a more disturbed environment, with less advanced infaunal succession and shallower aRPD depths.

The measured aRPD depths at all RISDS sampling areas were shallow, and significantly lower than the measured aRPD depths at the reference areas (Table 3-7; Figures 3-13 and 3-26). This is consistent with previous SPI/PV results from 2005, 2009, and 2013, where no significant change in aRPD depths at RISDS was reported between 2005 and 2013 (Carey et al. 2015). The 2020 aRPD depths were similar to those measured in 2013, suggesting continued high benthic respiration rates in combination with limited infaunal bioturbation activity, likely resulting from high organic matter and physical disturbance. Although, TOC values at all stations were quite low (around 1%) and only slightly higher at RISDS relative to the reference areas (Figure 3-30A) the amount of TOC relative to total percent fines tended to be higher at RISDS, particularly at RISDS-E and RISDS-B, compared to at the reference areas (Figure 3-30C). This may indicate differences in the characteristics or composition of the organic matter between native (reference areas) and non-native sediments, which can influence benthic respiration rates and aRPD depths. Despite highly reduced sediments below the sediment water interface at RISDS, there was no indication that oxygen levels in the water column were low and surficial sediments appeared oxic in all the PV images.

The evident lack of improvement in aRPD depths towards ambient reference aRPD depths, particularly in the southern and central areas where no recent disposal had been logged, may suggest more widespread disposal of dredged material than intended. As discussed above, trails of dredged material placement in the central area of RISDS were apparent in both the 2013 and 2020 backscatter data (Figure 4-2), and occurred in the vicinity of RISDS-B, RISDS-C, and RISDS-D, where aRPD depths were suppressed. Another possibility may be persistent contaminants inhibiting infaunal recruitment, survival, and bioturbation activity. However, the sediment grab data revealed generally low concentrations of analytes across RISDS. Several stations, particularly at RISDS-N and RISDS-C, consisted of hard substrate or coarser material where aRPD depths are optically indistinguishable, making comparisons with the largely soft bottom reference areas difficult.

Despite the generally more reduced sediment conditions at RISDS compared with reference areas, the maximum infaunal successional stages observed at RISDS were statistically similar to reference areas (Table 3-7; Figure 3-14). Infaunal successional stage was generally more advanced in the northern areas (RISDS-NW and RISDS-A) compared with the central and southern areas (RISDS-B, -E, and -D) (Figure 3-14). In the central and southern RISDS areas, infaunal successional stage was highly variable within stations. This heterogeneity indicates patchy distribution and generally low abundances of advanced-stage infauna (Figure 3-14). These SPI/PV observations were consistent with the sediment BCA results: the sampled RISDS areas (RISDS-N, -B, and -E) had overall lower abundances of infaunal organisms compared with the reference areas (Table 3-12; Figures 3-34 and 3-35). Despite the patchy distribution of advanced-stage infauna at RISDS, when considering the maximum successional stage observed at each station, RISDS stations were statistically similar to the reference areas. This suggests benthic recolonization at RISDS is on an expected recolonization trajectory (Table 3-6). Also, sediment BCA results showed species diversity (the number of unique species present) was similar between RISDS and the reference areas (Table 3-12; Figures 3-33 and 3-35).

Shallow aRPD depths concurrent with the presence of advanced-stage infauna, although patchy, documented in the central and southern areas of RISDS is slightly puzzling given dredged material has not been explicitly placed in this area since 2003-2005 (Figure 1-3). Non-targeted disposal activity, as evidenced by the backscatter trails in 2013 and 2020 (Figure 4-2), likely resulted in thin deposits of dredged material on the seafloor throughout this area. The physical disturbance associated with the continued deposition of thin drapes of dredged material over the seafloor could lead to patchy distribution of decreased aRPD depths while still allowing Stage 3 infauna to persist.

Deep burrowing polychaetes, subsurface voids, and large surface burrows were frequently observed at the soft sediment sites at RISDS (RISDS-A, -B, -D, -E, and -NW) (Figures 3-16 and 3-17). In soft sediments, deep burrowers are important members of a resilient infaunal community, functioning to rework the sediments and indirectly introduce oxygen through deep bioturbation activity. The number of subsurface voids and the depth at which these voids were documented were generally similar between RISDS and the reference areas (Figures 3-16 and 3-17), suggesting recolonization at RISDS after the physical disturbance of dredged material placement, or for thin deposits the recovery of existing populations. Notably, REF-E tended to have more, and deeper voids compared to the rest of the surveyed area, likely due to very high abundances of polychaetes, and specifically *Owenia fusiformis* (Figures 3-16, 3-17, and 3-35), which is a tube-dwelling polychaete known to live deep in the sediments (Dauer et al. 1981). In contrast, high abundance at REF-SW was dominated by amphipods that are shallow burrowers (Figures 3-17 and 3-35).

The taxonomic analysis of the sediment grab samples provided an assessment of the community composition and structure at RISDS and the reference areas. These data highlight the high spatial and temporal variability typical of infaunal communities as well as providing a baseline assessment prior to the anticipated increase in disposal site use. RISDS had lower overall infauna abundances compared to the reference areas. However, the higher abundance at the reference areas was driven by a small subset of taxa, including the deposit feeding bivalve *Nucula proxima* (REF-E and REF-SW), shallow-burrowing, suspension feeding amphipods *Leptocheirus pinguis* and *Byblis serrata* (REF-SW and REF-NE), and the deep-burrowing interface feeder *Owenia fusiformis* (REF-E) (Figure 3-35). In 2013, the opposite was documented: RISDS stations had overall higher infauna abundances compared to the reference areas, which was attributed to the very high abundances of *N. proxima* at RISDS (Carey et al. 2015). In 2020, *N. proxima* was observed in very high numbers at all three reference areas but were only a substantial component of the communities at one RISDS sample location (RISDS-B, Table 3-15; Figure 3-35). This highlights the dynamic nature of benthic infaunal assemblages and abundances, which can be influenced from year to year by large-scale factors such as hydrodynamics and biological recruitment events. It also demonstrates the importance of assessing the ecosystem functioning of the infaunal community (e.g., aRPD measurements, documenting subsurface voids, and classifying successional stage) and not solely the taxonomic identity of the infaunal organisms.

The benthic habitat at RISDS-N and RISDS-C consisted of a high contribution of gravel and cobble (Figures 3-18, 3-19, and 3-22), conditions less suitable for infaunal burrowers. Hard substrate also inhibits SPI prism penetration into the sediments, evading the detection of voids and deep burrowers. As such, the benthic community in these habitats require different considerations than soft sediment habitats when assessing recolonization and ecosystem function and condition. The colonization of predominantly encrusting and branching hydroids and bryozoa was observed in these areas (Figure 3-19). The percent cover of attached epifauna was higher at RISDS-C compared to RISDS-N (Figure 3-25), which was expected as RISDS-N experienced more recent dredged material placement (2017) compared with RISDS-C, where the last dredged material disposal occurred in 2008-2009 (Figures 1-3 and 1-4). It is not reasonable to expect the benthic communities at these hard bottom sites to be directly comparable to those of soft bottom reference areas given the fundamental differences in the physical characteristics of these habitats. Identifying additional reference areas with hard bottom features would be needed to make any direct comparisons between RISDS hard bottom and native hard bottom in the area.

4.4 Sediment Chemistry

Sediment grab samples were analyzed for a suite of chemical parameters to establish conditions prior to the anticipated increase in use of the site for dredged material disposal. Overall chemical concentrations were low across RISDS and comparable to concentrations measured at the reference areas. RISDS-B, located in the central region of RISDS had relatively higher concentrations of chemical analytes compared to the rest of the surveyed area, however concentrations here were still generally below the ER-L national guideline for most analytes and far below the ER-M for all analytes. Given the low values measured across RISDS and that values were similar between RISDS and reference areas, chemical contaminants are not likely influencing the benthic recolonization process.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The acoustic multibeam survey, sediment grab sampling, and SPI/PV survey supported the characterization of physical, chemical, and biological conditions at RISDS relative to the reference areas. Comparisons of 2020 measurements with those collected during the 2013 and 2015 surveys provided insights into changes to the seafloor at RISDS within the context of dredged material placement events. The overall findings were:

- Seafloor elevation increases were observed at expected locations within the northern area of RISDS based on disposal event records indicating that dredged material was placed at targeted locations.

- In the northeast corner of RISDS, two small, low-relief mounds were recently created through dredged material placement, rising up to 2.0 m above the ambient seafloor.

- The peak of RISDS-N received minimal dredged material since 2015. In 2020, the RISDS-N peak was measured at 27 m deep and 10 m above the seafloor. The 2020 RISDS-N peak elevation was observed to have been reduced by approximately 1.4 m between 2015 and 2020, likely due to consolidation of the relatively large volume of material placed there between 2013 and 2015.

- A broad oval-shaped area to the southwest of the northern mound increased in elevation since 2015 by as much as 1.4 m due to targeted dredged material placement.

- Numerous thin, trail deposits of dredged material were observed throughout RISDS. These dredged material trails are believed to be due to inadvertent release of dredged material during scow transport. Similar trails were observed during the 2013 survey and appear to be acoustically ephemeral.

- In the central and southern areas of RISDS (RISDS-B, -D, and -E), no recent dredged material placement was reported, but dredged material trails were observed. SPI/PV revealed shallow aRPD depths and patchy distributions of Stage 3 infauna in these areas. It appears likely that the thin trail deposits of dredged material observed in these areas depressed aRPD depths but allowed some Stage 3 infauna to persist.

- Hard bottom habitat was observed at RISDS-N and RISDS-C, consisting of cobble and gravels encrusted primarily with bryozoa and hydroids.

- Benthic community analysis of sediment grab samples showed overall lower abundances of infauna at RISDS stations compared with the reference areas, but similar species diversity. Infaunal species composition appeared dependent primarily on sediment type and secondarily on whether the sample was collected at RISDS or a reference area.

- Concentrations of measured analytes in sediment grab samples were generally similar at RISDS and the reference areas and were generally below ER-L values and universally below ER-M values. RISDS-B, located in the center of RISDS, had higher concentrations of several compounds relative to the other sampled areas.

Results from the 2020 surveys at RISDS led to the following recommendations:

R1: Future dredged material placement should avoid the large, high-relief RISDS-N mound peak area to avoid the potential for hydrodynamic transport of dredged materials.

R2: Future dredged material placement should be limited to specific target areas to limit the potential for benthic impacts in other portions of RISDS.

R3: Expansion of the berm along the northeast and eastern boundary of RISDS should be continued for future containment of larger dredged material projects in the center of the site.

R4: All three of the current reference areas are deeper than RISDS and consist of soft sediments. Large areas of hard bottom habitat are present within RISDS and are not comparable to existing reference sites. New reference areas that are more similar in depth and sediment type to RISDS should be identified and monitored.

6.0 REFERENCES

Battelle. 2002. Fall 2001 REMOTS® characterization report, Rhode Island Region. Long-term dredged material disposal site evaluation project. Report to the U.S. Army Corps of Engineers, New England District, Concord, MA, Contract No. DACW33-01-D-0004, Delivery Order No. 02.

Carey, D. A.; Hickey, K.; Saffert, H.; Read, L. B. 2015. Monitoring Survey at the Rhode Island Sound Disposal Site August 2013. DAMOS Contribution No. 196. U.S. Army Corps of Engineers, New England District, Concord, MA, 105 pp.

Dauer, D. M.; Maybury, C.A.; Ewing R.M. 1981. Feeding behavior and general ecology of several spionid polychaetes from the Chesapeake Bay. J. Exp. Mar. Biol. Ecol., 54 (1981), pp. 21-38.

ENSR. 2007. Monitoring Survey at the Rhode Island Sound Disposal Site, July 2005. DAMOS Contribution No. 176. U.S. Army Corps of Engineers, New England District, Concord, MA, 73 pp.

ENSR. 2008. Providence River and Harbor Maintenance Dredging Project Synthesis Report. DAMOS Contribution No. 178. U.S. Army Corps of Engineers, New England District, Concord, MA, 133 pp.

Federal Geographic Data Committee (FGDC). 2012. FGDC-STD-018-2012. Coastal and Marine Ecological Classification Standard. Reston, VA.

Folk, R.L. 1954. The Distinction between Grain Size and Mineral Composition in Sedimentary-Rock Nomenclature. The Journal of Geology 62: 344-359.

Fredette, T. J.; French, G. T. 2004. Understanding the physical and environmental consequences of dredged material disposal: history in New England and current perspectives. Mar. Pollut. Bull. 49:93–102.

Germano, J.D. 1983. Infaunal succession in Long Island Sound: animal sediment interactions and the effects of predation [dissertation]. New Haven (CT): Yale University.

Germano, J. D. 1999. Ecology, statistics, and the art of misdiagnosis: The need for a paradigm shift. Environ. Rev. 7(4):167–190.

Germano, J. D.; Rhoads, D. C.; Lunz, J. D. 1994. An Integrated, Tiered Approach to Monitoring and Management of Dredged Material Disposal Sites in the New England Regions. DAMOS Contribution No. 87. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 67 pp.

Germano, J. D.; Rhoads, D. C.; Valente, R. M.; Carey, D. A.; Solan, M. 2011. The use of sediment-profile imaging (SPI) for environmental impact assessments and monitoring studies: lessons learned from the past four decades. Oceanogr. Mar. Biol. Ann. Rev. 49:235–285.

INSPIRE. 2019a. Standard Operating Procedure (SOP) for Sediment Profile and Plan View Imaging Sample Collection and Image Analysis. Prepared by INSPIRE Environmental, Newport, RI. Revision 1 March 2019.

INSPIRE. 2019b. Standard Operating Procedure (SOP) for Sediment Grab Sampling. Prepared by INSPIRE Environmental, Newport, RI. Revision 1 May 2019.

INSPIRE. 2020a. Quality Assurance Project Plan (QAPP) for the Disposal Area Monitoring System (DAMOS) Program. Prepared for the U.S. Army Corps of Engineers, New England District under Contract No. W912WJ-19-D-0010. Submitted by INSPIRE Environmental, Newport, RI. September 2020.

INSPIRE. 2020b. Standard Operating Procedure (SOP) for Acoustic Surveys. Prepared by INSPIRE Environmental, Newport, RI. Revision 2 January 2020.

INSPIRE. 2020c. 2020 Cape Cod Bay and Rhode Island Sound Disposal Sites Sediment Profile and Plan View Imaging Survey Cruise Report. Prepared for the U.S. Army Corps of Engineers, New England District under Contract No. W912WJ-19-D-0010, Delivery Order W912WJ19F0126, Tasks 4a and 5a. Submitted by INSPIRE Environmental, Newport, RI. May 2020.

Long, E. R.; Morgan, L. G. 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants in the National Status and Trends program. NOAA Tech. Memo. NOS OMA 52, Seattle, WA 175 pp & appendices.

Long, E. R.; MacDonald, D. D.; Smith, S. L.; Calder, F. D. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environ. Manage. 19: 81-97.

Lunneborg, C. E. 2000. Data Analysis by Resampling: Concepts and Applications. Duxbury. 556 pp. + Appendices.

Manly, B. F. J. 1997. Randomization, Bootstrap and Monte Carlo Methods in Biology. Second edition. Chapman & Hall, London. 340 pp. + Appendices

McBride, G. B. 1999. Equivalence tests can enhance environmental science and management. Aust. New Zeal. J. Stat. 41(1):19–29.

NOAA NCEI. 2020a. Navigable Area Survey H12009, Rhode Island, Block Island Sound. May 2009. https://www.ngdc.noaa.gov/nos/H12001-H14000/H12009.html. Accessed December 2020.

NOAA NCEI. 2020b. Navigable Area Survey H11996, Rhode Island, Approaches to Buzzards Bay. October 2008. https://www.ngdc.noaa.gov/nos/H10001-H12000/H11996.html. Accessed December 2020.

Pearson, T. H.; Rosenberg, R. 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanogr. Mar. Biol. 16: 229-311.

Rhoads, D. C.; Boyer, L. F. 1982. The effects of marine benthos on physical properties of sediments. In: McCall, P.L. and M.J.S. Tevesz, editors. Animal-sediment relations. New York (NY): Plenum Press. p. 3-52.

Rhoads, D. C.; Germano, J. D. 1982. Characterization of organism-sediment relations using sediment profile imaging: an efficient method of remote ecological monitoring of the seafloor (REMOTS System). Mar. Ecol. Progr. 8: 115-128.

RStudio Team. 2020. RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL http://www.rstudio.com/.

SAIC. 1997. REMOTS sediment-profile imaging survey of selected sites in Narragansett Bay and Rhode Island Sound, November 1996, Report Addendum. Submitted to U.S. Army Corps of Engineers, New England Division. SAIC Report No. 390.

SAIC. 2000. REMOTS sediment-profile imaging survey of Sites 69a and 69b in Rhode Island Sound, November 1999. Submitted to Battelle Ocean Sciences. SAIC Report No. 493.

SAIC. 2004. Monitoring Surveys of the Rhode Island Sound Disposal Site, Summer 2003. DAMOS Contribution No. 155. U.S. Army Corps of Engineers, New England District, Concord, MA.

SAIC. 2005a. Disposal Plume Tracking and Assessment at the Rhode Island Sound Disposal Site, Spring 2004. DAMOS Contribution No. 166. U.S. Army Corps of Engineers, New England District, Concord, MA, 184 pp.

SAIC. 2005b. Disposal Plume Tracking and Assessment at the Rhode Island Sound Disposal Site, Summer 2004. DAMOS Contribution No. 167. U.S. Army Corps of Engineers, New England District, Concord, MA, 194 pp.

Satterthwaite, F. E. 1946. An Approximate Distribution of Estimates of Variance Components, Biometrics Bulletin, Vol. 2, No. 6, pp. 110-114.

Schuirmann, D. J. 1987. A comparison of the two one-sided tests procedure and the power approach for assessing the equivalence of average bioavailability. J. Pharmacokinet. Biopharm. 15:657–680.

Sturdivant, S. K.; Carey, D. A. 2017. Data Summary Report for the Monitoring Survey at the Rhode Island Sound Disposal Site, October 2015. U.S. Army Corps of Engineers, New England District, Concord, MA, 30 pp.

USACE. 1998. Shellfish Sampling and Site Characterization Narragansett Bay and Rhode Island Sound Proposed Disposal Sites. In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement Appendix C-6. Prepared under Contract No. DACW33- 96-D-0005 Delivery Order No. 14 by Battelle for the U.S. Army Corps of Engineers. January 1998.

USACE. 2001a. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Volumes I and II. Prepared by New England District, U.S. Army Corps of Engineers in cooperation with U.S. Environmental Protection Agency, National marine Fisheries Service, and U.S. Fish and Wildlife Service.

USACE. 2001b. Letter Report: Evaluation of Existing Physical Oceanographic Data. Prepared under Contract No. DACW33-01-D-0004 Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

USACE. 2002a. Fall 2001 Water Column Characterization Report. Rhode Island Region Long- term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004 Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. August 2002.

USACE. 2002b. Spring 2002 Water Column Characterization Report. Rhode Island Region Long- term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004 Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2002.

USACE. 2002c. Fall 2001 Infauna Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01- D-0004 Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. September 2002.

USACE. 2003a. Final Survey Report for Winter 2002 Physical Oceanography Data Collection Survey. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004 Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

USACE. 2003b. Benthic Infauna Data for Area E and Area W July 2003. Prepared under Contract No. DACW33-01-D-0004 Delivery Order No. 02 by Battelle for the U.S. Army Corps of Engineers. November 2003.

USACE. 2003c. Summer 2003 Quahog Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01- D-0004 Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2003.

USACE. 2013a. Engineering and Design - Hydrographic Surveying. Manual No. EM 1110-2-1003. November 2013.

USACE. 2013b. Hurricane Sandy Coastal Projects Performance Evaluation Study: Disaster Relief Appropriations Act, 2013. Submitted by the Assistant Secretary of the Army for Civil Works. November 6, 2013. http://www.nan.usace.army.mil/Portals/37/docs/civilworks/SandyFiles/USACE_Post-Sandy_Coastal_Projects_Performance_Evaluation_Study.pdf Accessed June 27, 2014

USEPA. 2004. Final Environmental Impact Statement Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared by U.S. Environmental Protection Agency, New England Region, in cooperation with U.S. Army Corps of Engineers, New England District.

Valente, R. M.; Carey, D. A.; Read, L. B.; Wright, C. 2007. Postdisposal Monitoring of Lobster Abundance at the Rhode Island Sound Disposal Site in 2005 Compared to the 1999 Predisposal Survey. DAMOS Contribution No. 174. U.S. Army Corps of Engineers, New England District, Concord, MA, 52 pp.

Valente, R. M.; Read, L. B., Esten, M. E. 2012a. Monitoring Survey at the Rhode Island Sound Disposal Site October 2009. DAMOS Contribution No. 183. U.S. Army Corps of Engineers, New England District, Concord, MA, 72 pp.

Valente, Raymond M.; Carey, D.A.; Read, L.B.; Esten, M.E. 2012b. Monitoring Survey at the Central Long Island Sound Disposal Site October 2009. DAMOS Contribution No. 184. U.S. Army Corps of Engineers, New England District, Concord, MA, 90 pp.

Wentworth, C. K. 1922. A Scale of Grade and Class Terms for Clastic Sediments. The Journal of Geology 30: 377–392.

Wolf, S.; Fredette, T. J.; Loyd, R. B. 2012. Thirty-Five Years of Dredged Material Disposal Area Monitoring – Current Work and Perspectives of the DAMOS Program. WEDA Journal of Dredging Engineering, Vol. 12, No. 2, p. 24-41.

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MAY/JUNE 2020

FIGURES

CONTRIBUTION #210

October 2021

Contract No. W912WJ-19-D-0010
Delivery Order W912WJ19F0126

Submitted to:
New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Prepared by:

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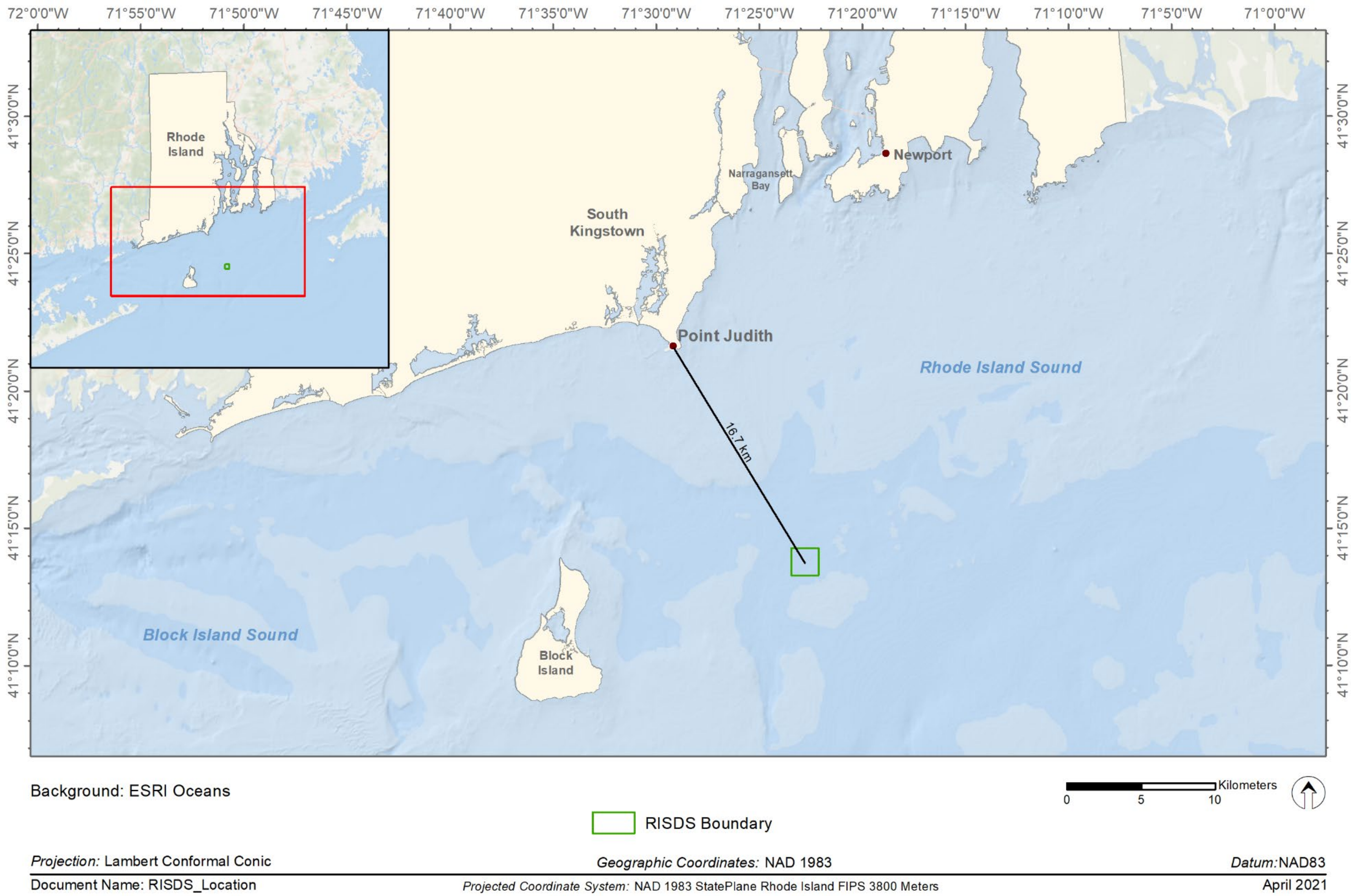

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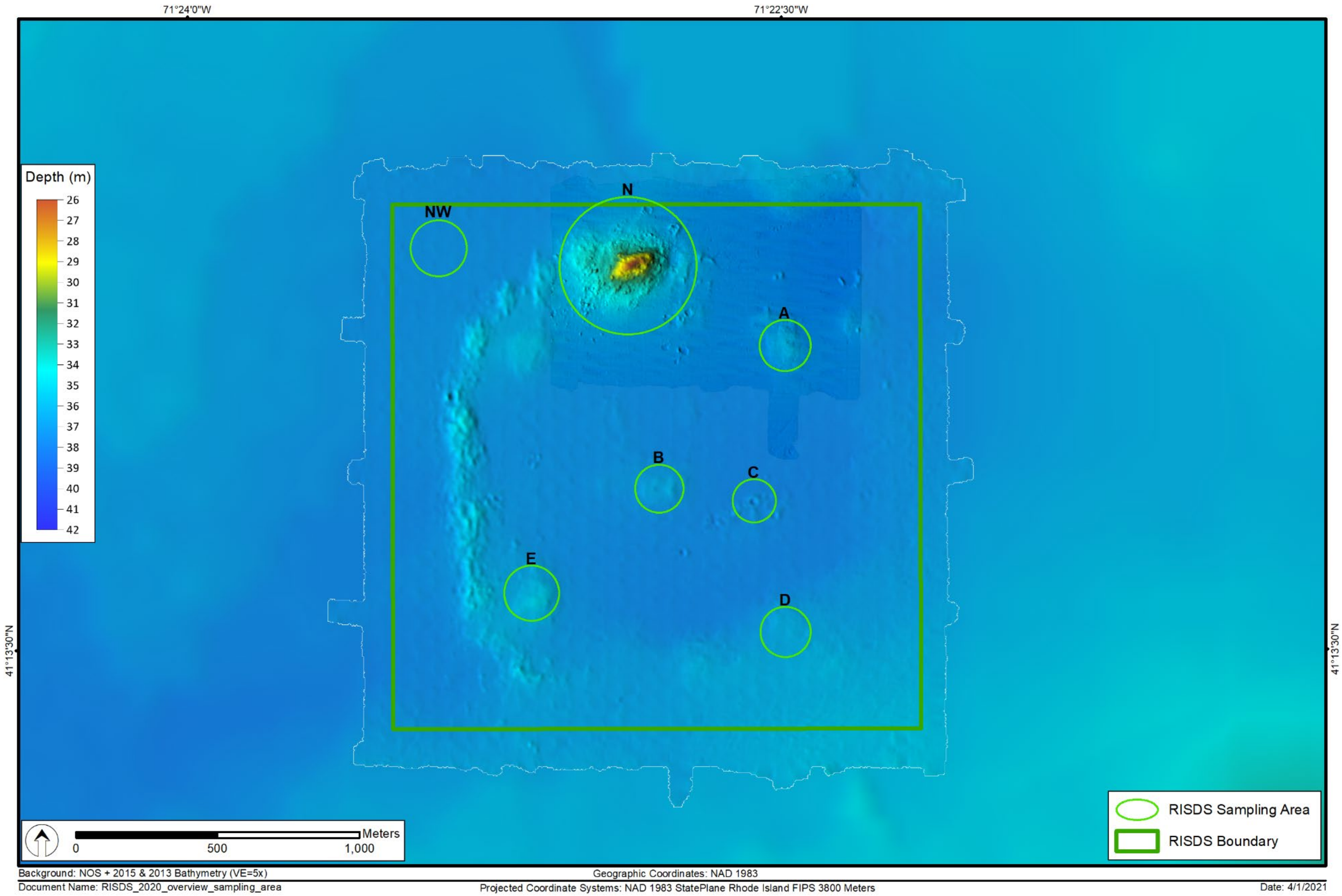

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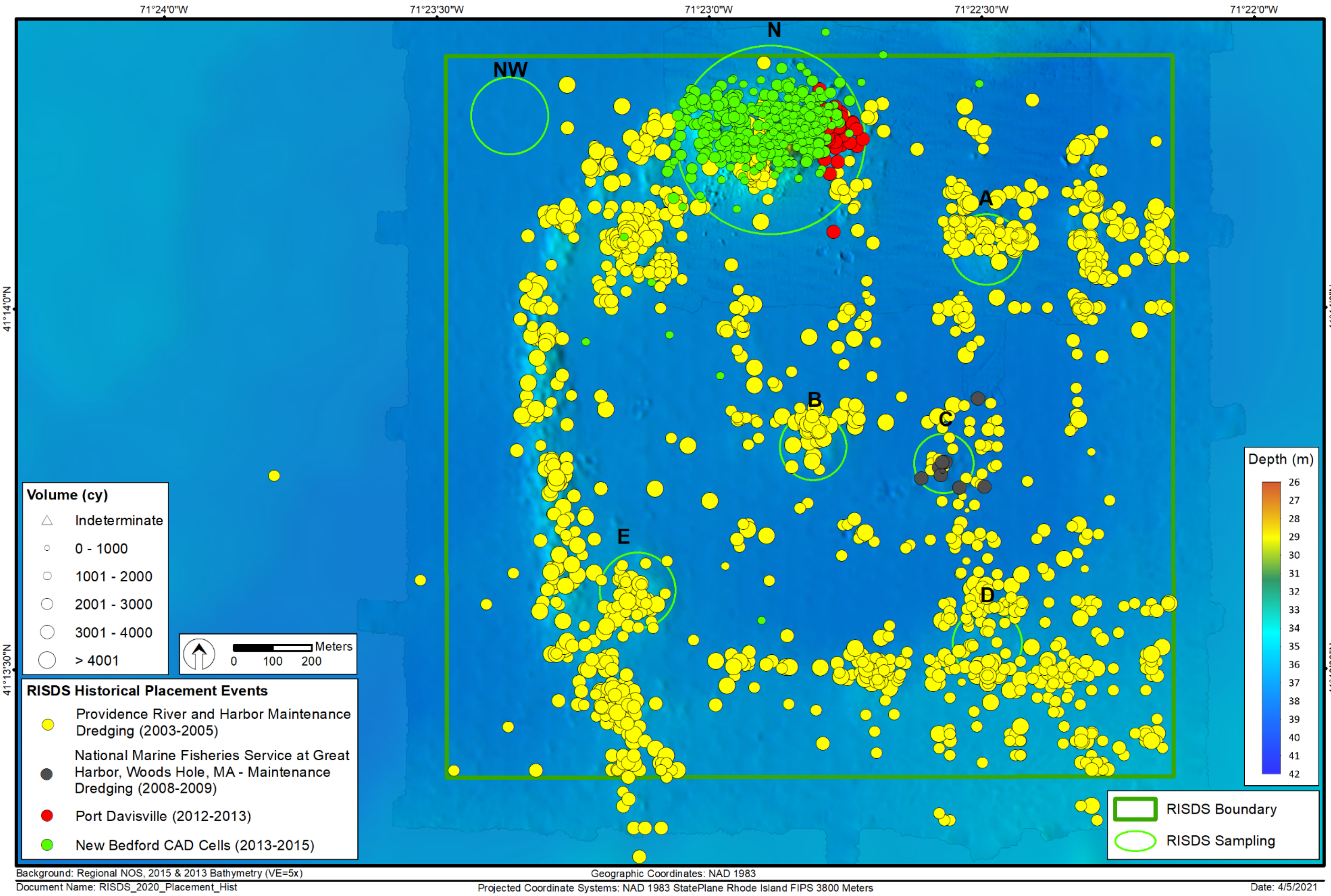

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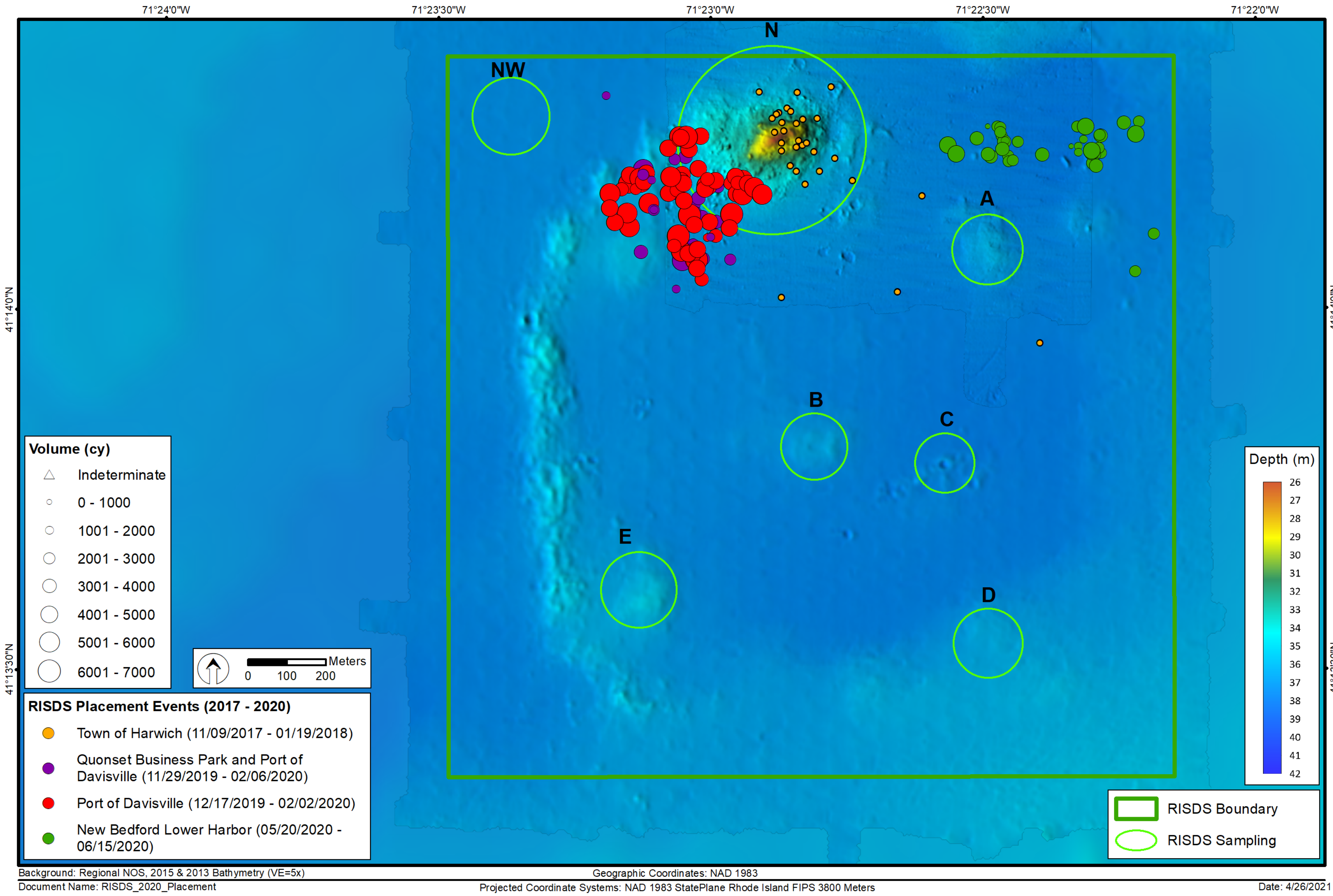

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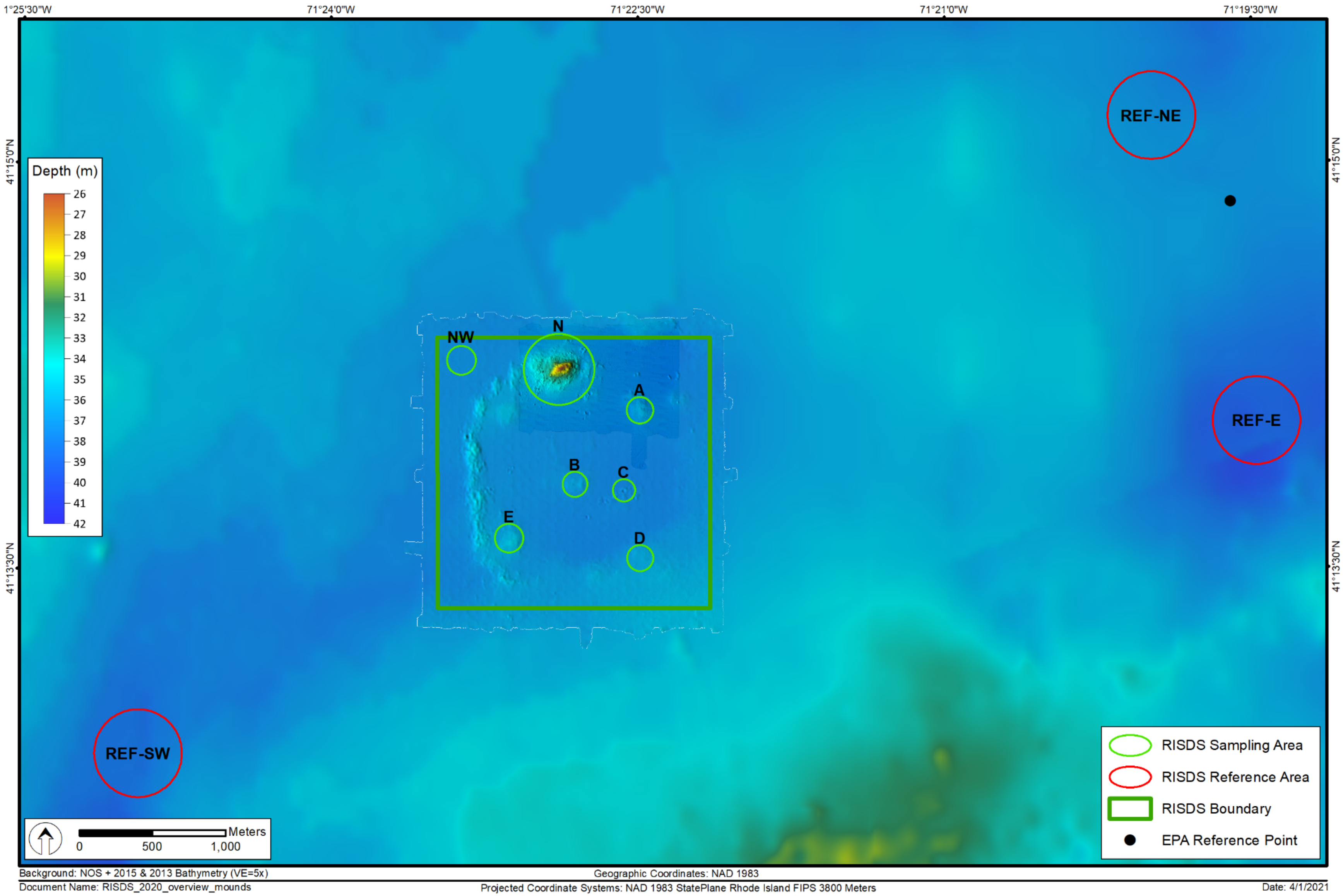

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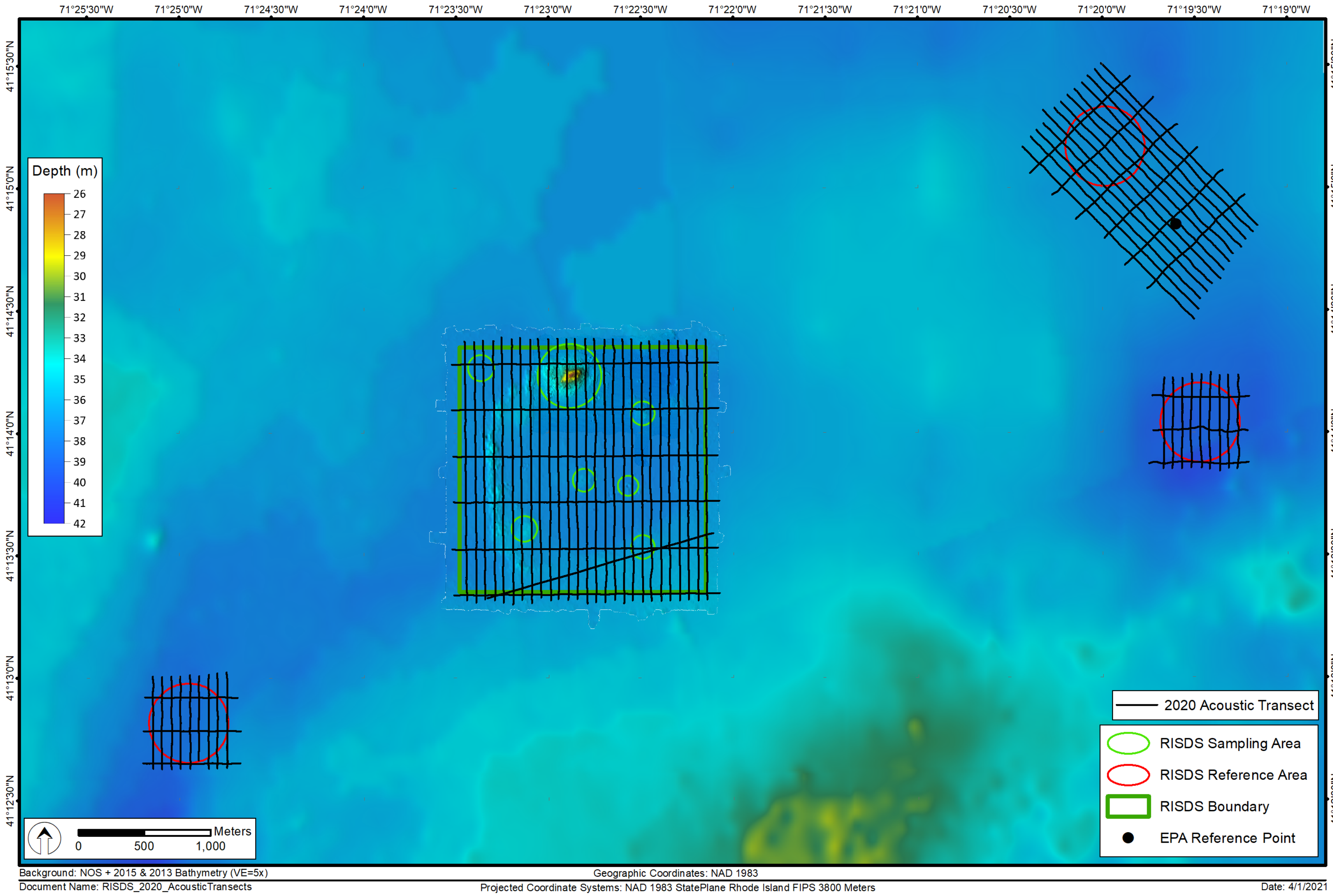

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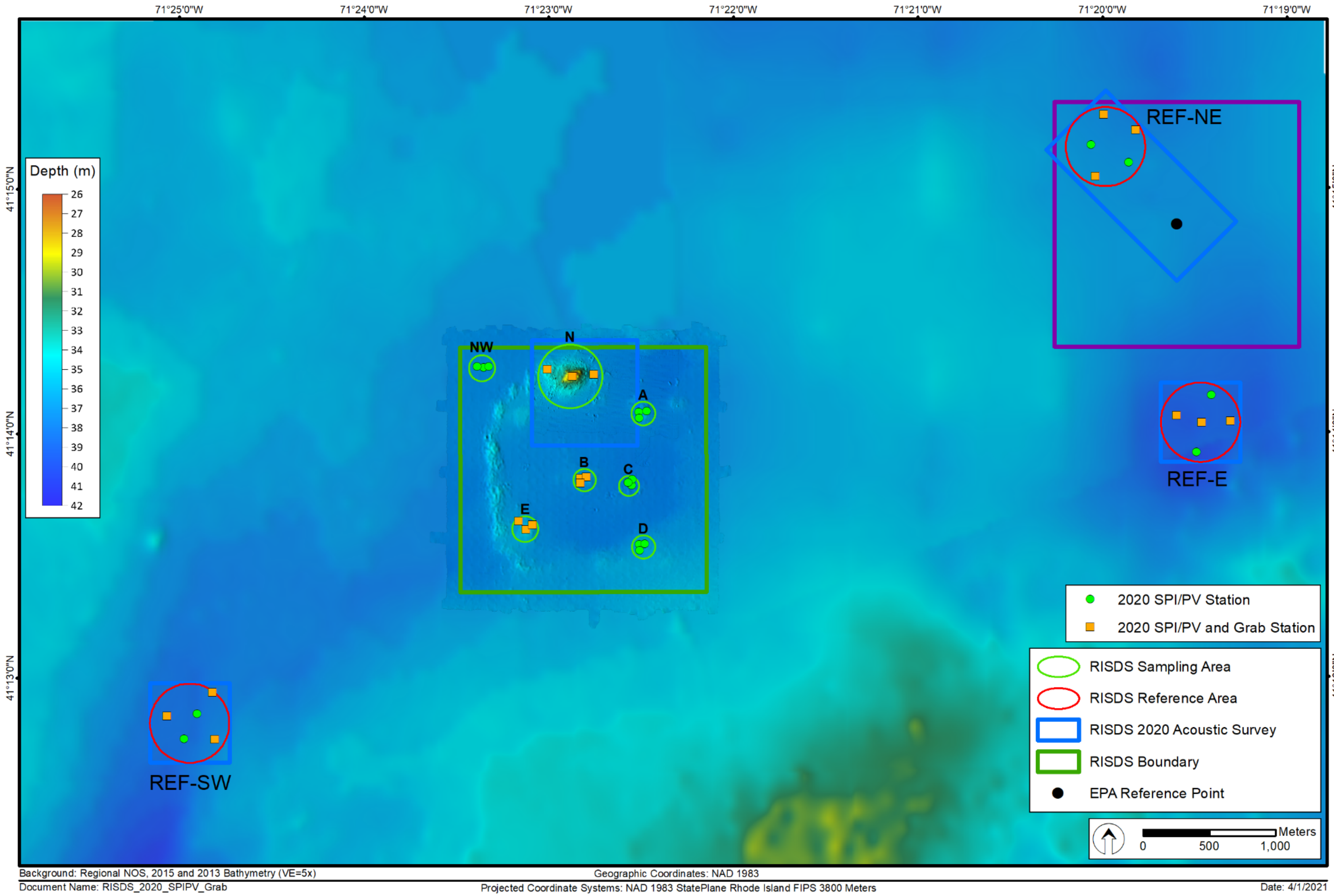

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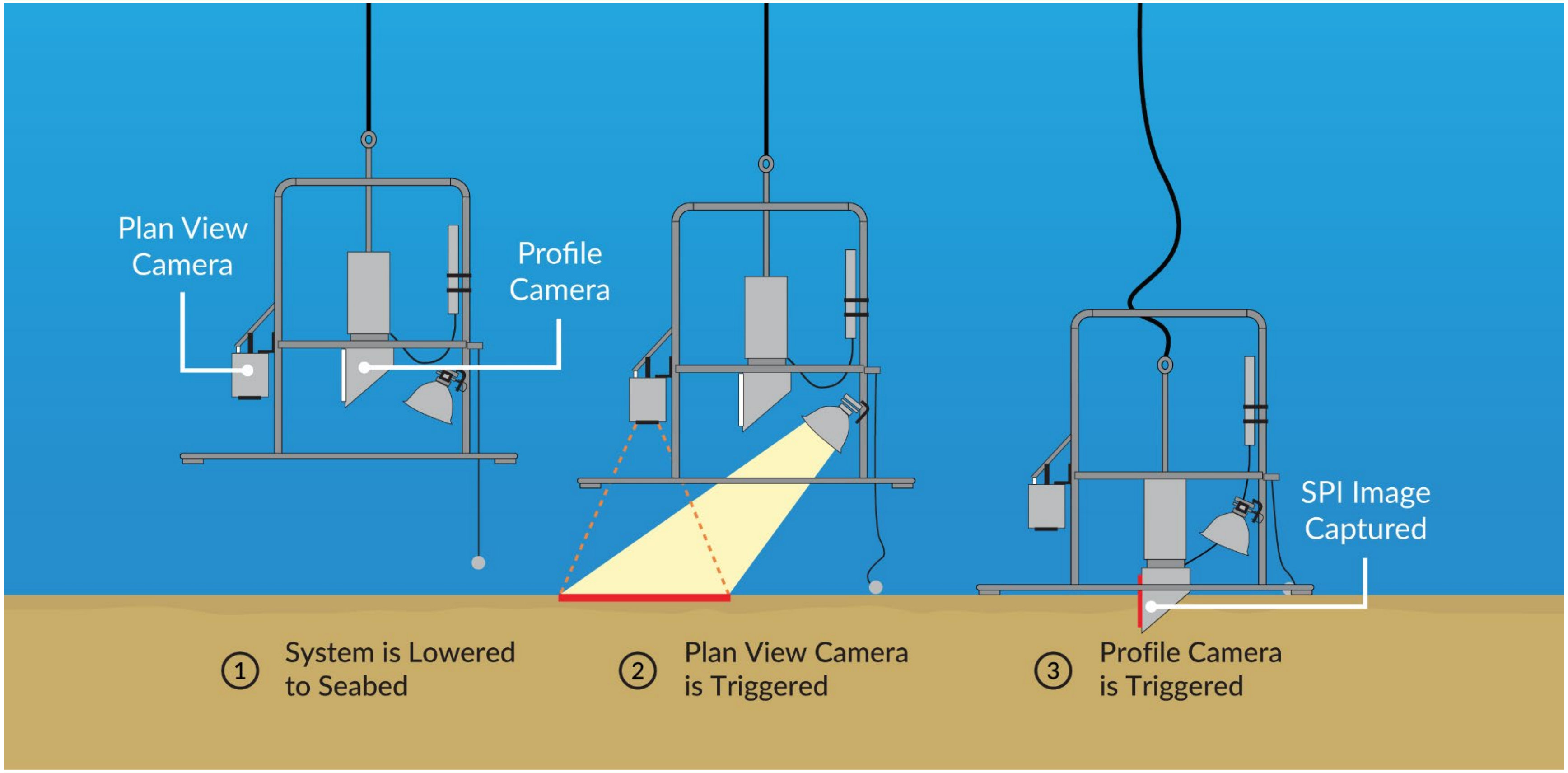

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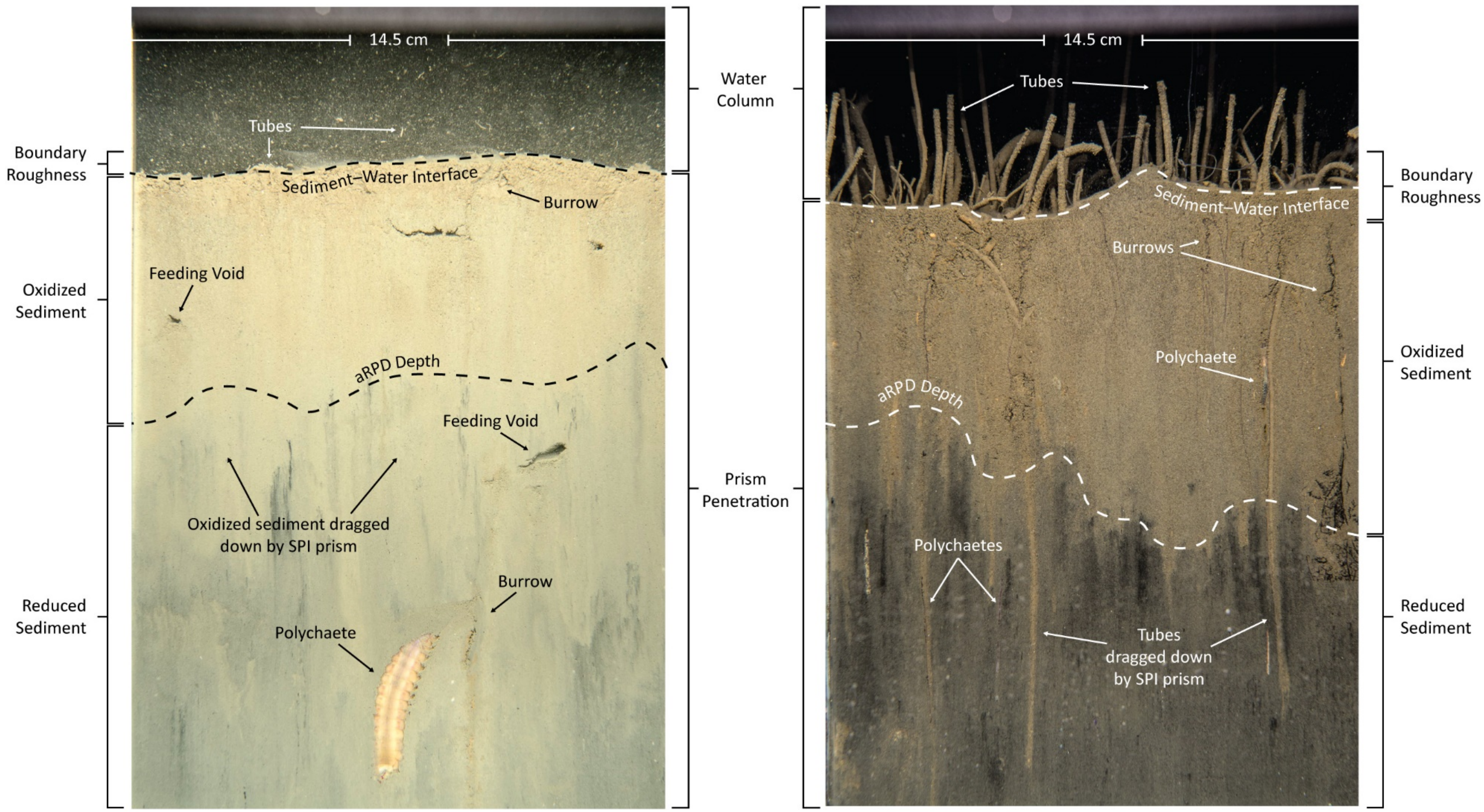

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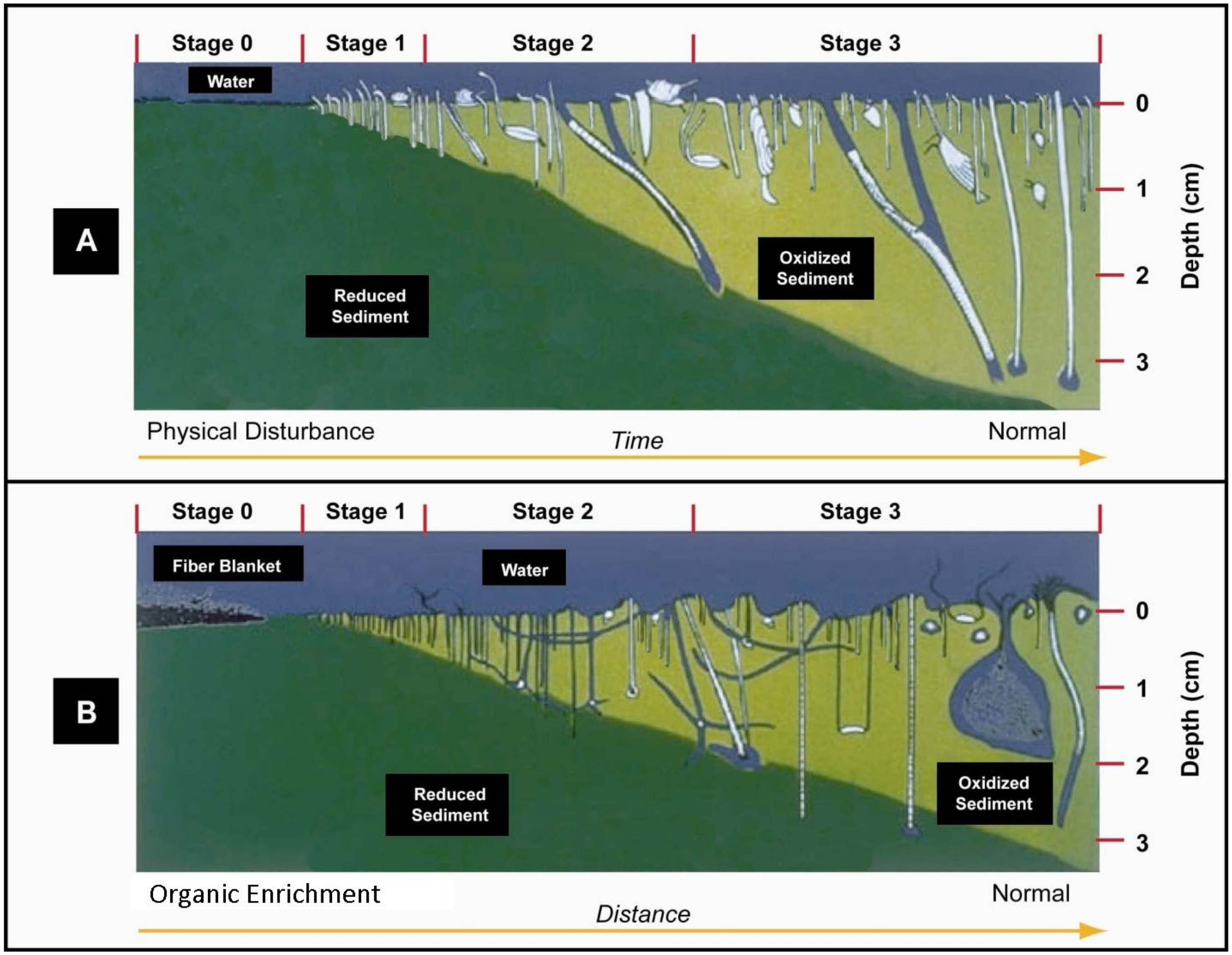

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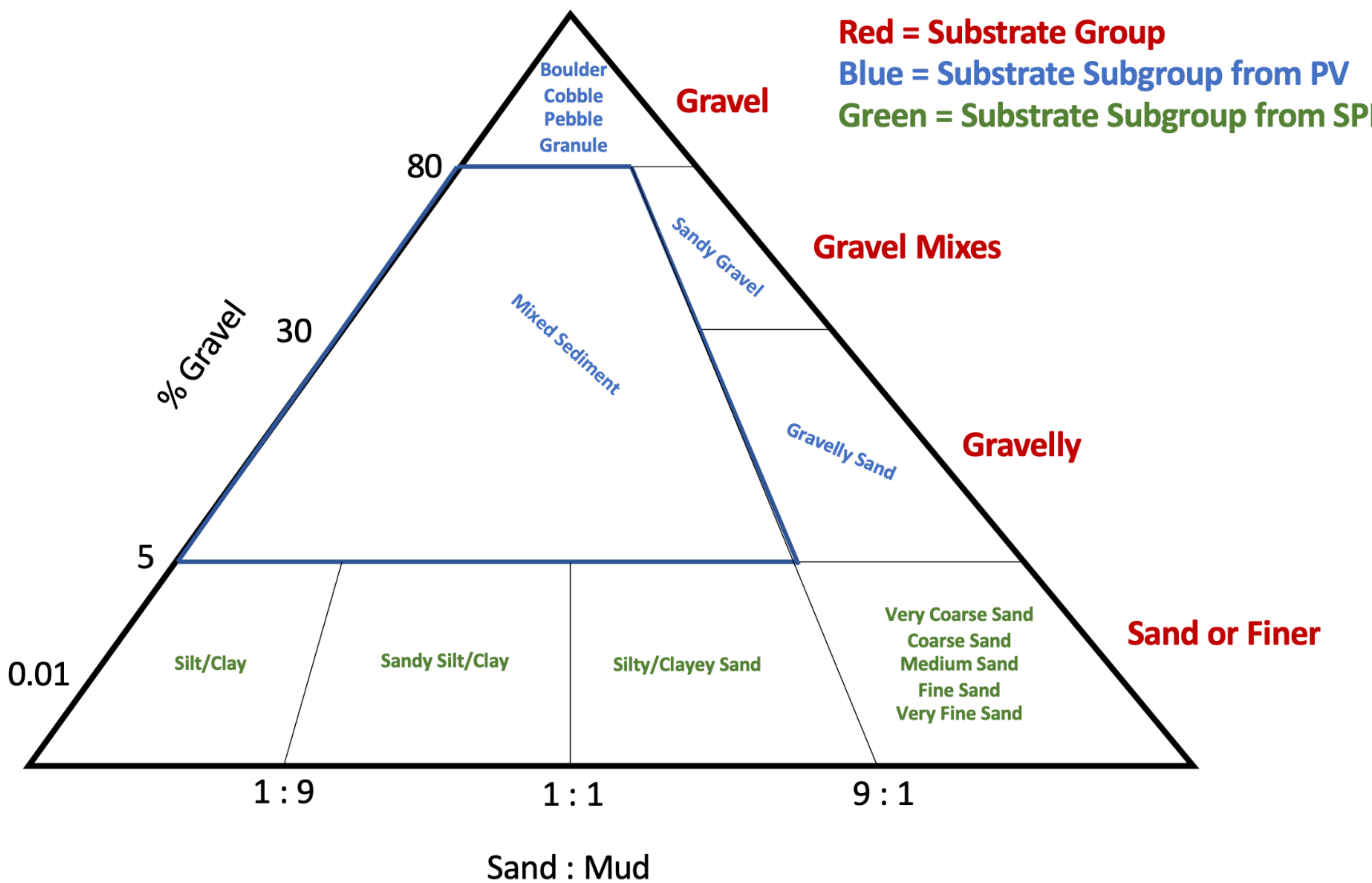

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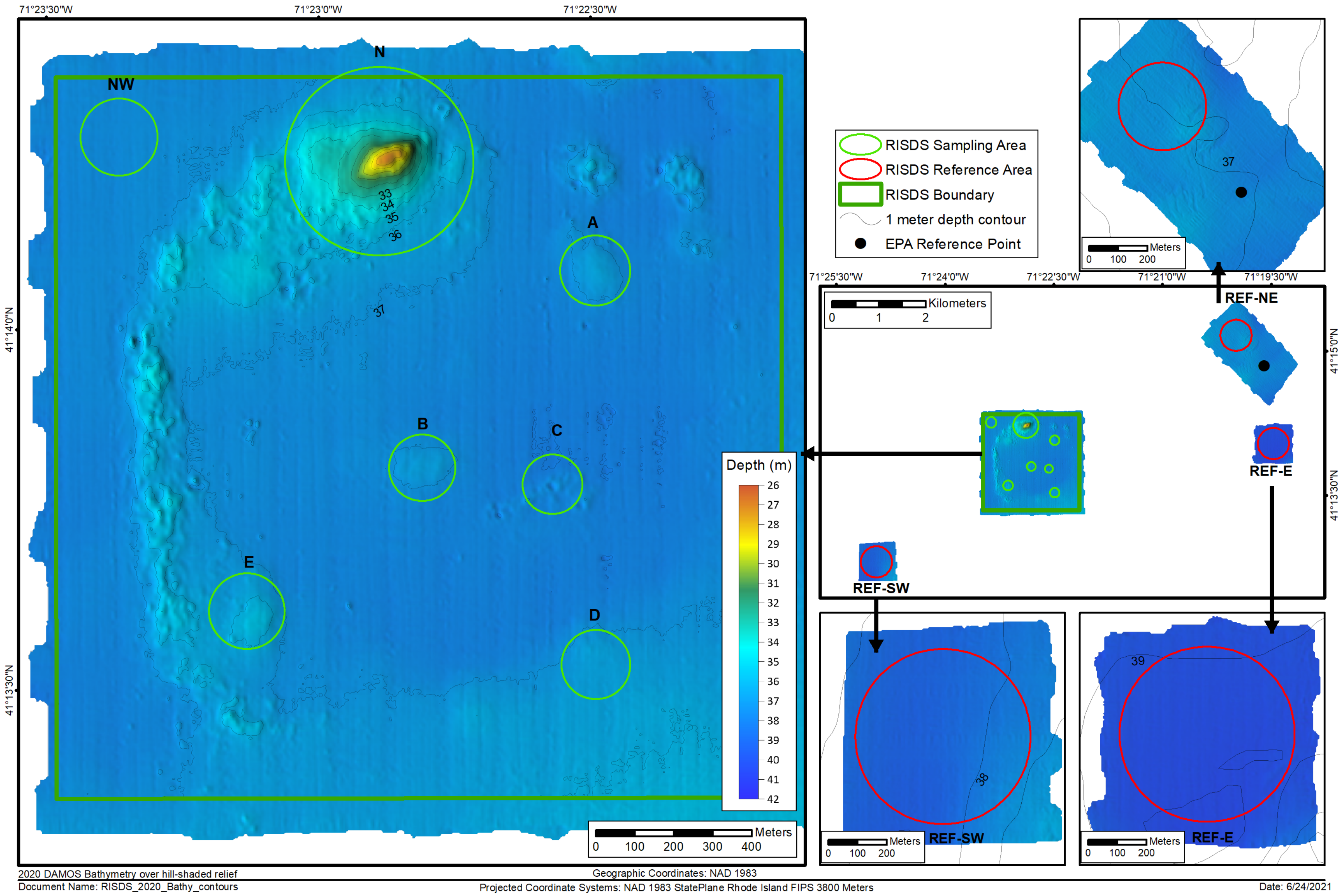

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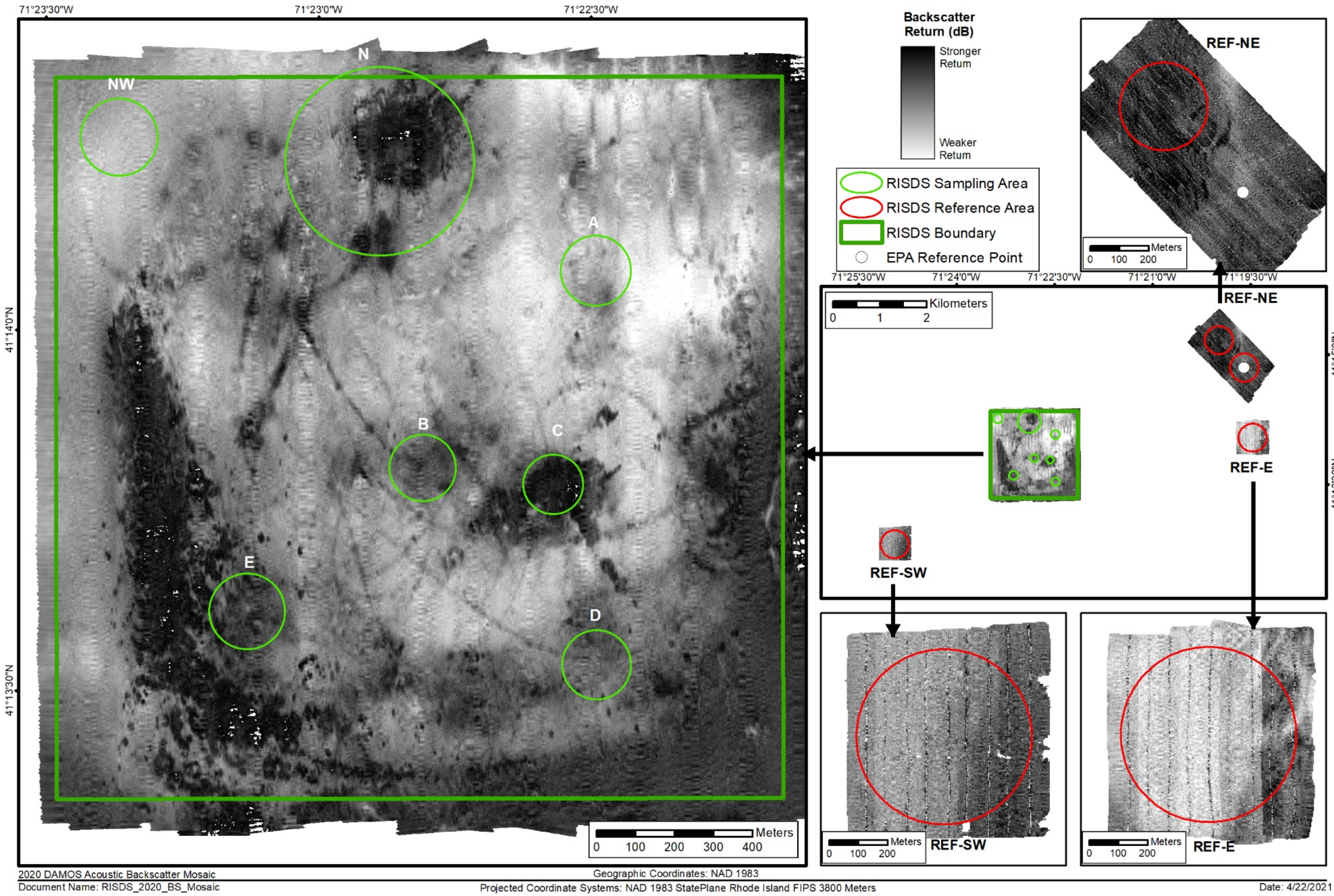

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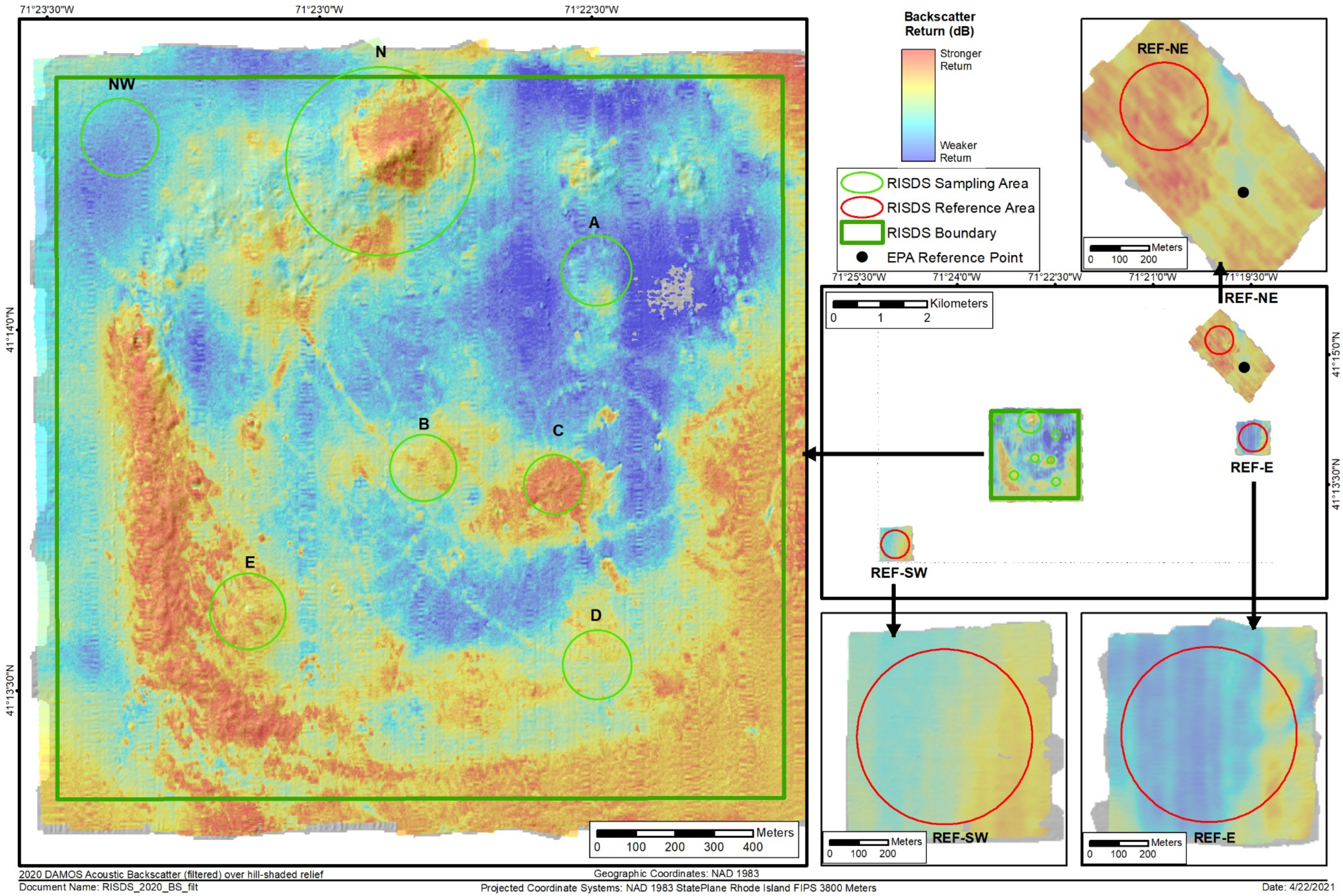

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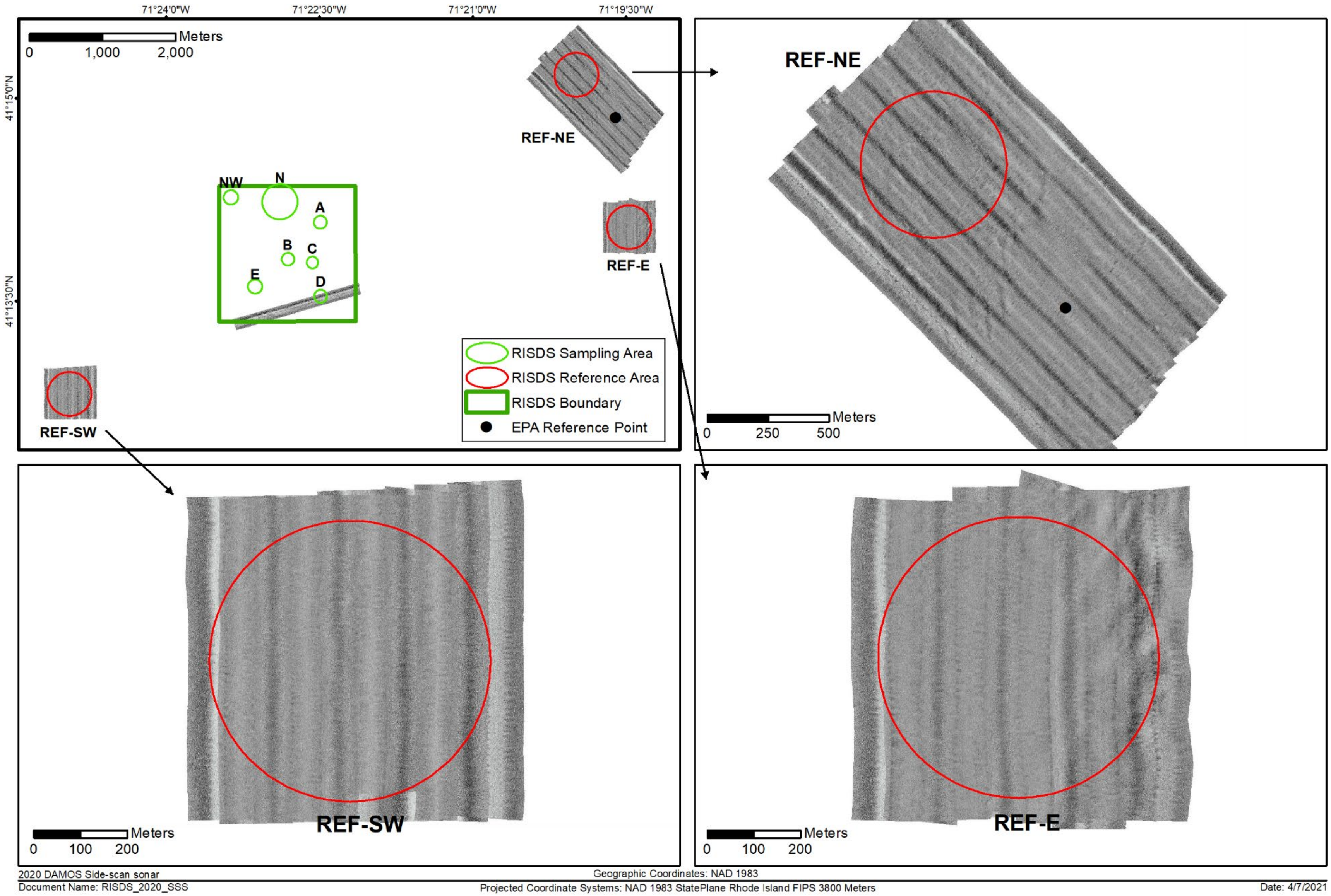

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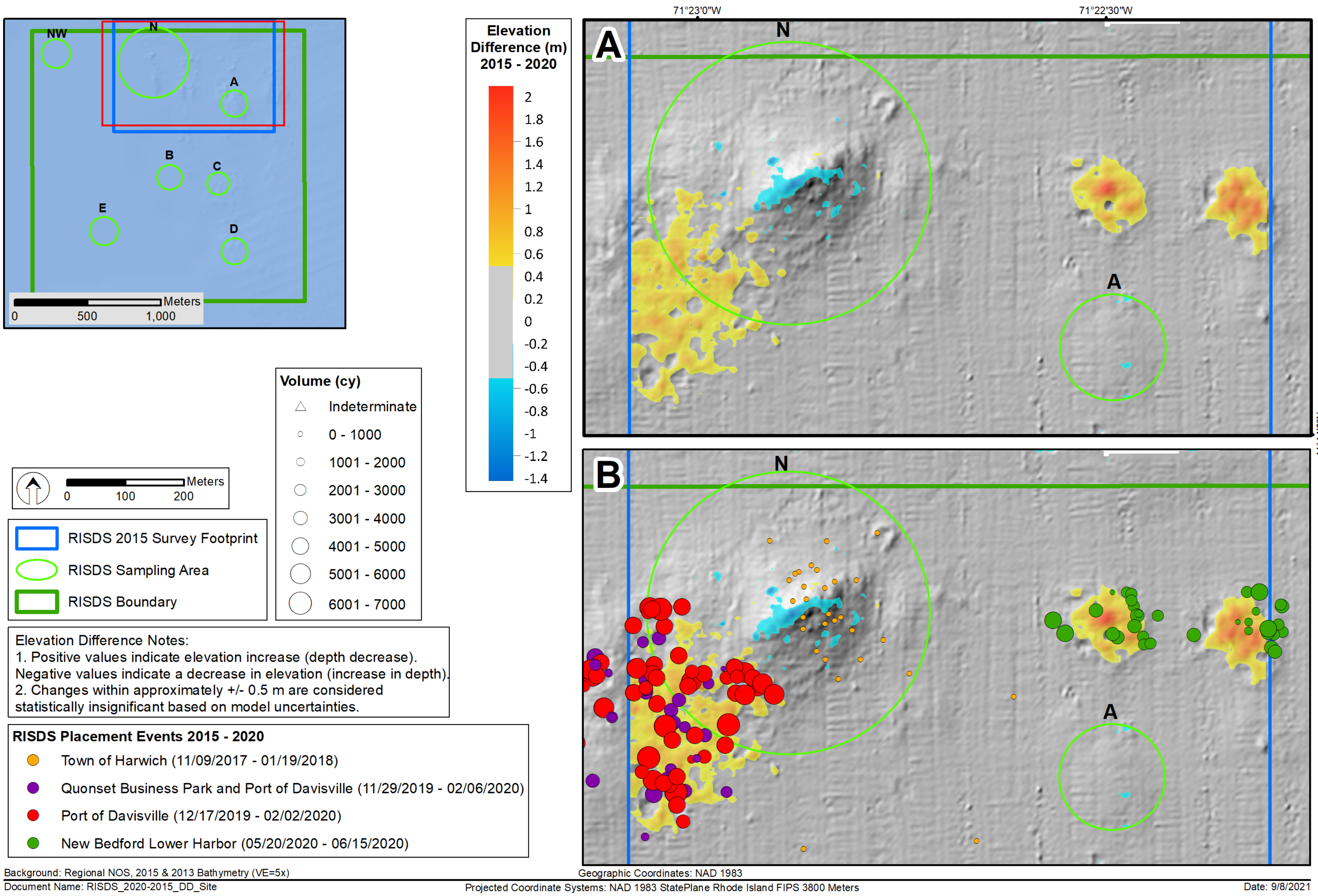

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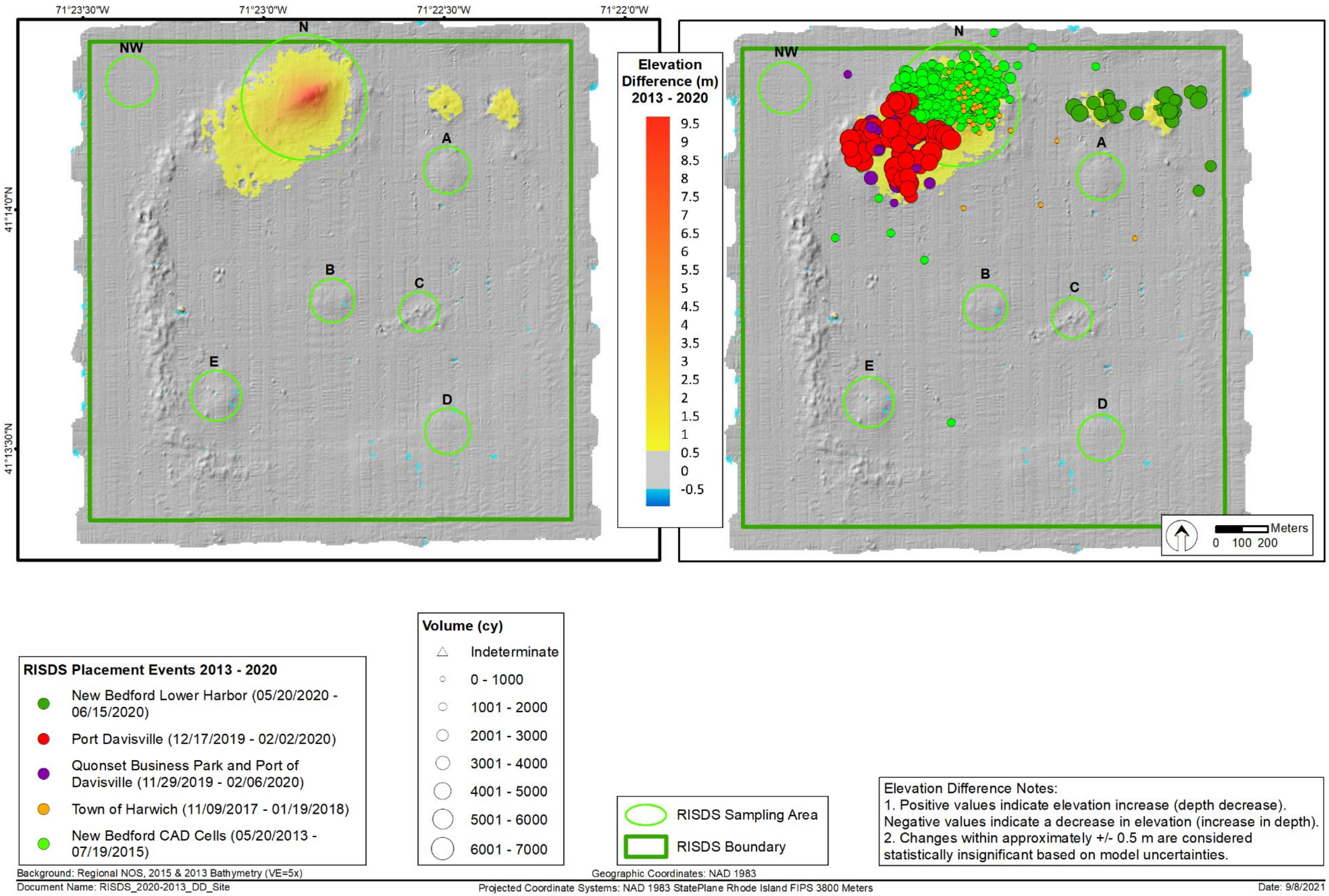

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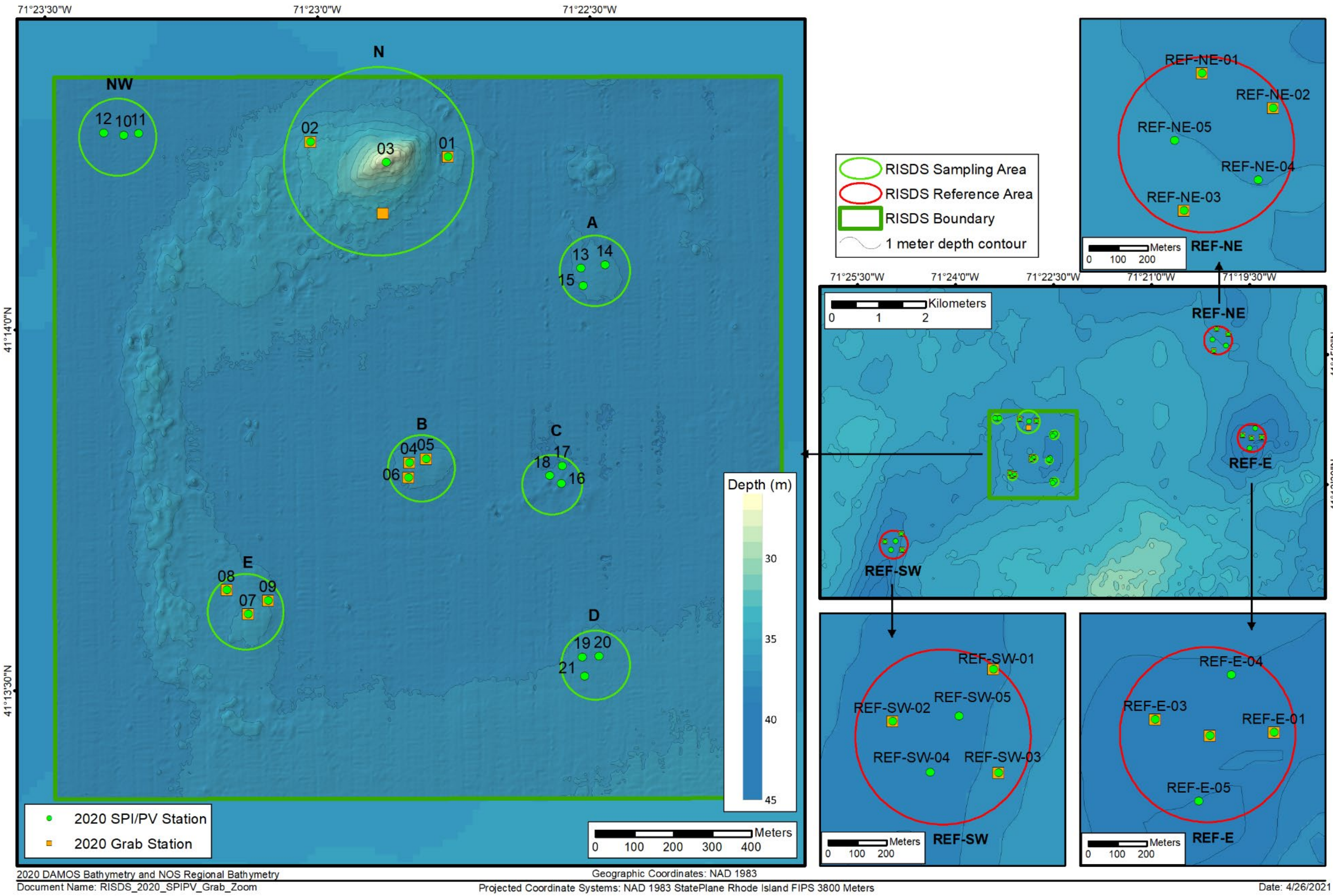

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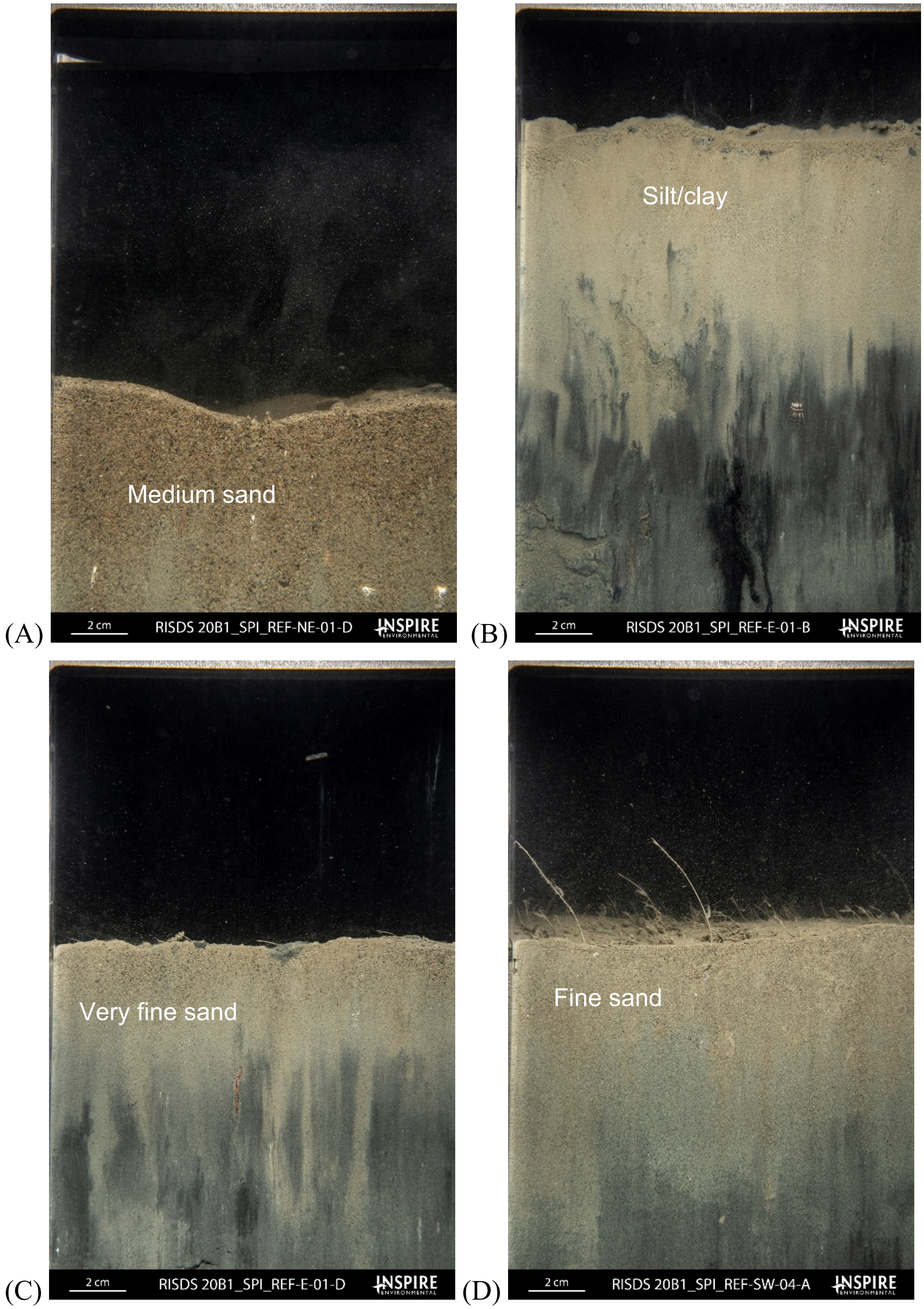

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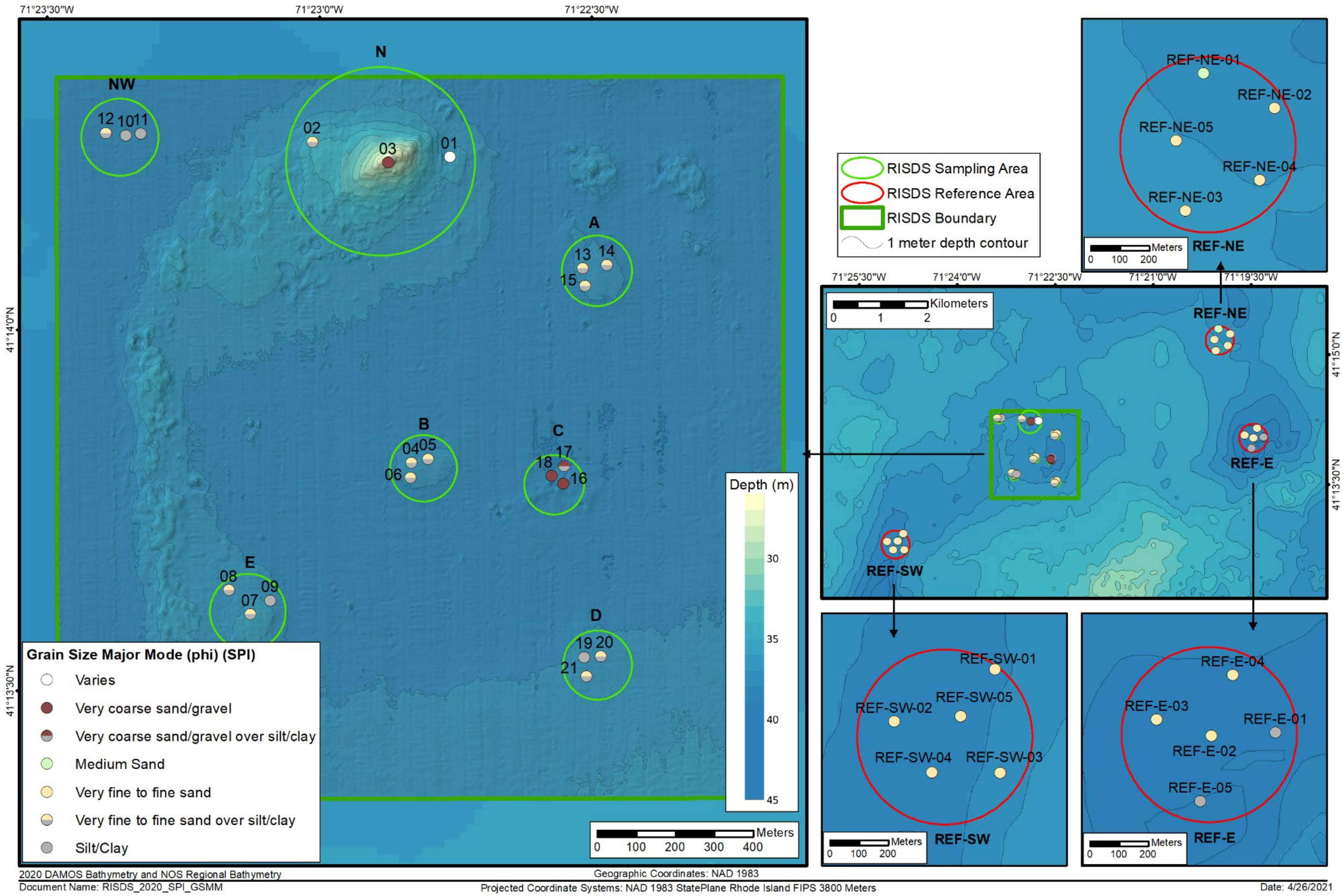

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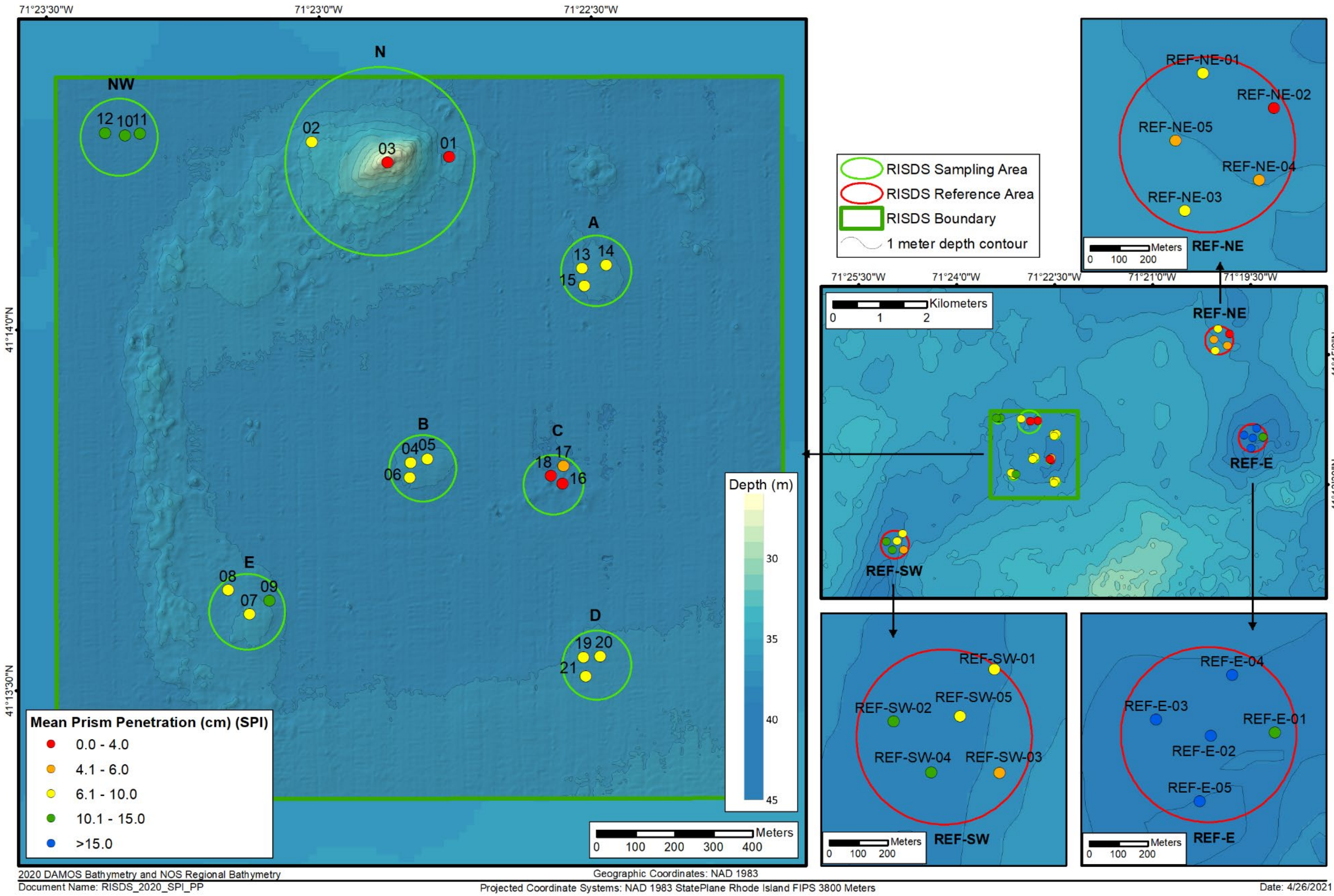

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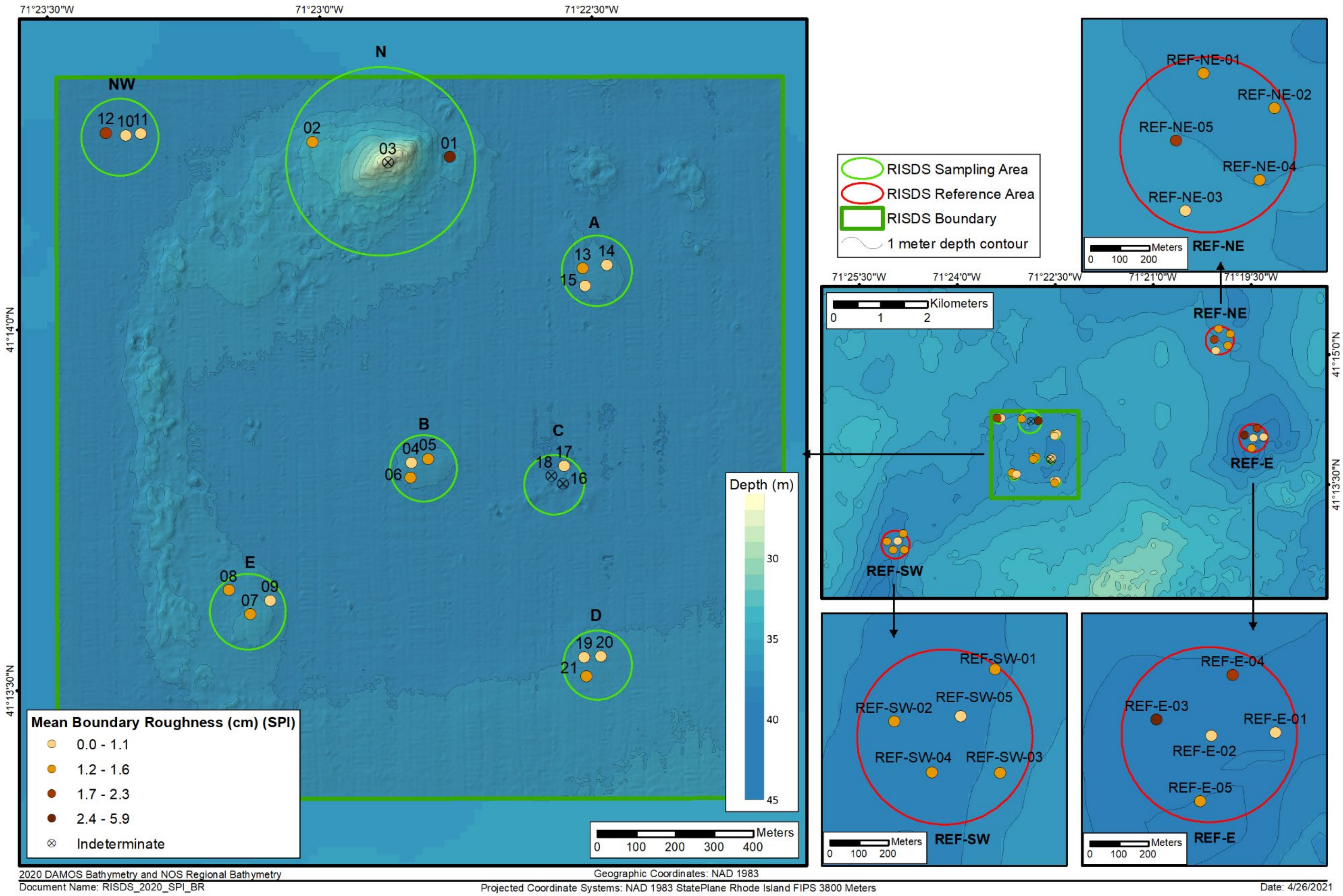

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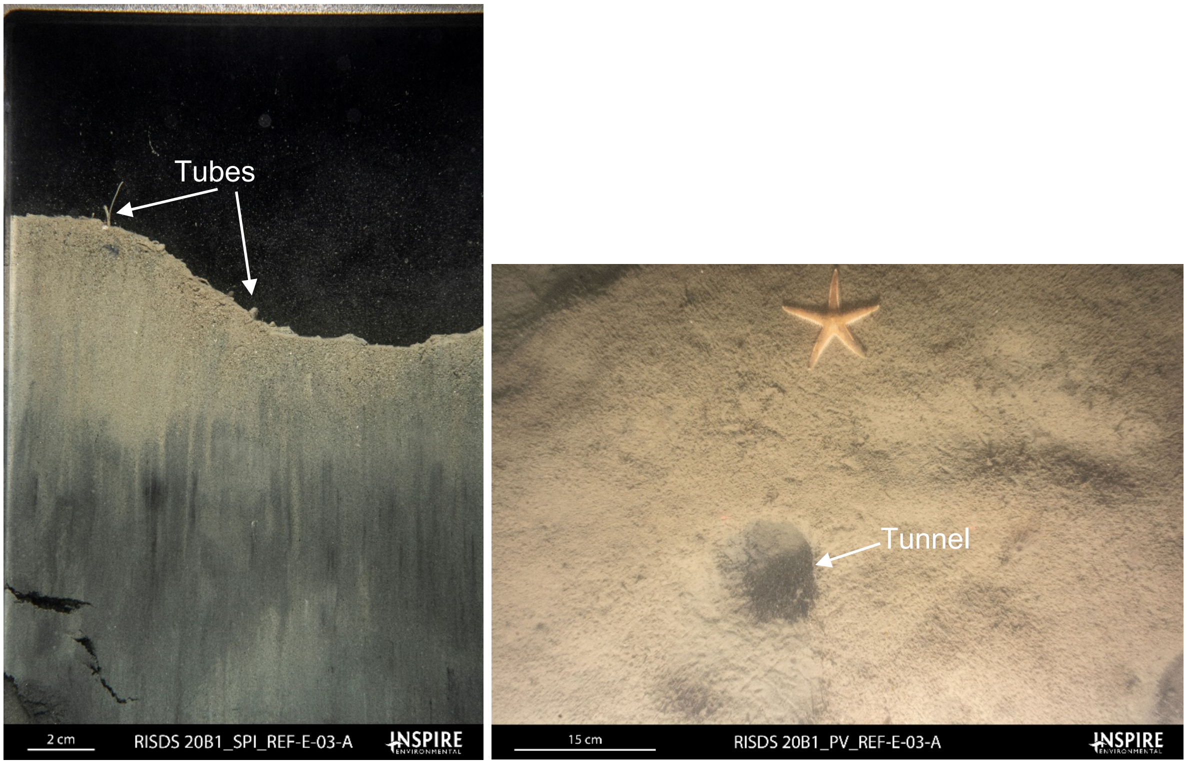
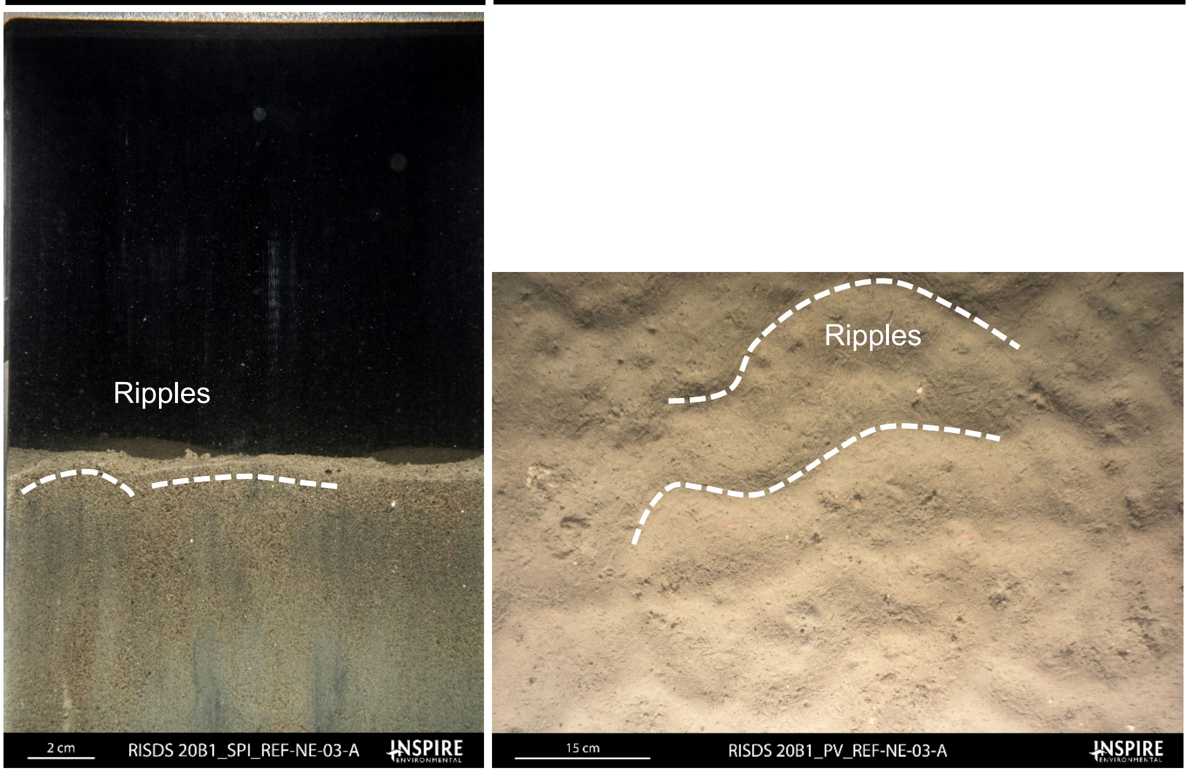


(A)

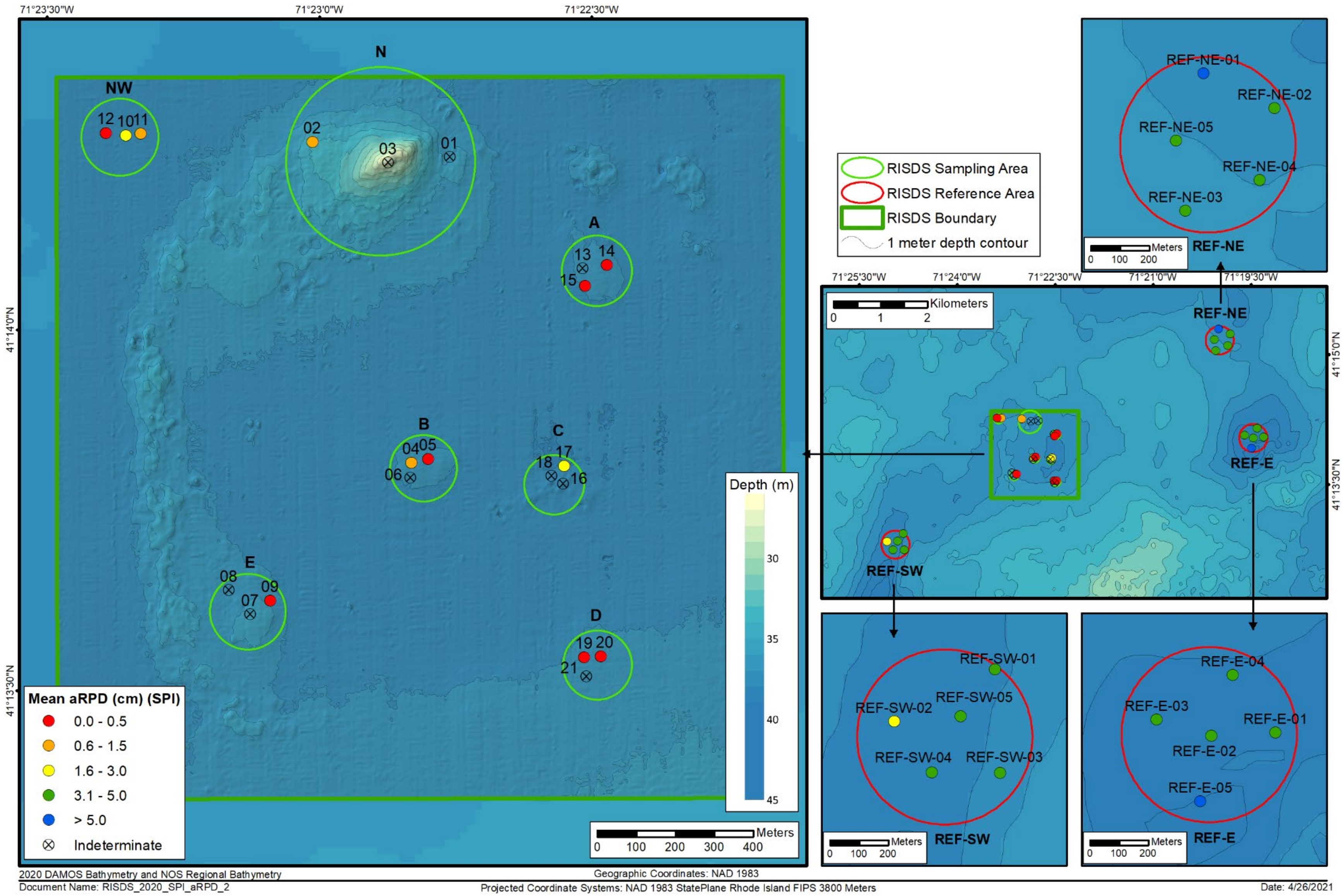


(B)

Figure 3-12. Profile and plan view images at reference areas showing (A) deep tunnels and tubes at REF-E resulting in large biogenically-derived boundary roughness; (B) small-scale bedforms (sand ripples) of low relief with small physically-driven boundary roughness at REF-NE; and (C) extensive tubes, burrows, and amphipod fecal stacks across the surface at REF-SW contributing to biologically-driven boundary roughness

(C)

Figure 3-12. continued Profile and plan view images at reference areas showing (A) deep tunnels and tubes at REF-E resulting in large biogenically-derived boundary roughness; (B) small-scale bedforms (sand ripples) of low relief with small physically-driven boundary roughness at REF-NE; and (C) extensive tubes, burrows, and amphipod fecal stacks across the surface at REF-SW contributing to biologically-driven boundary roughness



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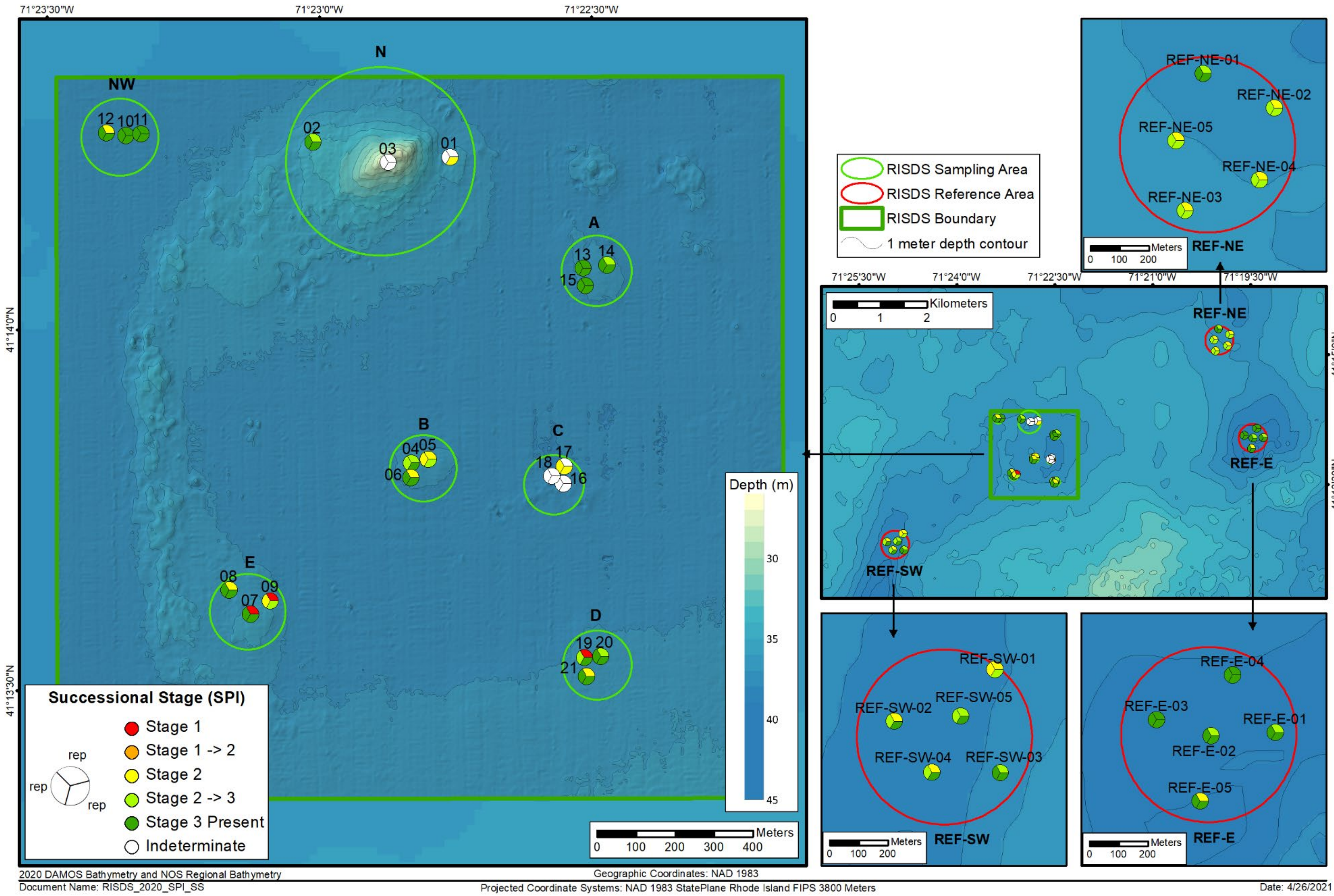

Figure 3-14. Infaunal successional stages at RISDS sampling and reference areas. Results shown provide a value for each of three replicate images at each sampling station.

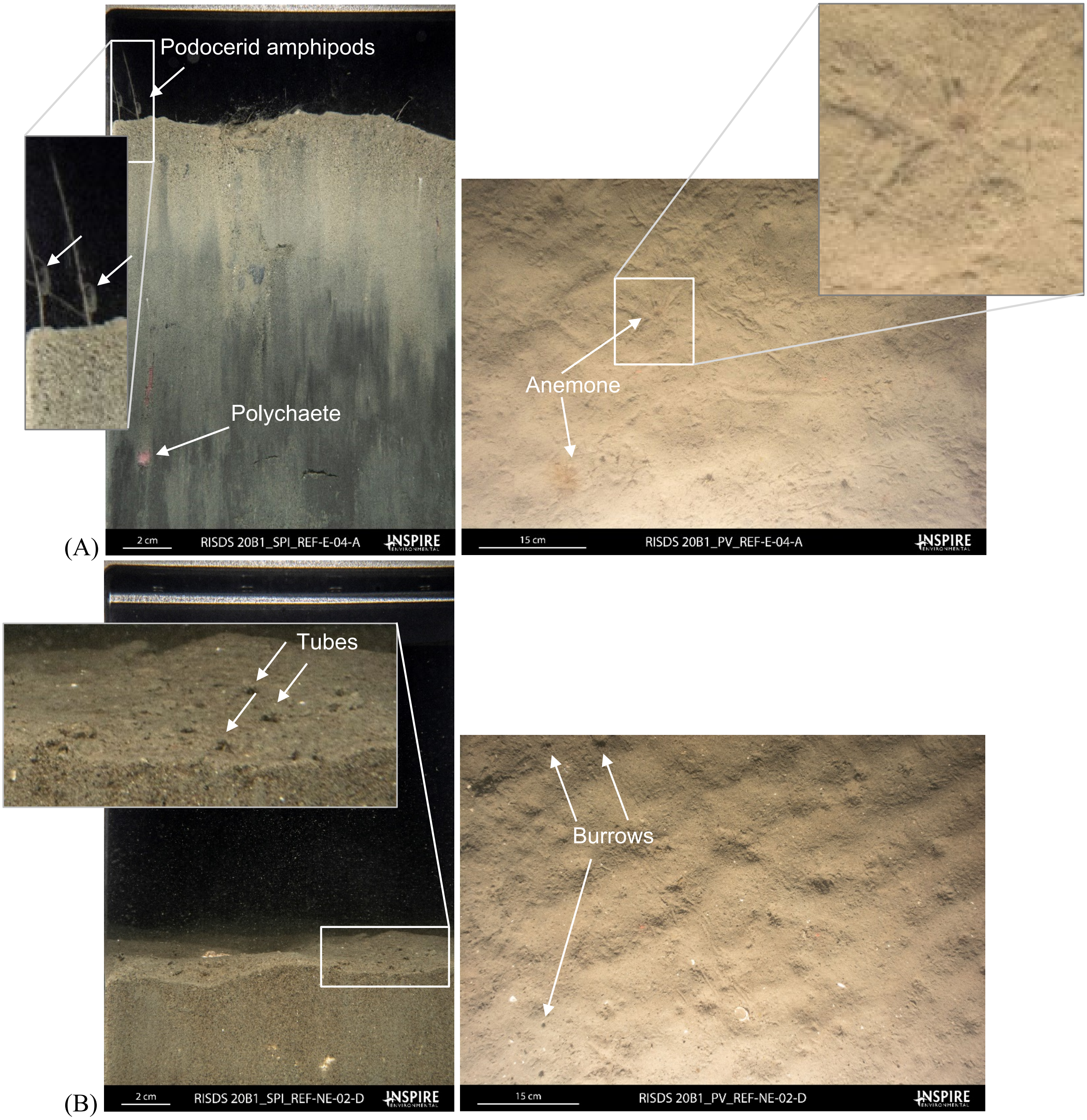

Figure 3-15. Profile and plan view images depicting infaunal successional stages as well as other biological characteristics found at the three RISDS reference areas: (A) Stage 2 on 3 at REF-E where podocerid amphipods and burrowing anemones (cerianthids) occurred at the sediment–water interface and deep-burrowing polychaetes were observed; (B) Stage 2 -> 3 at REF-NE where tubes and burrows were observed across the surface; and (C) Stage 2 on 3 at REF-SW evidenced by high densities of podocerid amphipods and small burrows across the sediment surface

(C)

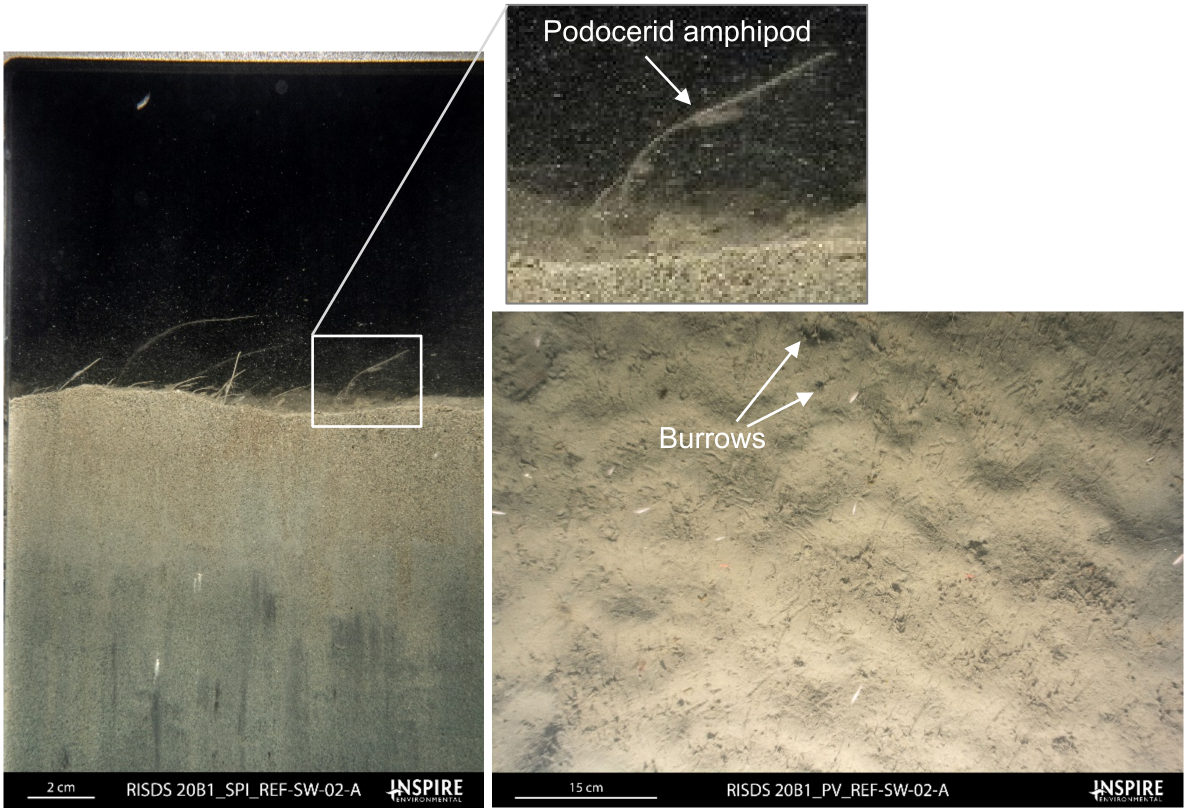

Figure 3-15. continued Profile and plan view images depicting infaunal successional stages as well as other biological characteristics found at the three RISDS reference areas: (A) Stage 2 on 3 at REF-E where podocerid amphipods and burrowing anemones (cerianthids) occurred at the sediment–water interface and deep-burrowing polychaetes were observed; (B) Stage 2 -> 3 at REF-NE where tubes and burrows were observed across the surface; and (C) Stage 2 on 3 at REF-SW evidenced by high densities of podocerid amphipods and small burrows across the sediment surface

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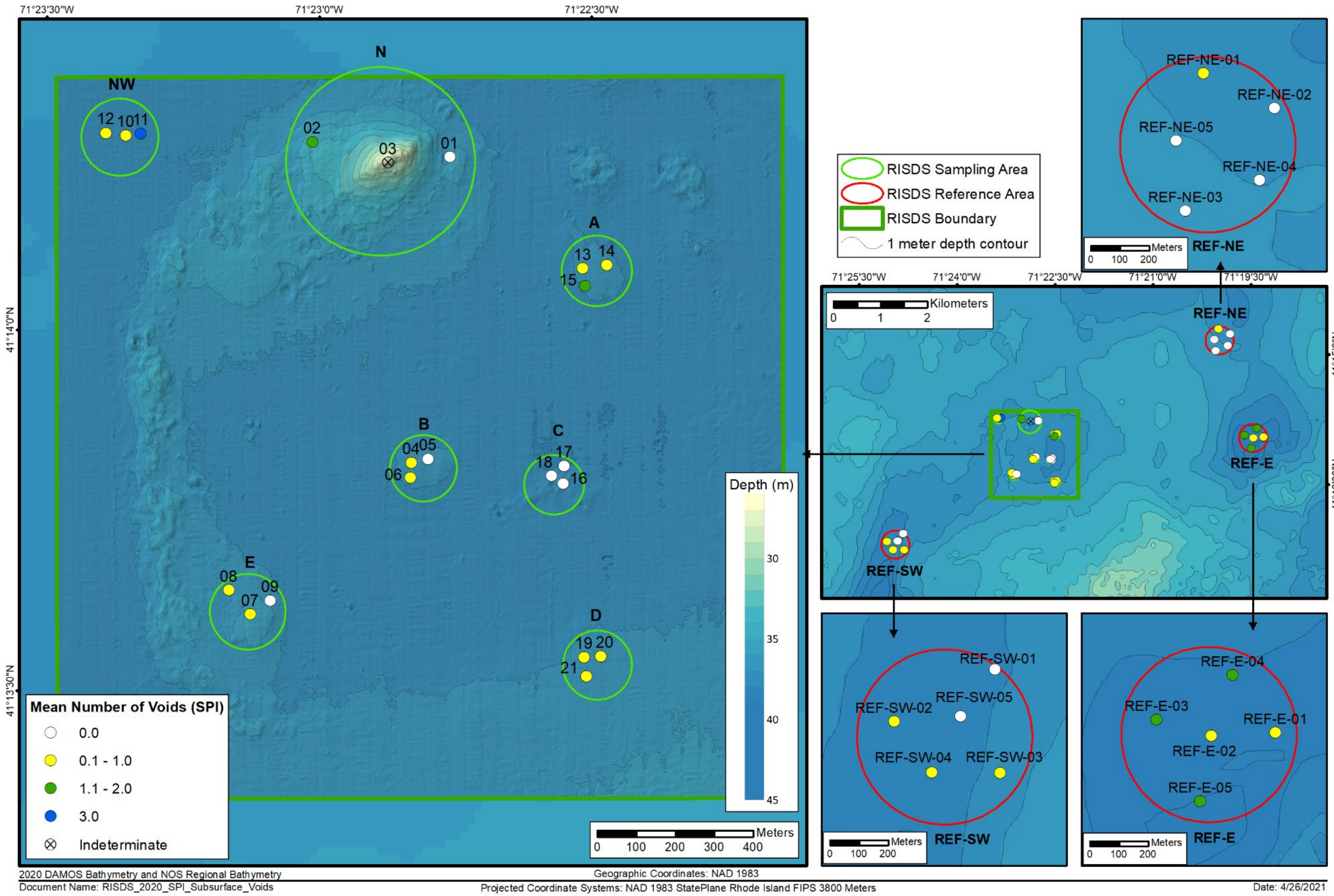

Figure 3-16. Mean number of subsurface voids observed in SPI at RISDS sampling and reference areas

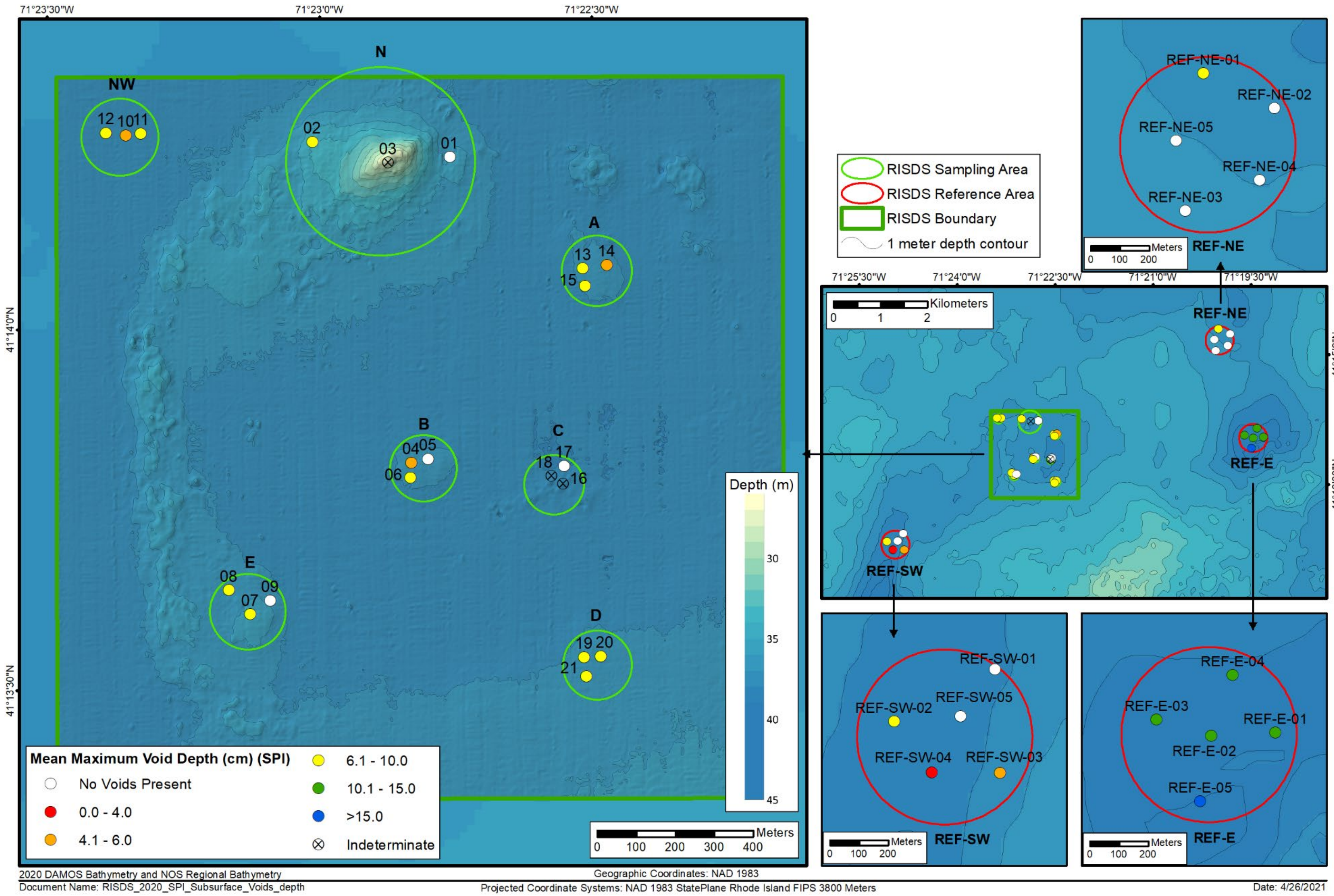

Figure 3-17. Mean station maximum depth of subsurface voids in SPI at RISDS sampling and reference areas

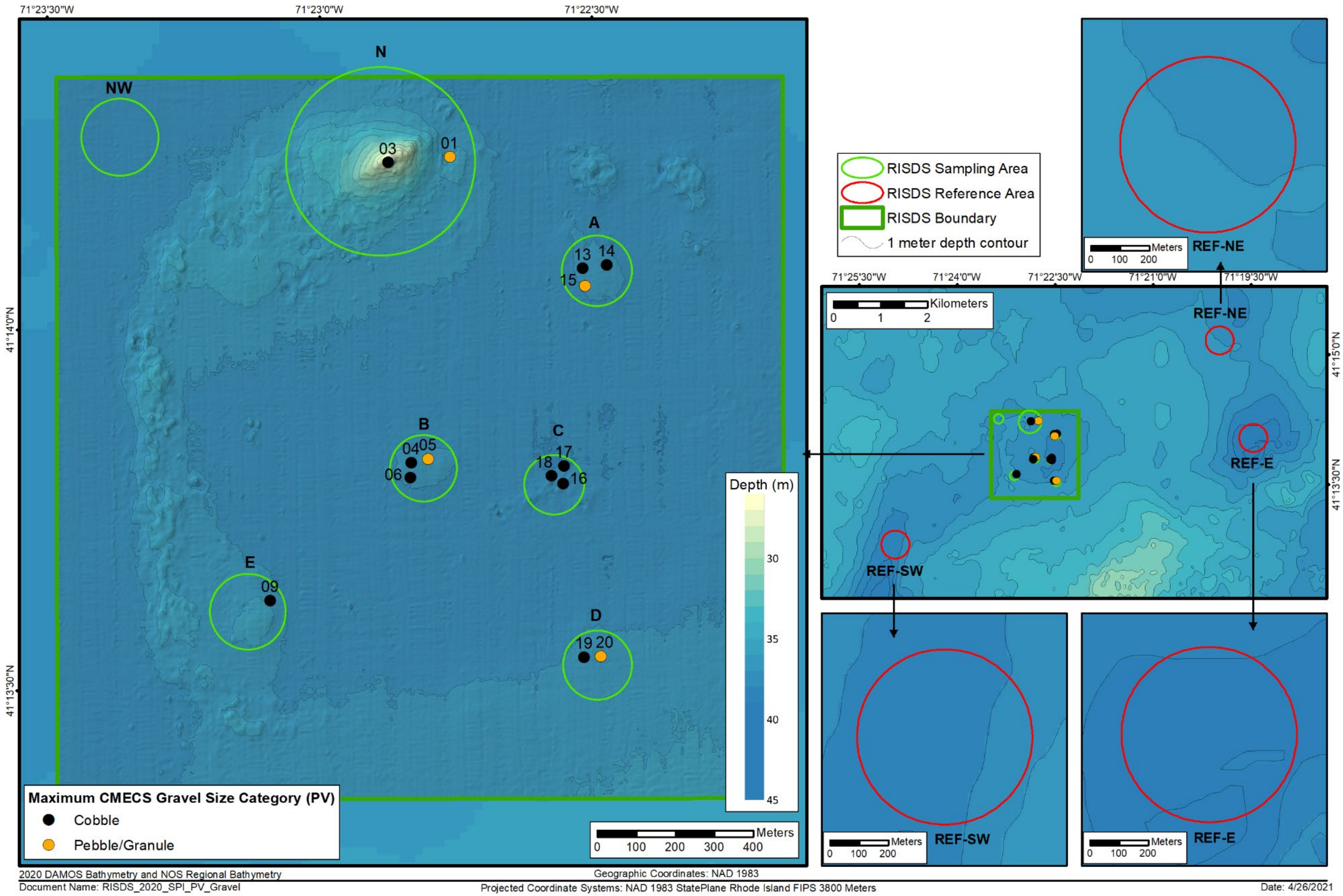

Figure 3-18. Maximum gravel size observed at stations where gravel was observed

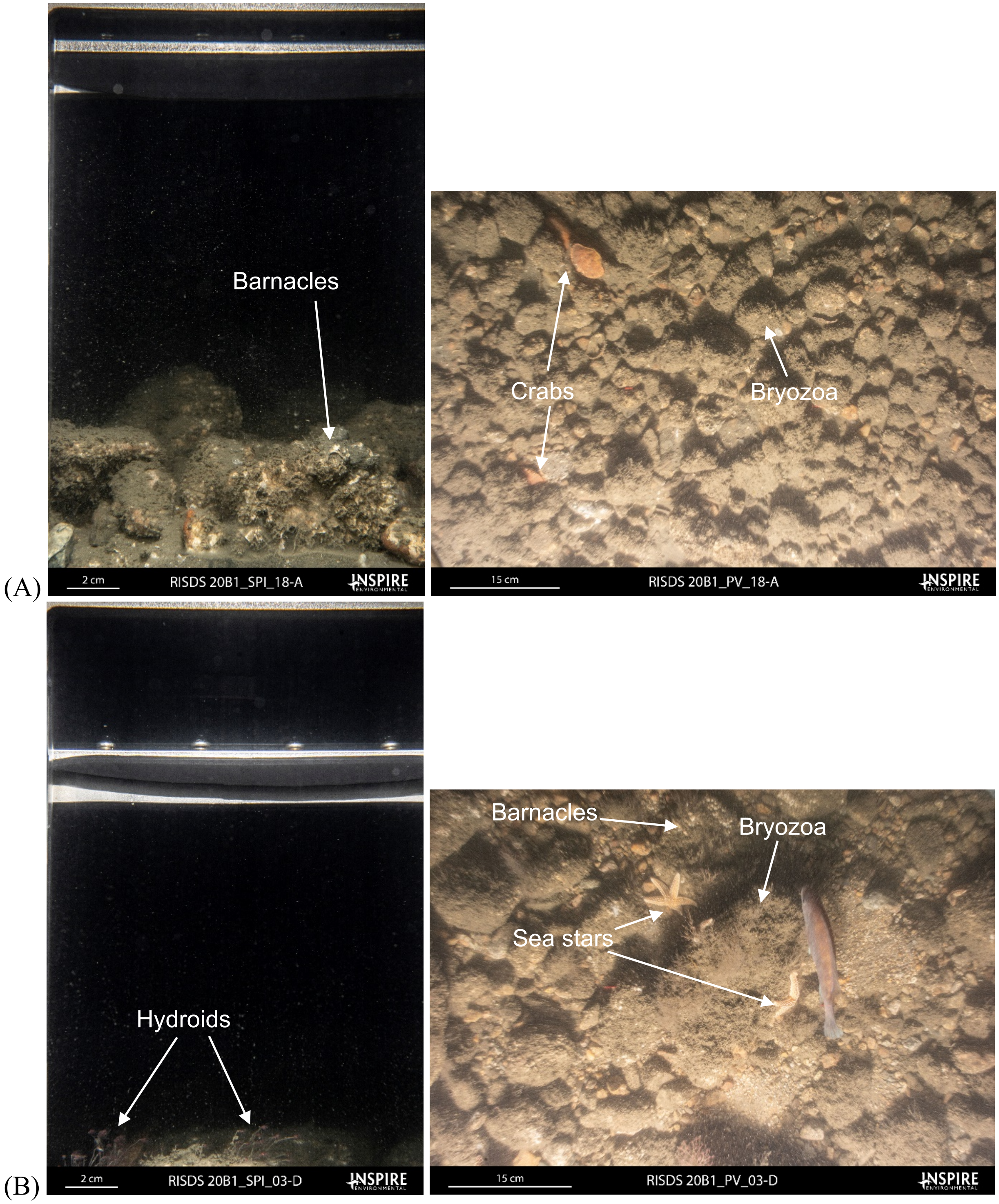

Figure 3-19. Sediment profile and plan view images at RISDS depicting hard bottom habitats including (A) small-sized gravel pavement on soft sediment at RISDS-C, with bryozoa, barnacles, and crab(s); and (B) large gravel encrusted with hydroids, bryozoa, barnacles, and sea stars at RISDS-N

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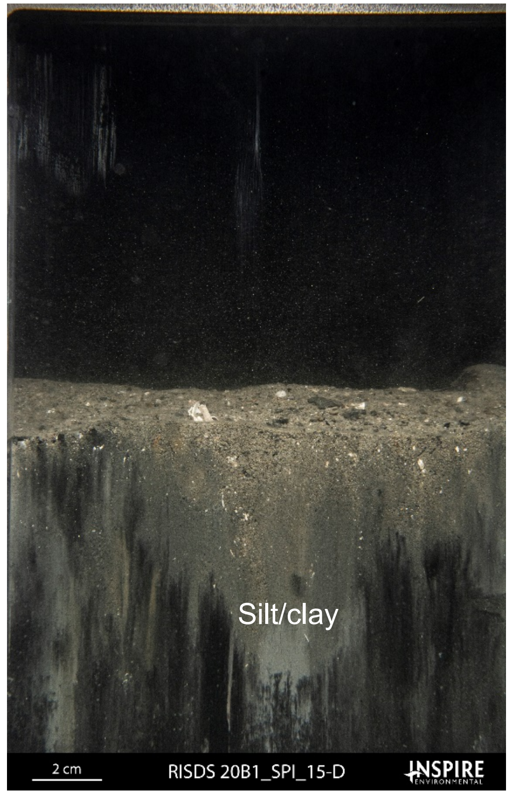
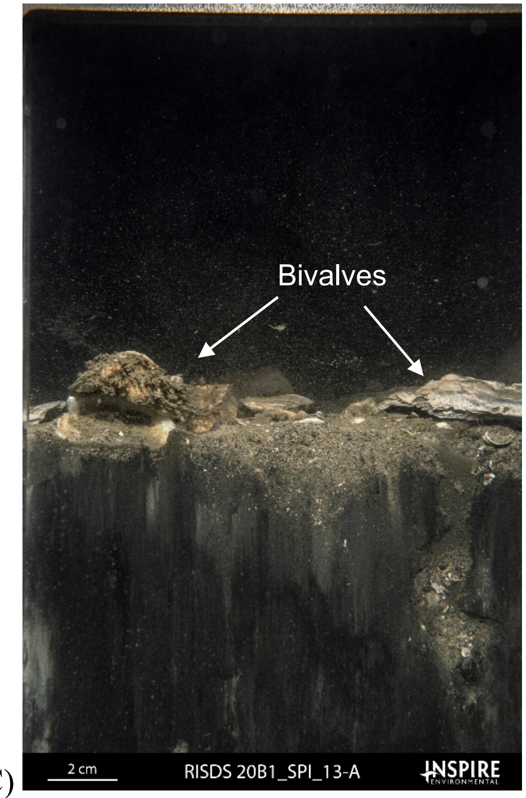
(A)


(B)


(C)


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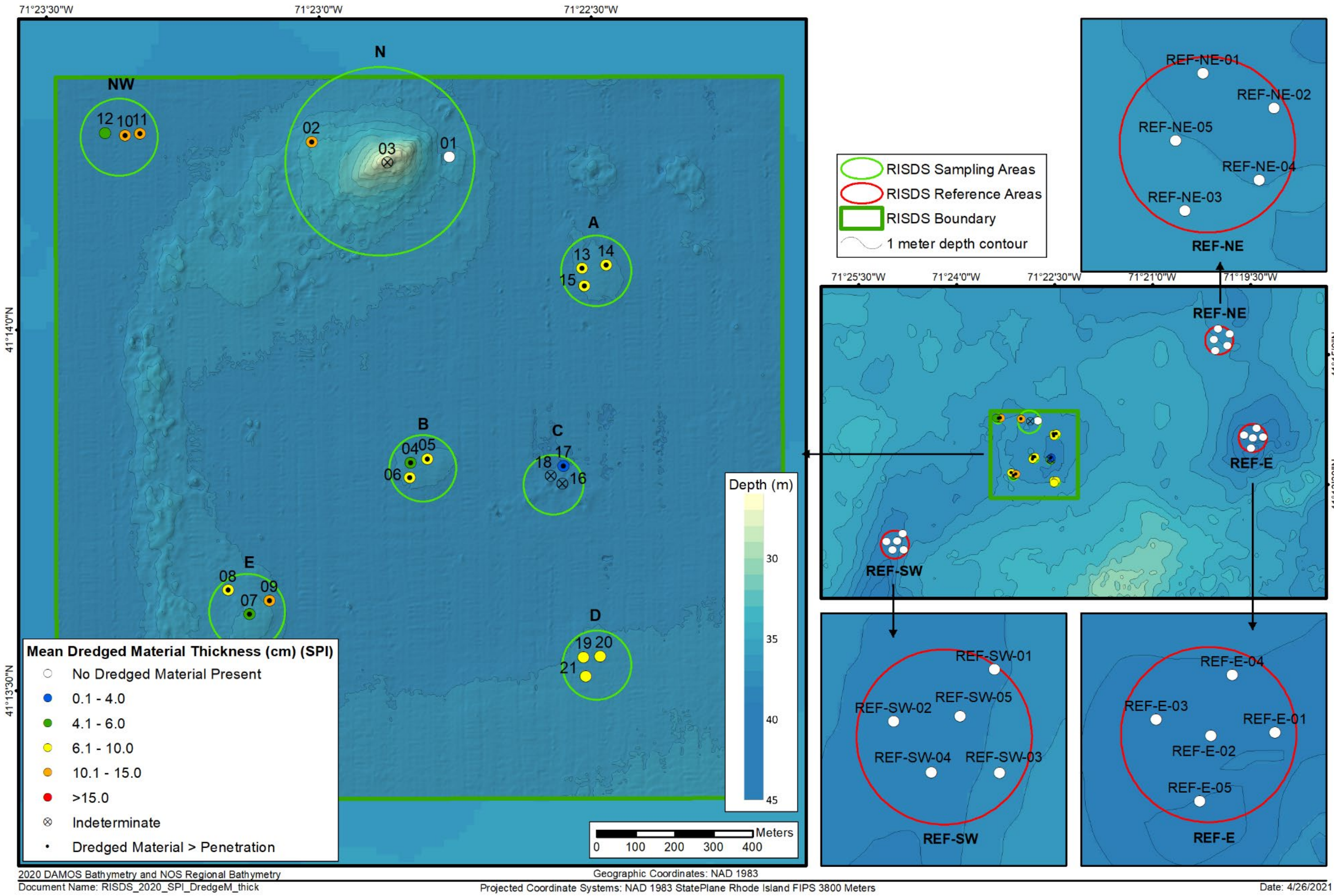

Figure 3-21. Dredged material thickness observed at stations at RISDS

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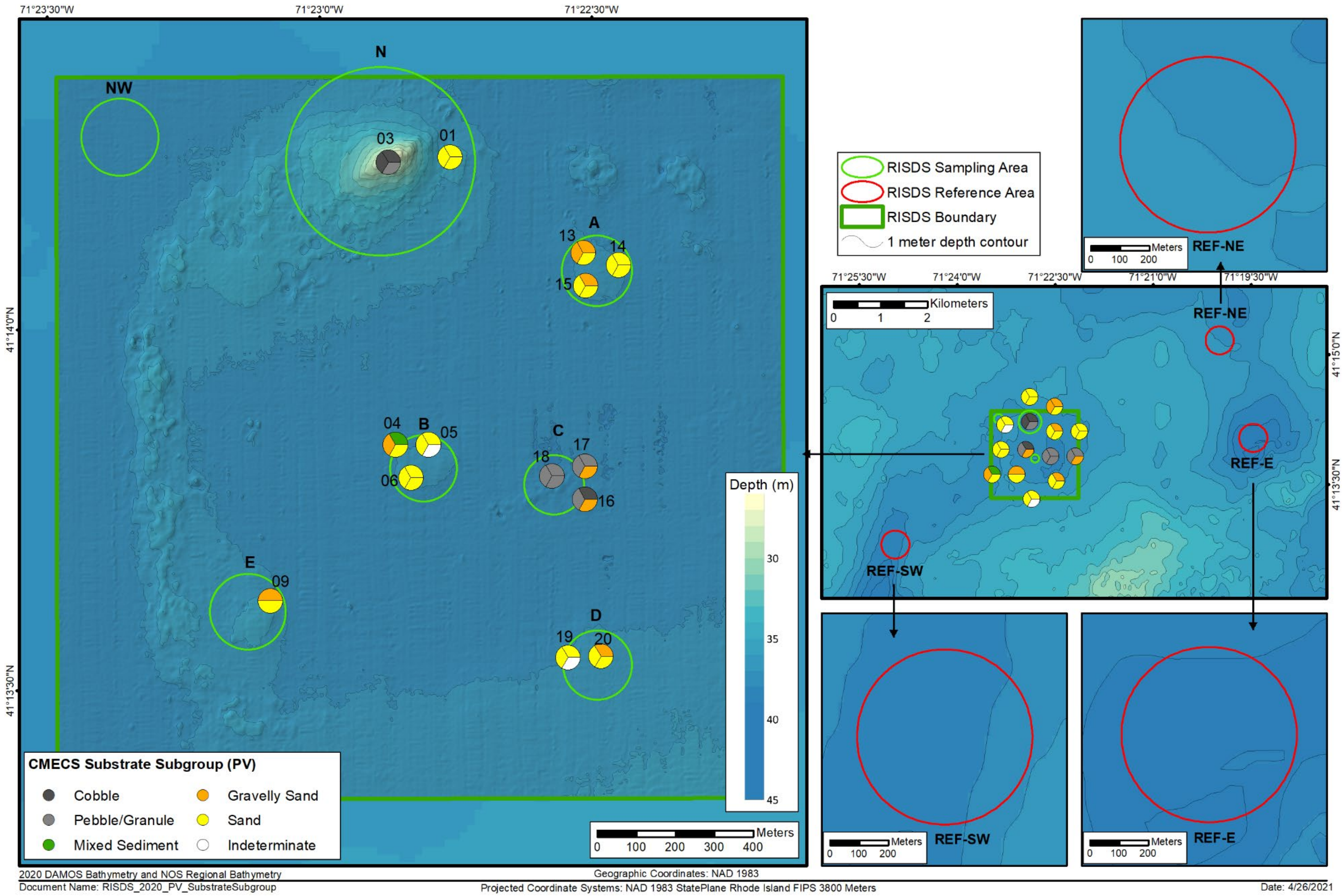
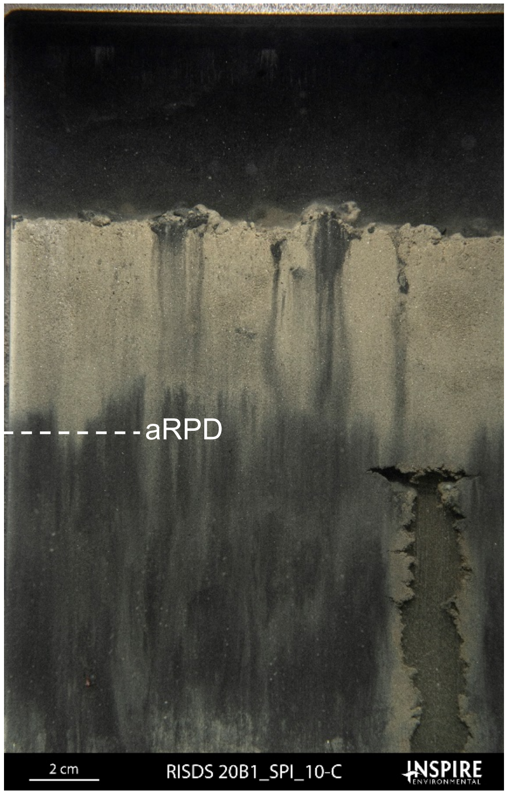
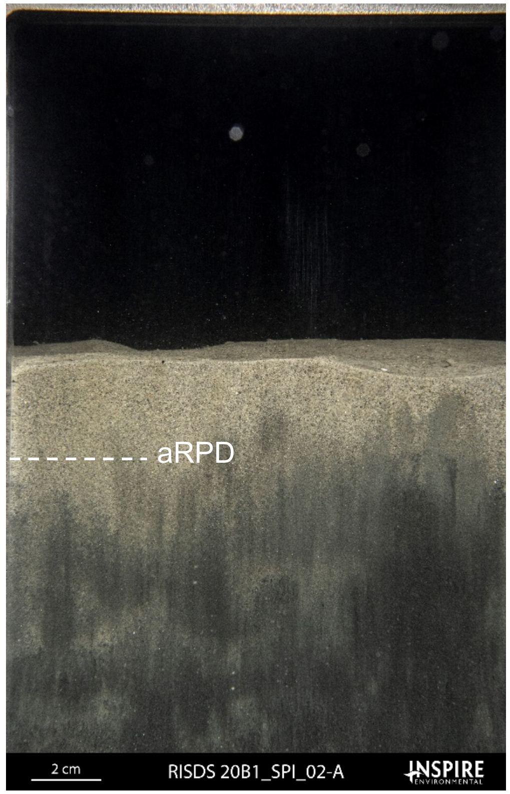


Figure 3-22. CMECS Substrate Subgroup determined from PV images at stations with hard substrata

(A) 

(B) 

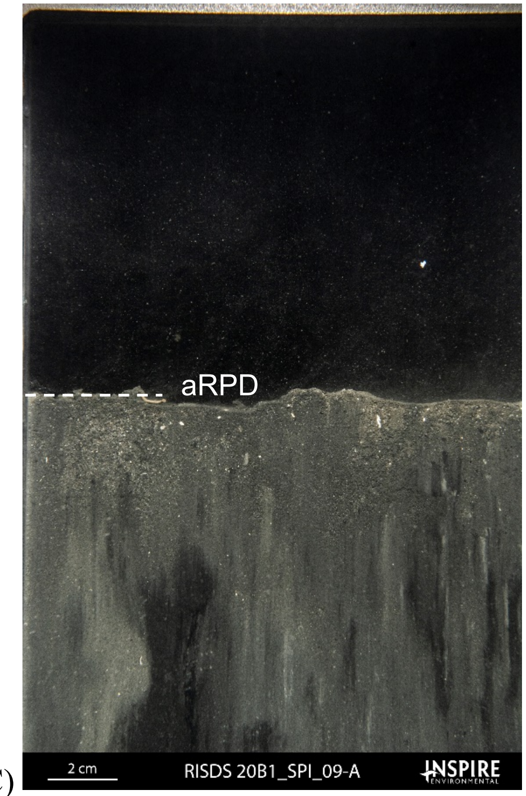
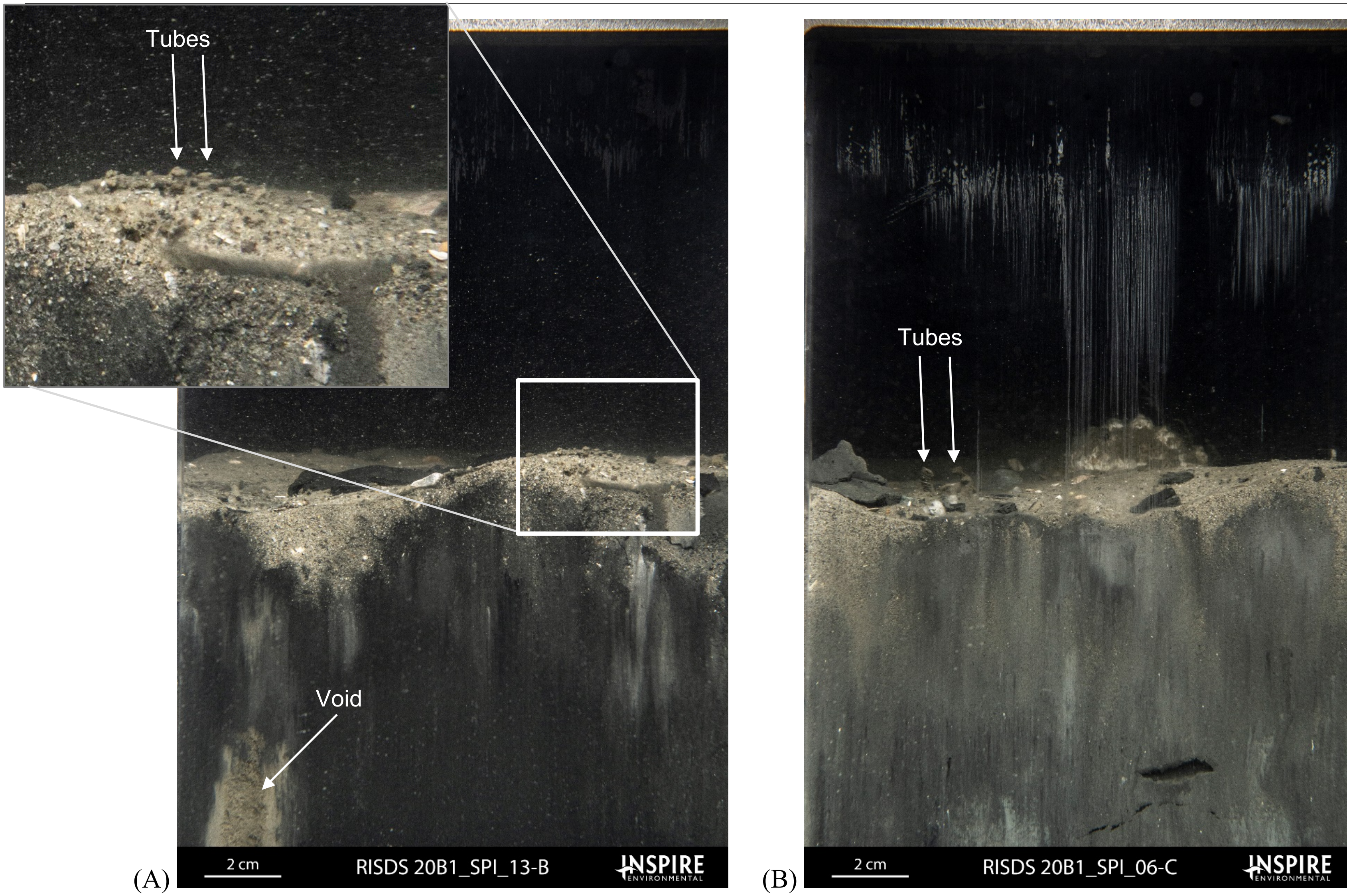
(C) 

Figure 3-23. Sediment profile images depicting the range of aRPD depths observed across RISDS including (A) a deep aRPD depth at RISDS-NW; (B) an intermediate aRPD depth at RISDS-N; and (C) an aRPD depth close to 0 cm where oxygen penetration was driven by diffusional processes only at RISDS-E



(A) (B)

Figure 3-24. Sediment profile images depicting frequently observed infaunal successional stages at RISDS including (A) Stage 1 on 3 at RISDS-A, with small tubes at the sediment–water interface indicate Stage 1 and a subsurface feeding void with a light brown oxygenated halo indicating the presence of Stage 3 taxa; and (B) Stage 2 on 3 at RISDS-B with larger Stage 2 tubes on the surface and a subsurface feeding void indicating the presence of Stage 3 taxa

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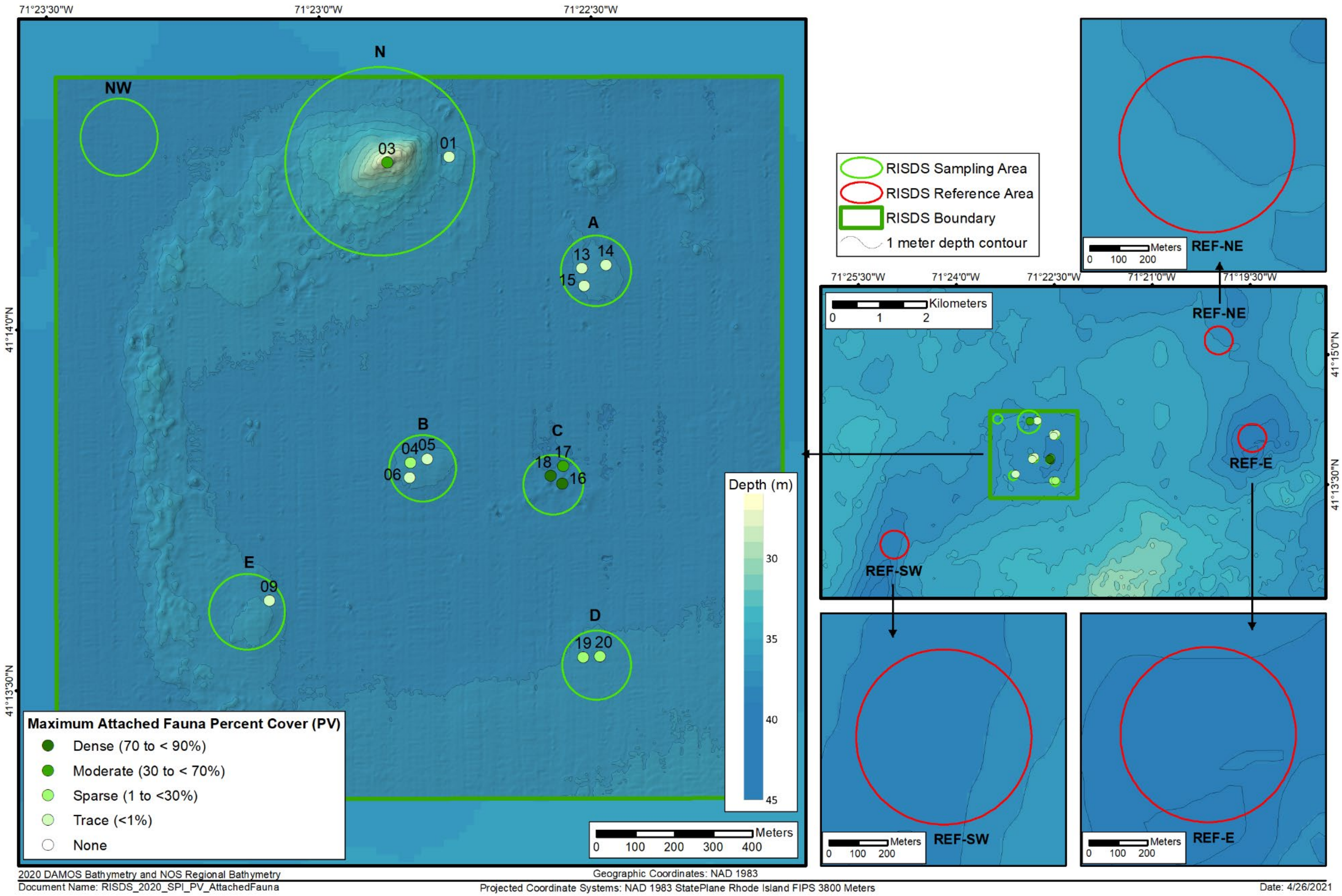

Figure 3-25. Maximum Attached Fauna Percent Cover (CMECS Percent Cover Modifier) at the stations with gravel at RISDS

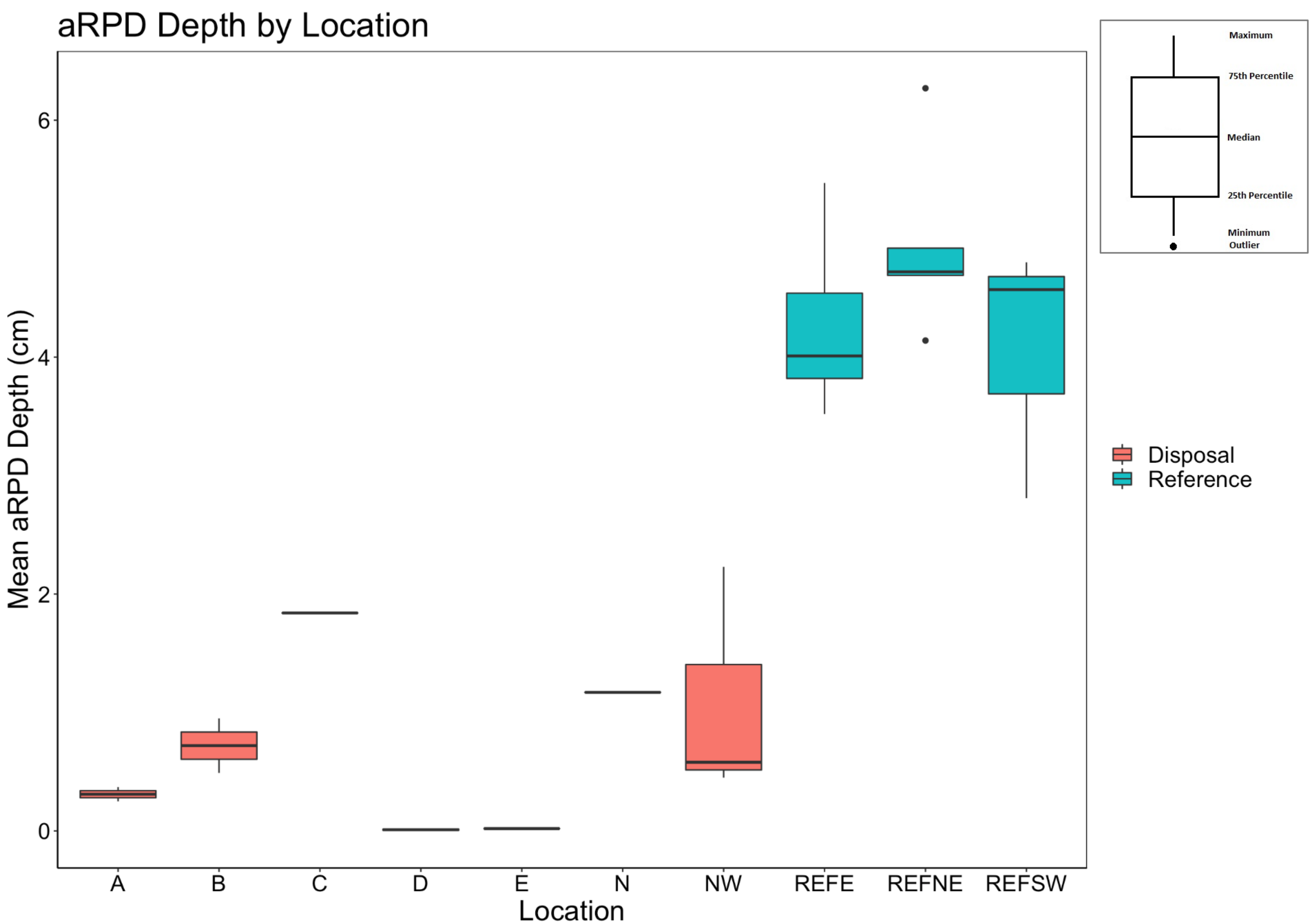

Figure 3-26. Distribution of aRPD depth measurements by sampling area at the disposal site and reference areas

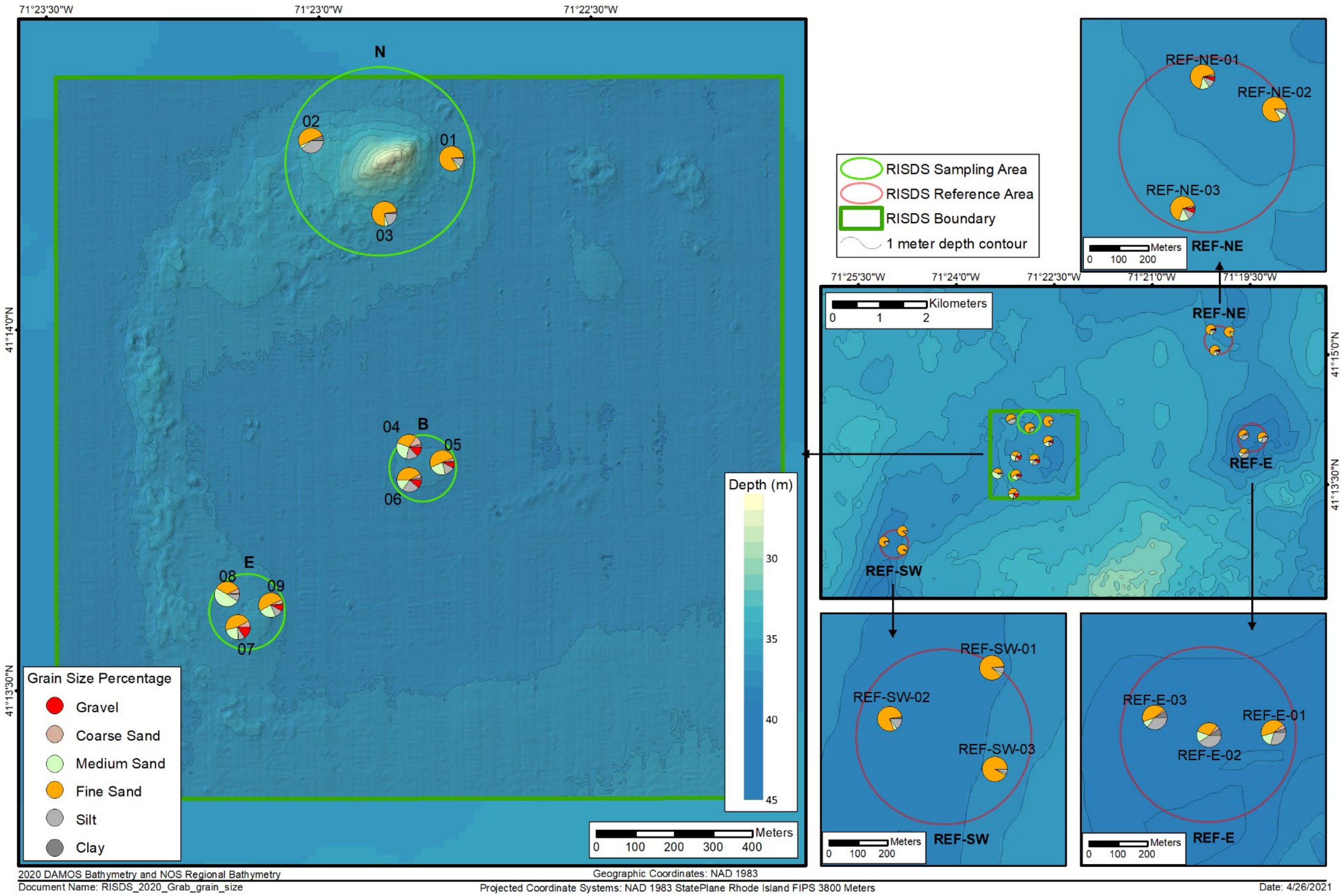

Figure 3-27. Grain size distribution from sediment grab samples at RISDS sampling and reference areas

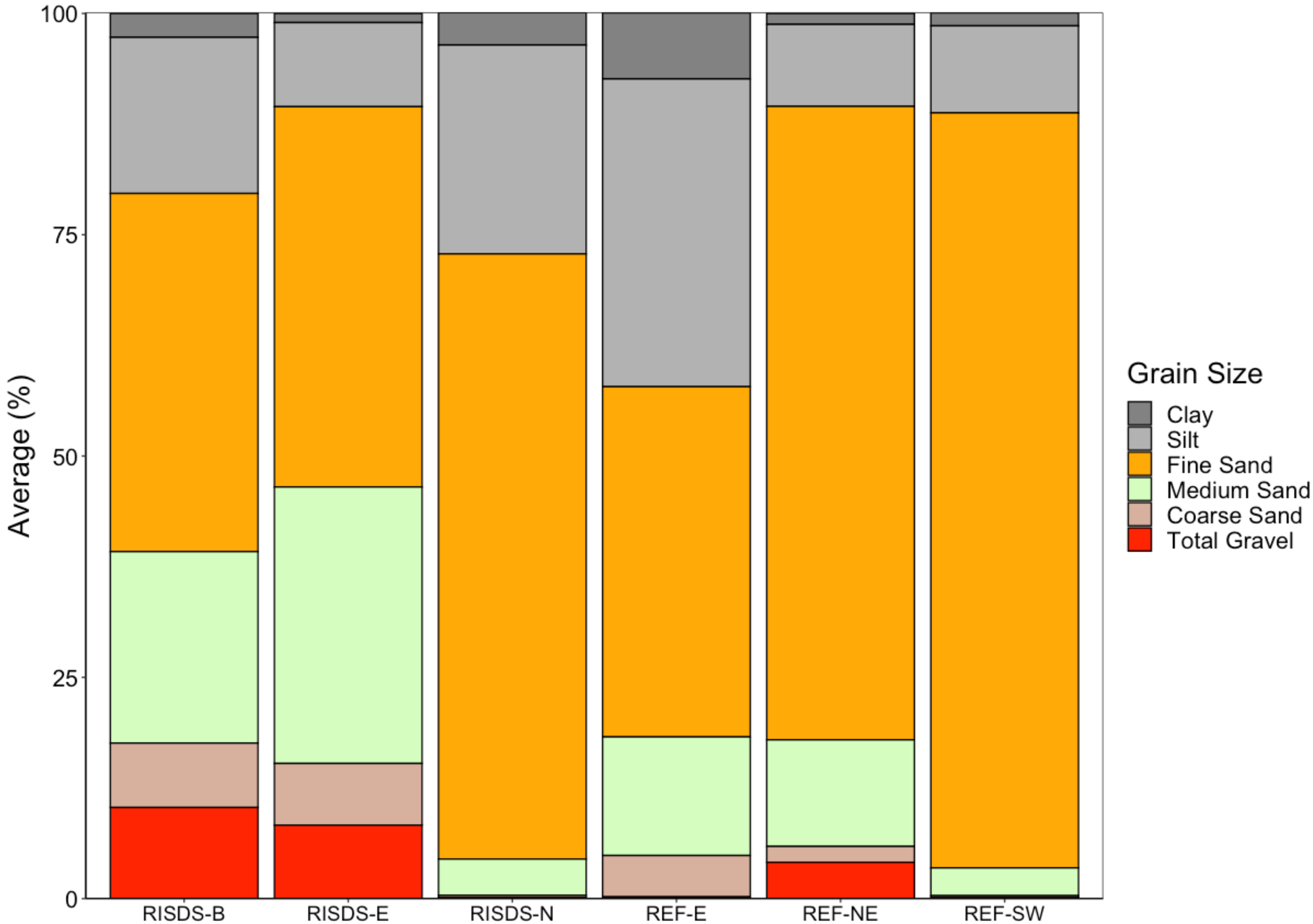

Figure 3-28. The average contribution of each grain size within each sampled area (n=3) within RISDS and across the three reference areas

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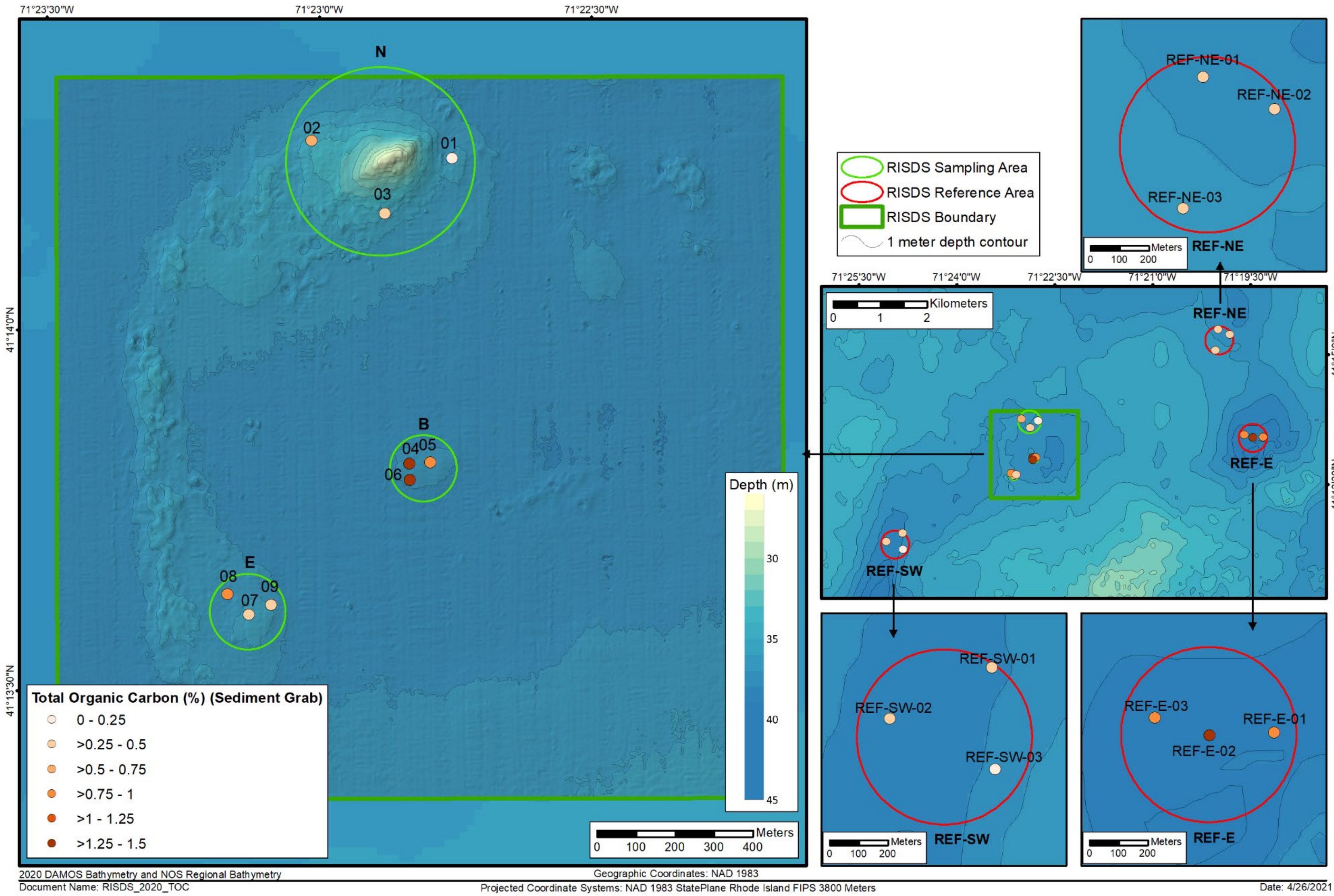

Figure 3-29. Percent total organic carbon (TOC) determined from sediment grab samples at RISDS sampling and reference areas

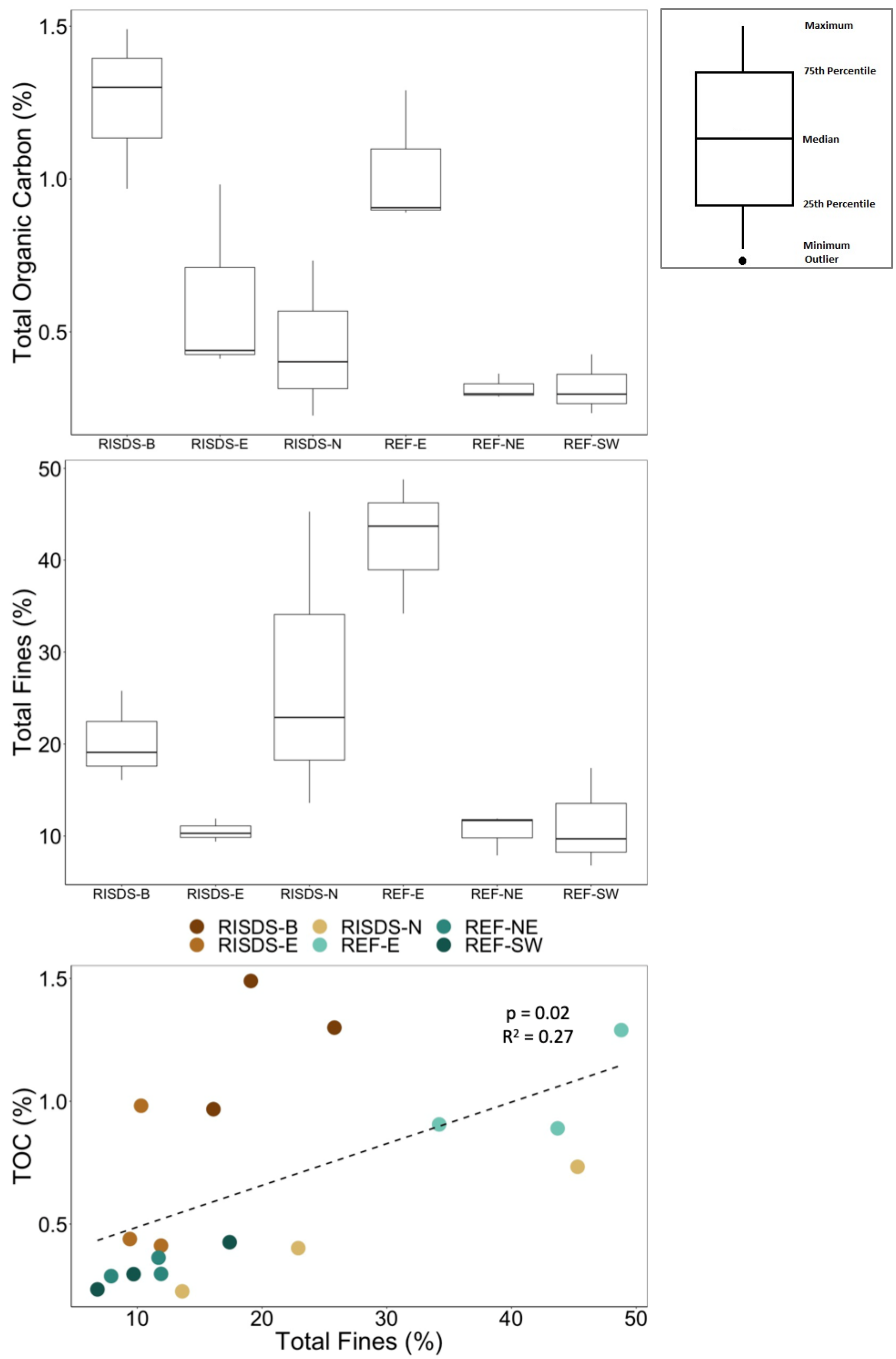

Figure 3-30. (A) Distribution of total organic carbon in benthic grab samples by sampling area; (B) Distribution of total percent fines in benthic grab samples by sampling area; and (C) Relationship between total percent fines and total organic carbon content in benthic grab samples

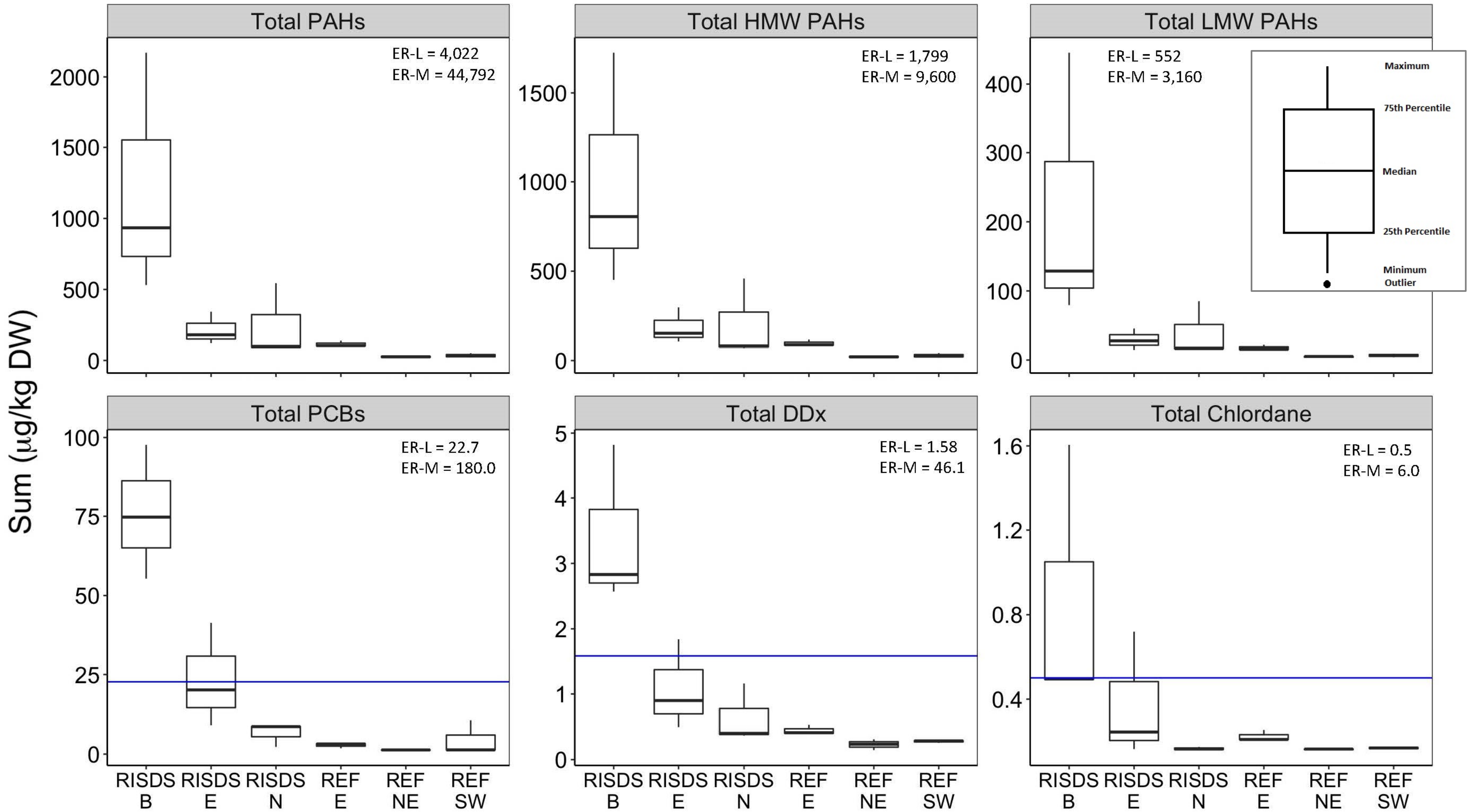

Figure 3-31. Concentrations of total PAHs, including total high and low molecular weight PAHs, total PCBs, total chlordanes, and total DDx. The blue line present in some graphs represents the ER-L.

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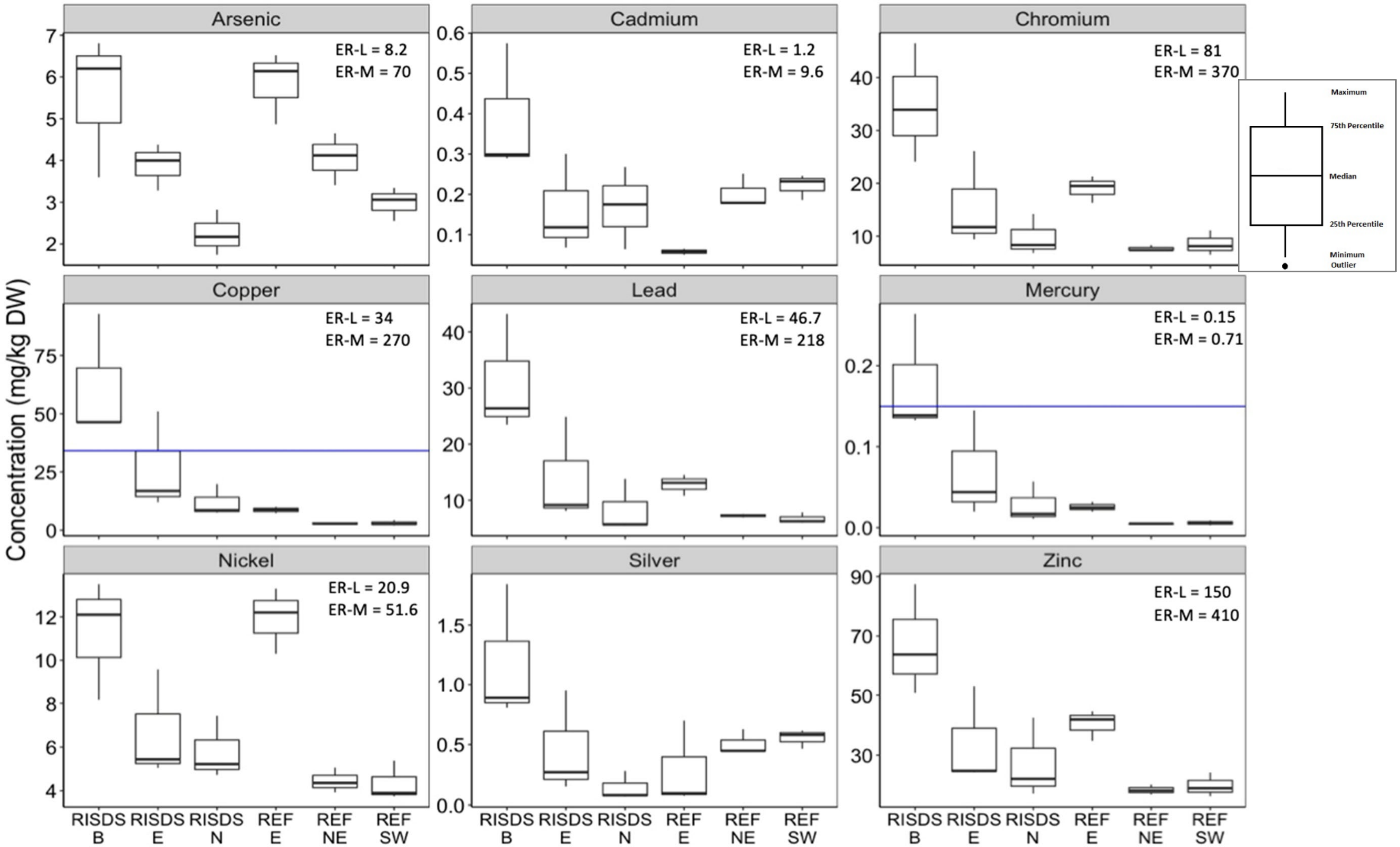

Figure 3-32. Concentrations of the nine metals analyzed in sediment grab samples. The blue line present in some graphs represents the ER-L.

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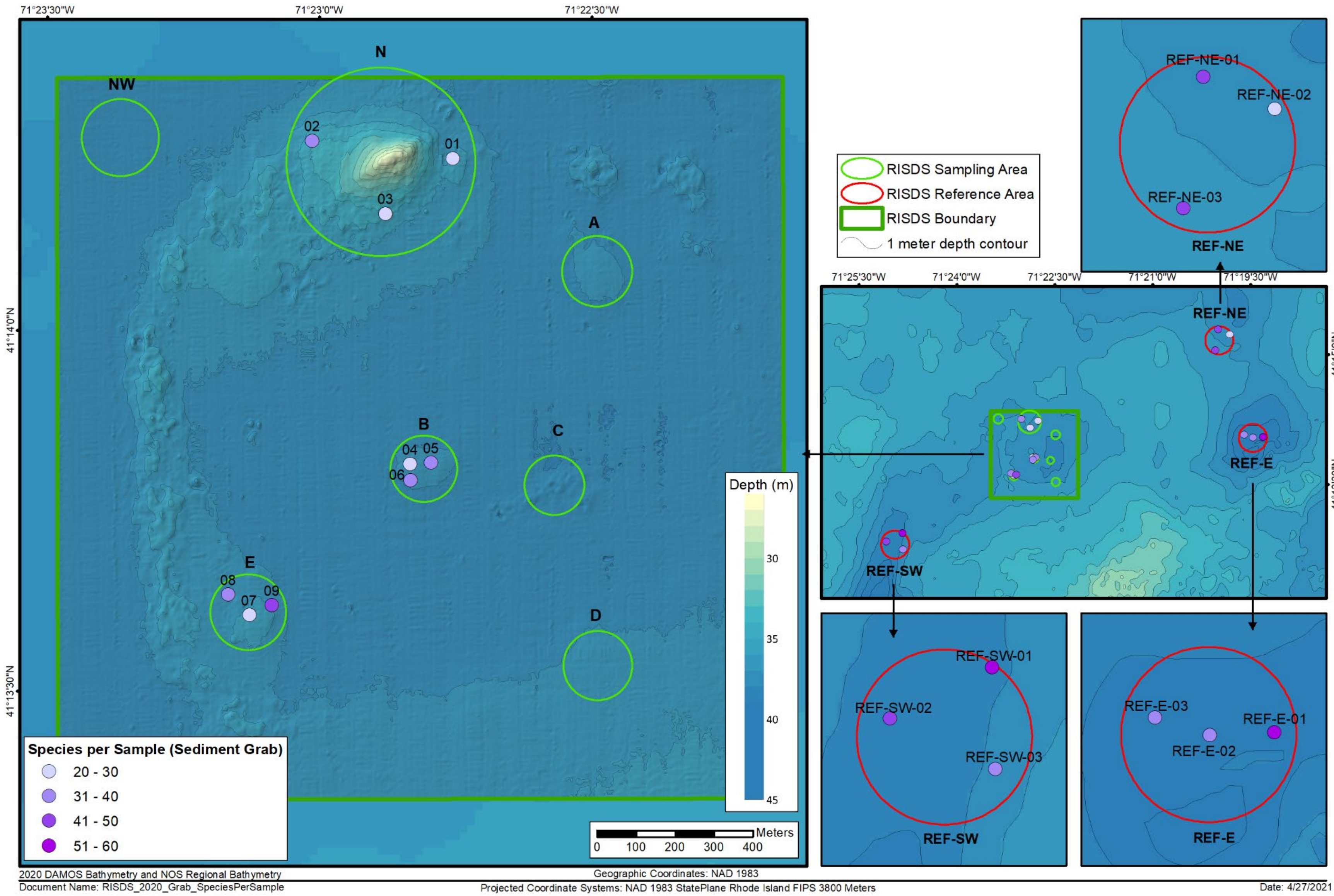

Figure 3-33. Number of species per sediment grab sample (0.04 m^2) at RISDS and reference areas

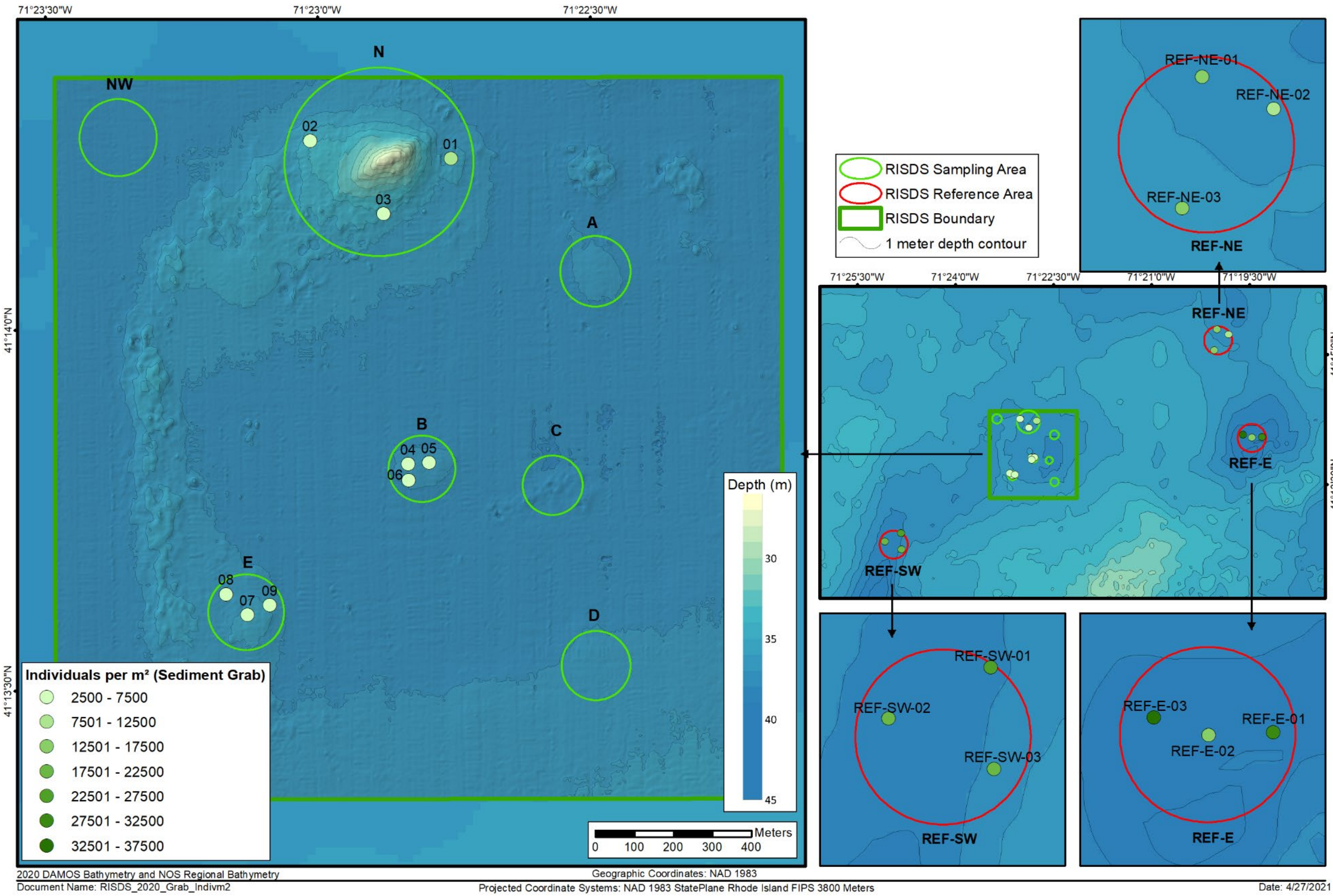

Figure 3-34. Number of individuals per m^2 at RISDS and reference areas

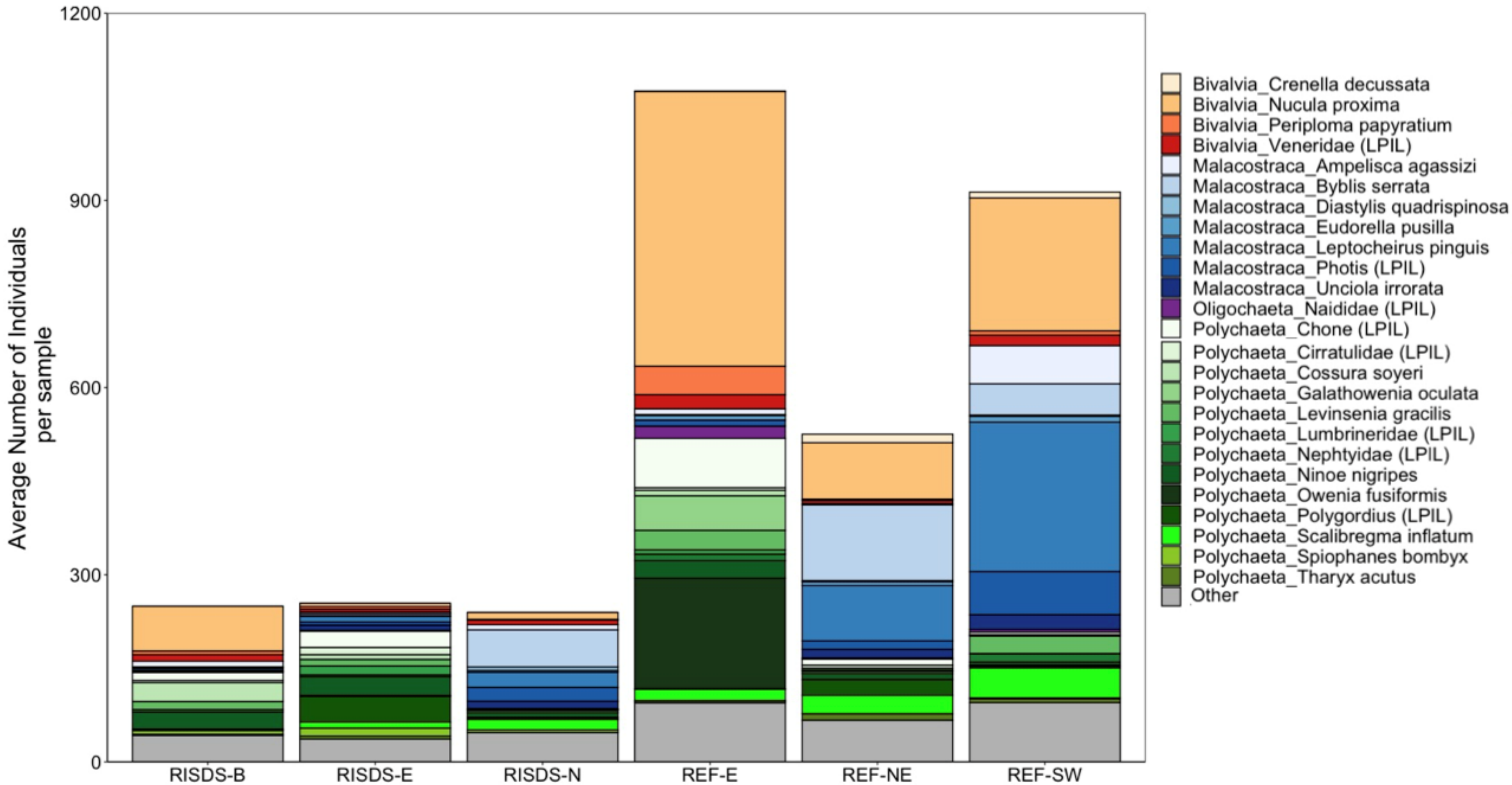

Figure 3-35. Average abundances of benthic infauna by sampled area (n=3)

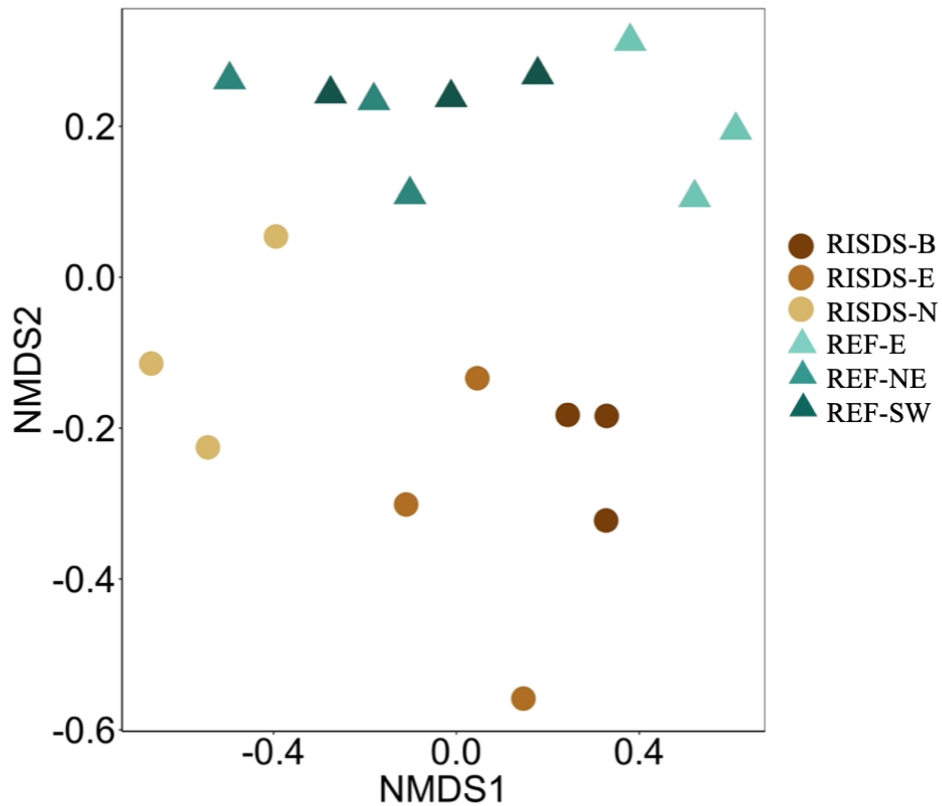

Figure 3-36. Non-metric multidimensional scaling plots depicting the relative similarity of benthic infaunal assemblages in the reference and disposal areas

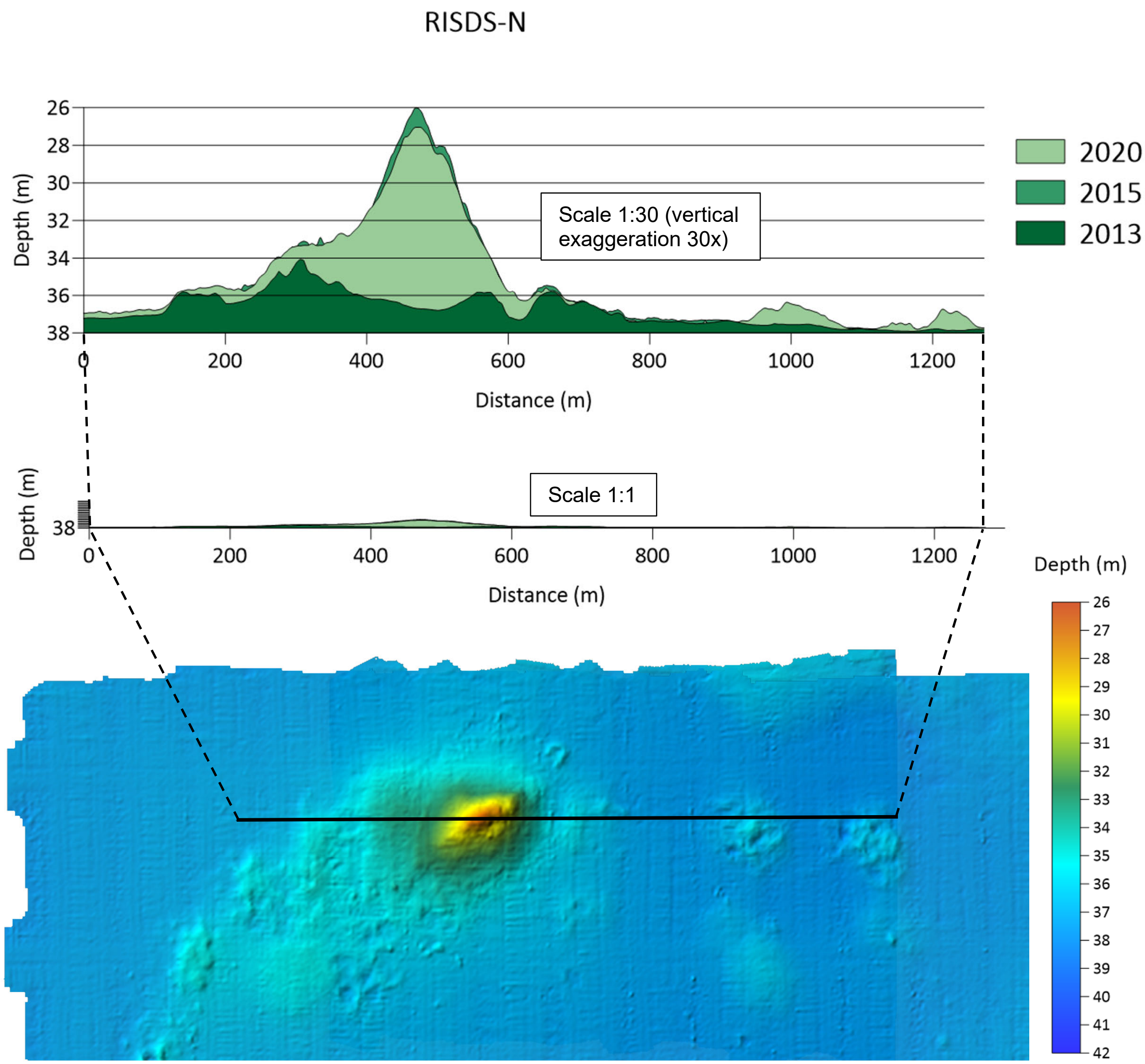

Figure 4-1. Depth profile across the northern region of RISDS showing elevation at a scale of 1:1 (middle panel) and 1:30 (upper panel) measured in 2013, 2015, and 2020 surveys. Bottom panel shows 2020 bathymetric data and the black line corresponds to the location of the depth profile transect.

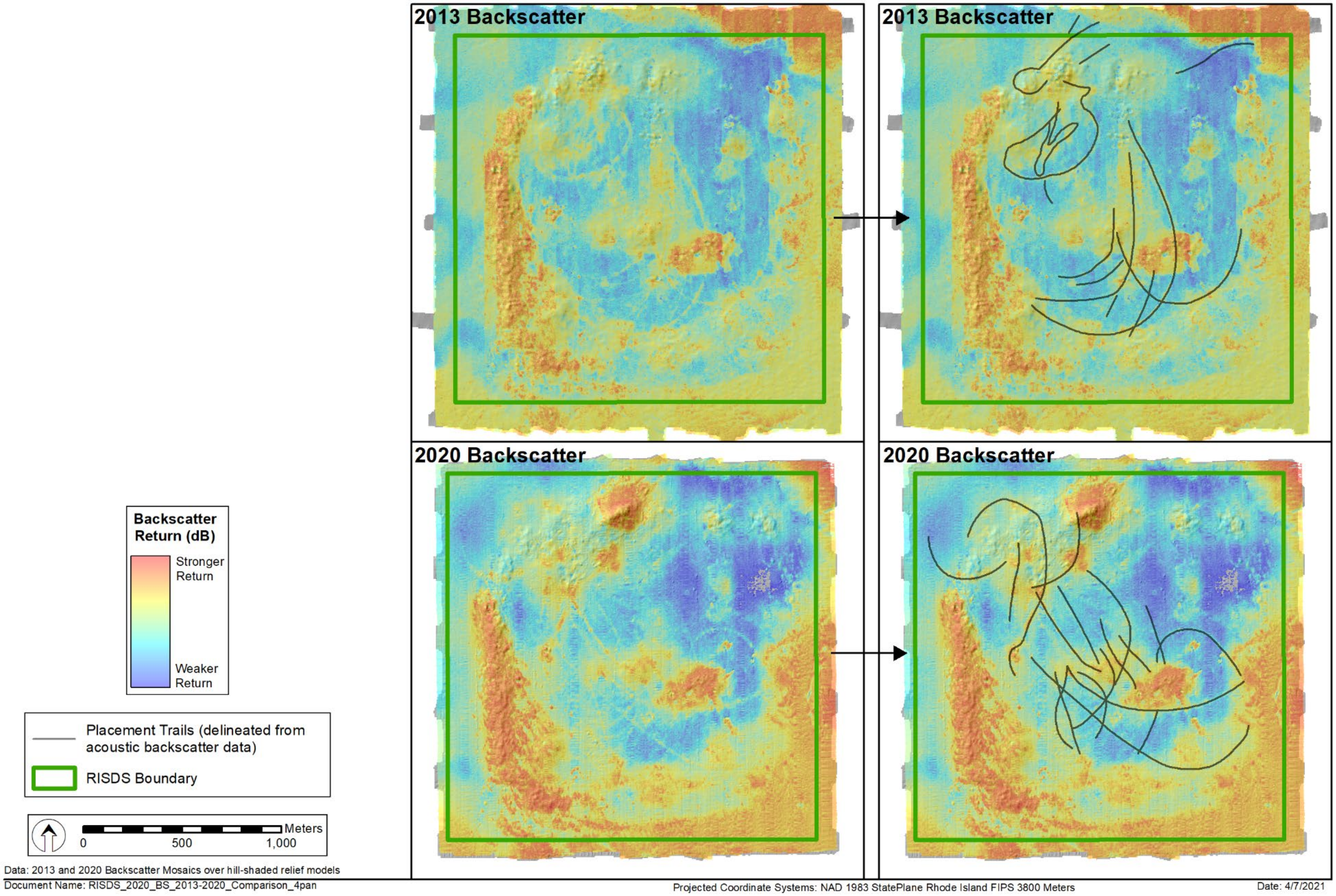

Figure 4-2. Backscatter comparison between 2013 (top) and 2020 (bottom) with linear trails of dredged material disposal highlighted with black lines in the right panels

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MONITORING SURVEY AT THE
RHODE ISLAND SOUND DISPOSAL SITE
MAY/JUNE 2020

APPENDICES

CONTRIBUTION #210

October 2021

Contract No. W912WJ-19-D-0010
Delivery Order W912WJ19F0126

Submitted to:
New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Prepared by:

INSPIRE Environmental
513 Broadway
Newport, RI 02840

LIST OF APPENDICES

APPENDIX A

TABLE OF COMMON CONVERSIONS

APPENDIX A

TABLE OF COMMON CONVERSIONS

Metric Unit Conversion to English Unit		**English Unit Conversion to Metric Unit**	
1 meter 1 m	3.2808 ft	1 foot 1 ft	0.3048 m
1 square meter 1 m^2	10.7639 ft^2	1 square foot 1 ft^2	0.0929 m^2
1 kilometer 1 km	0.6214 mi	1 mile 1 mi	1.6093 km
1 cubic meter 1 m^3	1.3080 yd^3	1 cubic yard 1 yd^3	0.7646 m^3
1 centimeter 1 cm	0.3937 in	1 inch 1 in	2.54 cm

APPENDIX B

RISDS DISPOSAL LOG DATA FROM NOV 2017 TO JUNE 2020

Target Site Code	Project Name	City/Town	State	Placement Date	Load volume (CM)	Load volume (CY)	Placement Latitude	Placement Longitude	ERS Permit Number
RISDS	Town of Harwich	Harwich	CT	11/9/2017	348	455	41.2372	-71.38065	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/11/2017	259	339	41.23358	-71.38117	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/12/2017	334	436	41.2371	-71.38053	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/14/2017	365	477	41.23663	-71.3809	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/16/2017	338	442	41.23762	-71.38115	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/23/2017	271	354	41.23845	-71.37965	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/25/2017	317	415	41.23795	-71.381	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/26/2017	285	373	41.23697	-71.38117	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	11/29/2017	308	402	41.23785	-71.38125	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/1/2017	286	374	41.2374	-71.38138	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/2/2017	275	360	41.2376	-71.38072	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/4/2017	306	400	41.23833	-71.38185	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/7/2017	265	347	41.27787	-71.23742	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/9/2017	278	363	41.23715	-71.38117	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/12/2017	293	384	41.41605	-70.84282	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/12/2017	293	384	41.23592	-71.37687	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/14/2017	301	394	41.23743	-71.3811	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/16/2017	260	340	41.2365	-71.38072	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/16/2017	260	340	41.23705	-71.38072	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/17/2017	286	374	41.23695	-71.38017	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/17/2017	286	374	41.2365	-71.38	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/18/2017	286	374	41.23772	-71.38008	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/19/2017	275	360	41.2362	-71.38045	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/19/2017	275	360	41.23782	-71.38133	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/19/2017	288	376	41.23715	-71.3804	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/21/2017	179	234	41.2368	-71.37953	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/21/2017	283	370	41.23628	-71.379	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/22/2017	219	286	41.23772	-71.38145	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	12/28/2017	78	102	41.23252	-71.37327	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	1/10/2018	159	209	41.23832	-71.38068	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	1/12/2018	236	308	41.2377	-71.38052	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	1/15/2018	332	434	41.23788	-71.38088	NAE-2016-00019
RISDS	Town of Harwich	Harwich	CT	1/19/2018	354	463	41.2337	-71.37763	NAE-2016-00019
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	11/29/2019	2,343	3,065	41.235993	-71.384383	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	11/30/2019	2,613	3,418	41.235723	-71.383873	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/1/2019	2,567	3,357	41.23605	-71.384378	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/4/2019	2,649	3,465	41.234475	-71.383585	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/4/2019	2,800	3,663	41.235878	-71.38371	NAE-2015-01853
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RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/5/2019	1,745	2,283	41.236135	-71.383107	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/6/2019	3,013	3,940	41.236827	-71.38411	NAE-2015-01853

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RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/7/2019	2,788	3,646	41.235335	-71.383177	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/7/2019	3,192	4,175	41.236545	-71.38541	NAE-2015-01853
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RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	12/8/2019	3,570	4,670	41.236228	-71.384307	NAE-2015-01853
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RISDS	Port of Davisville	Kingston	RI	12/23/2019	4,840	6,331	41.235477	-71.383982	NAE-2010-2410
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RISDS	Port of Davisville	Kingston	RI	12/24/2019	2,841	3,715	41.234003	-71.383623	NAE-2010-2410
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RISDS	Port of Davisville	Kingston	RI	1/2/2020	3,658	4,784	41.23642	-71.385815	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/3/2020	4,664	6,100	41.234995	-71.384328	NAE-2010-2410

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RISDS	Port of Davisville	Kingston	RI	1/3/2020	3,611	4,723	41.236382	-71.382573	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/4/2020	4,831	6,319	41.234455	-71.383773	NAE-2010-2410
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RISDS	Port of Davisville	Kingston	RI	1/6/2020	3,825	5,003	41.236342	-71.385515	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/7/2020	3,446	4,508	41.234583	-71.383907	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/8/2020	4,749	6,211	41.2355	-71.382693	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/9/2020	3,160	4,134	41.236095	-71.383515	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/10/2020	4,643	6,072	41.237282	-71.38408	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/13/2020	2,920	3,819	41.236085	-71.386065	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/14/2020	2,527	3,305	41.234775	-71.384472	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/14/2020	2,863	3,745	41.236232	-71.382527	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/15/2020	3,484	4,558	41.236288	-71.384248	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/15/2020	2,885	3,773	41.237233	-71.384327	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/16/2020	3,835	5,016	41.235987	-71.386425	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/16/2020	2,811	3,677	41.235007	-71.383192	NAE-2010-2410
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RISDS	Port of Davisville	Kingston	RI	1/18/2020	2,658	3,477	41.236065	-71.384388	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/18/2020	3,358	4,392	41.237277	-71.384253	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/19/2020	1,801	2,355	41.236093	-71.385637	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/20/2020	3,459	4,525	41.234603	-71.384028	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/20/2020	3,980	5,206	41.236127	-71.382005	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/21/2020	3,497	4,574	41.235332	-71.38338	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/21/2020	3,622	4,738	41.23646	-71.385298	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/22/2020	3,706	4,847	41.236263	-71.385387	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/22/2020	3,566	4,665	41.234702	-71.383745	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/23/2020	4,116	5,384	41.235963	-71.381767	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/23/2020	3,423	4,477	41.236225	-71.384162	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/23/2020	3,946	5,161	41.236368	-71.384572	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/24/2020	3,762	4,920	41.235325	-71.386278	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/25/2020	3,261	4,266	41.235263	-71.38384	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/25/2020	3,620	4,735	41.235187	-71.382762	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/26/2020	3,692	4,829	41.235823	-71.38415	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/27/2020	3,112	4,071	41.235657	-71.386427	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/28/2020	3,567	4,666	41.234262	-71.383753	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	1/30/2020	3,380	4,422	41.236287	-71.383193	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	2/1/2020	3,133	4,098	41.236562	-71.383708	NAE-2010-2410
RISDS	Port of Davisville	Kingston	RI	2/2/2020	2,362	3,089	41.236313	-71.38344	NAE-2010-2410
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	2/2/2020	1,362	1,781	41.236298	-71.385143	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	2/3/2020	1,067	1,396	41.234978	-71.38335	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	2/3/2020	1,539	2,013	41.234465	-71.382738	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	2/4/2020	1,230	1,609	41.238252	-71.386535	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	2/4/2020	1,651	2,159	41.235615	-71.385072	NAE-2015-01853
RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	2/5/2020	979	1,281	41.235615	-71.385072	NAE-2015-01853

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RISDS	Quonset Business Park and Port of Davisville	Kingston	RI	2/6/2020	1,539	2,013	41.236422	-71.38541	NAE-2015-01853
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/20/2020	1,597	2,089	41.237173	-71.373922	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/21/2020	1,341	1,754	41.237015	-71.371562	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/22/2020	1,699	2,222	41.23685	-71.374227	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/23/2020	1,881	2,460	41.23692	-71.37138	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/24/2020	1,730	2,262	41.23673	-71.374213	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/25/2020	1,878	2,456	41.237032	-71.371462	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/26/2020	1,955	2,558	41.236742	-71.374083	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/27/2020	2,051	2,683	41.236875	-71.371563	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/28/2020	1,807	2,364	41.237317	-71.37442	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/29/2020	2,023	2,646	41.23753	-71.372112	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/30/2020	1,972	2,580	41.237525	-71.374555	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	5/31/2020	2,144	2,805	41.236962	-71.371645	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/1/2020	2,086	2,729	41.237505	-71.374462	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/2/2020	2,439	3,190	41.23731	-71.371398	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/3/2020	2,692	3,521	41.23725	-71.375192	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/4/2020	2,500	3,270	41.236675	-71.37162	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/5/2020	2,521	3,297	41.236833	-71.374762	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/6/2020	2,548	3,332	41.236613	-71.371542	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/6/2020	752	983	41.23707	-71.3723	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/7/2020	2,528	3,307	41.237173	-71.374355	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/7/2020	82	107	41.23753	-71.37485	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/7/2020	945	1,236	41.23723	-71.37193	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/8/2020	2,494	3,262	41.236902	-71.371682	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/8/2020	941	1,231	41.2372	-71.37432	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/9/2020	2,630	3,440	41.237007	-71.374413	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/9/2020	995	1,301	41.23707	-71.37208	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/10/2020	2,591	3,389	41.23687	-71.373195	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/10/2020			41.23753	-71.37185	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/11/2020	2,667	3,489	41.236888	-71.374852	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/11/2020			41.2371	-71.37607	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/12/2020	2,161	2,827	41.237643	-71.370212	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/12/2020	1,942	2,540	41.237403	-71.374468	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/12/2020	829	1,084	41.23693	-71.37208	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/13/2020			41.23697	-71.37167	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/14/2020	2,179	2,851	41.234185	-71.37034	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/14/2020	2,537	3,319	41.237612	-71.370687	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/14/2020			41.2369	-71.37582	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/15/2020	2,214	2,895	41.235048	-71.369775	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/15/2020	2,289	2,994	41.237338	-71.37142	NAE-2007-2709
RISDS	New Bedford Lower Harbor	New Bedford	MA	6/15/2020			41.23735	-71.37032	NAE-2007-2709

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APPENDIX C

ACTUAL SPI/PV AND SEDIMENT GRAB REPLICATE LOCATIONS

SampleType	Category	StationID	Replicate	Date	Time	X_RIsp_m	Y_RIsp_m	Latitude_N_WGS84	Longitude_W_WGS84	Depth_ft	Comments
SPI/PV	Reference	REF-SW-03	A	5/6/2020	0:33:34	107249.5565	14348.09546	41.21250	71.41356	125	
SPI/PV	Reference	REF-SW-03	B	5/6/2020	0:34:23	107247.051	14349.79326	41.21251	71.41359	125	
SPI/PV	Reference	REF-SW-03	C	5/6/2020	0:35:19	107244.8321	14350.92096	41.21252	71.41361	125	
SPI/PV	Reference	REF-SW-03	D	5/6/2020	0:36:14	107245.5758	14350.34496	41.21252	71.41360	125	
SPI/PV	Reference	REF-SW-04	A	5/6/2020	0:43:31	107015.9146	14349.59816	41.21251	71.41634	131	
SPI/PV	Reference	REF-SW-04	B	5/6/2020	0:44:20	107012.571	14348.81486	41.21251	71.41638	131	
SPI/PV	Reference	REF-SW-04	C	5/6/2020	0:45:12	107013.1165	14351.79886	41.21253	71.41637	131	
SPI/PV	Reference	REF-SW-04	D	5/6/2020	0:46:07	107013.2354	14351.23186	41.21253	71.41637	131	
SPI/PV	Reference	REF-SW-02	A	5/6/2020	0:55:22	106886.7066	14524.05996	41.21409	71.41788	130	
SPI/PV	Reference	REF-SW-02	B	5/6/2020	0:56:16	106886.4506	14522.69446	41.21407	71.41788	130	
SPI/PV	Reference	REF-SW-02	C	5/6/2020	0:57:10	106884.0975	14520.77416	41.21406	71.41791	130	
SPI/PV	Reference	REF-SW-02	D	5/6/2020	0:58:07	106884.954	14526.09606	41.21410	71.41790	130	
SPI/PV	Reference	REF-SW-05	A	5/6/2020	1:04:43	107118.1173	14546.25856	41.21428	71.41512	128	Out of watch circle ~10 feet.
SPI/PV	Reference	REF-SW-05	B	5/6/2020	1:06:13	107113.9629	14541.52196	41.21424	71.41517	128	
SPI/PV	Reference	REF-SW-05	C	5/6/2020	1:07:13	107113.2862	14540.74476	41.21423	71.41518	128	
SPI/PV	Reference	REF-SW-05	D	5/6/2020	1:08:07	107111.683	14542.56136	41.21425	71.41520	128	
SPI/PV	Reference	REF-SW-05	E	5/6/2020	1:09:01	107113.3015	14540.21136	41.21423	71.41518	128	
SPI/PV	Reference	REF-SW-01	A	5/6/2020	1:17:04	107231.6769	14701.67946	41.21568	71.41376	128	
SPI/PV	Reference	REF-SW-01	B	5/6/2020	1:17:56	107232.0243	14700.73156	41.21567	71.41376	128	
SPI/PV	Reference	REF-SW-01	C	5/6/2020	1:18:52	107231.7775	14702.31956	41.21569	71.41376	128	
SPI/PV	Reference	REF-SW-01	D	5/6/2020	1:19:45	107229.8755	14701.84096	41.21568	71.41379	128	
SPI/PV	Reference	REF-E-05	A	5/6/2020	2:17:46	114676.4836	16521.94866	41.23197	71.32494	136	
SPI/PV	Reference	REF-E-05	B	5/6/2020	2:18:41	114672.8717	16525.87756	41.23201	71.32499	136	
SPI/PV	Reference	REF-E-05	C	5/6/2020	2:19:34	114673.1704	16527.98986	41.23203	71.32498	136	
SPI/PV	Reference	REF-E-05	D	5/6/2020	2:20:23	114672.4693	16527.18826	41.23202	71.32499	136	
SPI/PV	Reference	REF-E-02	A	5/6/2020	2:31:18	114714.3794	16745.50466	41.23398	71.32449	136	
SPI/PV	Reference	REF-E-02	B	5/6/2020	2:32:10	114712.7152	16743.18826	41.23396	71.32451	136	
SPI/PV	Reference	REF-E-02	C	5/6/2020	2:33:07	114719.4361	16740.50296	41.23394	71.32443	136	
SPI/PV	Reference	REF-E-02	D	5/6/2020	2:34:01	114718.3479	16743.61496	41.23397	71.32444	136	
SPI/PV	Reference	REF-E-01	A	5/6/2020	2:41:15	114933.8968	16756.80366	41.23408	71.32187	136	
SPI/PV	Reference	REF-E-01	B	5/6/2020	2:42:08	114936.064	16756.09046	41.23407	71.32184	136	
SPI/PV	Reference	REF-E-01	C	5/6/2020	2:42:59	114938.4627	16752.25296	41.23404	71.32181	136	
SPI/PV	Reference	REF-E-01	D	5/6/2020	2:43:56	114939.8435	16749.82676	41.23402	71.32180	136	
SPI/PV	Reference	REF-E-04	A	5/6/2020	2:51:59	114788.385	16953.62866	41.23586	71.32360	135	
SPI/PV	Reference	REF-E-04	B	5/6/2020	2:52:53	114784.7366	16956.87176	41.23589	71.32364	135	
SPI/PV	Reference	REF-E-04	C	5/6/2020	2:53:50	114785.3949	16954.32356	41.23586	71.32363	135	
SPI/PV	Reference	REF-E-04	D	5/6/2020	2:54:43	114786.8793	16953.72006	41.23586	71.32362	135	
SPI/PV	Reference	REF-E-03	A	5/6/2020	3:01:19	114527.4909	16800.08536	41.23448	71.32671	135	
SPI/PV	Reference	REF-E-03	B	5/6/2020	3:02:12	114526.54	16800.68276	41.23448	71.32673	135	
SPI/PV	Reference	REF-E-03	C	5/6/2020	3:03:04	114529.1734	16801.90496	41.23449	71.32669	135	
SPI/PV	Reference	REF-E-03	D	5/6/2020	3:04:00	114528.0518	16802.73406	41.23450	71.32671	135	
SPI/PV	Reference	REF-NE-03	A	5/6/2020	3:36:56	113910.8031	18608.58316	41.25077	71.33403	125	
SPI/PV	Reference	REF-NE-03	B	5/6/2020	3:37:53	113911.9522	18607.13536	41.25076	71.33402	125	
SPI/PV	Reference	REF-NE-03	C	5/6/2020	3:38:54	113912.9428	18603.85266	41.25073	71.33400	125	
SPI/PV	Reference	REF-NE-03	D	5/6/2020	3:39:54	113913.3909	18604.23676	41.25073	71.33400	125	
SPI/PV	Reference	REF-NE-04	A	5/6/2020	3:47:51	114164.9702	18713.49856	41.25171	71.33099	123	
SPI/PV	Reference	REF-NE-04	B	5/6/2020	3:48:47	114161.3126	18716.24786	41.25174	71.33104	123	
SPI/PV	Reference	REF-NE-04	C	5/6/2020	3:49:44	114158.417	18716.47956	41.25174	71.33107	123	
SPI/PV	Reference	REF-NE-04	D	5/6/2020	3:50:36	114159.2339	18719.53976	41.25177	71.33106	123	

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SampleType	Category	StationID	Replicate	Date	Time	X_RIsp_m	Y_RIsp_m	Latitude_N_WGS84	Longitude_W_WGS84	Depth_ft	Comments
SPI/PV	Reference	REF-NE-05	A	5/6/2020	3:57:27	113879.619	18848.17166	41.25293	71.33440	125	
SPI/PV	Reference	REF-NE-05	B	5/6/2020	3:58:20	113880.2682	18849.17446	41.25294	71.33439	125	
SPI/PV	Reference	REF-NE-05	C	5/6/2020	3:59:14	113878.9911	18854.44756	41.25299	71.33440	125	
SPI/PV	Reference	REF-NE-05	D	5/6/2020	4:00:12	113876.827	18854.74926	41.25299	71.33443	125	
SPI/PV	Reference	REF-NE-02	A	5/6/2020	4:09:08	114216.4236	18959.40256	41.25393	71.33038	125	
SPI/PV	Reference	REF-NE-02	B	5/6/2020	4:10:03	114216.6614	18959.54886	41.25393	71.33037	125	
SPI/PV	Reference	REF-NE-02	C	5/6/2020	4:10:59	114217.6611	18959.78966	41.25393	71.33036	125	
SPI/PV	Reference	REF-NE-02	D	5/6/2020	4:11:54	114214.9636	18958.24736	41.25392	71.33039	125	
SPI/PV	Reference	REF-NE-01	A	5/6/2020	4:21:47	113972.5252	19077.23846	41.25499	71.33328	126	
SPI/PV	Reference	REF-NE-01	B	5/6/2020	4:22:42	113973.6591	19074.55326	41.25497	71.33327	126	
SPI/PV	Reference	REF-NE-01	C	5/6/2020	4:23:37	113976.3078	19075.76326	41.25498	71.33324	126	
SPI/PV	Reference	REF-NE-01	D	5/6/2020	4:24:33	113975.3233	19075.62916	41.25498	71.33325	126	
SPI/PV	Disposal	12	A	5/6/2020	5:06:02	109233.0251	17169.35436	41.23788	71.38986	127	
SPI/PV	Disposal	12	B	5/6/2020	5:06:56	109229.6906	17168.58016	41.23787	71.38990	127	
SPI/PV	Disposal	12	C	5/6/2020	5:07:54	109230.4922	17168.20526	41.23787	71.38989	127	
SPI/PV	Disposal	12	D	5/6/2020	5:08:49	109228.3342	17171.82626	41.23790	71.38992	127	
SPI/PV	Disposal	10	A	5/6/2020	5:17:10	109283.1221	17162.79806	41.23782	71.38926	128	Out of watch circle ~1 foot.
SPI/PV	Disposal	10	B	5/6/2020	5:18:07	109281.9822	17153.62966	41.23774	71.38928	128	
SPI/PV	Disposal	10	C	5/6/2020	5:19:04	109281.973	17155.22986	41.23775	71.38928	128	
SPI/PV	Disposal	10	D	5/6/2020	5:20:01	109279.4188	17158.51866	41.23778	71.38931	128	
SPI/PV	Disposal	11	A	5/6/2020	5:28:32	109321.7952	17167.30916	41.23786	71.38880	128	Out of watch circle ~4.5 feet.
SPI/PV	Disposal	11	B	5/6/2020	5:29:24	109328.196	17166.05946	41.23785	71.38873	128	
SPI/PV	Disposal	11	C	5/6/2020	5:30:21	109326.8244	17167.71146	41.23787	71.38874	128	
SPI/PV	Disposal	11	D	5/6/2020	5:31:18	109326.4038	17165.69366	41.23785	71.38875	128	
SPI/PV	Disposal	11	E	5/6/2020	5:32:05	109331.8049	17168.51916	41.23787	71.38868	128	
SPI/PV	Disposal	02	A	5/6/2020	5:57:46	109762.9057	17146.42416	41.23767	71.38354	120	
SPI/PV	Disposal	02	B	5/6/2020	5:58:50	109767.5509	17146.35106	41.23767	71.38349	120	
SPI/PV	Disposal	02	C	5/6/2020	5:59:48	109762.6649	17152.09346	41.23772	71.38354	120	
SPI/PV	Disposal	02	D	5/6/2020	6:00:43	109764.8473	17155.62616	41.23775	71.38352	120	
SPI/PV	Disposal	03	A	5/6/2020	6:10:42	109956.0061	17094.32466	41.23720	71.38124	98	
SPI/PV	Disposal	03	B	5/6/2020	6:11:38	109954.476	17095.81816	41.23721	71.38126	98	
SPI/PV	Disposal	03	C	5/6/2020	6:12:34	109955.5915	17097.58596	41.23723	71.38124	98	
SPI/PV	Disposal	03	D	5/6/2020	6:13:32	109959.2126	17096.68686	41.23722	71.38120	98	
SPI/PV	Disposal	01	A	5/6/2020	6:21:25	110114.5115	17107.66876	41.23732	71.37935	125	
SPI/PV	Disposal	01	B	5/6/2020	6:22:19	110117.5839	17110.16816	41.23734	71.37931	125	
SPI/PV	Disposal	01	C	5/6/2020	6:23:17	110117.1023	17109.52196	41.23733	71.37932	125	
SPI/PV	Disposal	01	D	5/6/2020	6:24:13	110121.1958	17112.34446	41.23736	71.37927	125	
SPI/PV	Disposal	15	A	5/6/2020	6:35:56	110461.5758	16777.63376	41.23434	71.37521	128	
SPI/PV	Disposal	15	B	5/6/2020	6:36:57	110458.3327	16783.61696	41.23439	71.37525	128	
SPI/PV	Disposal	15	C	5/6/2020	6:37:56	110457.2903	16784.08336	41.23440	71.37526	128	
SPI/PV	Disposal	15	D	5/6/2020	6:39:05	110456.894	16783.41886	41.23439	71.37527	128	
SPI/PV	Disposal	13	A	5/6/2020	6:43:49	110455.7297	16822.84176	41.23475	71.37528	128	
SPI/PV	Disposal	13	B	5/6/2020	6:44:50	110457.5372	16825.74956	41.23477	71.37526	128	
SPI/PV	Disposal	13	C	5/6/2020	6:45:40	110453.337	16825.66426	41.23477	71.37531	128	
SPI/PV	Disposal	13	D	5/6/2020	6:46:37	110451.621	16819.72366	41.23472	71.37533	128	
SPI/PV	Disposal	14	A	5/6/2020	6:54:31	110517.1409	16830.95556	41.23482	71.37455	126	
SPI/PV	Disposal	14	B	5/6/2020	6:55:23	110515.0134	16830.80616	41.23482	71.37458	126	
SPI/PV	Disposal	14	C	5/6/2020	6:56:52	110514.5532	16823.94516	41.23476	71.37458	126	
SPI/PV	Disposal	14	D	5/6/2020	6:57:50	110515.4279	16826.58166	41.23478	71.37457	126	

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SampleType	Category	StationID	Replicate	Date	Time	X_RIsp_m	Y_RIsp_m	Latitude_N_WGS84	Longitude_W_WGS84	Depth_ft	Comments
SPI/PV	Disposal	16	A	5/6/2020	7:08:37	110405.145	16270.05536	41.22977	71.37590	130	
SPI/PV	Disposal	16	B	5/6/2020	7:09:50	110410.54	16264.64216	41.22972	71.37583	130	
SPI/PV	Disposal	16	C	5/6/2020	7:10:49	110407.4798	16262.97786	41.22971	71.37587	130	
SPI/PV	Disposal	16	D	5/6/2020	7:11:45	110409.3086	16263.71856	41.22971	71.37585	130	
SPI/PV	Disposal	18	A	5/6/2020	7:15:55	110375.3751	16289.70896	41.22995	71.37625	130	
SPI/PV	Disposal	18	B	5/6/2020	7:16:56	110369.593	16286.92306	41.22992	71.37632	130	
SPI/PV	Disposal	18	C	5/6/2020	7:17:56	110366.1732	16288.01426	41.22993	71.37636	130	
SPI/PV	Disposal	18	D	5/6/2020	7:18:52	110365.591	16292.33936	41.22997	71.37637	130	
SPI/PV	Disposal	17	A	5/6/2020	7:27:50	110407.8547	16314.77876	41.23017	71.37586	130	
SPI/PV	Disposal	17	B	5/6/2020	7:28:41	110408.7508	16312.44706	41.23015	71.37585	130	
SPI/PV	Disposal	17	C	5/6/2020	7:29:39	110412.2529	16313.75156	41.23016	71.37581	130	
SPI/PV	Disposal	17	D	5/6/2020	7:30:34	110408.894	16315.61696	41.23018	71.37585	130	
PV	Disposal	14	E	5/6/2020	8:11:18	110513.5778	16831.69016	41.23483	71.37459	125	PV only.
PV	Disposal	14	F	5/6/2020	8:12:07	110514.8702	16828.16966	41.23479	71.37458	125	PV only.
PV	Disposal	14	G	5/6/2020	8:12:36	110515.2237	16831.00736	41.23482	71.37457	125	PV only.
PV	Disposal	14	H	5/6/2020	8:13:06	110512.6299	16827.02976	41.23478	71.37460	125	PV only.
SPI/PV	Disposal	06	A	5/6/2020	8:24:05	110015.622	16287.62106	41.22993	71.38054	127	
SPI/PV	Disposal	06	B	5/6/2020	8:24:59	110013.9974	16285.44166	41.22991	71.38056	127	
SPI/PV	Disposal	06	C	5/6/2020	8:25:57	110012.2722	16285.32896	41.22991	71.38058	127	
SPI/PV	Disposal	06	D	5/6/2020	8:26:53	110016.8778	16289.76686	41.22995	71.38053	125	
SPI/PV	Disposal	05	A	5/6/2020	8:35:30	110058.9647	16332.60956	41.23034	71.38002	126	
SPI/PV	Disposal	05	B	5/6/2020	8:36:25	110058.733	16331.71046	41.23033	71.38003	126	
SPI/PV	Disposal	05	C	5/6/2020	8:37:23	110058.858	16328.62286	41.23030	71.38002	126	
SPI/PV	Disposal	05	D	5/6/2020	8:38:20	110060.2052	16325.86746	41.23028	71.38001	126	
SPI/PV	Disposal	04	A	5/6/2020	8:40:10	110015.4909	16323.27356	41.23025	71.38054	127	
SPI/PV	Disposal	04	B	5/6/2020	8:41:05	110011.7175	16322.15186	41.23024	71.38059	127	
SPI/PV	Disposal	04	C	5/6/2020	8:42:02	110012.6898	16324.68786	41.23027	71.38058	127	
SPI/PV	Disposal	04	D	5/6/2020	8:42:58	110010.3611	16323.51126	41.23026	71.38060	127	
SPI/PV	Disposal	09	A	5/6/2020	8:51:12	109653.4457	15969.59516	41.22707	71.38487	124	
SPI/PV	Disposal	09	B	5/6/2020	8:52:11	109653.5951	15969.65916	41.22707	71.38486	124	
SPI/PV	Disposal	09	C	5/6/2020	8:53:10	109654.8448	15968.42466	41.22706	71.38485	124	
SPI/PV	Disposal	09	D	5/6/2020	8:54:05	109657.6825	15968.29666	41.22706	71.38482	124	
SPI/PV	Disposal	07	A	5/6/2020	8:57:57	109602.7269	15935.75006	41.22677	71.38547	124	
SPI/PV	Disposal	07	B	5/6/2020	8:58:51	109602.4709	15937.60016	41.22679	71.38547	124	
SPI/PV	Disposal	07	C	5/6/2020	8:59:49	109600.9286	15935.28376	41.22676	71.38549	124	
SPI/PV	Disposal	07	D	5/6/2020	9:00:48	109597.8684	15936.13416	41.22677	71.38553	124	
SPI/PV	Disposal	08	A	5/6/2020	9:05:52	109547.7073	15994.62536	41.22730	71.38613	126	
SPI/PV	Disposal	08	B	5/6/2020	9:06:48	109548.2103	15997.21616	41.22732	71.38612	126	
SPI/PV	Disposal	08	C	5/6/2020	9:07:43	109546.86	15997.17346	41.22732	71.38614	126	
SPI/PV	Disposal	08	D	5/6/2020	9:08:40	109546.3906	15998.68836	41.22734	71.38614	126	
SPI/PV	Disposal	20	A	5/6/2020	9:23:33	110501.334	15827.39346	41.22578	71.37476	125	
SPI/PV	Disposal	20	B	5/6/2020	9:24:28	110500.9012	15831.77346	41.22582	71.37476	125	
SPI/PV	Disposal	20	C	5/6/2020	9:25:23	110496.9022	15831.76126	41.22582	71.37481	125	
SPI/PV	Disposal	20	D	5/6/2020	9:26:20	110498.0848	15836.09856	41.22586	71.37479	125	Out of watch circle ~1.75 feet.
SPI/PV	Disposal	19	A	5/6/2020	9:28:32	110459.238	15824.24786	41.22575	71.37526	126	
SPI/PV	Disposal	19	B	5/6/2020	9:29:29	110460.6705	15825.66826	41.22577	71.37524	126	
SPI/PV	Disposal	19	C	5/6/2020	9:30:23	110462.036	15822.02896	41.22573	71.37522	126	
SPI/PV	Disposal	19	D	5/6/2020	9:31:19	110463.5966	15822.86416	41.22574	71.37521	126	
SPI/PV	Disposal	21	A	5/6/2020	9:37:19	110465.1023	15776.21136	41.22532	71.37519	125	

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SampleType	Category	StationID	Replicate	Date	Time	X_RIsp_m	Y_RIsp_m	Latitude_N_WGS84	Longitude_W_WGS84	Depth_ft	Comments
SPI/PV	Disposal	21	B	5/6/2020	9:38:14	110465.0901	15778.44556	41.22534	71.37519	125	
SPI/PV	Disposal	21	C	5/6/2020	9:39:20	110463.1181	15780.76196	41.22536	71.37521	125	
SPI/PV	Disposal	21	D	5/6/2020	9:40:16	110459.7439	15777.30556	41.22533	71.37525	125	
PV	Disposal	06	E	5/6/2020	10:09:50	110012.4673	16286.89866	41.22993	71.38058	125	PV only.
PV	Disposal	06	F	5/6/2020	10:10:22	110011.7632	16289.02316	41.22995	71.38059	125	PV only.
PV	Disposal	06	G	5/6/2020	10:10:52	110011.3487	16287.45646	41.22993	71.38059	125	PV only.
PV	Disposal	06	H	5/6/2020	10:11:23	110011.1201	16283.99696	41.22990	71.38059	125	PV only.

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SampleType	StationType	StationID	Station_Num	Replicate	Date	Time	X_RIsp_m	Y_RIsp_m	lat_N_WGS84	lon_W_WGS84	Pen_cm
GRAB	Chem	REF-NE-01	1	C	6/14/2020	9:13:47	113972.6	19065.7	41.254888	-71.333281	8.8
GRAB	Bio	REF-NE-01	1	B	6/14/2020	9:27:22	113974.0	19065.1	41.254883	-71.333265	9
GRAB	Chem	REF-NE-02	2	C	6/14/2020	9:41:04	114218.5	18955.0	41.253887	-71.330351	9
GRAB	Bio	REF-NE-02	2	B	6/14/2020	9:49:02	114223.1	18958.5	41.253918	-71.330295	9
GRAB	Chem	REF-NE-03	3	C	6/14/2020	10:08:59	113904.7	18615.5	41.250836	-71.334102	8.5
GRAB	Bio	REF-NE-03	3	B	6/14/2020	10:18:56	113900.5	18604.4	41.250736	-71.334153	8.2
GRAB	Bio	REF-E-03	3	B	6/14/2020	10:39:18	114512.5	16801.6	41.234492	-71.326894	10
GRAB	Chem	REF-E-03	3	C	6/14/2020	10:52:27	114523.4	16807.9	41.234549	-71.326763	10
GRAB	Chem	REF-E-02	2	C	6/14/2020	11:04:02	114709.6	16747.4	41.234001	-71.324544	7.8
GRAB	Bio	REF-E-02	2	B	6/14/2020	11:13:57	114709.6	16749.6	41.234020	-71.324544	8.3
GRAB	Bio	REF-E-01	1	B	6/14/2020	11:46:24	114924.4	16763.2	41.234139	-71.321982	9
GRAB	Chem	REF-E-01	1	C	6/14/2020	12:05:04	114930.6	16756.3	41.234077	-71.321908	9
GRAB	Chem	REF-SW-01	1	C	6/14/2020	12:41:55	107222.3	14707.2	41.215732	-71.413877	9.5
GRAB	Bio	REF-SW-01	1	B	6/14/2020	12:52:11	107208.3	14704.6	41.215709	-71.414043	9.5
GRAB	Chem	REF-SW-02	2	C	6/14/2020	13:05:26	106873.2	14532.6	41.214163	-71.418041	10
GRAB	Bio	REF-SW-02	2	B	6/14/2020	13:18:58	106868.8	14525.7	41.214100	-71.418094	9.5
GRAB	Bio	REF-SW-03	3	B	6/14/2020	13:33:12	107240.3	14353.3	41.212545	-71.413666	8.8
GRAB	Chem	REF-SW-03	3	C	6/14/2020	13:42:33	107233.2	14359.9	41.212604	-71.413750	7.3
GRAB	Chem	02	2	C	6/16/2020	8:13:59	109760.1	17149.9	41.237700	-71.383575	9.2
GRAB	Bio	02	2	B	6/16/2020	8:28:41	109765.1	17146.1	41.237666	-71.383516	9
GRAB	Chem	01	1	C	6/16/2020	8:40:11	110120.2	17104.1	41.237283	-71.379280	8.3
GRAB	Bio	01	1	B	6/16/2020	8:49:53	110112.5	17093.0	41.237183	-71.379372	8.9
GRAB	Chem	03	3	C	6/16/2020	9:00:23	109948.0	16962.6	41.236010	-71.381336	8.6
GRAB	Bio	03	3	B	6/16/2020	9:12:49	109960.1	16953.2	41.235926	-71.381193	8.5
GRAB	Chem	05	5	C	6/16/2020	9:25:55	110064.4	16324.3	41.230262	-71.379959	8.4
GRAB	Bio	05	5	B	6/16/2020	9:40:46	110058.0	16313.0	41.230160	-71.380036	9.8
GRAB	Chem	04	4	C	6/16/2020	10:02:05	110011.0	16321.1	41.230234	-71.380596	9.7
GRAB	Bio	04	4	B	6/16/2020	10:22:08	110014.1	16321.4	41.230236	-71.380559	9.8
GRAB	Chem	06	6	C	6/16/2020	10:32:36	110011.9	16279.9	41.229863	-71.380586	9.5
GRAB	Bio	06	6	B	6/16/2020	10:44:18	110018.0	16272.8	41.229799	-71.380513	9.5
GRAB	Chem	09	9	C	6/16/2020	11:02:23	109656.8	15958.8	41.226976	-71.384826	8.4
GRAB	Bio	09	9	B	6/16/2020	11:13:13	109657.5	15961.5	41.227001	-71.384817	8.6
GRAB	Chem	07	7	C	6/16/2020	11:32:02	109598.7	15933.8	41.226751	-71.385519	8.8
GRAB	Bio	07	7	B	6/16/2020	11:44:18	109597.1	15925.7	41.226678	-71.385539	8.7
GRAB	Chem	08	8	C	6/16/2020	11:56:00	109544.6	15986.7	41.227229	-71.386164	9.1
GRAB	Bio	08	8	B	6/16/2020	12:22:22	109541.8	15983.3	41.227198	-71.386197	9.6

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APPENDIX D

SEDIMENT PROFILE IMAGE ANALYSIS RESULTS

Notes:

IND=Indeterminate
N/A=Not Applicable
Grain Size: “/” indicates layer of one phi size range over another.
Successional Stage: “on” indicates one Stage is found on top of another Stage (i.e., 1 on 3);
“->” indicates one Stage is progressing to another Stage (i.e., 2 -> 3).

Category	StationID	Replicate	Water Depth (ft)	Date	Time	Stop Collar Setting (in)	# of Weights (per side)	Image Width (cm)	Grain Size Major Mode (phi)	Grain Size Minimum (phi)	Grain Size Maximum (phi)	Grain Size Range (phi)	Penetration Mean (cm)	Penetration Minimum (cm)	Penetration Maximum (cm)	Over-penetration?	Boundary Roughness (cm)	Boundary Roughness Type
Disposal	01	A	125	5/6/2020	6:21:29	12	1	14.62	0 to -1/2 to 1	>4	-2	>4 to -2	4.52	1.60	6.33	No	4.72	Physical
Disposal	01	B	125	5/6/2020	6:22:22	12	1	14.62	3 to 2	>4	-1	>4 to -1	3.63	2.41	4.62	No	2.21	Physical
Disposal	01	D	125	5/6/2020	6:24:18	12	1	14.62	>4/3 to 2	>4	-5	>4 to -5	0.74	0.14	2.06	No	1.92	Physical
Disposal	02	A	120	5/6/2020	5:57:49	12	1	14.62	4 to 3/>4	>4	2	>4 to 2	0.74	10.94	11.55	No	0.61	Biological
Disposal	02	B	120	5/6/2020	5:58:54	12	1	14.62	4 to 3/>4	>4	2	>4 to 2	12.94	12.19	13.49	No	1.30	Biological
Disposal	02	C	120	5/6/2020	5:59:52	12	1	14.62	4 to 3/>4	>4	1	>4 to 1	9.91	8.68	10.43	No	1.75	Biological
Disposal	03	A	98	5/6/2020	6:10:45	12	1	14.62	-4 to -5	>4	-5	>4 to -5	0.00	0.00	0.00	No	IND	Physical
Disposal	03	C	98	5/6/2020	6:12:38	12	1	14.62	IND	>4	IND	>4 to IND	0.00	0.00	0.00	No	IND	Physical
Disposal	03	D	98	5/6/2020	6:13:41	12	1	14.62	IND	IND	IND	IND to IND	0.00	0.00	0.00	No	IND	Physical
Disposal	04	A	127	5/6/2020	8:40:12	12	1	14.62	3 to 2/>4	>4	1	>4 to 1	6.10	5.64	6.58	No	0.94	Physical
Disposal	04	B	127	5/6/2020	8:41:09	12	1	14.62	3 to 2/>4	>4	1	>4 to 1	7.41	6.86	8.15	No	1.30	Physical
Disposal	04	C	127	5/6/2020	8:42:06	12	1	14.62	3 to 2/>4	>4	1	>4 to 1	6.48	6.01	6.68	No	0.67	Physical
Disposal	05	A	126	5/6/2020	8:35:33	12	1	14.62	3 to 2/>4	>4	-2	>4 to -2	9.62	9.20	9.87	No	0.68	Physical
Disposal	05	C	126	5/6/2020	8:37:27	12	1	14.62	>4	>4	-2	>4 to -2	9.73	9.37	10.10	No	0.73	Biological
Disposal	05	D	126	5/6/2020	8:38:24	12	1	14.62	3 to 2/>4	>4	-3	>4 to -3	9.59	8.22	10.52	No	2.31	Biological
Disposal	06	B	127	5/6/2020	8:25:03	12	1	14.62	3 to 2/>4	>4	-1	>4 to -1	11.11	10.92	11.38	No	0.46	Biological
Disposal	06	C	127	5/6/2020	8:26:01	12	1	14.62	3 to 2/>4	>4	-2	>4 to -2	9.08	8.58	10.07	No	1.49	Biological
Disposal	06	D	125	5/6/2020	8:26:57	12	1	14.62	3 to 2/>4	>4	-2	>4 to -2	7.62	6.80	8.65	No	1.85	Biological
Disposal	07	A	124	5/6/2020	8:58:01	12	1	14.62	3 to 2/>4	>4	-3	>4 to -3	8.01	7.02	8.84	No	1.82	Biological
Disposal	07	B	124	5/6/2020	8:58:55	12	1	14.62	3 to 2/>4	>4	-5	>4 to -5	4.56	4.19	5.32	No	1.13	Biological
Disposal	07	C	124	5/6/2020	8:59:53	12	1	14.62	3 to 2/>4	>4	-2	>4 to -2	8.87	8.35	9.51	No	1.15	Biological

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Stop Collar Setting (in)	# of Weights (per side)	Image Width (cm)	Grain Size Major Mode (phi)	Grain Size Minimum (phi)	Grain Size Maximum (phi)	Grain Size Range (phi)	Penetration Mean (cm)	Penetration Minimum (cm)	Penetration Maximum (cm)	Over-penetration?	Boundary Roughness (cm)	Boundary Roughness Type
Disposal	08	B	126	5/6/2020	9:06:52	12	1	14.62	3 to 2/>4	>4	-4	>4 to -4	8.71	8.24	9.12	No	0.88	Biological
Disposal	08	C	126	5/6/2020	9:07:47	12	1	14.62	3 to 2/>4	>4	-2	>4 to -2	9.95	8.81	10.61	No	1.80	Biological
Disposal	08	D	126	5/6/2020	9:08:44	12	1	14.62	3 to 2/>4	>4	-1	>4 to -1	8.39	7.75	8.87	No	1.12	Biological
Disposal	09	A	124	5/6/2020	8:51:16	12	1	14.62	>4	>4	-1	>4 to -1	10.28	9.98	10.59	No	0.60	Biological
Disposal	09	C	124	5/6/2020	8:53:14	12	1	14.62	>4	>4	0	>4 to 0	11.13	10.86	11.51	No	0.64	Biological
Disposal	09	D	124	5/6/2020	8:54:09	12	1	14.62	>4	>4	-1	>4 to -1	10.02	9.40	10.81	No	1.40	Biological
Disposal	10	A	128	5/6/2020	5:17:14	12	1	14.62	>4	>4	2	>4 to 2	12.13	11.68	12.46	No	0.77	Biological
Disposal	10	B	128	5/6/2020	5:18:11	12	1	14.62	>4	>4	2	>4 to 2	14.54	13.79	15.04	No	1.26	Biological
Disposal	10	C	128	5/6/2020	5:19:08	12	1	14.62	>4	>4	2	>4 to 2	15.41	14.98	15.80	No	0.83	Biological
Disposal	11	A	128	5/6/2020	5:28:35	12	1	14.62	>4	>4	2	>4 to 2	14.05	13.58	14.35	No	0.77	Biological
Disposal	11	B	128	5/6/2020	5:29:28	12	1	14.62	>4	>4	1	>4 to 1	12.34	11.89	12.75	No	0.86	Biological
Disposal	11	C	128	5/6/2020	5:30:25	12	1	14.62	>4	>4	2	>4 to 2	13.97	13.45	14.39	No	0.94	Biological
Disposal	12	A	127	5/6/2020	5:06:05	12	1	14.62	4 to 3/>4	>4	1	>4 to 1	11.31	9.94	12.64	No	2.71	Biological
Disposal	12	B	127	5/6/2020	5:07:01	12	1	14.62	4 to 3/>4	>4	2	>4 to 2	10.81	9.66	11.35	No	1.69	Biological
Disposal	12	C	127	5/6/2020	5:07:59	12	1	14.62	4 to 3	>4	-1	>4 to -1	10.98	10.32	11.55	No	1.22	Biological
Disposal	13	A	128	5/6/2020	6:43:53	12	1	14.62	3 to 2/>4	>4	-1	>4 to -1	9.36	8.89	9.65	No	0.76	Biological
Disposal	13	B	128	5/6/2020	6:44:49	12	1	14.62	3 to 2/>4	>4	-1	>4 to -1	9.41	8.76	10.22	No	1.46	Biological
Disposal	13	D	128	5/6/2020	6:46:41	12	1	14.62	3 to 2/>4	>4	-1	>4 to -1	9.59	8.95	10.53	No	1.58	Biological

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Stop Collar Setting (in)	# of Weights (per side)	Image Width (cm)	Grain Size Major Mode (phi)	Grain Size Minimum (phi)	Grain Size Maximum (phi)	Grain Size Range (phi)	Penetration Mean (cm)	Penetration Minimum (cm)	Penetration Maximum (cm)	Over-penetration?	Boundary Roughness (cm)	Boundary Roughness Type
Disposal	14	A	126	5/6/2020	6:54:35	12	1	14.62	2 to 1/>4	>4	-1	>4 to -1	9.87	9.41	10.29	No	0.88	Biological
Disposal	14	B	126	5/6/2020	6:55:27	12	1	14.62	>4	>4	0	>4 to 0	9.95	9.26	10.47	No	1.21	Biological
Disposal	14	D	126	5/6/2020	6:57:54	12	1	14.62	3 to 2/>4	>4	-1	>4 to -1	10.20	9.88	10.58	No	0.70	Biological
Disposal	15	A	128	5/6/2020	6:36:00	12	1	14.62	>4	>4	-1	>4 to -1	8.16	7.92	9.07	No	1.15	Biological
Disposal	15	B	128	5/6/2020	6:37:01	12	1	14.62	3 to 2/>4	>4	-1	>4 to -1	8.18	7.83	8.40	No	0.56	Biological
Disposal	15	D	128	5/6/2020	6:39:08	12	1	14.62	3 to 2/>4	>4	-3	>4 to -3	9.44	9.13	9.70	No	0.57	Biological
Disposal	16	A	130	5/6/2020	7:08:40	12	1	14.62	-5 to -6	>4	-5	>4 to -5	0.00	0.00	0.00	No	IND	Physical
Disposal	16	B	130	5/6/2020	7:09:54	12	1	14.62	IND	>4	IND	>4 to IND	0.00	0.00	0.00	No	IND	Physical
Disposal	16	C	130	5/6/2020	7:10:53	12	1	14.62	-5 to -6	>4	-5	>4 to -5	0.00	0.00	0.00	No	IND	Physical
Disposal	17	A	130	5/6/2020	7:27:53	12	1	14.62	2 to 1/>4	>4	-4	>4 to -4	6.70	6.23	7.14	No	0.91	Physical
Disposal	17	B	130	5/6/2020	7:28:45	12	1	14.62	-3 to -4/>4	>4	-5	>4 to -5	2.96	2.48	3.73	No	1.25	Physical
Disposal	17	C	130	5/6/2020	7:29:42	12	1	14.62	3 to 2	>4	-5	>4 to -5	4.77	3.97	5.25	No	1.28	Physical
Disposal	18	A	130	5/6/2020	7:15:59	12	1	14.62	-4 to -5	>4	-6	>4 to -6	0.00	0.00	0.00	No	IND	Physical
Disposal	18	B	130	5/6/2020	7:17:00	12	1	14.62	-3 to -4	>4	-6	>4 to -6	0.00	0.00	0.00	No	IND	Physical
Disposal	18	C	130	5/6/2020	7:17:59	12	1	14.62	-3 to -4	>4	-5	>4 to -5	0.00	0.00	0.00	No	IND	Physical
Disposal	19	A	126	5/6/2020	9:28:36	12	1	14.62	>4	>4	0	>4 to 0	10.12	9.56	10.64	No	1.08	Biological
Disposal	19	C	126	5/6/2020	9:30:27	12	1	14.62	>4	>4	-3	>4 to -3	7.73	7.23	8.27	No	1.04	Biological
Disposal	19	D	126	5/6/2020	9:31:23	12	1	14.62	>4	>4	0	>4 to 0	10.16	9.36	10.57	No	1.21	Biological
Disposal	20	A	125	5/6/2020	9:23:37	12	1	14.62	3 to 2/>4	>4	0	>4 to 0	8.81	8.29	9.43	No	1.14	Biological
Disposal	20	B	125	5/6/2020	9:24:32	12	1	14.62	3 to 2/>4	>4	0	>4 to 0	8.31	8.05	8.52	No	0.48	Biological

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Disposal	20	C	125	5/6/2020	9:25:27	12	1	14.62	3 to 2/>4	>4	0	>4 to 0	9.95	8.83	10.64	No	1.81	Biological
Disposal	21	A	125	5/6/2020	9:37:23	12	1	14.62	3 to 2/>4	>4	0	>4 to 0	9.61	9.29	10.02	No	0.73	Biological
Disposal	21	C	125	5/6/2020	9:39:24	12	1	14.62	3 to 2/>4	>4	0	>4 to 0	10.18	9.76	10.65	No	0.89	Biological
Disposal	21	D	125	5/6/2020	9:40:19	12	1	14.62	3 to 2/>4	>4	0	>4 to 0	9.23	8.13	10.46	No	2.32	Biological
Reference	REF-E-01	A	136	5/6/2020	2:41:17	14	4	14.62	>4	>4	1	>4 to 1	12.01	11.41	12.39	No	0.98	Biological
Reference	REF-E-01	B	136	5/6/2020	2:42:10	14	4	14.62	>4	>4	1	>4 to 1	17.14	16.75	17.61	No	0.86	Biological
Reference	REF-E-01	D	136	5/6/2020	2:43:59	14	4	14.62	4 to 3	>4	1	>4 to 1	11.71	11.49	11.92	No	0.43	Biological
Reference	REF-E-02	A	136	5/6/2020	2:31:21	14	4	14.62	4 to 3	>4	1	>4 to 1	18.40	18.12	18.81	No	0.69	Biological
Reference	REF-E-02	B	136	5/6/2020	2:32:13	14	4	14.62	4 to 3	>4	1	>4 to 1	18.01	17.57	18.32	No	0.75	Biological
Reference	REF-E-02	C	136	5/6/2020	2:33:11	14	4	14.62	4 to 3	>4	0	>4 to 0	17.78	17.36	18.15	No	0.80	Biological
Reference	REF-E-03	A	135	5/6/2020	3:01:21	14	4	14.62	4 to 3	>4	0	>4 to 0	13.20	11.39	15.50	No	4.11	Physical
Reference	REF-E-03	B	135	5/6/2020	3:02:15	14	4	14.62	4 to 3	>4	0	>4 to 0	18.03	17.48	18.47	No	0.98	Biological
Reference	REF-E-03	C	135	5/6/2020	3:03:07	14	4	14.62	4 to 3	>4	0	>4 to 0	17.98	16.67	18.83	No	2.16	Biological
Reference	REF-E-04	A	135	5/6/2020	2:52:02	14	4	14.62	4 to 3	>4	0	>4 to 0	17.06	16.21	17.45	No	1.24	Biological

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Reference	REF-E-04	B	135	5/6/2020	2:52:57	14	4	14.62	4 to 3	>4	0	>4 to 0	17.45	17.00	17.81	No	0.81	Biological
Reference	REF-E-04	C	135	5/6/2020	2:53:53	14	4	14.62	4 to 3	>4	1	>4 to 1	16.02	13.04	17.30	No	4.26	Biological
Reference	REF-E-05	A	136	5/6/2020	2:17:49	14	4	14.62	>4	>4	0	>4 to 0	19.73	18.95	19.97	No	1.03	Biological
Reference	REF-E-05	B	136	5/6/2020	2:18:44	14	4	14.62	4 to 3	>4	0	>4 to 0	17.87	17.00	18.33	No	1.33	Biological
Reference	REF-E-05	C	136	5/6/2020	2:19:37	14	4	14.62	>4	>4	0	>4 to 0	19.02	17.75	19.94	No	2.19	Biological
Reference	REF-NE-01	A	126	5/6/2020	4:21:50	16	5	14.62	3 to 2	>4	0	>4 to 0	4.91	4.41	5.28	No	0.87	Biological
Reference	REF-NE-01	B	126	5/6/2020	4:22:45	16	5	14.62	2 to 1	>4	-1	>4 to -1	6.45	5.76	7.34	No	1.59	Physical
Reference	REF-NE-01	D	126	5/6/2020	4:24:37	16	5	14.62	2 to 1	>4	-1	>4 to -1	7.45	6.67	8.20	No	1.53	Physical
Reference	REF-NE-02	A	125	5/6/2020	4:09:10	16	5	14.62	3 to 2	>4	0	>4 to 0	4.72	4.30	5.28	No	0.98	Physical
Reference	REF-NE-02	C	125	5/6/2020	4:11:01	16	5	14.62	3 to 2	>4	0	>4 to 0	2.38	0.92	3.22	No	2.29	Physical
Reference	REF-NE-02	D	125	5/6/2020	4:11:56	16	5	14.62	3 to 2	>4	0	>4 to 0	4.62	4.00	5.08	No	1.07	Physical
Reference	REF-NE-03	A	125	5/6/2020	3:36:57	16	5	14.62	3 to 2	>4	0	>4 to 0	7.98	7.66	8.33	No	0.67	Physical
Reference	REF-NE-03	B	125	5/6/2020	3:37:56	16	5	14.62	4 to 3	>4	0	>4 to 0	7.10	6.27	7.73	No	1.45	Physical
Reference	REF-NE-03	C	125	5/6/2020	3:38:57	16	5	14.62	3 to 2	>4	1	>4 to 1	4.60	3.86	5.05	No	1.19	Physical
Reference	REF-NE-04	A	123	5/6/2020	3:47:54	16	5	14.62	3 to 2	>4	-2	>4 to -2	4.84	4.49	5.57	No	1.07	Physical
Reference	REF-NE-04	B	123	5/6/2020	3:48:47	16	5	14.62	3 to 2	>4	-1	>4 to -1	4.52	3.47	5.21	No	1.74	Physical
Reference	REF-NE-04	C	123	5/6/2020	3:49:46	16	5	14.62	3 to 2	>4	-1	>4 to -1	4.70	4.10	5.90	No	1.81	Physical
Reference	REF-NE-05	A	125	5/6/2020	3:57:30	16	5	14.62	3 to 2	>4	-1	>4 to -1	5.62	4.94	6.54	No	1.61	Physical
Reference	REF-NE-05	C	125	5/6/2020	3:59:18	16	5	14.62	3 to 2	>4	-2	>4 to -2	2.88	1.61	4.72	No	3.11	Physical
Reference	REF-NE-05	D	125	5/6/2020	4:00:15	16	5	14.62	3 to 2	>4	0	>4 to 0	3.91	3.20	4.57	No	1.36	Physical
Reference	REF-SW-01	A	128	5/6/2020	1:17:07	14	4	14.62	4 to 3	>4	0	>4 to 0	6.50	5.75	7.07	No	1.32	Biological

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Reference	REF-SW-01	B	128	5/6/2020	1:17:59	14	4	14.62	4 to 3	>4	0	>4 to 0	7.33	6.14	8.14	No	2.00	Biological
Reference	REF-SW-01	C	128	5/6/2020	1:18:55	14	4	14.62	4 to 3	>4	0	>4 to 0	6.71	5.87	7.30	No	1.43	Biological
Reference	REF-SW-02	A	130	5/6/2020	0:55:25	14	4	14.62	4 to 3	>4	0	>4 to 0	11.25	10.79	11.74	No	0.95	Biological
Reference	REF-SW-02	B	130	5/6/2020	0:56:19	14	4	14.62	4 to 3	>4	0	>4 to 0	12.11	11.67	12.46	No	0.79	Biological
Reference	REF-SW-02	D	130	5/6/2020	0:58:10	14	4	14.62	4 to 3	>4	0	>4 to 0	11.19	9.84	11.86	No	2.02	Biological
Reference	REF-SW-03	A	125	5/6/2020	0:33:35	14	4	14.62	3 to 2	>4	0	>4 to 0	5.11	4.49	6.03	No	1.54	Biological
Reference	REF-SW-03	B	125	5/6/2020	0:34:25	14	4	14.62	3 to 2	>4	0	>4 to 0	4.90	4.36	5.27	No	0.91	Physical
Reference	REF-SW-03	C	125	5/6/2020	0:35:22	14	4	14.62	3 to 2	>4	0	>4 to 0	3.71	3.07	4.70	No	1.63	Physical
Reference	REF-SW-04	A	131	5/6/2020	0:43:34	14	4	14.62	3 to 2	>4	-1	>4 to -1	11.87	11.55	12.40	No	0.85	Biological
Reference	REF-SW-04	B	131	5/6/2020	0:44:24	14	4	14.62	4 to 3	>4	-1	>4 to -1	11.57	11.11	12.08	No	0.97	Biological
Reference	REF-SW-04	C	131	5/6/2020	0:45:16	14	4	14.62	4 to 3	>4	-1	>4 to -1	10.12	8.95	10.70	No	1.76	Biological
Reference	REF-SW-05	B	128	5/6/2020	1:06:16	14	4	14.62	3 to 2	>4	-1	>4 to -1	6.80	6.61	7.01	No	0.41	Biological
Reference	REF-SW-05	C	128	5/6/2020	1:07:16	14	4	14.62	3 to 2	>4	1	>4 to 1	5.92	5.41	6.37	No	0.96	Biological
Reference	REF-SW-05	D	128	5/6/2020	1:08:10	14	4	14.62	3 to 2	>4	1	>4 to 1	7.02	6.66	7.34	No	0.68	Biological

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StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Dredged Material Present?	Dredged Material Layer Mean Thickness (cm)	Dredged Material Layer Minimum Thickness (cm)	Dredged Material Layer Maximum Thickness (cm)	Mean Dredged Material Depth (cm)	Buried Dredged Material?	Dredged Material > Pen	Dredged Material Notes	Methane Present?	Low DO Present?
01	A	IND	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
01	B	IND	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
01	D	IND	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
02	A	1.58	No	0	None	Yes	9.75	9.18	10.61	1.57	Yes	Yes	Mottled light gray and dark gray very fine sand and silt/clay	No	No
02	B	0.76	No	0	None	Yes	12.18	10.96	13.12	0.76	Yes	Yes	Dark gray and black very fine sand and silt/clay	No	No
02	C	1.16	No	0	None	Yes	9.23	8.46	10.14	0.69	Yes	Yes	Light gray very fine sand.	No	No
03	A	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel pavement	IND	IND
03	C	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel pavement	IND	IND
03	D	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel pavement	IND	IND
04	A	IND	No	0	None	Yes	3.92	4.65	5.50	1.11	Yes	Yes	Mottled dark and light gray silt/clay with some brown very fine sand on right.	No	No
04	B	IND	No	0	None	Yes	5.31	2.18	7.24	2.11	Yes	Yes	Light and dark gray silt/clay	No	No
04	C	0.95	No	0	None	Yes	5.24	4.84	6.12	2.12	Yes	Yes	Gray and light brownish gray silt/clay	No	No
05	A	IND	No	0	None	Yes	6.49	6.03	7.08	3.15	Yes	Yes	Dark gray silt/clay with streaks of light gray and light brown silt/clay	No	No
05	C	0.49	No	0	None	Yes	8.65	6.93	9.24	1.10	Yes	Yes	Dark gray silt/clay with darker and lighter gray streaks	No	No
05	D	IND	No	0	None	Yes	7.61	6.08	8.97	1.99	Yes	Yes	Light gray silt/clay with some black silt/clay at depth	No	No
06	B	IND	No	0	None	Yes	10.08	8.38	11.12	1.04	Yes	Yes	Very light grayish white silt/clay with streaks of dark gray silt/clay	No	No
06	C	IND	No	0	None	Yes	8.42	5.97	9.34	0.68	Yes	Yes	Light gray silt/clay	No	No
06	D	IND	No	0	None	Yes	5.73	3.35	8.20	1.90	Yes	Yes	Dark black silt/clay with streaks of whitish gray silt/clay	No	No
07	A	IND	No	0	None	Yes	5.12	3.48	7.54	2.91	Yes	Yes	Mix of gray and black silt/clay and gray fine sand	No	No
07	B	IND	No	0	None	Yes	1.74	0.72	3.41	2.83	Yes	Yes	Patches of light gray and dark gray silt/clay	No	No
07	C	IND	No	0	None	Yes	6.59	5.93	7.25	2.29	Yes	Yes	Mottled black and light gray silt/clay	No	No

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StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Dredged Material Present?	Dredged Material Layer Mean Thickness (cm)	Dredged Material Layer Minimum Thickness (cm)	Dredged Material Layer Maximum Thickness (cm)	Mean Dredged Material Depth (cm)	Buried Dredged Material?	Dredged Material > Pen	Dredged Material Notes	Methane Present?	Low DO Present?
08	B	IND	No	0	None	Yes	7.92	3.90	9.01	0.81	Yes	Yes	Mottled gray and black silt/clay	No	No
08	C	IND	No	0	None	Yes	8.55	7.99	8.97	1.41	Yes	Yes	Streaked gray and black silt/clay	No	No
08	D	IND	No	0	None	Yes	5.39	3.10	7.14	3.00	Yes	Yes	Dark gray silt/clay	No	No
09	A	0.02	No	0	None	Yes	10.28	9.96	10.59	0.00	No	Yes	Dark gray silt/clay with streaks of light gray silt/clay and large patch of black silt/clay	No	Yes
09	C	0.02	No	2	Reduced	Yes	10.26	7.97	11.22	0.88	Yes	Yes	Mottled gray, black, and light gray silt/clay	No	No
09	D	0.02	No	3	Reduced	Yes	9.78	8.88	10.63	0.25	Yes	Yes	Mottled gray, black, and light gray silt/clay	No	No
10	A	0.55	No	0	None	Yes	9.93	10.47	10.90	0.54	Yes	No	Homogenous dark gray silt/clay	No	No
10	B	1.20	No	0	None	Yes	10.77	9.71	12.03	1.20	Yes	No	Homogenous dark gray silt/clay	No	No
10	C	4.94	No	0	None	Yes	10.32	9.26	11.31	5.10	Yes	Yes	Dark gray silt/clay with streaks of lighter gray silt/clay	No	No
11	A	0.72	No	0	None	Yes	11.86	10.71	12.40	0.71	Yes	No	Homogenous dark gray silt/clay	No	No
11	B	0.53	No	0	None	Yes	11.94	11.51	12.50	0.41	Yes	Yes	Dark gray silt/clay with some patches of light gray silt/clay at depth.	No	No
11	C	0.49	No	0	None	Yes	12.46	11.65	12.96	0.83	Yes	No	Homogenous dark gray silt/clay	No	No
12	A	IND	No	0	None	Yes	3.91	2.86	5.64	4.03	Yes	No	Light and dark gray silt/clay	No	No
12	B	0.34	No	0	None	Yes	5.56	3.13	6.51	1.18	Yes	No	Light gray silt/clay	No	No
12	C	0.56	No	0	None	Yes	2.75	1.91	3.61	4.69	Yes	No	Very light gray silt/clay; mostly reworked	No	No
13	A	IND	No	0	None	Yes	8.57	7.91	9.04	0.81	Yes	Yes	Black silt/clay with some dark gray patches	No	IND
13	B	IND	No	0	None	Yes	8.47	7.38	9.81	0.95	Yes	Yes	Black silt/clay with streaks of light grayish white silt/clay	No	IND
13	D	IND	No	0	None	Yes	8.94	7.57	10.48	0.65	Yes	Yes	Mottled dark gray/black silt/clay with some light brown and light gray patches.	No	IND

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StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Dredged Material Present?	Dredged Material Layer Mean Thickness (cm)	Dredged Material Layer Minimum Thickness (cm)	Dredged Material Layer Maximum Thickness (cm)	Mean Dredged Material Depth (cm)	Buried Dredged Material?	Dredged Material > Pen	Dredged Material Notes	Methane Present?	Low DO Present?
14	A	0.00	No	0	None	Yes	9.18	8.13	10.14	0.70	Yes	Yes	Dark gray silt/clay	No	Yes
14	B	0.00	No	0	None	Yes	9.90	8.65	10.41	0.00	No	Yes	Very dark gray/black silt/clay	No	Yes
14	D	1.11	No	0	None	Yes	8.74	6.97	9.46	2.84	Yes	Yes	Mottled dark gray/black silt/clay with some light gray silt/clay	No	No
15	A	0.25	No	0	None	Yes	8.16	7.87	9.04	0.00	Yes	Yes	Mottled gray silt/clay with black and light gray silt/clay	No	No
15	B	IND	No	0	None	Yes	7.55	6.43	7.78	0.65	Yes	Yes	Gray silt/clay with some dark gray and brown silt/clay	No	No
15	D	IND	No	0	None	Yes	8.88	8.43	9.16	0.57	Yes	Yes	Mottled light gray and black silt/clay with some brown silt/clay streaks	No	No
16	A	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel and shell fragments	No	IND
16	B	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel and shell fragments	IND	IND
16	C	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel and shell fragments	No	IND
17	A	IND	No	0	None	Yes	4.86	5.41	4.00	1.84	Yes	Yes	Dark gray and black very fine sand and silt/clay; shell and gravels on surface	No	No
17	B	IND	No	0	None	Yes	2.96	2.48	3.73	0.00	No	Yes	Dark gray and black fine sand with shell hash. shell and gravels on surface	No	No
17	C	1.84	No	0	None	Yes	2.94	1.51	4.49	1.84	Yes	Yes	Grayish brown very fine sand. shell and gravels on surface	No	No
18	A	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel and cobble on surface	No	No
18	B	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel and cobble on surface	No	No
18	C	IND	No	0	None	Yes	IND	IND	IND	IND	No	No	Gravel and cobble on surface	No	No
19	A	0.02	No	0	None	Yes	10.12	9.56	10.64	0.00	No	No	Mottled black and light gray silt/clay	No	No
19	C	0.02	No	0	None	Yes	7.73	7.23	8.27	0.00	No	No	Black silt/clay with some streaks of light gray silt/clay and light brown silt/clay	No	No
19	D	0.02	No	0	None	Yes	10.16	9.36	10.57	0.00	No	No	Dark gray and black silt/clay with a large patch of light gray silt/clay.	No	No
20	A	IND	No	0	None	Yes	5.54	2.96	7.70	3.29	Yes	No	Dark gray silt/clay	No	No
20	B	0.00	No	0	None	Yes	7.56	6.68	8.17	0.76	Yes	No	Mottled dark gray and light gray silt/clay	No	Yes

StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Dredged Material Present?	Dredged Material Layer Mean Thickness (cm)	Dredged Material Layer Minimum Thickness (cm)	Dredged Material Layer Maximum Thickness (cm)	Mean Dredged Material Depth (cm)	Buried Dredged Material?	Dredged Material > Pen	Dredged Material Notes	Methane Present?	Low DO Present?
20	C	IND	No	0	None	Yes	9.95	8.83	10.64	0.00	No	No	Dark black silt/clay	No	No
21	A	IND	No	0	None	Yes	8.48	7.25	9.15	1.13	Yes	No	Dark black silt/clay	No	No
21	C	IND	No	0	None	Yes	9.63	8.90	10.29	0.56	Yes	No	Dark black silt/clay with some light gray silt/clay at depth	No	No
21	D	IND	No	0	None	Yes	8.45	6.79	9.78	0.79	Yes	No	Dark gray silt/clay with patches and streaks of light gray silt/clay	No	No
REF-E-01	A	3.56	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-01	B	5.81	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-01	D	2.65	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-02	A	4.17	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-02	B	4.61	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-02	C	4.84	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-03	A	2.69	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-03	B	4.27	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-03	C	3.59	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-04	A	4.20	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No

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REF-E-04	B	4.45	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-04	C	2.79	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-05	A	4.75	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-05	B	4.02	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-E-05	C	7.65	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-01	A	4.91	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-01	B	6.45	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-01	D	7.45	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-02	A	IND	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-02	C	IND	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-02	D	4.72	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-03	A	5.29	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-03	B	4.87	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-03	C	4.60	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-04	A	4.84	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-04	B	4.52	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-04	C	4.70	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-05	A	5.62	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-05	C	2.88	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-NE-05	D	3.91	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-01	A	5.40	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No

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REF-SW-01	B	4.39	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-01	C	4.60	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-02	A	3.59	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-02	B	1.71	No	5	Oxidized	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-02	D	3.11	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-03	A	5.11	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-03	B	4.90	Yes	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-03	C	3.71	Yes	2	Oxidized	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-04	A	2.86	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-04	B	4.91	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-04	C	3.30	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-05	B	4.98	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-05	C	4.59	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No
REF-SW-05	D	4.48	No	0	None	No	N/A	N/A	N/A	N/A	N/A	No		No	No

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StationID	Replicate	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage	Comment
01	A	Low	No	None	0	N/A	N/A	IND	Light gray very coarse sand over medium sand at depth. SWI slopes up to the right. Some fines resuspended into the water column.
01	B	Low	No	None	0	N/A	N/A	IND	Shallow penetration. Light gray fine sand with a small ripple mound in center.
01	D	Low	No	None	0	N/A	N/A	2	Very shallow penetration. Light brown silt/clay mixed with some fine sand. Pinkish white amphipod at SWI. Black worm appendages extended above SWI, left center, with a shallow burrow below. Several larger rocks in far field.
02	A	Medium	No	None	0	N/A	N/A	2 -> 3	Light grayish white fine sand overlying light gray very fine sand transitioning to dark gray very fine sand and silt/clay at depth. Small tubes on surface, far field.
02	B	Medium	No	None	2	0.99	11.88	2 on 3	Thin layer of light brown fine sand at SWI overlying dark gray very fine sand with some silt/clay at depth. Several small tubes on surface, far field. Numerous small shallow burrows just below SWI. Deeper burrow at SWI on the right, with a small void below it. Light gray filled void at depth, left.
02	C	Medium	No	None	2	1.00	6.76	2 on 3	Thin layer of light brown fine sand overlying dark gray very fine sand. Several deep burrows with oxygenated halos extending from SWI on the right. Dark gray fecal pellets deposited along SWI, left with a small void below.
03	A	IND	No	None	IND	IND	IND	IND	No penetration. Coarse pebbles and very coarse pebbles with thin layer of dark gray silt/clay over the surface. White barnacles encrusting pebbles on left and far field.
03	C	IND	No	None	IND	IND	IND	IND	No penetration. Dark gray silt/clay over top of rocky hard substrate. Cluster of hydroids on far right.
03	D	IND	No	None	IND	IND	IND	IND	No penetration. Hydroids extending from hard substrate.
04	A	Medium	No	None	1	2.78	5.53	2 on 3	Gray fine sand mixed with shell hash over top of dark and light gray silt/clay. Brown very fine sand and silt/clay on right. Several pebbles on surface encrusted with barnacles and bryozoa. Numerous camera artifacts across surface, far field, right. Drag down at SWI, center into a void. Void with visible worm at depth, center.
04	B	Medium	No	None	0	N/A	N/A	2 -> 3	Grayish brown fine sand mixed with white shell hash overlying dark gray and black silt/clay. Hard substrate with barnacles on surface, far field. Burrows just below SWI, left. Drag down of coarser material in center, left.
04	C	Medium	No	None	0	N/A	N/A	2 -> 3	Grayish brown fine sand mixed with white shell hash overlying gray and brownish gray silt/clay. Several pebbles with bryozoa and barnacles on surface, far field. Significant drag down of larger shell fragments into the sediment column, right center and just below SWI.
05	A	Medium	No	None	0	N/A	N/A	2 -> 3	Light gray fine sand overlying dark gray silt/clay with streaks of light gray and brown silt/clay at depth. Small tubes on surface, far field, right.
05	C	Medium	No	None	0	N/A	N/A	2	Light grayish brown fine sand transitioning to very fine sand with streaks of light gray silt/clay. Small tubes on surface, far field.
05	D	Medium	No	None	0	N/A	N/A	2	Light brown fine sand overlying gray silt/clay with some black silt/clay patches at depth. Several small gravels and shell fragments across surface. Some small shell pieces dragged down into the sediment column at surface. Some tubes on surface, left. Brown object/organism in center of sediment column, middle.
06	B	Medium	No	None	2	6.31	9.41	2 on 3	Light brown fine sand overlying light grayish white silt/clay with patches of black silt/clay. Small tubes on surface, left. Two large voids at depth.
06	C	Medium	No	None	1	6.75	8.41	2 on 3	Thin layer of grayish brown fine sand on far left and far right. Light gray silt/clay mottled with whitish gray and dark gray streaks. Gravel encrusted with barnacles and bryozoa in far field, right. Several large angular reduced camera artifacts on surface. Large tubes on surface, left. Large void at depth.
06	D	High	No	None	0	N/A	N/A	2	Thin layer of grayish brown fine sand overlying dark black silt/clay with streaks of light whitish gray silt/clay. Some drag down in center by a piece of shell and on far right, drag down of fine sand. Bryozoa colony on surface, right far field. Several small reduced camera artifacts across surface.
07	A	Medium	No	None	2	2.93	7.72	3	
07	B	Medium	No	None	0	N/A	N/A	1	Grayish brown fine sand overlying silt/clay, dark gray on left and light gray on right. Several shell fragments and small gravel, encrusted with barnacles on surface, far field. Several small reduced camera artifacts on surface. Some brown silt/clay dragged down from surface in center, left.
07	C	Medium	No	None	1	4.87	9.50	1 on 3	Grayish brown fine sand overlying dark gray mottled with light gray silt/clay. Several small shell fragments on surface and just below SWI. Large void extends the width of the image along the bottom.

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StationID	Replicate	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage	Comment
08	B	Medium	No	None	1	5.76	6.38	3	Thin layer of brown medium sand overlying dark gray silt/clay. Disturbed SWI on left, dragged down to just below SWI. Some shells and small gravel on surface. Small void on far right, at depth.
08	C	Medium	No	None	1	9.90	10.30	1 on 3	Thick layer of brown fine sand with several patches of reduced sediment overlying dark gray silt/clay at depth. A few small reduced camera artifacts on surface. Large void at bottom of image, left.
08	D	Medium	No	None	0	N/A	N/A	2	Light brown medium sand overlying dark gray silt/cay. Oyster shell fragment on surface, right. Some small reduced camera artifacts on surface. Large collapsed tube on surface, far field, left.
09	A	High	No	None	0	N/A	N/A	2 -> 3	Gray very fine sand over gray silt/clay with patches of black silt/clay. Worm on surface, left. Small shallow burrows at SWI. Burrows and tunnel in PV pair.
09	C	High	No	None	0	N/A	N/A	2	Very thin layer of light brown fine sand overlying dark gray silt/clay with streaks of black silt/clay and a patch of white silt/clay. Reduced camera artifact on surface. Podocerid amphipod fecal stack on surface, left. Several small shallow burrows just below SWI on left and right.
09	D	High	No	None	0	N/A	N/A	1	Very thin layer of light brown fine sand overlying dark gray silt/clay with patches of black and light gray silt/clay. Some angular reduced camera artifacts on surface, right. Small tube fragment on surface, left.
10	A	Medium	No	None	1	1.95	2.70	2 on 3	Light brown very fine sand transitioning to gray silt/clay with light gray silt/clay at depth. Podocerid amphipod fecal stacks on surface. Small shallow burrows just below SWI. Larger burrow in center and a small void below SWI on right.
10	B	Medium	No	None	1	2.95	3.14	1 on 3	Light brown very fine sand and silt/clay overlying dark gray silt/clay with light gray silt/clay at depth. Small reduced camera artifact on surface, center. Small tubes in far field and several small shallow burrows at SWI.
10	C	Medium	No	None	1	2.94	7.40	2 on 3	Light brown very fine sand overlying dark gray silt/clay. Several reduced camera artifacts dragged down into sediment column from surface. Small shallow burrows across SWI. Large burrow with oxygenated halo that extends from halfway down sediment column to the bottom of image.
11	A	High	No	None	2	3.55	7.91	2 on 3	Thin layer of light grayish brown fine sand overlying dark gray silt/clay with light gray silt/clay at depth. Some resuspension at the SWI. Small shallow burrows across the SWI. A small void just below the SWI, center and another small void on the far left about three quarters the way down sediment column.
11	B	High	No	None	4	4.99	10.68	2 on 3	Thin layer of light grayish brown fine sand overlying gray silt/clay with streaks of light gray silt clay. Some small reduced camera artifacts on surface. Podocerid amphipod on fecal stack on surface, center. Several small filled voids.
11	C	High	No	None	3	3.20	7.08	2 on 3	Thin layer of light brown very fine sand overlying dark gray silt/clay with some light gray silt/clay at depth. Several small camera artifacts on surface. Podocerid amphipod fecal stacks on surface. Small shallow burrows at the SWI. Large void just below SWI with two filled voids nearby.
12	A	Medium	No	None	2	4.32	6.96	2 on 3	Light gray very fine sand transitioning to darker gray silt/clay overlying light gray very fine sand at depth. SWI slopes down in the center. Small tubes on surface, far field. Large worm half way down sediment column, left. Two small filled voids half way down sediment column on far right.
12	B	Medium	No	None	0	N/A	N/A	2 on 3	Thin layer of light grayish brown fine sand overlying dark gray silt/clay over top of light gray very fine sand at depth. A few large tubes and podocerid amphipod fecal stacks on surface, far field. Several reduced small camera artifacts on surface, center.
12	C	Low	No	None	0	N/A	N/A	2	Light brownish gray very fine sand with band of patchy gray silt/clay, likely reworked DM. Sea star on surface and several podocerid amphipods and fecal stacks on surface, far field. Pile of fecal pellets at SWI, left. A small brown worm half way down sediment column, far left.
13	A	High	No	None	1	0.86	7.21	3	Very thin layer of light grayish brown medium sand overlying dark gray/back silt/clay with a patch of gray silt/clay in lower left. Several large shell fragments (oyster shell) with some bryozoa encrusting one. Burrow on far right extending down into a void which has been filled by some drag down of larger shell fragments.
13	B	High	No	None	1	5.79	8.82	1 on 3	Very thin layer of light grayish brown medium sand overlying dark gray/black silt/clay with a few small patches of light gray silt/clay. Some angular reduced camera artifacts on surface, likely sampling artifact. Small tubes on surface, right far field. Disturbed SWI on far right where a few small burrows are. Large filled void that has a light brown halo on left at depth.
13	D	High	No	None	1	5.06	8.77	1 on 3	Thin layer of light brown medium sand overlying dark gray and black silt/clay with some patches of light gray silt/clay. Several oyster shell fragments on surface and a large reduced camera artifact likely from the camera deposited on surface. A small pink worm below SWI on left. A large void at depth.

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14	A	High	No	None	0	N/A	N/A	2 -> 3	Thin layer of grayish brown medium sand overlying dark gray silt/clay. A few small shell hash at SWI. Small patch of brown silt/clay at depth, left. Large burrow/tunnel in PV pair.
14	B	High	No	None	1	1.85	4.13	1 on 3	Dark gray/black silt/clay throughout. Very thin layer of oxidized sand on surface, far field. Several angular reduced camera artifacts that are likely sampling artifacts. A large void just below the SWI, partially filled.
14	D	High	No	None	0	N/A	N/A	1 on 3	Thin layer of light brown medium sand transitioning to light brownish gray very fine sand overlying dark gray silt/clay. Tube fragment on surface, left, far field. Small white worm at depth, left surrounded by light brown silt/clay.
15	A	High	No	None	1	3.53	8.09	2 on 3	Mottled light gray to near black clay with very thin layer of recently deposited sands at SWI. Many large shell fragments and small gravels at SWI. Long vertical burrow void transected to left of image center, infauna visible to left of void. Large dragdown area where shell hash been pushed into sediment column. Metal tube at left edge of SWI, above shell.
15	B	High	No	None	2	4.98	8.31	1 on 3	Thin layer of light brown fine sand overlying mottled gray and near black silt/clay. Small shell fragment on surface. Horizontal void at depth, that may be a sampling artifact.
15	D	High	No	None	1	4.85	5.36	3	Thin layer of grayish brown medium sand that extends deeper into the sediment column in center, overlying mottled near black and gray silt/clay. Some shell hash and small reduced camera artifacts across surface. Small filled void about halfway down sediment column on far right. Worm in center at depth.
16	A	IND	No	None	0	IND	IND	IND	No penetration. Coarse to very coarse pebbles encrusted with bryozoa and barnacles. Some resuspension into the water column.
16	B	IND	IND	None	0	IND	IND	IND	No penetration.
16	C	IND	No	None	0	IND	IND	IND	Very little penetration. Coarse to very coarse pebbles encrusted by bryozoa and barnacles overlying fine sand.
17	A	Medium	No	None	0	N/A	N/A	2	Grayish brown medium sand with small shell hash overlying dark gray and black silt/clay. Medium and coarse pebbles on surface encrusted with some bryozoa and barnacles, including grazed barnacles. Large burrow exaggerated by some drag down from the surface on the far left. Some smaller shallow burrows at the SWI, center. A small worm on far right about half way down the sediment column.
17	B	Medium	No	None	0	N/A	N/A	IND	Disturbed SWI, with a pebble dragged down on left. Medium and coarse pebbles on surface encrusted with bryozoa and barnacles overlying gray and dark gray fine sand. Numerous small shell fragments and shell hash.
17	C	Medium	No	None	0	N/A	N/A	2	Grayish brown fine sand overlying gray very fine sand. Several medium and coarse pebbles on surface, encrusted with bryozoa and barnacles. SWI is disturbed on far right with coarse material dragged down through sediment column.
18	A	IND	No	None	0	IND	IND	IND	Minimal penetration. Coarse pebbles encrusted with bryozoa and barnacles over top of grayish brown fine sand.
18	B	IND	No	None	0	IND	IND	IND	Minimal penetration. Medium and fine pebbles, some encrusted with bryozoa and barnacles, over top of grayish brown very fine sand.
18	C	IND	No	None	0	IND	IND	IND	Minimal penetration. Medium and fine pebbles, some encrusted with bryozoa and barnacles, over top of grayish brown very fine sand.
19	A	High	No	None	0	N/A	N/A	2 -> 3	Very thin layer of light brown fine sand overlying mottled near black and light gray silt/clay. Gravel encrusted with barnacles in center, far field. Deep burrow from SWI with a worm on far left. Burrow sin PV pair.
19	C	High	No	None	0	N/A	N/A	1	Very thin layer of light brown fine sand overlying mottled near black, light gray, and light brown silt/clay. A few small gravel and reduced camera artifacts on surface, far field. Burrow on far left from SWI leading through the light brown silt/clay at depth.
19	D	High	No	None	1	2.42	9.36	1 on 3	Very thin layer of light brown fine sand overlying nearly black silt/clay with a large patch of light gray silt/clay just below SWI, right. Large reduced camera artifact on surface, center. Small tubes on surface, far field, left. Very large void that extends from just below the SWI to bottom of image.
20	A	Medium	No	None	1	7.30	8.69	2 on 3	Light brown medium sand overlying dark gray silt/clay. Medium sand extends deep into the sediment column in the center. Tube fragment and small shell hash on surface. Void in lower left.
20	B	High	No	None	0	N/A	N/A	2 -> 3	Light brown medium sand over top of dark gray silt/clay with streaks of light gray silt/clay. A few small gravels encrusted with barnacles and bryozoa on surface, far field. Some small burrows at SWI, left, with a deeper narrow burrow extending half way down sediment column on far left. Burrows in PV pair.

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20	C	High	No	None	1	3.52	6.00	2 on 3	Large deposits of angular camera artifacts on sediment surface and likely some dragged into sediment column from camera. Thin layer of light brown medium sand overlying dark black silt/clay. Podocerid amphipod fecal stack on surface, right far field. Small shell fragment on left. Large void half way down sediment column, center left.
21	A	High	No	None	1	2.20	2.68	1 on 3	Thin layer of light brown fine sand transitioning to dark gray silt/clay with streaks of light brown vary fine sand. Some small shell fragments and small gravel on surface, far field. Small shallow burrows at the SWI and a very small void in the center just below the SWI.
21	C	High	No	None	1	8.20	10.44	1 on 3	Angular camera artifact on surface and some dark black silt/clay dragged into sediment column off prism at surface, center. Thin layer of light brown fine sand overlying gray silt/clay with a patch of light gray silt/clay at depth, right. Large void in lower right corner.
21	D	High	No	None	0	N/A	N/A	2	Thin layer of light brown fine sand transitioning to light gray and dark gray silt/clay. Small tubes on surface. Divot in SWI, right.
REF-E-01	A	Low	No	None	0	N/A	N/A	2 -> 3	Light brown very fine sand transitioning to light gray very fine sand with streaks of darker gray and white silt/clay at depth. Two podocerid amphipod fecal stacks on surface. Several small tubes on surface. Numerous small shallow burrows just below the SWI. A small worm half way down the sediment column, center, right. Burrows in PV pair.
REF-E-01	B	Low	No	None	2	5.67	16.72	1 on 3	Light tan silt/clay overlying dark gray and black silt/clay beginning about half way down the sediment column. Some light gray silt/clay at depth, right. Very small shallow burrows at the SWI. Very small brown worm half way down sediment column, left, below is a large filled void. A large brown and white polychaete half way down on right and another below that on the left next to a large void.
REF-E-01	D	Low	No	None	1	10.69	11.82	2 on 3	Light tan very fine sand transitioning to light gray very fine sand with patches of dark gray and small streaks of white silt/clay. A few podocerid amphipod fecal stacks on surface. Very small shallow burrows just below SWI. Large pick worm half way down sediment column, center. Narrow brown worm to its left. Void at depth, left center.
REF-E-02	A	Low	No	None	2	4.61	6.08	2 on 3	Light brown very fine sand transitioning to light gray very fine sand with streaks of dark gray and black silt/clay at depth. Numerous small shallow burrows just below the SWI and a few tubes on surface. Two small voids just above the transition to darker gray sediment.
REF-E-02	B	Low	No	None	0	N/A	N/A	2 -> 3	Light brown very fine sand transitioning to light grayish brown very fine sand and silt/clay at depth. Numerous small burrows at SWI and a few small tubes on surface, middle. Two small brown worms about half way down sediment column, center left. Burrows in PV pair.
REF-E-02	C	Low	No	None	1	14.74	16.33	2 on 3	Light tan silt/clay transitioning to light grayish brown very fine sand overlying dark gray very fine sand at depth. Small fecal pellets deposited across SWI, center. Numerous small shallow burrows below SWI. Small void in lower left corner.
REF-E-03	A	Low	No	None	3	11.16	15.41	2 on 3	Light brown very fine sand transitioning to light grayish brown very fine sand with streaks of darker gray very fine sand. SWI slopes up to the left. A few small tubes on surface. Numerous small shallow burrows just below SWI. Three large voids in lower left corner.
REF-E-03	B	Low	No	None	1	4.61	5.33	2 on 3	Light brown very fine sand overlying light gray very fine sand and silt/clay at depth. Numerous small tubes, amphipods, and podocerid fecal stacks across surface. Small shallow burrows just below the SWI with a larger, deeper burrow below SWI on right. Small filled void at the transition to gray sediment on right.
REF-E-03	C	Low	No	None	1	8.57	9.96	2 on 3	Light brown fine sand overlying light brown very fine sand transitioning to light grayish brown very fine sand and darker gray very fine sand at depth. Small tubes on surface. Small shallow burrows just below the SWI with a layer of fecal pellets across the SWI, right. Small filled void half way down, center.
REF-E-04	A	Low	No	None	2	13.89	15.22	2 on 3	Light brown fine sand transitioning to light grayish brown very fine sand overlying gray very fine sand and silt/clay at depth. Several podocerid amphipods on fecal stacks on surface. Small shallow burrows just below the SWI. Small brown worm a quarter of the way down on far right. Large pink worm at depth, left. Two small voids in center at depth.

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StationID	Replicate	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage	Comment
REF-E-04	B	Low	No	None	2	5.93	13.85	2 on 3	Light brown fine sand overlying light brownish gray very fine sand followed by gray very fine sand with streaks of darker gray very fine sand. Small shallow burrows at the SWI. A small brown worm just below SWI, left. A brownish red worm in middle of sediment column, center. Small filled void on far right. A large void filled with light brown silt/clay on far left extending to bottom of the sediment column.
REF-E-04	C	Low	No	None	0	N/A	N/A	2 on 3	Light brown very fine sand overlying grayish brown very fine sand transitioning to light gray very fine sand at depth. Small divot in SWI on far right. Small tubes and podocerid amphipod tubes on surface. Small shallow burrows just below the SWI. Large pink worm near the bottom in center.
REF-E-05	A	Low	No	None	4	3.35	15.47	2 on 3	Light brown silt/clay mixed with very fine sand overlying dark gray silt/clay. Extensive small burrows across SWI. Large void just below the SWI, center. Three more smaller voids in the center about mid way down the sediment column. A narrow brown worm halfway down the sediment column, center.
REF-E-05	B	Low	No	None	2	4.45	15.14	1 on 3	Light brown very fine sand overlying light gray very fine sand and darker gray very fine sand and silt/clay at depth. Small shallow burrows across the SWI with some fecal pellets deposited on surface, right. Infilled voids deep in sediment column. Partially visible infauna at center left of penetration area.
REF-E-05	C	Low	No	None	0	N/A	N/A	2	Light brown very fine sand with streaks of dark gray very fine sand transitioning to light grayish brown very fine sand overlying dark gray very fine sand and silt/clay at depth. Small shallow burrows at SWI with a small divot in the SWI, left.
REF-NE-01	A	Low	No	None	0	N/A	N/A	2 -> 3	Light brown fine sand with some light brown and gray very fine sand. Small tubes on surface, center. An amphipod in water column just above SWI. Burrows in PV pair.
REF-NE-01	B	Low	No	None	1	6.96	7.34	1 on 3	Light brown medium sand with some patches of light gray silt/clay. Significant resuspension of fines into the water column. Small white worm just below SWI, center. A small void in lower right corner.
REF-NE-01	D	Low	No	None	1	5.73	6.01	1 on 3	Light brown medium sand, some gray very fine sand and silt/clay mixed in at depth. Small tubes at SWI center. Small void at depth, center; a small worm to the left of it.
REF-NE-02	A	Low	No	None	0	N/A	N/A	2 -> 3	Shallow penetration. Light grayish brown fine sand with some gray silt/clay at SWI, right. Small tubes and small white shell fragments on surface, far field. Burrows in PV pair.
REF-NE-02	C	Low	No	None	0	N/A	N/A	2	Very shallow penetration. Brown fine sand mixed with gray silt/clay on right. A few large shells on surface, left far field. Several small pieces of shell hash on surface and sediment column, left. Few fecal pellets and tube fragments at SWI.
REF-NE-02	D	Low	No	None	0	N/A	N/A	2 -> 3	Light brown fine sand with some patches of gray very fine sand on left. Small tubes on surface, far field. Burrows in PV pair.
REF-NE-03	A	Low	No	None	0	N/A	N/A	2 -> 3	Light grayish brown fine sand transitioning to very fine sand with streaks of light gray silt/clay. Small tubes on surface, far field. Burrows in PV pair.
REF-NE-03	B	Low	No	None	0	N/A	N/A	2	Light grayish brown fine sand transitioning to light grayish brown very fine sand with some streaks of silt/clay. Small tubes on surface, right far field.
REF-NE-03	C	Low	No	None	0	N/A	N/A	2 -> 3	Shallow penetration. Light grayish brown fine sand with some streaks of light gray silt/clay. Small tubes on surface, far field. Small shallow burrow at SWI, right. Burrows in PV pair.
REF-NE-04	A	Low	No	None	0	N/A	N/A	2 -> 3	Reddish-brown sand throughout with some small streaks of gray silt/clay. Several light gray flocs on surface. A few small shell fragments on surface, far field and in sediment column. Burrows in PV pair.
REF-NE-04	B	Low	No	None	0	N/A	N/A	2	Rusty light brown fine sand throughout. Several small gray sediment flocs on surface, far field. A few podocerid fecal stacks on surface, far field.
REF-NE-04	C	Low	No	None	0	N/A	N/A	2 -> 3	Shallow penetration. Rusty light brown fine sand with some streaks of light gray very fine sand. So Burrows in PV pair.me resuspension of fines into the water column.
REF-NE-05	A	Low	No	None	0	N/A	N/A	2 -> 3	Significant resuspension of fines into the water column. Light grayish brown fine sand with some light gray very fine sand on left. Small tubes on surface. Burrows in PV pair.
REF-NE-05	C	Low	No	None	0	N/A	N/A	2	Very shallow penetration. Light gray fine sand with a patch of gray very fine sand and silt/clay in center. Burrow at SWI, far left and another in the center. Some small tubes on surface.
REF-NE-05	D	Low	No	None	0	N/A	N/A	2 -> 3	Shallow penetration and some resuspension. Light gray fine sand with some streaks of gray very fine sand on left. Small sediment flocs on surface, far field. Tube on surface, left far field. Small white worm just below SWI, center. Burrows in PV pair.
REF-SW-01	A	Low	No	None	0	N/A	N/A	2 -> 3	Light grayish brown very fine sand throughout. Numerous tubes and fecal stacks from podocerid amphipods across surface, far field. A small pebble on surface, center. Burrows in PV pair.

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StationID	Replicate	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage	Comment
REF-SW-01	B	Low	No	None	0	N/A	N/A	2	Light brown very fine sand, some shell hash at depth and a patch of darker brown very fine sand in lower left corner. Several fecal stacks from podocerid amphipods on surface, far field. Some small tubes on surface, far field.
REF-SW-01	C	Low	No	None	0	N/A	N/A	2	Light brown very fine sand throughout. Numerous podocerid amphipod fecal stacks on surface, far field. An isopod on surface, center far field next to small white shell fragment. Small brown worm on left a quarter the way down sediment column.
REF-SW-02	A	Low	No	None	0	N/A	N/A	2 -> 3	Light brown fine sand transitioning to light grayish brown very fine sand overlying darker gray very fine sand. Numerous podocerid amphipods and associated fecal stacks on surface. Some small shallow burrows just below SWI, left. Burrows in PV pair.
REF-SW-02	B	Low	No	None	0	N/A	N/A	2	Light brown very fine sand transitioning to light gray very fine sand with streaks of darker gray very fine sand at depth. Numerous tubes and podocerid amphipods and associated fecal stacks on surface. A few buried podocerid fecal stacks just below SWI, center and left. Possible worm near the bottom of sediment column on far left.
REF-SW-02	D	Low	No	None	1	5.50	6.62	2 on 3	Light brown very fine sand with light gray very fine sand at depth. Numerous podocerid amphipods and fecal stacks across surface. Numerous tubes ono surface, left far field. Some small shallow burrows just below SWI. Small void half way down the sediment column, center.
REF-SW-03	A	Low	No	None	0	N/A	N/A	2 on 3	Light brown fine sand with streaks of gray very fine sand and silt/clay. Several podocerid amphipod fecal stacks and small tubes on surface, far field. Dark brown worm half way down sediment column, center.
REF-SW-03	B	Low	No	None	1	4.37	4.70	2 on 3	Light brown fine sand with streaks of light gray very fine sand and silt/clay. Some small tubes and podocerid amphipod fecal stacks on surface, far field. Small void at depth, left.
REF-SW-03	C	Low	No	None	0	N/A	N/A	2 -> 3	Light brown fine sand with some streaks of light gray silt/clay. Sediment flocs across the surface and several podocerid amphipods and associated fecal stacks on surface, far field. Burrows in PV pair.
REF-SW-04	A	Low	No	None	0	N/A	N/A	2 -> 3	Light brown fine sand transitioning to light gray fine sand overlying darker gray very fine sand at depth. Numerous tubes and podocerid amphipods and associated fecal stacks across surface. Small amphipod dragged down just below SWI, center. Burrows in PV pair.
REF-SW-04	B	Low	No	None	0	N/A	N/A	2	Shallow layer of light brown fine sand transiting to light brown very fine sand overlying gray very fine sand and silt/clay at depth. Many podocerid amphipods on top of associated fecal stacks on surface, far field.
REF-SW-04	C	Low	No	None	1	3.59	3.81	2 on 3	Light brown very fine sand with light gray very fine sand at depth. Several podocerid amphipods on fecal stacks on surface, far field. Small void a third of the way down sediment column, center. A reddish brown worm at depth, right.
REF-SW-05	B	Low	No	None	0	N/A	N/A	2 on 3	Light brown fine sand throughout. Several tubes and podocerid amphipod and fecal stacks on surface, far field. Small light brown worm half way down sediment column, left. A large pinkish brown worm at depth, far right.
REF-SW-05	C	Low	No	None	0	N/A	N/A	2 -> 3	Homogenous light brown fine sand with a patch of light brown silt/clay at SWI, center. Several podocerid amphipod fecal stacks on surface, far field. Unidentifiable organism on surface, left far field. Burrows in PV pair.
REF-SW-05	D	Low	No	None	0	N/A	N/A	2 -> 3	Homogenous light brown fine sand with some traces of grayish brown very fine sand at depth. Tubes and podocerid amphipods on fecal stacks on surface, far field. Burrows in PV pair.

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APPENDIX E

PLAN VIEW IMAGE ANALYSIS RESULTS and PLAN VIEW HARD SUBSTRATE IMAGE ANALYSIS RESULTS

Notes:

IND=Indeterminate
N/A=Not Applicable
SAV=Submerged Aquatic Vegetation

Category	StationID	Replicate	Water Depth (ft)	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Bedforms	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?	Dredged Material Notes	Debris	Tubes	Burrows	Tracks
Disposal	01	A	125	5/6/2020	6:21:20	72.49	48.33	0.35	Sand or finer	Oxidized	Ripples	No	IND	No		No	Yes	No	Yes
Disposal	01	C	125	5/6/2020	6:23:12	IND	IND	IND	Sand or finer	Oxidized	Ripples	No	IND	No		No	IND	IND	IND
Disposal	01	D	125	5/6/2020	6:24:09	79.35	52.90	0.42	Sand or finer	Oxidized	Ripples	No	IND	No		No	Yes	No	Yes
Disposal	02	A	120	5/6/2020	5:57:41	76.43	50.96	0.39	Sand	Oxidized	Small ripples	No	IND	No		No	No	Yes	Yes
Disposal	02	B	120	5/6/2020	5:58:45	73.72	49.15	0.36	Sand	Oxidized	None	No	IND	No		No	No	Yes	Yes
Disposal	02	C	120	5/6/2020	5:59:44	70.62	47.08	0.33	Sand	Oxidized	None	No	IND	No		No	No	Yes	Yes
Disposal	03	A	98	5/6/2020	6:10:37	73.17	48.78	0.36	Gravels	Oxidized	None	No	IND	Yes	Cobble and boulder sized gravel pavement	No	No	No	No
Disposal	03	C	98	5/6/2020	6:12:30	69.33	46.22	0.32	Gravels	Oxidized	None	No	IND	Yes	Cobble and boulder sized gravel pavement	Yes	No	No	No
Disposal	03	D	98	5/6/2020	6:13:29	68.87	45.92	0.32	Gravels	Oxidized	None	No	IND	Yes	Cobble and boulder sized gravel pavement	No	No	No	No
Disposal	04	A	127	5/6/2020	8:40:05	72.12	48.08	0.35	Shelly sand	Oxidized	Small ripples	No	IND	No		No	Yes	No	No
Disposal	04	B	127	5/6/2020	8:41:00	83.69	55.79	0.47	Sand or finer	Oxidized	Small ripples	No	IND	No		Yes	Yes	Yes	Yes
Disposal	04	C	127	5/6/2020	8:41:58	80.70	53.80	0.43	Shelly sand	Oxidized	None	No	IND	No		No	No	Yes	No
Disposal	05	A	126	5/6/2020	8:35:25	74.78	49.86	0.37	Sand or finer	Oxidized	Small ripples	No	IND	No		No	Yes	Yes	Yes
Disposal	05	C	126	5/6/2020	8:37:18	IND	IND	IND	IND	Oxidized	IND	No	None	IND	IND	IND	IND	IND	IND
Disposal	05	D	126	5/6/2020	8:38:16	73.21	48.80	0.36	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	Yes
Disposal	06	A	127	5/6/2020	8:24:01	72.80	48.53	0.35	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	No	Yes
Disposal	06	B	127	5/6/2020	8:24:56	68.48	45.65	0.31	Sand or finer	Oxidized	None	No	None	No		No	Yes	No	Yes
Disposal	06	E	125	5/6/2020	10:09:45	77.30	51.54	0.40	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	07	A	124	5/6/2020	8:57:53	76.06	50.71	0.39	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	07	B	124	5/6/2020	8:58:47	IND	IND	IND	Sand or finer	Oxidized	Small ripples	No	None	No		No	IND	IND	IND
Disposal	07	C	124	5/6/2020	8:59:45	77.38	51.59	0.40	Sand or finer	Oxidized	Small ripples	No	None	No		No	No	Yes	No
Disposal	08	A	126	5/6/2020	9:05:47	67.53	45.02	0.30	Sand or finer	Oxidized	Ripples	No	None	No		No	No	Yes	Yes
Disposal	08	B	126	5/6/2020	9:06:44	65.00	43.33	0.28	Sand or finer	Oxidized	None	No	None	No		No	No	No	No
Disposal	09	A	124	5/6/2020	8:51:08	75.47	50.31	0.38	Sand or finer	Oxidized	None	No	None	Yes	Oyster Shells	No	Yes	Yes	Yes

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Bedforms	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?	Dredged Material Notes	Debris	Tubes	Burrows	Tracks
Disposal	09	C	124	5/6/2020	8:53:05	75.99	50.66	0.38	Sand or finer	Oxidized	None	No	None	Yes	Concrete fragment at image center surrounded by black clasts.	Yes	Yes	No	No
Disposal	10	A	128	5/6/2020	5:17:05	77.00	51.33	0.40	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	10	B	128	5/6/2020	5:18:03	76.36	50.91	0.39	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	11	A	128	5/6/2020	5:28:27	70.24	46.83	0.33	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	11	B	128	5/6/2020	5:29:19	76.96	51.31	0.39	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	11	C	128	5/6/2020	5:30:17	72.02	48.01	0.35	Sand or finer	Oxidized	None	No	None	No		No	No	Yes	Yes
Disposal	12	A	127	5/6/2020	5:05:57	73.72	49.15	0.36	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	12	B	127	5/6/2020	5:06:52	74.71	49.81	0.37	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	13	A	128	5/6/2020	6:43:45	80.00	53.33	0.43	Sand or finer	>50% Oxidized	Small ripples	No	None	Yes	Cobbles and areas of reduced surface oxidization. Oyster shell.	No	Yes	No	Yes
Disposal	13	B	128	5/6/2020	6:44:41	IND	IND	IND	Sand or finer	Oxidized	Small ripples	No	None	No		No	IND	IND	IND
Disposal	13	D	128	5/6/2020	6:46:31	78.43	52.29	0.41	Sand or finer	Oxidized	None	No	None	Yes	Oyster Shells	No	Yes	No	Yes
Disposal	14	A	126	5/6/2020	6:54:26	78.20	52.13	0.41	Sand or finer	Oxidized	None	No	None	No		No	No	Yes	Yes
Disposal	14	D	126	5/6/2020	6:57:46	73.52	49.01	0.36	Sand or finer	Oxidized	None	No	None	Yes	Gravels and irregularly shaped debris.	Yes	Yes	No	Yes
Disposal	14	E	125	5/6/2020	8:11:14	73.79	49.20	0.36	Sand or finer	Oxidized	Small ripples	No	None	Yes	Gravels and oyster shell	No	No	No	No
Disposal	15	A	128	5/6/2020	6:35:52	76.62	51.08	0.39	Shelly sand	Oxidized	None	No	None	Yes	Gravels and shell fragments including oyster shells	No	No	No	No
Disposal	15	B	128	5/6/2020	6:36:53	IND	IND	IND	Sand or finer	Oxidized	IND	No	None	No		IND	IND	IND	IND
Disposal	15	D	128	5/6/2020	6:39:00	IND	IND	IND	Sand or finer	Oxidized	None	No	None	No		No	No	No	No
Disposal	16	A	130	5/6/2020	7:08:32	76.47	50.98	0.39	Gravels	Oxidized	None	No	None	Yes	Gravel pavement, mostly cobble	No	No	No	No
Disposal	16	B	130	5/6/2020	7:09:46	80.95	53.97	0.44	Gravels	Oxidized	None	No	None	Yes	Gravel pavement, mostly cobble	No	No	No	No

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Bedforms	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?	Dredged Material Notes	Debris	Tubes	Burrows	Tracks
Disposal	16	C	130	5/6/2020	7:10:44	72.36	48.24	0.35	Gravelly sand	Oxidized	Small ripples	No	None	Yes	Gravels and shell fragments	No	No	No	Yes
Disposal	17	A	130	5/6/2020	7:27:44	72.86	48.58	0.35	Gravelly sand	Oxidized	None	No	None	Yes	Gravels and shell fragments	No	Yes	No	Yes
Disposal	17	B	130	5/6/2020	7:28:36	78.51	52.34	0.41	Gravels	Oxidized	None	No	None	Yes	Gravel pavement, mostly cobble	No	No	No	No
Disposal	17	C	130	5/6/2020	7:29:34	75.76	50.51	0.38	Sandy gravel	Oxidized	None	No	None	No		No	No	No	No
Disposal	18	A	130	5/6/2020	7:15:51	77.46	51.64	0.40	Gravels	Oxidized	None	No	None	Yes	Gravel pavement, mostly cobble	No	No	No	No
Disposal	18	B	130	5/6/2020	7:16:51	83.83	55.88	0.47	Gravels	Oxidized	None	No	None	Yes	Gravel pavement, mostly cobble	No	No	No	No
Disposal	18	C	130	5/6/2020	7:17:51	78.95	52.63	0.42	Gravels	Oxidized	None	No	None	Yes	Gravel pavement, mostly cobble	No	No	No	No
Disposal	19	A	126	5/6/2020	9:28:27	71.82	47.88	0.34	Sand or finer	Oxidized	None	No	None	Yes	Cobbles and shell fragments	No	No	Yes	Yes
Disposal	19	C	126	5/6/2020	9:30:49	IND	IND	IND	Sand or finer	Oxidized	IND	No	None	IND		IND	IND	IND	IND
Disposal	19	D	126	5/6/2020	9:31:14	76.51	51.01	0.39	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	20	A	125	5/6/2020	9:23:29	72.19	48.13	0.35	Sand or finer	Oxidized	Small ripples	No	None	No		No	No	Yes	Yes
Disposal	20	B	125	5/6/2020	9:24:24	74.29	49.52	0.37	Gravelly sand	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Disposal	20	C	125	5/6/2020	9:25:19	78.20	52.13	0.41	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	Yes
Disposal	21	A	125	5/6/2020	9:37:15	74.22	49.48	0.37	Sand or finer	Oxidized	None	No	None	No		No	No	Yes	Yes
Disposal	21	C	125	5/6/2020	9:39:16	76.73	51.16	0.39	Sand or finer	Oxidized	Small ripples	No	None	No		No	No	No	No
Disposal	21	D	125	5/6/2020	9:40:11	72.90	48.60	0.35	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	No	Yes
Reference	REF-E-01	A	136	5/6/2020	2:41:10	67.80	45.20	0.31	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-E-01	D	136	5/6/2020	2:43:51	71.10	47.40	0.34	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	No
Reference	REF-E-02	A	136	5/6/2020	2:31:14	68.33	45.55	0.31	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-E-02	B	136	5/6/2020	2:32:06	73.97	49.31	0.36	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-E-02	C	136	5/6/2020	2:33:02	71.53	47.68	0.34	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-E-03	A	135	5/6/2020	3:01:14	73.58	49.06	0.36	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	No

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Bedforms	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?	Dredged Material Notes	Debris	Tubes	Burrows	Tracks
Reference	REF-E-03	B	135	5/6/2020	3:02:08	IND	IND	IND	Sand or finer	Oxidized	None	No	None	No		No	Yes	IND	IND
Reference	REF-E-04	A	135	5/6/2020	2:51:55	73.34	48.90	0.36	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-E-05	A	136	5/6/2020	2:17:42	69.92	46.62	0.33	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-01	A	126	5/6/2020	4:21:43	68.57	45.71	0.31	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-01	B	126	5/6/2020	4:22:38	73.52	49.01	0.36	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-01	C	126	5/6/2020	4:23:33	IND	IND	IND	Sand or finer	Oxidized	None	No	None	No		No	IND	IND	IND
Reference	REF-NE-02	A	125	5/6/2020	4:09:03	64.54	43.03	0.28	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-02	C	125	5/6/2020	4:10:55	IND	IND	IND	Sand or finer	Oxidized	Large ripples	No	None	No		No	IND	IND	IND
Reference	REF-NE-02	D	125	5/6/2020	4:11:48	77.57	51.72	0.40	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-03	A	125	5/6/2020	3:36:50	76.62	51.08	0.39	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-03	C	125	5/6/2020	3:38:49	71.20	47.47	0.34	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	No
Reference	REF-NE-04	A	123	5/6/2020	3:47:47	74.14	49.43	0.37	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-04	B	123	5/6/2020	3:48:40	76.85	51.23	0.39	Sand or finer	Oxidized	None	No	None	No		No	Yes	No	No
Reference	REF-NE-04	C	123	5/6/2020	3:49:39	71.79	47.86	0.34	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	No
Reference	REF-NE-05	A	125	5/6/2020	3:57:23	71.63	47.75	0.34	Sand or finer	Oxidized	Small ripples	No	None	No		No	Yes	Yes	Yes
Reference	REF-NE-05	C	125	5/6/2020	3:59:11	76.55	51.03	0.39	Sand or finer	Oxidized	Ripples	No	None	No		No	Yes	No	Yes
Reference	REF-NE-05	D	125	5/6/2020	4:00:09	72.76	48.51	0.35	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	No
Reference	REF-SW-01	A	128	5/6/2020	1:16:59	72.83	48.55	0.35	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-SW-01	B	128	5/6/2020	1:17:51	IND	IND	IND	Sand or finer	Oxidized	None	No	None	No		No	IND	IND	IND
Reference	REF-SW-02	A	130	5/6/2020	0:55:18	72.93	48.62	0.35	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-SW-02	D	130	5/6/2020	0:58:02	71.96	47.97	0.35	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-SW-03	A	125	5/6/2020	0:33:28	72.19	48.13	0.35	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	No
Reference	REF-SW-03	B	125	5/6/2020	0:34:18	72.26	48.17	0.35	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	No

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Bedforms	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?	Dredged Material Notes	Debris	Tubes	Burrows	Tracks
Reference	REF-SW-03	C	125	5/6/2020	0:35:15	74.53	49.69	0.37	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	No
Reference	REF-SW-04	A	131	5/6/2020	0:43:27	70.18	46.78	0.33	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-SW-04	C	131	5/6/2020	0:45:08	71.07	47.38	0.34	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-SW-05	A	128	5/6/2020	1:04:37	77.04	51.36	0.40	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-SW-05	B	128	5/6/2020	1:06:09	73.41	48.94	0.36	Sand or finer	Oxidized	None	No	None	No		No	Yes	Yes	Yes
Reference	REF-SW-05	D	128	5/6/2020	1:08:03	72.69	48.46	0.35	Sand or finer	Oxidized	IND	No	None	No		No	Yes	Yes	IND

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StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
01	A	None	None	0	Light brown sand with silt/clay on right. Cluster of tubes in upper right corner. Tracks along right side with some shell fragments.
01	C	None	None	0	Turbid water column. Small ripple in upper right corner and lower center. Some small white shell fragments.
01	D	Hermit Crab(s), Snail(s)	None	0	Brown sand with a few larger gravels. Hermit crab in whelk shell in lower right. Small snail near left laser. Tubes and tracks at image center.
02	A	Podocerid Amphipod(s), Shrimp	None	0	Light brown muddy sand with regular small ripples. Extensive small tracks. Numerous small burrows and a few tube fragments. Thin podocerid fecal stacks. Few small shrimp near right laser.
02	B	None	None	0	Light brown muddy sand with extensive small tracks, several small and larger burrows.
02	C	None	None	0	Light brown muddy sand. Numerous small burrows and small tracks.
03	A	Barnacle(s), Bryozoa	None	1	Gravel pavement. Some gravels encrusted in barnacles and bryozoa. Small fish in upper right.
03	C	Barnacle(s), Bryozoa, Hydroids	None	0	Gravel pavement encrusted with bryozoa and some barnacles. Patches of pink hydroids. Small piece of green glass on far right, center.
03	D	Barnacle(s), Bryozoa, Hydroids, Sea Star(s)	None	1	Gravel pavement encrusted with bryozoa and barnacles. Patch of pink hydroids in bottom center. Four large sea stars and a fish.
04	A	Bryozoa	None	0	Fine sand with white shell hash and shell fragments. Small ripples. Few gravels encrusted with bryozoa. Few short tubes.
04	B	None	None	0	Muddy sand with regular ripples and some small shell hash. Tracks and small burrows.
04	C	Bryozoa, Shrimp	None	0	Gravelly sand with many large shell fragments encrusted with bryozoa. Burrows on right and reduced sediment in upper right corner. Small pink shrimp in upper right corner.
05	A	Podocerid Amphipod(s)	None	0	Muddy sand with small ripples. Small tubes and burrows. Large burrow with excavated reduced sediment on far right. Few podocerid fecal stacks
05	C	IND	IND	0	High turbidity. Shell fragments in lower left corner.
05	D	Bryozoa	None	0	Some turbidity. Muddy sand with small ripples and white shell fragments. Small burrows. Bryozoa on small gravel lower center.
06	A	Bryozoa, Shrimp	None	0	Muddy sand with small ripples and extensive small tracks. Many tubes. Divot in lower left corner. Cobble wit bryozoa at lower edge of image. Small shrimp near image center
06	B	Ampelisca Amphipod(s)	None	0	Muddy sand with few small gravels and shell fragments in center and upper right. Many small tubes including ampelisca amphipod tubes.
06	E	Bryozoa	None	0	Muddy sand with faint small ripples and several shell fragments, including two oyster valves. Numerous small burrows.
07	A	None	None	0	Muddy sand with numerous bivalve shells and shell fragments. Small burrows.
07	B	None	None	0	Some turbidity. Muddy sand with small ripples and numerous white shell fragments and shell hash.
07	C	None	None	0	Muddy sand with numerous white shell fragments and shell hash.
08	A	Hermit Crab(s), Shrimp	None	0	Sand with shallow irregular ripples. Several large burrows in lower half. Shrimp and hermit crab above right laser.
08	B	Hermit Crab(s)	None	0	Brown sand with some small gravels and shell fragments.
09	A	Shrimp	None	0	Brown muddy sand with shell hash and shell fragments. Large burrows in upper half and square depression on far left. Few small shrimp in upper right corner of image.

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StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
09	C	Barnacle(s), Shrimp	None	0	Brown muddy sand with some small gravel and concrete fragment encrusted with small barnacles. Large tunnel in upper right corner.
10	A	None	None	0	Light brown muddy sand with numerous small burrows and several large burrows. Large tunnel in upper left. Extensive small tracks across upper right. Two cerianthids.
10	B	Sea Star(s)	None	0	Light brown muddy sand with numerous small burrows and tracks. Sea star and worm along lower border. Cerianthid in right middle.
11	A	Shrimp	None	0	Light brown muddy sand with tracks, small burrows, and tubes. Patch of reduced sediment in lower left, excavated from a tunnel. Shrimp in upper left corner.
11	B	Crab(s), Podocerid Amphipod(s)	None	0	Light brown muddy sand with tracks and small burrows throughout. Reduced sediment in lower right corner. Podocerid amphipod fecal stacks throughout image.
11	C	Podocerid Amphipod(s)	None	0	Light brown muddy sand with numerous small burrows. Tracks in lower left corner. Cerianthid above left laser. Many podocerid amphipod fecal stacks.
12	A	Podocerid Amphipod(s)	None	0	Light brown muddy sand with extensive small tracks and numerous small burrows. Numerous podocerid amphipod fecal stacks. Cerianthid in lower left.
12	B	Podocerid Amphipod(s)	None	0	Light brown muddy sand with numerous small burrows and podocerid amphipod fecal stacks. Two cerianthids in lower middle and one in the upper right corner. Tunnel with excavated reduced sediment in lower left corner.
13	A	Bryozoa, Shrimp	None	0	Muddy sand with large shell fragments including bay scallop and oyster shells. A few gravels encrusted with bryozoa in lower half. Patches of reduced sediment in center, lower middle, and lower right.
13	B	Barnacle(s)	None	0	Some turbidity. Muddy sand with shell fragments and small ripples. Barnacles on small gravel in upper right.
13	D	Bryozoa, Hermit Crab(s)	None	0	Muddy sand with small shell fragments, mainly oyster shells, and a few small gravels encrusted with bryozoa. Hermit crab at far right of image.
14	A	Bryozoa, Podocerid Amphipod(s), Shrimp	None	0	Muddy sand with some small shell fragments. Large tunnel with exposed reduced sediment in upper right. Small pink shrimp below right laser. Gravel with bryozoa growth in lower center.
14	D	Bryozoa, Shrimp	None	0	Muddy sand with small shells and shell hash. Numerous tube fragments. Large tunnel in upper center. A few patches of bryozoa. Large irregular shaped debris above right laser.
14	E	Bryozoa	None	0	Grayish brown sand with shell hash and fragments, including oyster shell. Small gravels with bryozoa. A few large burrows on left and upper right corner.
15	A	Barnacle(s), Bryozoa, Hermit Crab(s)	None	0	Light brown muddy sand overlaid with small gravels and shell fragments. Orange encrusting bryozoa, barnacles, and branching bryozoa. Small hermit crab in upper right, cerianthid in lower center.
15	B	IND	None	0	High turbidity. Small shell fragments.
15	D	None	None	0	Some turbidity. Muddy sand with numerous shell fragments and hash.
16	A	Barnacle(s), Bryozoa, Crab(s)	None	0	Small gravels encrusted with branching bryozoa and barnacles. Large crab buried just below left laser.
16	B	Barnacle(s), Bryozoa	None	0	Small gravels encrusted with branching bryozoa and barnacles on muddy sand.

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StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
16	C	Barnacle(s), Bryozoa, Podocerid Amphipod(s), Shrimp	None	0	Muddy sand with small gravels encrusted with bryozoa, barnacles, and grazed barnacles. Few podocerid amphipod fecal stacks along upper edge. Small shrimp in lower left and upper right.
17	A	Barnacle(s), Bryozoa, Podocerid Amphipod(s), Shrimp	None	0	Muddy sand with small gravels and shell fragments. Branching bryozoa, orange encrusting bryozoa, and barnacles.
17	B	Barnacle(s), Bryozoa	None	0	Small gravels over muddy sand. Branching and orange encrusting bryozoa
17	C	Barnacle(s), Bryozoa	None	0	Small gravels over muddy sand encrusted with bryozoa and barnacles.
18	A	Barnacle(s), Bryozoa, Crab(s)	None	0	Small gravel encrusted with branching bryozoa and barnacles. Crab in the upper left and lower left corners.
18	B	Barnacle(s), Bryozoa, Sponge	None	0	Small gravel with branching and orange encrusting bryozoa, barnacles over muddy sand. Brownish yellow sponge above left laser.
18	C	Anemone(s), Barnacle(s), Bryozoa	None	0	Small gravel with bryozoa and barnacle growth over muddy sand. Two retracted anemones between the laser and another in the upper right corner.
19	A	Barnacle(s), Bryozoa	None	0	Light brown sand with large shell fragments and several large gravels with bryozoa and barnacle growth.
19	C	IND	None	0	Significant turbidity. Fine sand with numerous shell fragments.
19	D	Bryozoa, Podocerid Amphipod(s)	None	0	Light brown sand with some small gravel and shell fragments. Small burrows and some tubes. Cluster of reduced sediment in lower right corner. Some bryozoa on small gravel.
20	A	Bryozoa, Hermit Crab(s)	None	0	Light brown sand with small shell fragments and small gravel. Small ripples. Patches of reduced sediment on left. Bryozoa growth on small gravel. Single burrow in lower right corner.
20	B	Barnacle(s), Bryozoa	None	0	Light brown sand with shell hash and small gravel encrusted with bryozoa and barnacles.
20	C	None	None	0	Light brown sand with small ripples and small shell fragments. Several small burrows and small tube fragments.
21	A	None	None	0	Light brown sand with small white shell hash. Large burrow below left laser. Several small burrows and tracks.
21	C	None	None	0	Light brown sand with small ripples. Reduced camera artifacts above right laser and another in lower left corner.
21	D	Ampelisca Amphipod(s), Podocerid Amphipod(s)	None	0	Light brown sand with small faint ripples. Many tubes, mostly ampelisca amphipods. Podocerid amphipod fecal stacks throughout image.
REF-E-01	A	Podocerid Amphipod(s)	None	0	Muddy sand with numerous small burrows, tubes, and tracks. Podocerid amphipod fecal stacks.
REF-E-01	D	Crab, Shrimp	None	0	Muddy sand with small tubes and burrows. Several larger burrows near right laser. Cerianthid below lasers. Shrimp above right laser and a crab in upper center.
REF-E-02	A	Sea Star(s)	None	0	Muddy sand with numerous small burrows. Cerianthid below right laser and two buried sea stars near right laser.
REF-E-02	B	None	None	0	Muddy sand with large track through center up to upper right corner. Several small and large burrows.
REF-E-02	C	None	None	0	Muddy sand with extensive tracks. Large burrow on far left and several smaller burrows throughout.
REF-E-03	A	Sea Star(s)	None	0	Muddy sand carpeted with small tubes. Large tunnel near left laser. Cerianthid next to right laser. Sea star in upper center.

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StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
REF-E-03	B	IND	None	0	High turbidity. Muddy sand with numerous small tubes
REF-E-04	A	Podocerid Amphipod(s)	None	0	Muddy sand with numerous podocerid amphipod fecal stacks. Extensive small tracks and small burrows throughout. Cerianthid in lower left, above left laser, two to the right of right laser, and one in lower right corner.
REF-E-05	A	Sea Star(s)	None	0	Muddy sand with extensive small tracks. Several large burrows. Several cerianthids. Sea star next to left laser.
REF-NE-01	A	Bryozoa	None	0	Light brown sand with numerous small burrow and tubes. Bryozoa colony next to left laser.
REF-NE-01	B	Shrimp	None	0	Light brown sand with numerous small tubes and burrows. Shrimp in upper right corner.
REF-NE-01	C	Sea Star(s)	None	0	High turbidity. Sand with burrows. Sea star in center.
REF-NE-02	A	Shrimp	None	0	Sand with numerous burrows and tubes. Small faint ripples. Shrimp below left laser.
REF-NE-02	C	IND	None	0	High turbidity. Sand with shell hash and a large ripple.
REF-NE-02	D	None	None	0	Muddy sand with numerous small burrows and tubes, tracks through the center. Small faint sand ripples.
REF-NE-03	A	None	None	0	Sand with irregular small ripples. Numerous small and large burrows and small tubes.
REF-NE-03	C	None	None	0	Sand with irregular small ripples/hummocks. Numerous small burrows and tubes.
REF-NE-04	A	Shrimp	None	0	Sand with some small tubes and tracks. Shrimp below left laser and in lower left corner.
REF-NE-04	B	None	None	0	Some turbidity. Sand with many tubes.
REF-NE-04	C	Ampelisca Amphipod(s)	None	0	Some turbidity. Sand with many tubes. Few ampelisca tubes.
REF-NE-05	A	None	None	0	Muddy sand with irregular small ripples. Numerous small tubes and burrows. Clam shell in upper center.
REF-NE-05	C	Bryozoa	None	0	Sand with several small gravels. Bryozoa growth on gravel in upper and lower left corner and lower right corner.
REF-NE-05	D	None	None	0	Some turbidity. Pale brown sand. Many tubes and small burrows.
REF-SW-01	A	Crab, Podocerid Amphipod(s), Shrimp(s)	None	0	Muddy sand with numerous small tubes, burrows, and podocerid amphipod fecal stacks. Large crab between lasers and shrimp below left laser.
REF-SW-01	B	IND	None	0	High turbidity. Muddy sand.
REF-SW-02	A	Ampelisca Amphipod(s), Podocerid Amphipod(s)	None	0	Muddy sand with small tubes and numerous podocerid amphipod fecal stacks and ampelisca tubes. Cerianthid to other left of the left laser and sabellid worm below left laser.
REF-SW-02	D	Ampelisca Amphipod(s), Podocerid Amphipod(s), Shrimp(s)	None	0	Muddy sand with numerous tubes and burrows. Sabellid worm above left laser. Shrimp in lower center. Numerous podocerid amphipod fecal stacks. Ampelisca tubes, especially visible along lower edge.
REF-SW-03	A	Podocerid Amphipod(s), Shrimp(s)	None	0	Muddy sand with numerous small tubes and some burrows. Some podocerid amphipod fecal stacks. Shrimp above lasers.
REF-SW-03	B	Podocerid Amphipod(s)	None	0	Some turbidity. Muddy sand with numerous small tubes and some burrows. Some podocerid amphipod fecal stacks.

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StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
REF-SW-03	C	Podocerid Amphipod(s)	None	0	Muddy sand with dense tubes and some burrows. Many podocerid amphipod fecal stacks.
REF-SW-04	A	Podocerid Amphipod(s)	None	0	Muddy sand with extensive tracks down right side and across lower half. High density of podocerid amphipod fecal stacks and some burrows and tubes. Several cerianthids and a few sabellid worms.
REF-SW-04	C	Podocerid Amphipod(s)	None	0	Muddy sand with tracks across upper right corner. High density of podocerid fecal stacks and tubes. Sabellid worm to the left of right laser and on far right.
REF-SW-05	A	Podocerid Amphipod(s), Shrimp(s)	None	0	Muddy sand with high density of podocerid amphipod fecal stacks and tubes. Some larger burrows on left. Shrimp above left laser as well as a sabellid worm.
REF-SW-05	B	Podocerid Amphipod(s)	None	0	Muddy sand with small ripples in upper left. Many small tubes and burrows, some podocerid amphipod fecal stacks.
REF-SW-05	D	IND	None	0	High turbidity. Muddy sand with high density of tubes and burrows.

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Substrate Group	Substrate Subgroup	Maximum Gravel Size Category	Degree of Sorting	Biogenic Structure Type	Percent Cover of All Attached Fauna	Percent Cover of Macroalgae and/or SAV	Coastal Shell Notes
Disposal	01	A	125	5/6/2020	6:21:20	72.49	48.33	0.35	Sand	Sand	Pebble/Granule	N/A	None	None	None	
Disposal	01	C	125	5/6/2020	6:23:12	IND	IND	IND	Sand	Sand	Pebble/Granule	N/A	None	None	None	
Disposal	01	D	125	5/6/2020	6:24:09	79.35	52.90	0.42	Sand	Sand	Pebble/Granule	N/A	Bryozoa/Hydroids	Trace (<1%)	None	
Disposal	03	A	98	5/6/2020	6:10:37	73.17	48.78	0.36	Gravel	Pebble/Granule	Cobble	Moderately Sorted	Bryozoa/Hydroids	Sparse (1 to <30%)	None	
Disposal	03	C	98	5/6/2020	6:12:30	69.33	46.22	0.32	Gravel	Cobble	Cobble	Poorly Sorted	Bryozoa/Hydroids	Moderate (30 to < 70%)	None	
Disposal	03	D	98	5/6/2020	6:13:29	68.87	45.92	0.32	Gravel	Cobble	Cobble	Poorly Sorted	Bryozoa/Hydroids	Moderate (30 to < 70%)	None	
Disposal	04	A	127	5/6/2020	8:40:05	72.12	48.08	0.35	Gravelly	Gravelly Sand	Pebble/Granule	Moderately Sorted	Bryozoa/Hydroids	Trace (<1%)	None	Shell fragments
Disposal	04	B	127	5/6/2020	8:41:00	83.69	55.79	0.47	Sand	Sand	N/A	N/A	None	None	None	
Disposal	04	C	127	5/6/2020	8:41:58	80.70	53.80	0.43	Gravel Mixes	Mixed Sediment	Cobble	Poorly Sorted	Bryozoa/Hydroids	Sparse (1 to <30%)	None	Shell fragments
Disposal	05	A	126	5/6/2020	8:35:25	74.78	49.86	0.37	Sand	Sand	N/A	N/A	None	None	None	
Disposal	05	C	126	5/6/2020	8:37:18	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	
Disposal	05	D	126	5/6/2020	8:38:16	73.21	48.80	0.36	Sand	Sand	Pebble/Granule	N/A	Bryozoa/Hydroids	Trace (<1%)	None	
Disposal	06	A	127	5/6/2020	8:24:01	72.80	48.53	0.35	Sand	Sand	Cobble	N/A	Bryozoa/Hydroids	Trace (<1%)	None	
Disposal	06	B	127	5/6/2020	8:24:56	68.48	45.65	0.31	Sand	Sand	Pebble/Granule	N/A	None	Trace (<1%)	None	Oyster shell(s)
Disposal	06	E	125	5/6/2020	10:09:45	77.30	51.54	0.40	Sand	Sand	Pebble/Granule	N/A	Bryozoa/Hydroids	Trace (<1%)	None	Oyster shell(s)
Disposal	09	A	124	5/6/2020	8:51:08	75.47	50.31	0.38	Sand	Sand	N/A	N/A	None	None	None	Clam shell(s), Oyster shell(s)
Disposal	09	C	124	5/6/2020	8:53:05	75.99	50.66	0.38	Gravelly	Gravelly Sand	Cobble	Moderately Sorted	None	Trace (<1%)	None	
Disposal	13	A	128	5/6/2020	6:43:45	80.00	53.33	0.43	Gravelly	Gravelly Sand	Cobble	Moderately Sorted	Bryozoa/Hydroids	Trace (<1%)	None	Bay Scallop shell(s), Oyster shell(s)
Disposal	13	B	128	5/6/2020	6:44:41	IND	IND	IND	Sand	Sand	IND	N/A	None	None	None	Shell fragments
Disposal	13	D	128	5/6/2020	6:46:31	78.43	52.29	0.41	Gravelly	Gravelly Sand	Cobble	Well Sorted	Bryozoa/Hydroids	Trace (<1%)	None	Oyster shell(s)
Disposal	14	A	126	5/6/2020	6:54:26	78.20	52.13	0.41	Sand	Sand	Pebble/Granule	N/A	Bryozoa/Hydroids	Trace (<1%)	None	
Disposal	14	D	126	5/6/2020	6:57:46	73.52	49.01	0.36	Sand	Sand	Cobble	N/A	Bryozoa/Hydroids	Trace (<1%)	None	Clam shell(s)
Disposal	14	E	125	5/6/2020	8:11:14	73.79	49.20	0.36	Sand	Sand	Cobble	N/A	Bryozoa/Hydroids	Trace (<1%)	None	Oyster shell(s)
Disposal	15	A	128	5/6/2020	6:35:52	76.62	51.08	0.39	Gravelly	Gravelly Sand	Pebble/Granule	Well Sorted	Bryozoa/Hydroids	Trace (<1%)	None	Oyster shell(s)
Disposal	15	B	128	5/6/2020	6:36:53	IND	IND	IND	Sand	Sand	IND	N/A	IND	IND	IND	Shell fragments
Disposal	15	D	128	5/6/2020	6:39:00	IND	IND	IND	Sand	Sand	IND	N/A	IND	IND	None	Oyster shell(s)
Disposal	16	A	130	5/6/2020	7:08:32	76.47	50.98	0.39	Gravel	Cobble	Cobble	Well Sorted	Bryozoa/Hydroids	Dense (70 to < 90%)	None	
Disposal	16	B	130	5/6/2020	7:09:46	80.95	53.97	0.44	Gravel	Pebble/Granule	Cobble	Well Sorted	Bryozoa/Hydroids	Moderate (30 to < 70%)	None	
Disposal	16	C	130	5/6/2020	7:10:44	72.36	48.24	0.35	Gravelly	Gravelly Sand	Pebble/Granule	Moderately Sorted	Bryozoa/Hydroids	Sparse (1 to <30%)	None	
Disposal	17	A	130	5/6/2020	7:27:44	72.86	48.58	0.35	Gravelly	Gravelly Sand	Pebble/Granule	Moderately Sorted	Bryozoa/Hydroids	Sparse (1 to <30%)	None	Bay Scallop shell(s)
Disposal	17	B	130	5/6/2020	7:28:36	78.51	52.34	0.41	Gravel	Pebble/Granule	Cobble	Well Sorted	Bryozoa/Hydroids	Moderate (30 to < 70%)	None	
Disposal	17	C	130	5/6/2020	7:29:34	75.76	50.51	0.38	Gravel	Pebble/Granule	Cobble	Well Sorted	Bryozoa/Hydroids	Sparse (1 to <30%)	None	
Disposal	18	A	130	5/6/2020	7:15:51	77.46	51.64	0.40	Gravel	Pebble/Granule	Cobble	Well Sorted	Bryozoa/Hydroids	Dense (70 to < 90%)	None	
Disposal	18	B	130	5/6/2020	7:16:51	83.83	55.88	0.47	Gravel	Pebble/Granule	Cobble	Well Sorted	Bryozoa/Hydroids	Moderate (30 to < 70%)	None	
Disposal	18	C	130	5/6/2020	7:17:51	78.95	52.63	0.42	Gravel	Pebble/Granule	Cobble	Well Sorted	Bryozoa/Hydroids	Moderate (30 to < 70%)	None	
Disposal	19	A	126	5/6/2020	9:28:27	71.82	47.88	0.34	Sand	Sand	Cobble	N/A	Bryozoa/Hydroids	Sparse (1 to <30%)	None	Blue Mussel shell(s), Oyster shell(s)
Disposal	19	C	126	5/6/2020	9:30:49	IND	IND	IND	IND	IND	Pebble/Granule	IND	IND	IND	None	Oyster shell(s)
Disposal	19	D	126	5/6/2020	9:31:14	76.51	51.01	0.39	Sand	Sand	Pebble/Granule	N/A	Bryozoa/Hydroids	Trace (<1%)	None	

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Category	StationID	Replicate	Water Depth (ft)	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Substrate Group	Substrate Subgroup	Maximum Gravel Size Category	Degree of Sorting	Biogenic Structure Type	Percent Cover of All Attached Fauna	Percent Cover of Macroalgae and/or SAV	Coastal Shell Notes
Disposal	20	A	125	5/6/2020	9:23:29	72.19	48.13	0.35	Sand	Sand	Pebble/Granule	N/A	Bryozoa/Hydroids	Trace (<1%)	None	Shell fragments
Disposal	20	B	125	5/6/2020	9:24:24	74.29	49.52	0.37	Gravelly	Gravelly Sand	Pebble/Granule	Moderately Sorted	Bryozoa/Hydroids	Sparse (1 to <30%)	None	Blue Mussel shell(s)
Disposal	20	C	125	5/6/2020	9:25:19	78.20	52.13	0.41	Sand	Sand	N/A	N/A	None	None	None	

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APPENDIX F

GRAIN SIZE SCALE FOR SEDIMENTS

APPENDIX F

GRAIN SIZE SCALE FOR SEDIMENTS

Phi (Φ) Size	Size Range (mm)	Size Class (Wentworth Class)
<-1	>2	Gravel
0 to –1	1 to 2	Very coarse sand
1 to 0	0.5 to 1	Coarse sand
2 to 1	0.25 to 0.5	Medium sand
3 to 2	0.125 to 0.25	Fine sand
4 to 3	0.0625 to 0.125	Very fine sand
>4	<0.0625	Silt/clay

APPENDIX G

NON-PARAMETRIC BOOTSTRAPPED CONFIDENCE LIMITS

Bootstrapping is a statistical resampling procedure that uses the sample data to represent the entire population in order to construct confidence limits around population parameters. Bootstrapping assumes only that the sample data are representative of the underlying population, so random sampling is a prerequisite for appropriate application of this method.

Bootstrapping procedures entail resampling, with replacement, from the observed sample of size n. Each time the sample is resampled, a summary statistic (e.g., mean or standard deviation) of the bootstrapped sample is computed and stored. After repeating this procedure many times, a summary of the bootstrapped statistics is used to construct the confidence limit. For the bootstrap-*t* method (e.g., Manly 1997, pp. 56-59; or Lunneborg 2000, pp. 129-131), the bootstrapped statistic (T) is a pivotal statistic, which means that the distribution of T is the same for all values of the true mean (θ). The bootstrap-*t* is essentially the "Studentized" version (i.e., subtract the mean and divide by the standard error, as is done to obtain the Student *t*-distribution for the sample mean) of the statistic of interest. This approach is quite versatile, and can be applied to construct a confidence interval around any linear combination of means (Lunneborg 2000, p. 364).

For the purpose of constructing a confidence interval around the true value for the linear combination of means ($\Theta = \mu_{Ref} - \mu_{Mound}$) the pivotal statistic T for the true difference is defined as

$$T = \frac{d - \theta}{SE(d)} \qquad \text{(Eq. A-1)}$$

We assume that this is adequately approximated by the bootstrap sampling distribution of T, denoted T*:

$$T^* = \frac{d^* - \hat{\theta}}{SE(d^*)} \qquad \text{(Eq. A-2)}$$

This distribution is comprised of the studentized statistic (T^*_B) computed from a large number (B) of randomly chosen bootstrapped samples y_1^*, y_2^*, ... y_B^* from each of the four groups or populations. Here, d^* is the linear combination of group means for the bootstrapped sample; $\hat{\theta}$ is the observed difference in sample means from the original samples; $SE(d^*)$ is the estimated standard error of the linear contrast.

The 5th and the 95th quantiles of the T^* distribution ($T^*_{0.05}$ and $T^*_{0.95}$, respectively) satisfy the equations:

$$\Pr\left[\frac{\theta - d}{SE(d)} > T^*_{0.05}\right] = 0.95 \qquad \text{(Eq. A-3a)}$$

$$\Pr\left[\frac{\theta - d}{SE(d)} < T^*_{0.95}\right] = 0.95 \qquad \text{(Eq. A-3b)}$$

Rearranging these equations yields 95% confidence in each of the following two inequalities:

$$\Pr[d + T^*_{0.05}\, SE(d) < \theta] = 0.95 \qquad \text{(Eq. A-4a)}$$

$$\Pr[d + T^*_{0.95}\, SE(d) > \theta] = 0.95 \qquad \text{(Eq. A-4b)}$$

Bootstrapping is used to estimate the values $T^*_{0.05}$, $T^*_{0.95}$ and $SE(d)$. The left side of equation A-4a represents the 95% lower confidence limit on the difference equation ($\mu_y - \mu_x$); the left side of equation A-4b is the 95% upper confidence limit on the difference equation. Based on the two one-sided testing (TOST) approach presented in McBride (1999), if the bounds computed by Equations A-4a and A-4b are fully contained within the interval [–δ , +δ], then we conclude equivalence within δ units.

The specific steps used to compute the 95% upper and 95% lower confidence limits on the difference between two means using the bootstrap-*t* method are described below.

1. Bootstrap (sample with replacement from the original sample of size n) B = 10,000 samples from each of the four populations (1 pooled reference group and 3 mounds) separately.
2. Compute the T^*_B statistic for each bootstrapped set of independent samples. T^*_i is the bootstrapped-*t* statistic computed from the i^{th} bootstrap sample, defined by the following equation

$$T*_i = \frac{\sum_{j=1}^{4} c_j \bar{y}*_{ji} - \sum_{j=1}^{4} c_j \bar{y}_j}{SE\left(\sum_{j=1}^{4} c_j \bar{y}*_{ji}\right)} = \frac{\sum_{j=1}^{4} c_j \bar{y}*_{ji} - \sum_{j=1}^{4} c_j \bar{y}_j}{\sqrt{\sum_{j=1}^{4} s^2_{y*ji} c_j^2 / n_j}} \qquad \text{(Eq. A-5)}$$

   where $\bar{y}*_{ji}$, and $s^2_{y*_{ji}}$ are the means and variances for the i^{th} bootstrapped sample from the j^{th} group (j=1 to 4); and $\bar{y}_j$ is the observed mean for the j^{th} group. Multiplying these group means by their respective coefficients c_j ($^1/_3$, -1, -1, -1) and summing the products yields the difference equation we wish to test (Equation 1). This step produces 10,000 values of the bootstrapped-*t* statistic which comprise the "bootstrap-*t* distribution".
3. Compute the standard deviation of the 10,000 bootstrapped linear combinations, $\sum_{j=1}^{4} c_j\, \bar{y}*_{ji}$ and save it as $SE(d)$. This is the bootstrap estimate of the true standard error.
4. Find $T^*_{0.05}$ and $T^*_{0.95}$, the 5th and 95th quantiles of the bootstrap-*t* distribution generated in Step 2. These values satisfy Equations A- 3a and A-3b.
5. Applying Equations A-4a and A-4b using the values $T^*_{0.05}$ and $T^*_{0.95}$ found in Step 4 gives the bootstrap-*t* estimate of the 95% lower and upper confidence limits on the difference equation, i.e.,

$$95\%\ \text{LCL} = \sum_{j=1}^{4} c_j\, \bar{y}_j + T*_{0.05}\, SE(d) \qquad \text{(Eq. A-6a)}$$

$$95\%\ \text{UCL} = \sum_{j=1}^{4} c_j \bar{y}_j + T*_{0.95}\, SE(d) \qquad \text{(Eq. A-6b)}$$

   where ($\sum_{j=1}^{4} c_j \bar{y}_j$) is the linear combination expressing the difference between the mean of the reference group and the mean of the three disposal mounds based on the original sample observations, and $SE(d)$ is the standard deviation of the bootstrapped differences computed in Step 3.

References

Lunneborg, Clifford E. 2000. Data Analysis by Resampling: Concepts and Applications. Duxbury. 556 pp. + Appendices.

Manly, Bryan F.J. 1997. Randomization, Bootstrap and Monte Carlo Methods in Biology. Second edition. Chapman & Hall, London. 340 pp. + Appendices

APPENDIX H

SEDIMENT GRAIN SIZE AND CHEMISTRY LAB REPORTS

(Provided as stand-alone electronic document in Technical Support Notebook)

APPENDIX I

BENTHIC COMMUNITY ANALYSIS RESULTS

DAMOS RISDS June 2020

*A 600 µm sieve was used on sample 005-A instead of the correct 500 µm sieve

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
001-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	7
001-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	14
001-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	3
001-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	2
001-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	1
001-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	38
001-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Exogone verugera	2
001-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	1
001-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	1
001-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	3
001-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	2
001-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	5
001-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	177
001-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	21
001-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	26
001-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	8
001-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	2
001-A	Arthropoda	Malacostraca	Amphipoda	Pleustidae	Stenopleustes inermis	1
001-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	2
001-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	9
001-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	2
001-A	Arthropoda	Malacostraca	Decapoda	Crangonidae	Crangon septemspinosa	1
001-A	Arthropoda	Malacostraca	Isopoda	Cirolanidae	Politolana (LPIL)	1
001-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	18
001-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	3
001-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	4
001-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	22
001-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	1
001-A	Mollusca	Bivalvia	Veneroida	Solenidae	Solen viridis	11
002-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	2
002-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	4
002-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	2
002-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	4
002-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	9
002-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	1
002-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	2
002-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	1
002-A	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	13
002-A	Annelida	Polychaeta	Scolecida	Paraonidae	Paraonidae (LPIL)	1
002-A	Annelida	Polychaeta	Spionida	Spionidae	Dipolydora socialis	1
002-A	Annelida	Polychaeta	Spionida	Spionidae	Spionidae (LPIL)	2
002-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	12
002-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	1
002-A	Arthropoda	Malacostraca	Amphipoda	Ampithoidae	Ampithoidae (LPIL)	10
002-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	34
002-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	8
002-A	Arthropoda	Malacostraca	Amphipoda	Argissidae	Argissa hamatipes	1
002-A	Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprellidae (LPIL)	1
002-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	32
002-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	10

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
002-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	1
002-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	9
002-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	11
002-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	3
002-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	8
002-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	1
002-A	Mollusca	Bivalvia	Veneroida	Solenidae	Solen viridis	11
002-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	2
002-A	Nemertea	Enopla	Hoplonemertea	Amphiporidae	Amphiporidae (LPIL)	1
002-A	Nemertea				Nemertea (LPIL)	1
003-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	1
003-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	5
003-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	1
003-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	8
003-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	3
003-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	6
003-A	Annelida	Polychaeta	Scolecida	Paraonidae	Paraonidae (LPIL)	1
003-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	10
003-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetidae (LPIL)	1
003-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	1
003-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	8
003-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	19
003-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	3
003-A	Arthropoda	Malacostraca	Amphipoda	Argissidae	Argissa hamatipes	1
003-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	26
003-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	7
003-A	Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	Oedicerotidae (LPIL)	1
003-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	6
003-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	3
003-A	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	4
003-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	8
003-A	Mollusca	Bivalvia	Veneroida	Cardiidae	Cerastoderma pinnulatum	2
003-A	Mollusca	Bivalvia	Veneroida	Solenidae	Solen viridis	7
004-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	1
004-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	23
004-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	35
004-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	2
004-A	Annelida	Polychaeta	Phyllodocida	Goniadidae	Goniadidae (LPIL)	1
004-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	3
004-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	4
004-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	5
004-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	9
004-A	Annelida	Polychaeta	Spionida	Spionidae	Prionospio (LPIL)	1
004-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	2
004-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	1
004-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	6
004-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	6
004-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	3
004-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	1
004-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	2
004-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	1
004-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	1
004-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	4
004-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	149

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
004-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	6
004-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	10
004-A	Mollusca	Bivalvia	Veneroida	Thyasiridae	Thyasira trisinuata	1
004-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	1
*005-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	49
*005-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	24
*005-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	1
*005-A	Annelida	Polychaeta	Opheliida	Opheliidae	Opheliidae (LPIL)	1
*005-A	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	3
*005-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	5
*005-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	4
*005-A	Annelida	Polychaeta	Phyllodocida	Pilargidae	Sigambra (LPIL)	1
*005-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	1
*005-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Syllidae (LPIL)	1
*005-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	19
*005-A	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	2
*005-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	1
*005-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	18
*005-A	Annelida	Polychaeta	Scolecida	Paraonidae	Paraonidae (LPIL)	2
*005-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	11
*005-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	3
*005-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetidae (LPIL)	1
*005-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	3
*005-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	4
*005-A	Annelida	Polychaeta	Terebellida	Sabellariidae	Sabellaria vulgaris	21
*005-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	14
*005-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	2
*005-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	3
*005-A	Arthropoda	Malacostraca	Amphipoda	Argissidae	Argissa hamatipes	1
*005-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	2
*005-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	1
*005-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	1
*005-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Leptostylis longimana	1
*005-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	2
*005-A	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	2
*005-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	8
*005-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	24
*005-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	8
*005-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	2
*005-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	16
*005-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	1
*005-A	Phoronida			Phoronidae	Phoronis (LPIL)	1
006-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	19
006-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	25
006-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	1
006-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	1
006-A	Annelida	Polychaeta	Phyllodocida	Goniadidae	Goniada (LPIL)	1
006-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	4
006-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	2
006-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Polynoidae (LPIL)	2
006-A	Annelida	Polychaeta	Phyllodocida	Sphaerodoridae	Sphaerodoridium claparedii	1
006-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	16
006-A	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	1
006-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	2

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
006-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	3
006-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	11
006-A	Annelida	Polychaeta	Spionida	Chaetopteridae	Spiochaetopterus oculatus	1
006-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	6
006-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	9
006-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetidae (LPIL)	2
006-A	Annelida	Polychaeta	Terebellida	Sabellariidae	Sabellaria vulgaris	7
006-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	7
006-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	4
006-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	2
006-A	Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprella (LPIL)	1
006-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	1
006-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	1
006-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	2
006-A	Arthropoda	Malacostraca	Cumacea	Bodotriidae	Bodotriidae (LPIL)	1
006-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	1
006-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	3
006-A	Arthropoda	Malacostraca	Decapoda	Paguridae	Pagurus (LPIL)	2
006-A	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	1
006-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	2
006-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	43
006-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	3
006-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	6
006-A	Mollusca	Bivalvia	Veneroida	Lucinidae	Lucina (LPIL)	1
006-A	Mollusca	Bivalvia			Bivalvia (LPIL)	1
006-A	Mollusca	Gastropoda	Mesogastropoda	Calyptraeidae	Crepidula plana	1
006-A	Mollusca	Gastropoda	Nudibranchia		Nudibranchia (LPIL)	9
006-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	1
007-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	16
007-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	7
007-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae (LPIL)	5
007-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	28
007-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	2
007-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	8
007-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	1
007-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	2
007-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	17
007-A	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	1
007-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	1
007-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	5
007-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	9
007-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	14
007-A	Annelida	Polychaeta	Scolecida	Paraonidae	Paraonidae (LPIL)	1
007-A	Annelida	Polychaeta	Spionida	Chaetopteridae	Spiochaetopterus oculatus	1
007-A	Annelida	Polychaeta	Spionida	Spionidae	Spionidae (LPIL)	1
007-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	8
007-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	7
007-A	Annelida	Polychaeta	Terebellida	Sabellariidae	Sabellaria vulgaris	18
007-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	2
007-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	3
007-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	11
007-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	1
007-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	3
007-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	1

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
007-A	Arthropoda	Malacostraca	Decapoda	Axiidae	Axiidae (LPIL)	1
007-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	4
007-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	1
007-A	Mollusca	Bivalvia	Veneroida	Thyasiridae	Thyasira trisinuata	1
008-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	4
008-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	99
008-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	10
008-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae (LPIL)	33
008-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	30
008-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	6
008-A	Annelida	Polychaeta	Orbiniida	Orbiniidae	Leitoscoloplos (LPIL)	2
008-A	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glyceridae (LPIL)	2
008-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	2
008-A	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Fimbriosthenelais (LPIL)	1
008-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	1
008-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	1
008-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	1
008-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	1
008-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	15
008-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	1
008-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetidae (LPIL)	1
008-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	21
008-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	11
008-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	4
008-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	7
008-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	3
008-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	3
008-A	Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprella (LPIL)	1
008-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	3
008-A	Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	Oedicerotidae (LPIL)	1
008-A	Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia propinqua	3
008-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	2
008-A	Arthropoda	Malacostraca	Cumacea	Bodotriidae	Bodotriidae (LPIL)	1
008-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	3
008-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	8
008-A	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia hyalina	1
008-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	4
008-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	3
008-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	4
008-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	1
008-A	Mollusca	Bivalvia	Veneroida	Cardiidae	Cerastoderma pinnulatum	1
008-A	Mollusca	Bivalvia	Veneroida	Lucinidae	Lucina (LPIL)	2
008-A	Nemertea	Anopla	Paleonemertea	Tubulanidae	Tubulanus sp. A	1
009-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	10
009-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	5
009-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae (LPIL)	6
009-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	33
009-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	1
009-A	Annelida	Polychaeta	Opheliida	Opheliidae	Opheliidae (LPIL)	1
009-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	14
009-A	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	3
009-A	Annelida	Polychaeta	Phyllodocida	Goniadidae	Goniada maculata	1
009-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	5
009-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	2

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
009-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	62
009-A	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	1
009-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	2
009-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	16
009-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	15
009-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	4
009-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetidae (LPIL)	1
009-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	7
009-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	4
009-A	Annelida	Polychaeta	Terebellida	Sabellariidae	Sabellaria vulgaris	1
009-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	4
009-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	1
009-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	23
009-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	11
009-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	10
009-A	Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	Oedicerotidae (LPIL)	1
009-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	2
009-A	Arthropoda	Malacostraca	Cumacea	Bodotriidae	Bodotriidae (LPIL)	1
009-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	5
009-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	1
009-A	Arthropoda	Malacostraca	Decapoda	Crangonidae	Crangon septemspinosa	1
009-A	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	1
009-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	1
009-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	7
009-A	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia hyalina	3
009-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	4
009-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	2
009-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	11
009-A	Mollusca	Bivalvia	Veneroida	Solenidae	Solen viridis	1
009-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	1
E-01-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	17
E-01-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	2
E-01-A	Annelida	Polychaeta	Canalipalpata	Sternaspidae	Sternaspis scutata	3
E-01-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	9
E-01-A	Annelida	Polychaeta	Eunicida	Dorvilleidae	Dorvilleidae (LPIL)	1
E-01-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae (LPIL)	17
E-01-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	40
E-01-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	5
E-01-A	Annelida	Polychaeta	Eunicida	Oenonidae	Drilonereis longa	1
E-01-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	6
E-01-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	2
E-01-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	55
E-01-A	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	18
E-01-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	11
E-01-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	1
E-01-A	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eumida sanguinea	1
E-01-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	1
E-01-A	Annelida	Polychaeta	Phyllodocida	Sphaerodoridae	Sphaerodoridium claparedii	1
E-01-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	61
E-01-A	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	5
E-01-A	Annelida	Polychaeta	Scolecida	Maldanidae	Axiothella mucosa	5
E-01-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	8
E-01-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	24
E-01-A	Annelida	Polychaeta	Spionida	Spionidae	Scolelepis texana	1

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
E-01-A	Annelida	Polychaeta	Spionida	Spionidae	Spionidae (LPIL)	1
E-01-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	1
E-01-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	11
E-01-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	11
E-01-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	8
E-01-A	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellidae (LPIL)	2
E-01-A	Annelida	Polychaeta	Terebellida	Trichobranchidae	Terebellides stroemi	10
E-01-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	17
E-01-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Isaeidae (LPIL)	1
E-01-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	4
E-01-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	13
E-01-A	Arthropoda	Malacostraca	Amphipoda	Pleustidae	Stenopleustes inermis	5
E-01-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	8
E-01-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	3
E-01-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	2
E-01-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Leptostylis longimana	6
E-01-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	14
E-01-A	Chordata	Ascidiacea			Ascidiacea (LPIL)	2
E-01-A	Mollusca	Bivalvia	Mytiloida	Mytilidae	Crenella decussata	2
E-01-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	17
E-01-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	644
E-01-A	Mollusca	Bivalvia	Pectinida	Pectinidae	Argopecten (LPIL)	1
E-01-A	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia hyalina	3
E-01-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	70
E-01-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	4
E-01-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	40
E-01-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	3
E-01-A	Mollusca	Bivalvia	Veneroida	Cardiidae	Cerastoderma pinnulatum	2
E-01-A	Mollusca	Bivalvia	Veneroida	Thyasiridae	Thyasira trisinuata	10
E-01-A	Mollusca	Gastropoda	Heterostropha	Acteonidae	Japonactaeon punctostriatus	1
E-01-A	Mollusca	Gastropoda	Neotaenioglossa	Rissoidae	Alvania (LPIL)	17
E-01-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	1
E-01-A	Nemertea	Enopla	Hoplonemertea	Amphiporidae	Amphiporidae (LPIL)	1
E-02-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	21
E-02-A	Annelida	Polychaeta	Canalipalpata	Sternaspidae	Sternaspis scutata	11
E-02-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	8
E-02-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae (LPIL)	2
E-02-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	24
E-02-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	2
E-02-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	2
E-02-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	1
E-02-A	Annelida	Polychaeta	Oweniida	Oweniidae	Galathowenia oculata	2
E-02-A	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	34
E-02-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	9
E-02-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	77
E-02-A	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	3
E-02-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	1
E-02-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	20
E-02-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	7
E-02-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	1
E-02-A	Annelida	Polychaeta	Terebellida	Trichobranchidae	Terebellides stroemi	5
E-02-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	9
E-02-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	10
E-02-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	1

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
E-02-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	1
E-02-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Leptostylis longimana	1
E-02-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	3
E-02-A	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	4
E-02-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	7
E-02-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	240
E-02-A	Mollusca	Bivalvia	Pectinida	Pectinidae	Argopecten (LPIL)	1
E-02-A	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia hyalina	1
E-02-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	21
E-02-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	20
E-02-A	Mollusca	Bivalvia	Veneroida	Lucinidae	Lucina (LPIL)	5
E-02-A	Mollusca	Bivalvia	Veneroida	Thyasiridae	Thyasira trisinuata	2
E-02-A	Mollusca	Gastropoda	Cephalaspidea	Haminoeidae	Haminoea solitaria	2
E-02-A	Mollusca	Gastropoda	Neotaenioglossa	Rissoidae	Alvania (LPIL)	4
E-03-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	21
E-03-A	Annelida	Polychaeta	Canalipalpata	Sternaspidae	Sternaspis scutata	1
E-03-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	10
E-03-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae (LPIL)	1
E-03-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	20
E-03-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	9
E-03-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	2
E-03-A	Annelida	Polychaeta	Oweniida	Oweniidae	Galathowenia oculata	165
E-03-A	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	480
E-03-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	11
E-03-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	2
E-03-A	Annelida	Polychaeta	Phyllodocida	Pholoidae	Pholoe minuta	1
E-03-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	2
E-03-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	100
E-03-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	2
E-03-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	2
E-03-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	50
E-03-A	Annelida	Polychaeta	Spionida	Chaetopteridae	Spiochaetopterus oculatus	2
E-03-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	5
E-03-A	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellidae (LPIL)	1
E-03-A	Annelida	Polychaeta	Terebellida	Trichobranchidae	Terebellides stroemi	1
E-03-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	1
E-03-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	15
E-03-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	6
E-03-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	1
E-03-A	Arthropoda	Malacostraca	Amphipoda		Amphipoda (LPIL)	1
E-03-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	1
E-03-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	1
E-03-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	5
E-03-A	Echinodermata	Asteroidea	Paxillosida	Astropectinidae	Astropecten (LPIL)	1
E-03-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	6
E-03-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	438
E-03-A	Mollusca	Bivalvia	Pectinida	Pectinidae	Argopecten (LPIL)	1
E-03-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	46
E-03-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	8
E-03-A	Mollusca	Bivalvia	Veneroida	Lucinidae	Lucina (LPIL)	9
E-03-A	Mollusca	Bivalvia	Veneroida	Thyasiridae	Thyasira trisinuata	5
E-03-A	Mollusca	Gastropoda	Neotaenioglossa	Rissoidae	Alvania (LPIL)	1
NE-01-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	1
NE-01-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	9

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
NE-01-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	7
NE-01-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	20
NE-01-A	Annelida	Polychaeta	Eunicida	Oenonidae	Drilonereis longa	1
NE-01-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	7
NE-01-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	26
NE-01-A	Annelida	Polychaeta	Orbiniida	Orbiniidae	Leitoscoloplos (LPIL)	5
NE-01-A	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glyceridae (LPIL)	2
NE-01-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	10
NE-01-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	2
NE-01-A	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Fimbriosthenelais (LPIL)	3
NE-01-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Exogone verugera	2
NE-01-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Syllidae (LPIL)	2
NE-01-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	11
NE-01-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	1
NE-01-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	3
NE-01-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	2
NE-01-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	2
NE-01-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetidae (LPIL)	1
NE-01-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	10
NE-01-A	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellidae (LPIL)	1
NE-01-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	114
NE-01-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	106
NE-01-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	23
NE-01-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	23
NE-01-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	2
NE-01-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	9
NE-01-A	Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia propinqua	1
NE-01-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	8
NE-01-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	2
NE-01-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	10
NE-01-A	Arthropoda	Malacostraca	Decapoda	Axiidae	Axiidae (LPIL)	1
NE-01-A	Mollusca	Bivalvia	Mytiloida	Mytilidae	Crenella decussata	21
NE-01-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	1
NE-01-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	154
NE-01-A	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia hyalina	1
NE-01-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	2
NE-01-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	3
NE-01-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	10
NE-01-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	6
NE-01-A	Mollusca	Bivalvia	Veneroida	Cardiidae	Cerastoderma pinnulatum	1
NE-02-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	35
NE-02-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	4
NE-02-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	3
NE-02-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	32
NE-02-A	Annelida	Polychaeta	Orbiniida	Orbiniidae	Leitoscoloplos (LPIL)	2
NE-02-A	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glycera americana	1
NE-02-A	Annelida	Polychaeta	Phyllodocida	Goniadidae	Goniada littorea	1
NE-02-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	1
NE-02-A	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Fimbriosthenelais (LPIL)	1
NE-02-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Exogone verugera	11
NE-02-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	2
NE-02-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	2
NE-02-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	1
NE-02-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	6

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
NE-02-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	13
NE-02-A	Arthropoda	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae (LPIL)	1
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	1
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	166
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	87
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	9
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprellidae (LPIL)	1
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	8
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	3
NE-02-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	14
NE-02-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	2
NE-02-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	1
NE-02-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	3
NE-02-A	Mollusca	Bivalvia	Mytiloida	Mytilidae	Crenella decussata	5
NE-02-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	9
NE-02-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	1
NE-03-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	4
NE-03-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	31
NE-03-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae (LPIL)	3
NE-03-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	18
NE-03-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	13
NE-03-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	3
NE-03-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	31
NE-03-A	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glycera (LPIL)	2
NE-03-A	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glycera americana	1
NE-03-A	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glyceridae (LPIL)	1
NE-03-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	2
NE-03-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	2
NE-03-A	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Fimbriosthenelais (LPIL)	1
NE-03-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Exogone verugera	2
NE-03-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Syllidae (LPIL)	2
NE-03-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	16
NE-03-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	1
NE-03-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	2
NE-03-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	1
NE-03-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	6
NE-03-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	1
NE-03-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetidae (LPIL)	3
NE-03-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	9
NE-03-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	8
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	5
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	84
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	73
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	11
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	9
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	7
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	2
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	Oedicerotidae (LPIL)	1
NE-03-A	Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia propinqua	1
NE-03-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	10
NE-03-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	4
NE-03-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	4
NE-03-A	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	1
NE-03-A	Mollusca	Bivalvia	Mytiloida	Mytilidae	Crenella decussata	15

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
NE-03-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	2
NE-03-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	109
NE-03-A	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia hyalina	2
NE-03-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	4
NE-03-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	2
NE-03-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	5
NE-03-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	7
NE-03-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	3
SW-01-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	9
SW-01-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	4
SW-01-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	1
SW-01-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	5
SW-01-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	1
SW-01-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	5
SW-01-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	3
SW-01-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	71
SW-01-A	Annelida	Polychaeta	Orbiniida	Orbiniidae	Leitoscoloplos (LPIL)	2
SW-01-A	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	3
SW-01-A	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glyceridae (LPIL)	1
SW-01-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	4
SW-01-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	1
SW-01-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	2
SW-01-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Exogone verugera	4
SW-01-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Syllidae (LPIL)	1
SW-01-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	9
SW-01-A	Annelida	Polychaeta	Scolecida	Maldanidae	Axiothella mucosa	23
SW-01-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	5
SW-01-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	26
SW-01-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	9
SW-01-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	40
SW-01-A	Annelida	Polychaeta	Spionida	Chaetopteridae	Spiochaetopterus oculatus	1
SW-01-A	Annelida	Polychaeta	Spionida	Spionidae	Dipolydora socialis	1
SW-01-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	1
SW-01-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	2
SW-01-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	2
SW-01-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	4
SW-01-A	Annelida	Polychaeta	Terebellida	Trichobranchidae	Terebellides stroemi	1
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	84
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	2
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	313
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	24
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprellidae (LPIL)	1
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	153
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	7
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	4
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia propinqua	8
SW-01-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	1
SW-01-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	3
SW-01-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	2
SW-01-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	12
SW-01-A	Arthropoda	Malacostraca	Decapoda	Axiidae	Axiidae (LPIL)	1
SW-01-A	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	1
SW-01-A	Echinodermata				Echinodermata (LPIL)	1
SW-01-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	226

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
SW-01-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	5
SW-01-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	1
SW-01-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	2
SW-01-A	Mollusca	Gastropoda	Heterostropha	Acteonidae	Japonactaeon punctostriatus	1
SW-01-A	Mollusca	Gastropoda	Heterostropha	Pyramidellidae	Turbonilla interrupta	1
SW-01-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	1
SW-02-A	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	4
SW-02-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	3
SW-02-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	3
SW-02-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma (LPIL)	6
SW-02-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	3
SW-02-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	2
SW-02-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	2
SW-02-A	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	1
SW-02-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	28
SW-02-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	4
SW-02-A	Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe imbricata	1
SW-02-A	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Fimbriosthenelais (LPIL)	1
SW-02-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	2
SW-02-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	6
SW-02-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	2
SW-02-A	Annelida	Polychaeta	Scolecida	Paraonidae	Aricidea (LPIL)	1
SW-02-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	42
SW-02-A	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	3
SW-02-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	1
SW-02-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	7
SW-02-A	Annelida	Polychaeta	Terebellida	Trichobranchidae	Terebellides stroemi	2
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	89
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	3
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	7
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	16
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprellidae (LPIL)	1
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	7
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	7
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	1
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia propinqua	16
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Pleustidae	Stenopleustes inermis	6
SW-02-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	15
SW-02-A	Arthropoda	Malacostraca	Cumacea	Bodotriidae	Bodotriidae (LPIL)	1
SW-02-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	10
SW-02-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	2
SW-02-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	11
SW-02-A	Arthropoda	Malacostraca	Isopoda	Anthuridae	Cyathura polita	1
SW-02-A	Arthropoda	Malacostraca	Isopoda	Cirolanidae	Politolana (LPIL)	1
SW-02-A	Chordata	Ascidiacea			Ascidiacea (LPIL)	1
SW-02-A	Echinodermata				Echinodermata (LPIL)	1
SW-02-A	Mollusca	Bivalvia	Nuculanida	Yoldiidae	Yoldia limatula	13
SW-02-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	386
SW-02-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	14
SW-02-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	7
SW-02-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	39
SW-02-A	Mollusca	Bivalvia	Veneroida	Lucinidae	Lucina (LPIL)	1
SW-02-A	Mollusca	Gastropoda	Neotaenioglossa	Rissoidae	Alvania (LPIL)	1
SW-03-A	Annelida	Polychaeta	Archiannelida	Polygordiidae	Polygordius (LPIL)	5

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
SW-03-A	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	1
SW-03-A	Annelida	Polychaeta	Eunicida	Dorvilleidae	Dorvilleidae (LPIL)	1
SW-03-A	Annelida	Polychaeta	Eunicida	Lumbrineridae	Ninoe nigripes	7
SW-03-A	Annelida	Polychaeta	Flabelligerida	Flabelligeridae	Pherusa affinis	1
SW-03-A	Annelida	Polychaeta	Opheliida	Opheliidae	Armandia agilis	3
SW-03-A	Annelida	Polychaeta	Opheliida	Scalibregmatidae	Scalibregma inflatum	71
SW-03-A	Annelida	Polychaeta	Orbiniida	Orbiniidae	Leitoscoloplos (LPIL)	1
SW-03-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtyidae (LPIL)	8
SW-03-A	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	2
SW-03-A	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eumida sanguinea	1
SW-03-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Exogone verugera	2
SW-03-A	Annelida	Polychaeta	Phyllodocida	Syllidae	Syllidae (LPIL)	1
SW-03-A	Annelida	Polychaeta	Sabellida	Sabellidae	Chone (LPIL)	1
SW-03-A	Annelida	Polychaeta	Scolecida	Maldanidae	Clymenella torquata	1
SW-03-A	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	1
SW-03-A	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	3
SW-03-A	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharete oculata	1
SW-03-A	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	7
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	11
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Byblis serrata	146
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocheirus pinguis	399
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Aoridae	Unciola irrorata	30
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Isaeidae	Photis (LPIL)	48
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius brasiliensis	3
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomenella minuta	6
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Rhepoxynius hudsoni	2
SW-03-A	Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dyopedos porrectus	1
SW-03-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis polita	3
SW-03-A	Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis quadrispinosa	1
SW-03-A	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella pusilla	5
SW-03-A	Mollusca	Bivalvia	Mytiloida	Mytilidae	Crenella decussata	28
SW-03-A	Mollusca	Bivalvia	Nuculida	Nuculidae	Nucula proxima	28
SW-03-A	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia hyalina	1
SW-03-A	Mollusca	Bivalvia	Pholadomyoida	Periplomatidae	Periploma papyratium	1
SW-03-A	Mollusca	Bivalvia	Venerida	Veneridae	Pitar (LPIL)	17
SW-03-A	Mollusca	Bivalvia	Venerida	Veneridae	Veneridae (LPIL)	9
SW-03-A	Mollusca	Bivalvia	Veneroida	Astartidae	Astarte (LPIL)	2
SW-03-A	Mollusca	Bivalvia	Veneroida	Cardiidae	Cerastoderma pinnulatum	3
SW-03-A	Nemertea	Anopla	Heteronemertea	Lineidae	Lineidae (LPIL)	2