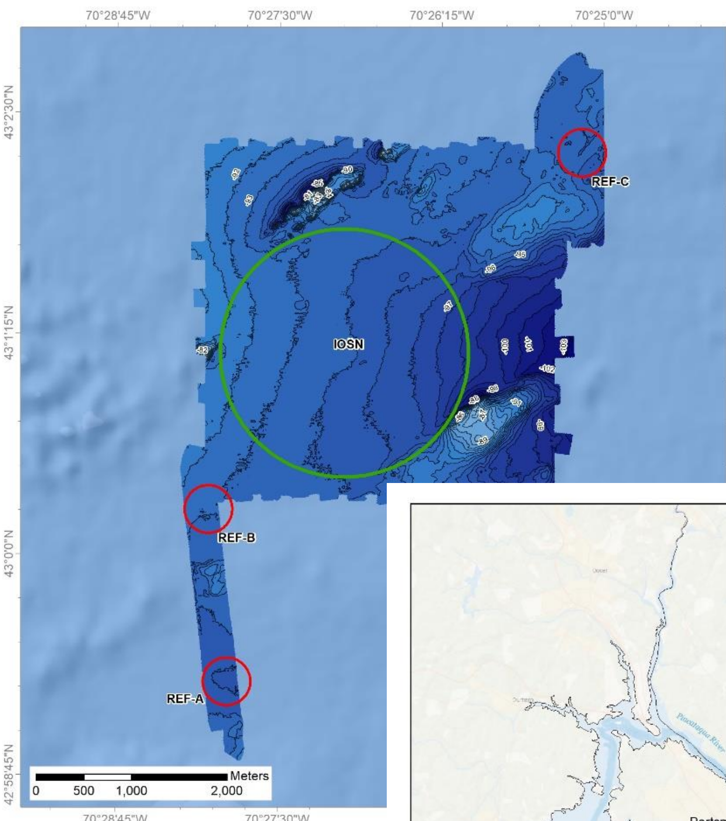
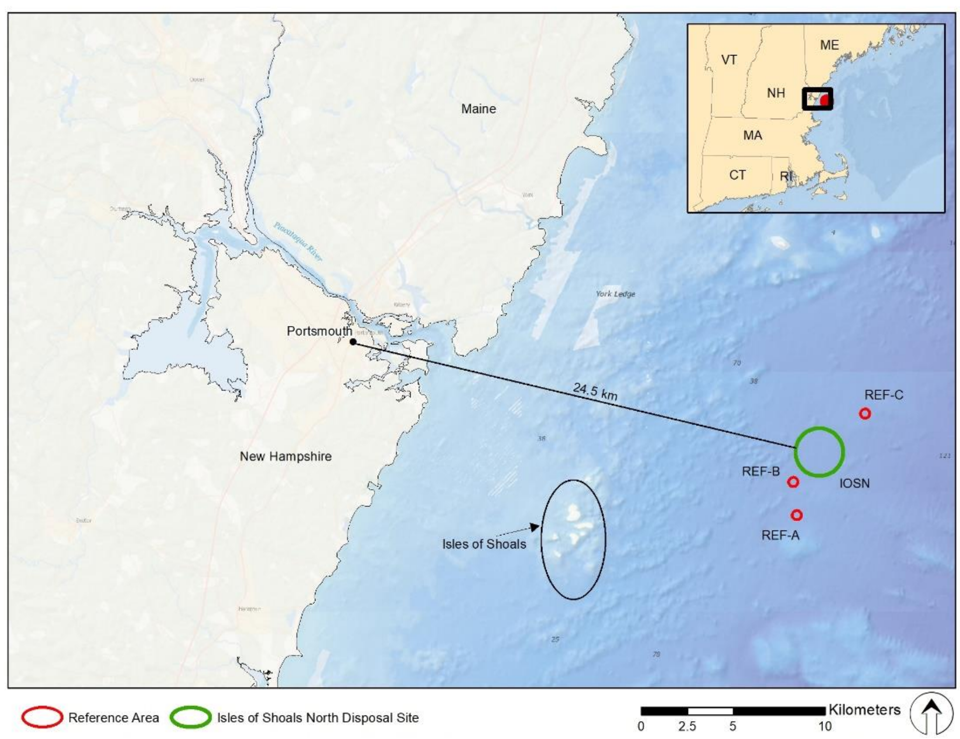
Data Summary Report for the Baseline Surveys of the Isles of Shoals North Disposal Site – September/October 2019 and September 2020

Disposal Area Monitoring System DAMOS





Data Summary Report
DR 2020-01
December 2021

DAMOS
DISPOSAL AREA MONITORING SYSTEM

US Army Corps of Engineers®
New England District

DATA SUMMARY REPORT FOR THE BASELINE SURVEYS OF THE ISLES OF SHOALS NORTH DISPOSAL SITE SEPTEMBER/OCTOBER 2019 AND SEPTEMBER 2020

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DR 2020-1
December 2021

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696 Virginia Road
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Prepared by:
AECOM and CR Environmental, Inc.

Submitted by:
AECOM Technical Services, Inc.
250 Apollo Drive
Chelmsford, MA 01824
(978) 905-2121

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of Engineers®
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AECOM
250 Apollo Drive
Chelmsford, MA 01824

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13. ABSTRACT

A set of baseline characterization surveys were conducted at the Isles of Shoals North Disposal Site (IOSN) (the site) in September/October 2019 and September 2020 as part of the United States (U.S.) Army Corps of Engineers (USACE) New England District (NAE) Disposal Area Monitoring System (DAMOS) Program. The initial IOSN baseline survey was planned for 2019; however, due to weather constraints that limited the initial effort, the survey was divided into two phases and completed in 2020.

The 2019 and 2020 IOSN surveys were designed as focused baseline studies of an area that was being evaluated as a potential dredged material disposal site (and has not yet received dredged material). The baseline surveys included the assessment of sediment and water quality at the proposed site and potential reference areas. The data collected during these surveys was intended to support the designation of the IOSN site by the U.S. Environmental Protection Agency (USEPA) under the Marine Protection, Research, and Sanctuaries Act (MPRSA). Through the MPRSA, the USEPA and USACE share the authority to manage and regulate dredged material disposal, while the authority to designate ocean disposal sites rests solely with the USEPA under Section 102(c) of MPRSA.

Data from these baseline survey efforts provide information on the IOSN site conditions prior to any dredged material disposal and will be used as a comparative dataset for future monitoring events. Additionally, sufficient data has been collected to establish three reference areas (A, B, and C), and while minor variations were noted within reference area REF C, it is still considered to be representative of site conditions based on water depth, sediment quality, water quality, and the benthic ecosystem. The results of these baseline surveys, and the associated reference areas, should be used for future management considerations and will provide useful information to identify any environmental impacts and assess ecosystem recovery from future dredged material disposal at the IOSN.

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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. A table of common conversions can be found in Appendix A.

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LIST OF ACRONYMS

APP	Accident Prevention Plan
As	arsenic
Cd	cadmium
Cr	chromium
Cu	copper
CVAA	Cold Vapor Atomic Absorption
DAMOS	Disposal Area Monitoring System
DDD	4,4'-dichlorodiphenyldichloroethane
DDE	4,4'-dichlorodiphenyldichloroethylene
DDT	4,4'-dichlorodiphenyltrichloroethane
DGPS	differential global positioning system
EA	Environmental Assessment
ER-L	effects range low
ER-M	effects range median
FD	field duplicate
FSU	formazin nephelometric units
ft	foot/feet
GPS	global positioning system
GC-MS	Gas Chromatography-Mass Spectrometry
Hg	mercury
HMW	high molecular weight
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry

IOSN	Isle of Shoals North Disposal Site
km	kilometer
LCS	laboratory control sample
LMW	low molecular weight
LPTL	lowest practical taxonomic level
m	meter
m^2	square meter
MA	Massachusetts
ME	Maine
MB	method blank
MDL	method detection limit
mg/kg	milligrams per kilogram
MLLW	Mean Lower Low Water
mm	millimeter
MPRSA	Marine Protection, Research, and Sanctuaries Act
MS/MSD	matrix spike/matrix spike duplicate
NAD 83	North American Datum of 1983
NAE	New England District
NH	New Hampshire
Ni	nickel
nmi	nautical mile
NOAA	National Oceanic and Atmospheric Administration
PAHs	polycyclic aromatic hydrocarbons

Pb	lead
PCA	Principal Components Analysis
PCB	polychlorinated biphenyl
PSU	practical salinity unit
QAPP	Quality Assurance Project Plan
QC	quality control
RIM	Regional Implementation Manual
R/V	Research Vessel
ROV	remotely operated vehicle
SOPs	Standard Operating Procedures
SPI	sediment profile imagery
SQG	sediment quality guideline
TOC	total organic carbon
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
Zn	zinc
µg/kg	micrograms per kilogram
µg/L	micrograms per liter

1.0 INTRODUCTION

A set of baseline characterization surveys were conducted at the Isles of Shoals North Disposal Site (IOSN) (the site) in September/October 2019 and September 2020 as part of the United States (U.S.) Army Corps of Engineers (USACE) New England District (NAE) Disposal Area Monitoring System (DAMOS) Program. The initial IOSN baseline survey was planned for 2019; however, due to weather constraints that limited the initial effort, the survey was divided into two phases and completed in 2020.

The DAMOS program 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. This section presents an overview of the DAMOS Program and a description of IOSN, including a brief description of recent survey activities and a description of the study objectives for the 2019 and 2020 baseline surveys.

The remainder of the report includes an overview of the methods used to collect and analyze the survey data, a summary of the results, and a list of references cited in the document.

1.1 Overview of the DAMOS Program

The DAMOS program features a tiered monitoring and 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 disposal site data throughout New England. Based on these data, patterns of physical, chemical, and biological responses of seafloor environments to dredged material placement activity have been documented (Fredette and French 2004; Wolf et al., 2012).

DAMOS monitoring surveys fall into two general categories: confirmatory studies and focused studies. 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. The data collected and evaluated during these studies provide answers to strategic management questions in determining the next step in the disposal site environmental management process. Two primary goals of DAMOS confirmatory 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 the dredged material. Standard survey techniques employed to characterize these responses to dredged material placement include acoustic surveys and sediment profile imagery (SPI).

Focused studies are periodically conducted under the DAMOS Program to evaluate baseline conditions for proposed or newly designated disposal sites and to evaluate inactive and/or historical disposal sites. Focused studies aid in the development of dredged material disposal techniques and management planning. Focused DAMOS monitoring surveys often feature additional types of data collection activities as deemed appropriate to achieve specific survey objectives, such as grab sampling of sediment for physical and biological analysis, sub-bottom profiling, sediment coring, towed video, water quality measurements, or video collection via a remotely operated vehicle (ROV).

The 2019 and 2020 IOSN surveys were designed as focused baseline studies of an area that was being evaluated as a potential dredged material disposal site (and has not yet received dredged material). The baseline surveys included the assessment of sediment and water quality at the proposed site and potential reference areas. The data collected during these surveys was intended to support the designation of the IOSN site by the U.S. Environmental Protection Agency (USEPA) under the Marine Protection, Research, and Sanctuaries Act (MPRSA). Through the MPRSA, the USEPA and USACE share the authority to manage and regulate dredged material disposal, while the authority to designate ocean disposal sites rests solely with the USEPA under Section 102(c) of MPRSA.

The Final Environmental Assessment (EA) for the designation of an Ocean Dredged Material Disposal Site for the Southern Maine, New Hampshire, and Northern Massachusetts Coastal Region and Finding of No Significant Impact (USEPA, 2020) was finalized 18 September 2020. The official site designation Final Rule was published in the Federal Register on 25 September 2020 and went into effect on 26 October 2020. Data for the two surveys discussed herein was collected 30 September and 1 October 2019 and 10 – 12 September 2020, before the site designation went into effect, and will serve as the baseline datasets for the site.

1.2 Introduction to the Isles of Shoals North Disposal Site

The IOSN site is located approximately 24.5 kilometers (km) (15 nautical miles [nmi]) east of Portsmouth, New Hampshire (NH), in the Gulf of Maine and approximately 11.2 km (6 nmi) from the Isles of Shoals themselves (Figure 1-1). The newly designated site is expected to receive dredged material from southern Maine (ME), NH, and northern Massachusetts (MA).

The IOSN site is circular in shape and approximately 2.5 km (1.3 nmi) in diameter. Based on a 2015 acoustic survey conducted under the DAMOS Program (Guarinello et al, 2016), the water depths at the site range from approximately 77 to 104 meters (m) (252 to 341 feet [ft]) Mean Lower Low Water (MLLW) (Figure 1-2). The seafloor at the IOSN site slopes gradually and increases in depth from the western boundary to the eastern boundary of the site. Outside of the northwest and southeast boundaries of the site the seafloor is noticeably elevated, approximately 10 to 20 m (33 to 66 ft) above the ambient seafloor, with areas of hard bottom evident in the backscatter and side scan sonar data (Guarinello et al, 2016).

Three potential reference areas were also surveyed in 2015 and included in the 2019/2020 baseline characterization effort; two potential reference areas (REF A and REF B) located to the south of the IOSN and one potential reference area (REF C) located to the north of the IOSN. The proposed reference areas are circular in shape and 500 m in diameter. Depths within the potential reference areas range from 93 to 95 m (305 to 312 ft).

1.3 Previous Monitoring Events at IOSN

As mentioned above, the DAMOS Program conducted an initial survey at the IOSN in 2015 that included the collection of acoustic and SPI data (Table 1-1). Results of the acoustic survey are noted above in Section 1.2. SPI results from the 2015 survey indicated that surficial sediments at the site were uniform and fine-grained with deep SPI camera penetration depths indicating softer sediments. Cohesive clay was identified in SPI images from the northern portion of the survey area and one potential reference area, REF C, a possible indicator of previous dredged material disposal (Guarinello, et al, 2016). Stage III infauna were present across the IOSN and included large-bodied infauna, deep surface burrowers, and deep feeding voids. In addition, opportunistic Stage I fauna were observed as small tubes at the sediment-water interface (Guarinello, et al, 2016).

1.4 2019 and 2020 Study Objectives

The September/October 2019 and September 2020 surveys were designed to provide additional site information to supplement the data collected in 2015 and to support future monitoring following the placement of dredged materials after the site designation. The specific survey objectives included:

- Characterize the surficial sediment chemical quality and grain size across the site and the potential reference areas;
- Characterize the benthic community structure across the site and the potential reference areas; and
- Characterize the water quality across the site and potential reference areas.

Table 1-1.

DAMOS Survey Chronology at IOSN

Date (month/year)	Purpose of Survey	No. SPI Stations	Sediment Grab	Additional Studies	Reference/ Contribution No.
September 2015	Baseline Acoustic Monitoring/SPI	45	-	-	DAMOS Data Report 2015-D-01 (Guarinello et al, 2016)

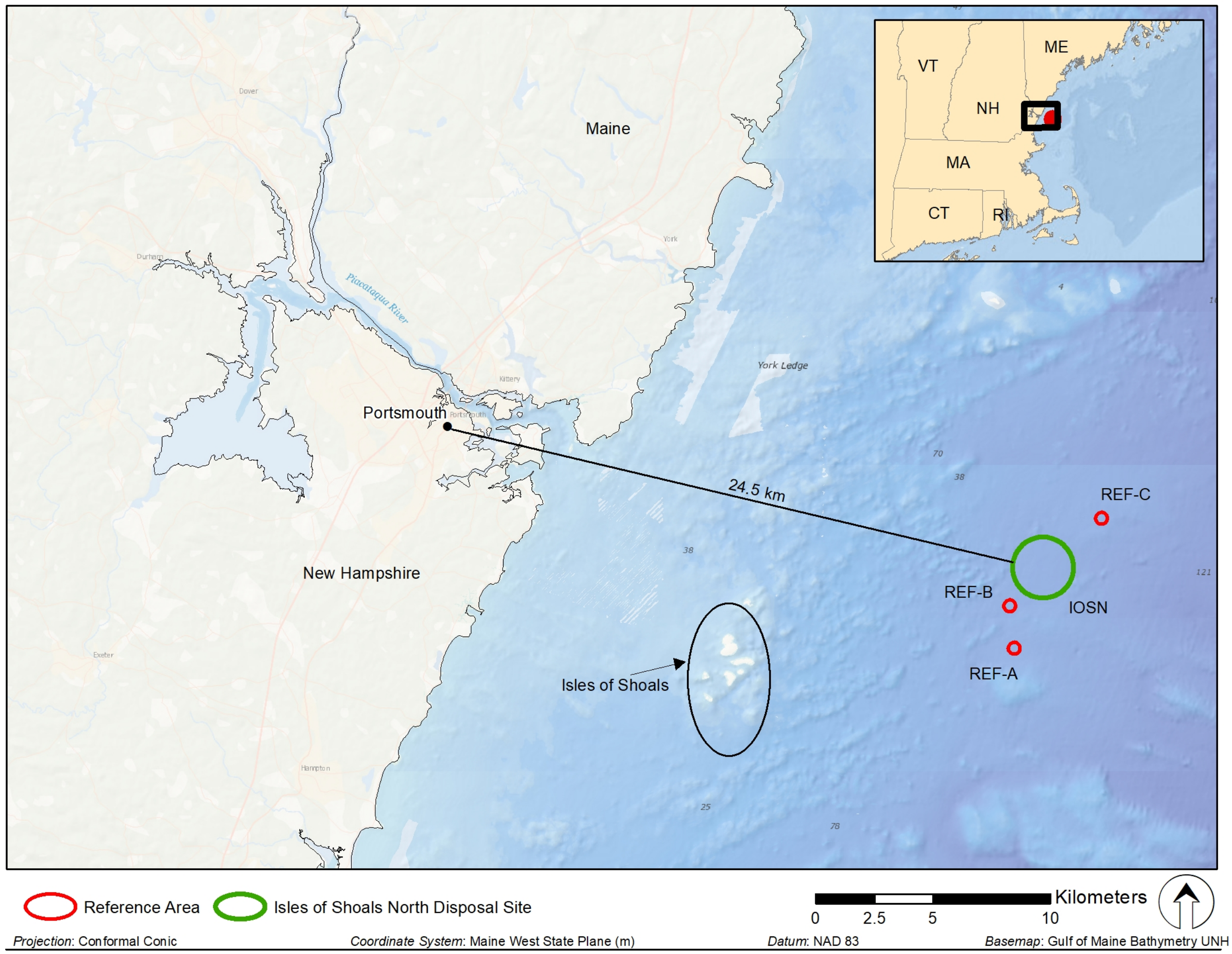


Figure 1-1. Location of IOSN and potential reference areas

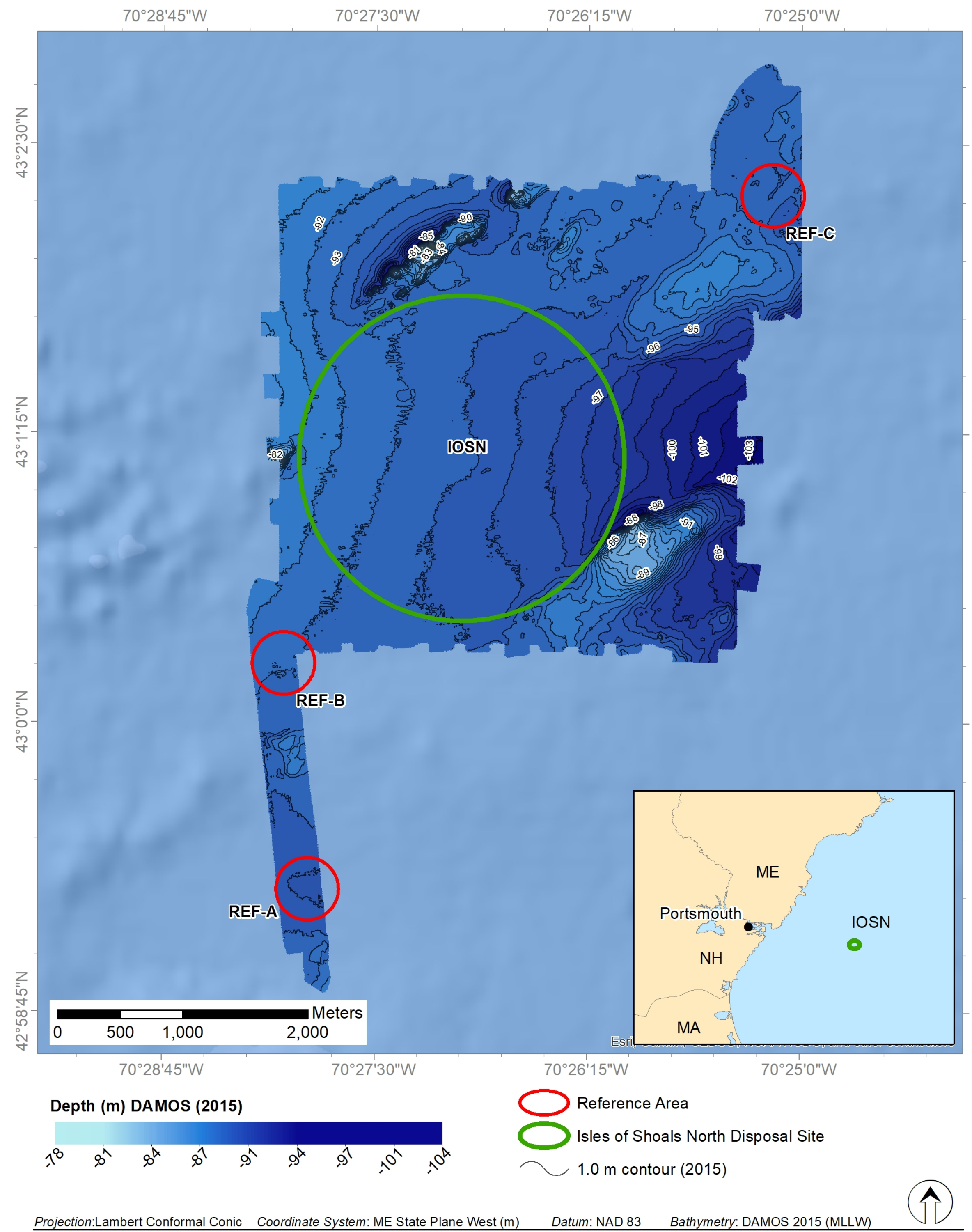


Figure 1-2. DAMOS 2015 bathymetric survey at IOSN

2.0 METHODS

AECOM and CR Environmental, Inc. conducted the 2019 and 2020 surveys at IOSN. Katahdin Analytical Services (Katahdin) (Scarborough, ME), and GeoTesting, Inc. (GeoTesting) (Acton, MA) performed sediment laboratory analyses, Alpha Analytical Services (Alpha) (Westborough, MA) performed sediment and water laboratory analyses, and AECOM's Benthic Laboratory (Pocasset, MA) performed the sorting and identification of infaunal organisms from the sediment samples collected during the survey. Sediment samples were collected from eight locations within the IOSN and from nine locations within the three potential reference areas (REF A, REF B, and REF C). Water quality samples paired with physical water column profiles were collected from one central location within the site and from one central location within each of the three potential reference areas.

The 2019 and 2020 surveys were conducted aboard the 55-ft Research Vessel (R/V) *Jamie Hannah.* Field activities are summarized in Table 2-1, and an overview of the methods used to collect and analyze sediment and water samples is provided below. Detailed Standard Operating Procedures (SOPs) for data collection and processing are presented in the program Quality Assurance Project Plan (QAPP) (AECOM, 2019a/2020). In addition, the marine operations were conducted in accordance with the Accident Prevention Plan (APP) for Marine Operations Associated with the DAMOS Program (AECOM, 2019b/2020).

2.1 Navigation and On-Board Data Acquisition

Navigation for the surveys was accomplished using a Hemisphere R110 differential global positioning system (DGPS) capable of sub-meter horizontal accuracy. HYPACK® Hydrographic Survey and Processing Software was used to continually record vessel position and global positioning system (GPS) satellite quality; it also provided a steering display for the vessel captain to accurately navigate to pre-determined sampling targets.

2.2 Sample Design and Collection

A total of fifteen target sediment sampling locations were selected for the 2019 survey effort. Inclement weather during the 2019 survey window limited the number of samples that could be collected, resulting in the collection of sediment from eight of the fifteen proposed sampling stations. The 2020 survey was conducted in September, prior to the official site designation and any dredged material disposal, and was designed to collect the remaining seven sampling stations from the previous (2019) sampling event. In addition, two sediment sampling locations were added to the previous sampling design and four additional water quality profile/sampling locations were included.

Ahead of each survey, the target locations were pre-programmed into the on-board navigation system. The survey vessel navigated within 10 m (33 ft) of the selected target sampling location prior to deployment of the sampling equipment over the side of the vessel.

Actual sediment and water sampling locations are depicted on Figure 2-1 and sample collection coordinates are presented in Tables 2-2 and 2-3.

2.2.1 Sediment Sample Collection – Chemistry and Grain Size

Samples for sediment chemistry and grain size analysis were collected using a 0.1 square meter (m^2) grab sampler. Upon collection, sediment was brought aboard the vessel to be visually inspected and generally described, including color, texture, general grain size observations, and additional characteristics such as odor. Descriptions were recorded in the dedicated project field notebook and photos were cataloged and are presented in Appendix B.

After collection, any overlying water within the grab sampler was poured off or siphoned from the sediment sample and the entire contents from the grab sampler were placed in a decontaminated stainless-steel bowl and homogenized to be collected for non-discrete sampling parameters. Sediment samples were then placed in pre-cleaned glassware for chemistry and grain size analysis. Sample container sizes, preservation requirements, and holding times are detailed in the program QAPP (AECOM, 2019a/2020). Between samples, the grab sampler, spoons, and bowl were thoroughly decontaminated with a non-phosphate detergent and then rinsed with de-ionized water prior to re-deployment.

2.2.2 Sediment Sample Collection – Benthic

Samples for benthic community structure and taxonomic analysis were collected using a 0.04 m^2 Ted Young grab sampler. After retrieving the samples from the seafloor, they were photographed and general notes were made on grab penetration, general sediment characteristics, and presence of odor. The entire volume of sediment was removed from the grab sampler and washed into a clean 9.4 liter (2.5 gallon) plastic bucket and sieved through a 0.5 millimeter (mm) mesh screen. The material retained on the sieve was then placed into a sample container and preserved with 10% formalin buffered with sodium borate.

2.3 Water Column Profile/Water Quality Sampling

Four water quality profiles were cast at the centroid of each sampling area (Figure 2-1) using a YSI EXO2 sonde which collected data for the following physical parameters: temperature, salinity, dissolved oxygen, pH, and turbidity. The sonde was attached to a weighted frame and lowered through the water column at a steady rate. Once the sonde was approximately 1 m from the seafloor, the instrument was brought up to the surface at a steady rate to generate a consistent profile for the previously mentioned parameters.

Water quality analytical samples were collected from four locations, centrally located within each of the three potential reference areas and one centrally located within the IOSN site. Samples were collected from three depths within the water column (within 1 m of the surface, mid-depth/pycnocline (as determined from the water quality profile), and within 1.5 m of the seafloor (bottom). To collect water, a Niskin bottle sampler was lowered to the appropriate depth and a trigger was released to close the bottle and collect the water sample. Water from the Niskin bottle was poured into the appropriate laboratory bottle to be delivered for analysis.

2.4 Laboratory Analysis

2.4.1 Sediment Chemistry and Grain Size Samples

The sediment samples were analyzed for metals (arsenic [As], cadmium [Cd], chromium [Cr], copper [Cu], lead [Pb], mercury [Hg], nickel [Ni], and zinc [Zn]), TOC, grain size, pesticides, PAHs, and PCBs (National Oceanic and Atmospheric Association [NOAA] 18 congeners).

Analytical samples were analyzed by Alpha for total organic carbon (TOC), metals, pesticides, and polychlorinated biphenyls (PCBs), by Katahdin for polycyclic aromatic hydrocarbons (PAHs), and by GeoTesting for grain size. Analytical chemistry samples were stored on ice and shipped under chain-of-custody to the previously mentioned laboratories.

Table 2-4 includes a summary of the laboratory analytical work and Appendix C presents expanded analytical results. A routine set of quality control (QC) samples was collected, including one field duplicate (FD) and one matrix spike/matrix spike duplicate (MS/MSD) for the previously described analyses. A rinsate blank was collected from the sediment grab sampling and processing equipment and was analyzed to provide a quality check of decontamination processes. Samples were extracted and analyzed within the holding times for the analytes mentioned above.

For the metals, pesticides, PAH, and PCB analyses, standard QC procedures included analysis of a method blank (MB) and a laboratory control sample (LCS) in order to evaluate the accuracy of the dataset. For TOC, all samples were analyzed in duplicate per the method requirements and the QC samples included a MB and a LCS.

Analytical methods applied within this study are consistent with those prescribed in the Regional Implementation Manual (RIM) that provides guidance for testing dredged material for open water disposal in New England (USEPA and USACE, 2004).

2.4.2 Benthic Biology

Benthic community samples were transported under chain-of-custody to the AECOM laboratory. After 48 hours, but within the holding time of 10 days, benthic samples were transferred out of the formalin, rinsed on a 0.5 mm sieve with fresh water, and preserved in an 80% ethanol solution. To facilitate the sorting process, the samples were stained in a solution of Rose Bengal, a biological stain that adds color to proteinaceous tissue. Benthic infaunal samples were sorted using a dissecting microscope to identify major taxonomic categories, such as Polychaeta to family level and Arthropoda, Mollusca, and Echinodermata to class level.

Following sorting, individual organisms were identified to the lowest practical taxonomic level (LPTL), typically species, and enumerated. The final dataset excluded infaunal taxa such as juveniles and indeterminate specimens that could not be identified to the species level, as well as epifauna, shellborers, and parasites. Organisms such as meiofauna (e.g., Nematoda, Harpacticoida, and Ostracoda), planktonic fauna, and colonial epifauna were neither identified nor included in the raw data files. Data were recorded on project-specific datasheets and entered into an Excel™ spreadsheet (presented in Appendix D). The final dataset excluded infaunal taxa such as juveniles and indeterminate specimens, however, indeterminate individuals of benthic fauna were included in total abundance.

2.4.3 Water Quality Samples

Samples collected from all four water quality stations were analyzed for chlorophyll, total nitrogen, and total phosphorus. In addition, samples collected from IOSN 8 and REF B were also analyzed for metals (arsenic [As], cadmium [Cd], chromium [Cr], copper [Cu], lead [Pb], mercury [Hg], nickel [Ni], and zinc [Zn]), pesticides, PAHs, and PCB congeners, as outlined in Table 2-5. Analytical water chemistry samples were stored on ice and delivered under chain-of-custody to Alpha. Sample analysis was conducted as described within the project specific QAPP (AECOM, 2020).

2.5 Data Analysis

2.5.1 Sediment Chemistry Analysis

Calculations for PAHs (total, high molecular weight [HMW], and low molecular weight [LMW]) and total DDx (sum of 4,4'-dichlorodiphenyldichloroethane [DDD], 4,4'-dichlorodiphenyldichloroethylene [DDE], and 4,4'-dichlorodiphenyltrichloroethane [DDT]) were calculated using one-half the method detection limit (MDL) for individual analytes that were recorded as non-detect. Total PCBs were calculated as the sum of the 18 NOAA congeners multiplied by two, with non-detects included as one-half of the MDL. Individual compounds that were recorded as non-detect are reported as one-half of the MDL.

Chemistry results from the two surveys were compared to national sediment quality guidelines (SQGs). These SQGs were derived using a database that compiled data from multiple studies and investigators and contained paired sediment chemistry and bioassay data (Long and Morgan, 1991; Long et al. 1995). From these data, the 10^{th} and 50^{th} percentile of the effect values were identified for each chemical of interest. The two guidance values used for comparative purposes herein (effects range low [ER-L] and effects range median [ER-M]) are intended to delineate three concentration ranges for a specific chemical. The concentrations that are less than the ER-L (10^{th} percentile) value represent a minimal effects range, or those that would rarely cause adverse effects. Concentrations that are greater than the ER-L, but less than the ER-M (between 10th and 50th percentile), represent a possible adverse effects range, and concentrations that are greater than the ER-M (>50th percentile) represent a probable effects range (Long et al., 1995). The screening values used in this report are intended to provide a general context for the baseline sediment conditions at IOSN.

2.5.2 Infaunal Community Analysis and Trophic Groupings

The PRIMER E (v.7) statistical package was used to calculate diversity indices, including Shannon-Weiner diversity index (H′), Pielou's evenness value (J′), and Log-series Fisher's alpha (Clarke and Gorley, 2001). Shannon-Weiner's index (H′) is based on information theory and is the most widely used diversity index among benthic ecologists. Shannon-Weiner's index assumes that individuals are randomly sampled from an infinitely large population and that the total number of species are present in the sample obtained (Wilhm and Dorris, 1968; Pielou, 1975; Magurran, 1988). Neither assumption correctly describes the environmental samples collected in most marine benthic programs; therefore, it is important to include additional metrics to assess for benthic community structure. Pielou's evenness index (J′) expresses H′ relative to the maximum value that H′ can obtain when the number of species in the sample is perfectly even (J′ is constrained between 0 and 1). The less-evenly distributed species are in a community, the lower the value of J′. Log-series Fisher's *alpha* (Fisher's α) model of species abundance (Fisher et al., 1943) has also been widely used and is considered a better index for discriminating diversity among samples with subtly different characteristics in community structure (Taylor, 1978). Fisher's α is a measure of diversity that is calculated to be independent of sample size and does not assume, as H′ does, that the total number of species is present within the sample obtained.

A species-area curve was generated to evaluate the success of sampling the two types of areas (IOSN and potential reference areas) relative to the number of species identified per number of samples collected. The cumulative species count should increase with the number of samples collected until an asymptote (plateau) is reached indicating that there is a low likelihood of finding additional species with increased sampling effort. PRIMER was also used to calculate the Bray-Curtis Similarity matrix and to perform a Principal Components Analysis (PCA) to discern patterns of community structure among the stations sampled. These multivariate and univariate metrics were used to test the hypothesis that the IOSN and potential reference areas have similar infaunal community assemblages.

To further evaluate the species composition of IOSN relative to the potential reference areas, the species identified were assigned to one of six trophic groupings (feeding modes): 1. omnivores/scavengers; 2. subsurface deposit feeders; 3. interface feeders; 4. suspension feeders; 5. surface deposit feeders; or 6. predators. Trophic grouping assignments were referenced to Pollock, 1998 and QA'd by a qualified benthic ecologist.

2.5.3 Water Quality Analysis

Total PAHs, total DDx, and total PCBs were calculated for the water samples using the same method as described for sediment in Section 2.5.1. Individual compounds that were recorded as non-detect were reported as one-half of the MDL.

Surface water samples that were analyzed for chemistry parameters were compared to marine surface water screening values obtained from the NOAA Screening Quick Reference Tables (Buchman, 2008). Water samples analyzed for nutrients were compared to values from a State of Maine study (Battelle, 2008) to provide a general context of regional concentrations.

Table 2-1.

IOSN Field Activities Summary (2019 and 2020)

Survey	Grab Samples (Chemistry)	Grab Samples (Benthic)	Water Quality (Chemistry)	Water Quality (Nutrient)	Water Column Profile
2019	IOSN n=6 REF n=2	IOSN n=6 REF n=2			
2020	IOSN n=2 REF n=7	IOSN n=2 REF n=7	IOSN n=1 REF n=1	IOSN n=1 REF n=3	IOSN n=1 REF n=3

n= number of stations visited

Table 2-2.

IOSN and Potential Reference Area Sediment Grab Locations

Station ID	Easting	Northing	Latitude (N)	Longitude (W)	Physical and Chemical Analysis	Benthic Community Structure Analysis	Year
IOSN Site							
IOSN 1a	876466.8	20284.44	43° 00.9340'	70° 27.3212'	X		2019
IOSN 1b	876469.3	20294.80	43° 00.9396'	70° 27.3194'		X	2019
IOSN 2a	876226.2	21190.73	43° 01.4231'	70° 27.5006'	X		2019
IOSN 2b	876227.7	21188.09	43° 01.4216'	70° 27.4995'		X	2019
IOSN 3a	876421.1	21695.66	43° 01.6961'	70° 27.3585'	X		2019
IOSN 3b	876423.5	21692.76	43° 01.6946'	70° 27.3567'		X	2019
IOSN 4a	877122.5	21331.89	43° 01.5010'	70° 26.8412'	X		2019
IOSN 4b	877120.6	21329.42	43° 01.4996'	70° 26.8426'		X	2019
IOSN 5a	877556.9	20764.61	43° 01.1953'	70° 26.5200'	X		2019
IOSN 5b	877555.4	20764.17	43° 01.1951'	70° 26.5212'		X	2019
IOSN 6a	877536.9	19907.18	43° 00.7322'	70° 26.5327'	X		2019
IOSN 6b	877536.8	19910.08	43° 00.7338'	70° 26.5328'		X	2019
IOSN 7a	877616.5	21258.23	43° 01.4640'	70° 26.4780'	X		2020
IOSN 7b	877636.6	21232.94	43° 01.4460'	70° 26.4600'		X	2020
IOSN 8a	876912.7	20673.46	43° 01.1460'	70° 26.9940'	X		2020
IOSN 8b	876919.3	20676.12	43° 01.1460'	70° 26.9880'		X	2020
Potential Reference Areas							
REF A-1a	875606.2	17096.89	42° 59.2080'	70° 27.9420'	X		2020
REF A-1b	875610.6	17105.93	42° 59.2140'	70° 27.9420'		X	2020
REF A-2a	875514.9	17283.88	42° 59.3100'	70° 28.0080'	X		2020
REF A-2b	875491.9	17301.84	42°.59.3160'	70° 28.0260'		X	2020
REF A-3a	875888.4	17284.10	42° 59.3100'	70° 27.7380'	X		2020
REF A-3b	875877.8	17283.79	42° 59.3100'	70° 27.7440'		X	2020
REF B-1a	875358.2	19129.43	43° 00.3060'	70° 28.1340'	X		2020
REF B-1b	875358.5	19131.83	43° 00.3060'	70° 28.1280'		X	2020
REF B-2a	875377.3	19021.44	43° 00.2498'	70° 28.1198'	X		2019
REF B-2b	875381.7	19015.03	43° 00.2464'	70° 28.1166'		X	2019
REF B-3a	875585.6	19023.97	43° 00.2516'	70° 27.9665'	X		2019
REF B-3b	875583.2	19029.50	43° 00.2546'	70° 27.9683'		X	2019
REF C-1a	879248.8	22749.41	43° 02.2680'	70° 25.2780'	X		2020
REF C-1b	879276.4	22759.55	43° 02.2740'	70° 25.2540'		X	2020
REF C-2a	879397.6	22900.49	43° 02.3520'	70° 25.1640'	X		2020
REF C-2b	879404.1	22923.57	43° 02.3640'	70° 25.1640'		X	2020
REF C-3a	879571.2	22746.93	43° 02.2680'	70° 25.0380'	X		2020
REF C-3b	879558.6	22744.38	43° 02.2680'	70° 25.0500'		X	2020

Notes:
1. Grid coordinates are NAD_1983_StatePlane_Maine_West_FIPS_1802_Meters
2. Geographic coordinates are North American Datum of 1983 (NAD 83) degree decimal minute
3. X indicates the sample location for the specified parameter

Table 2-3.

IOSN Water Quality Samples and Water Column Profile Locations

Station ID	Easting	Northing	Latitude (N)	Longitude (W)	Year	Chemical Water Quality Sample	Nutrient Water Quality Sample	Water Column Profile
IOSN Site								
IOSN-Water	876917.4	20693.5	43° 01.1580	70° 26.9880'	2020	X	X	X
Potential Reference Areas								
REF-A-Water	875678.5	17211.6	42° 59.2680'	70° 27.8880'	2020		X	X
REF-B-Water	875494.3	19019.1	43° 00.2460'	70° 28.0320'	2020	X	X	X
REF-C-Water	879405.6	22766.7	43° 02.2740'	70° 25.1580'	2020		X	X

Notes:
1. Grid coordinates are NAD_1983_StatePlane_Maine_West_FIPS_1802_Meters
2. Geographic coordinates are North American Datum of 1983 (NAD 83) degree decimal minute

Table 2-4.

Summary of Laboratory Analytical Work for Sediment Samples

	Test Method USEPA Test Method No.		
	Sample Prep	**Analytical**	**Instrumentation**
Metals	3050B	6020B	ICP-MS
Mercury (Hg)	7471B	7471B	CVAA
Polynuclear Aromatic Hydrocarbons (PAHs)	3540C	8270D SIM	GC/MS
Polychlorinated Biphenyls	3540C	8082A	GC/MS
Pesticides	3540C	8081B	GC/MS
Total Organic Carbon (TOC)	-	9060A	Carbonaceous analyzer
Grain Size	ASTM D422-63		

Notes:

ICP-MS - Inductively Coupled Plasma-Mass Spectrometry

CVAA - Cold Vapor Atomic Absorption

GC-MS - Gas Chromatography-Mass Spectrometry

Table 2-5.

Summary of Laboratory Analytical Work for Water Samples

	Test Method USEPA Test Method No. Sample Prep	Analytical	Instrumentation
Metals	3005	6020B	Acid digestion/ICP-MS
Mercury (Hg)	7474	7474	Atomic Fluorescence
Nitrate + Nitrite	353.2	353.2	Automated colorimetry
Total Kjeldahl Nitrogen (TKN)	351.2	351.2	Automated colorimetry
Total Phosphorus	SM4500P-E	SM4500P-E	Automated colorimetry
Polynuclear Aromatic Hydrocarbons (PAHs)	3570	8270D SIM	Separatory funnel extraction/GC/MS SIM
Polychlorinated Biphenyls	3510C	8270D SIM	Separatory funnel extraction/GC/MS/SIM
Chlorinated Pesticides	3510C	8081B	Separatory funnel extraction/GC/ECD

Notes:

ECD – Electron Capture Detector

GC-MS - Gas Chromatography-Mass Spectrometry

ICP – MS - Inductively Coupled Plasma-Mass Spectrometry

SIM – Selected Ion Monitoring

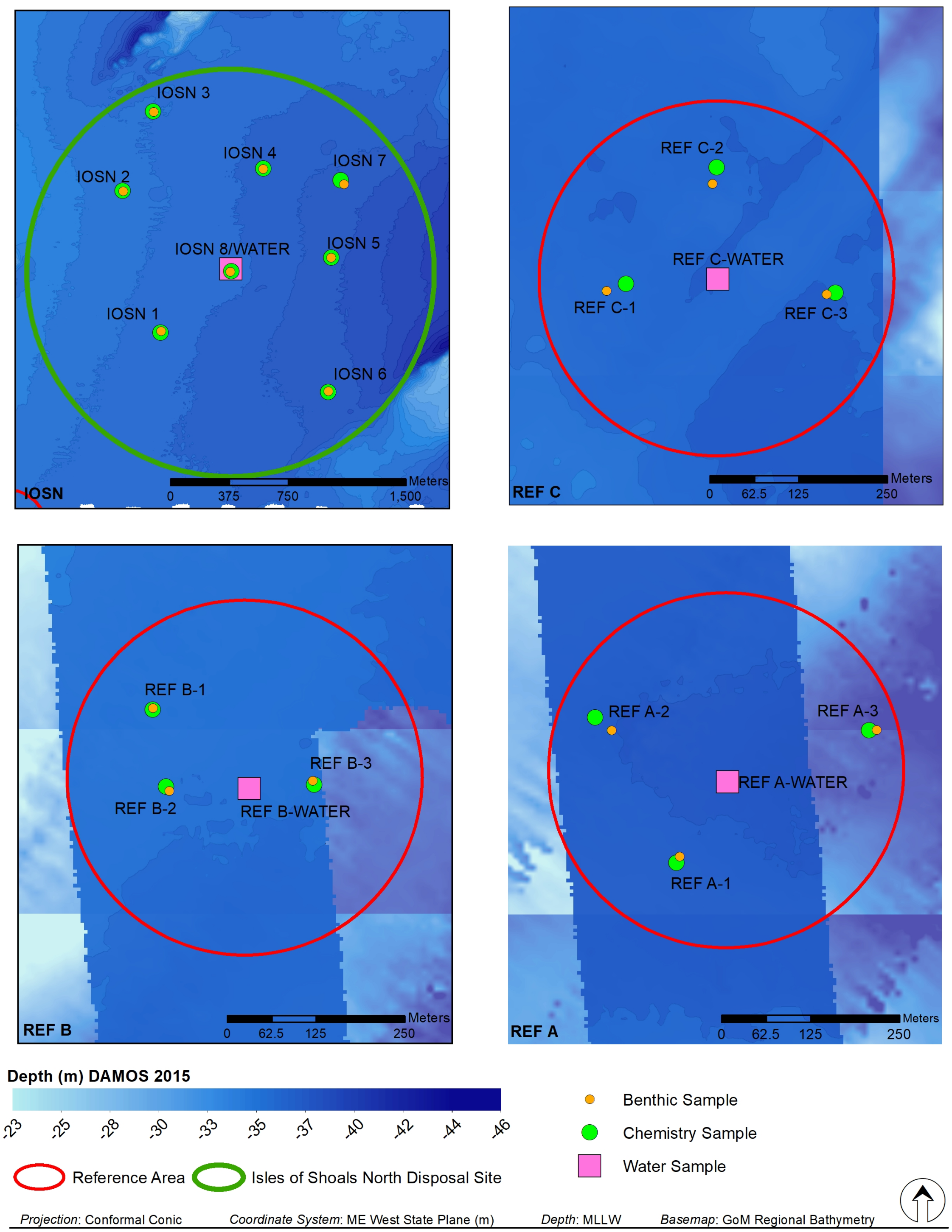


Figure 2-1. IOSN 2019 and 2020 stations for water quality profiles and sediment, water, and benthic sampling, detailed panels

3.0 RESULTS

3.1 Sediment Grain Size and Chemistry

Results of the physical and chemical sediment analyses are summarized below and analytical data tables are presented in Appendix C. Sediments from the IOSN that were analyzed for chemistry parameters were compared to the ER-L and ER-M values (Long et al., 1995), as outlined within section 2.2.2.

3.1.1 Grain Size and Total Organic Carbon

Surficial sediment samples were dominated by fine-grained material at each IOSN station and potential reference areas REF A and REF B with percent fines (silt and clay) ranging from 87.2 to 96.9%. The three samples collected from potential reference area REF C were comprised of less fine-grained material than the other stations, ranging from 60.5 to 70% (silt and clay), and higher amounts of sand (21.9 to 28.3%) and gravel (5.4 to 17.3%). TOC values ranged from 1.3 to 1.6% within the IOSN and from 0.8 to 1.4% in the potential reference areas with the lowest two values measured in REF C samples (0.8 and 1.1%). A summary of the grain size data is presented in Table 3-1 and TOC data are shown in Table 3-2. Grain size data are displayed on Figure 3-1 and a comparison of co-located grain size and TOC data is displayed on Figure 3-2.

3.1.2 Metals

Sediment samples were analyzed for the metals listed in Section 2.2.1. There were detectable concentrations of metals in the samples collected from IOSN and all three potential reference areas; a summary of the results is presented in Tables 3-2 and 3-3 and on Figures 3-3 through 3-10. Arsenic concentrations were slightly greater than the ER-L of 8.2 milligrams per kilogram (mg/kg) in six of the samples collected from the site and at five locations within the potential reference areas; the average arsenic concentration within the site measured 9.0 mg/kg and the average concentration within the three potential reference areas measured 9.7 mg/kg. The greatest arsenic concentration was measured in a sample collected from potential reference area REF C (20 mg/kg in REF C-2). Nickel concentrations were slightly greater than the ER-L of 20.9 mg/kg at IOSN 4 (23.6 mg/kg), IOSN 5 (21.0 mg/kg), and IOSN 8 (22.2 mg/kg) and in two samples from REF C (21.3 mg/kg at REF C-2 and 21.6 at REF C-3); the average nickel concentration was 20.7 mg/kg at the site, and 19.7 mg/kg within the three potential reference areas. The other metals concentrations were less than the respective ER-L guidelines. Based on the relatively low (i.e., below or only slightly above the respective ER-L values) and similar concentrations of arsenic and nickel across the site and potential reference areas, the concentrations of these metals within the study area are considered representative of native (unimpacted) sediment in the region.

3.1.3 PAHs

The concentrations of Total, LMW, and HMW PAHs were less than their respective ER-Ls within the site and the three potential reference areas. Summary statistics for total, LMW, and HMW PAHs are displayed on Table 3-4, and Total PAHs compared to the ER-L and ER-M are displayed on Figure 3-11. The average Total PAH concentration within the site was 268 micrograms per kilogram (µg/kg) and the average total PAH concentration within the three potential reference areas was 144 µg/kg.

3.1.4 PCBs and Pesticides

Sediment PCB concentrations were less than the method detection limit for the congeners that were analyzed. Individual pesticides were also not detected in the IOSN samples or in the majority of the potential reference area samples. Detected compounds from the pesticide analyte list were limited to 4,4’- DDD and 4,4’-DDE in REF C-2 (0.596 and 0.264 µg/kg, respectively). Total chlordane was not detected in any sample.

3.2 Benthic Community Structure

Benthic biology samples to characterize the benthic infaunal community were collected at 17 locations: eight within the IOSN site and three at each of the three potential reference areas. From these samples, 52 taxa were identified from the IOSN site samples and 62 taxa were identified from the three potential reference areas. The mean species richness was 28 species from the disposal site stations and 31 species at potential reference area stations. Average density was 5,528 individuals/m^2 for the combined IOSN locations and 6,211 individuals/m^2 for the three potential reference areas combined, with a similar mean Shannon-Weiner (Log_2) diversity (H') at the site and potential reference areas (2.72 and 2.71, respectively). The average measures of the benthic community for the univariate metrics calculated were comparable for the IOSN stations and potential reference areas (Table 3-5).

Trophic guild analysis showed that the potential reference area and disposal site samples were dominated by surface deposit and subsurface deposit feeding polychaetes, though all trophic guilds were represented in the samples analyzed. Numerically, the surface deposit feeding polychaete, *Ampharete acutifrons,* was the most dominant species in 16 of the 17 stations analyzed (IOSN and potential reference areas combined). Other dominant species identified included subsurface deposit feeding polychaetes *Levinsenia gracilis*, *Terebellides stroemii,* and *Cossura longocirrata*, multiple species of the polychaete family Cirratulidae (surface deposit feeders), polychaete *Ninoe nigripes* (omnivore/scavenger), and bivalves *Nucula proxima* (subsurface deposit feeder), *Periploma papyratium,* and *Thyasira gouldi* (suspension feeders) (Tables 3-6 and 3-7, Figures 3-12 and 3-13, and Appendix C). These species were consistently within the top ten dominant taxa identified from stations sampled within both reference and disposal site areas. Though polychaetes were the dominant taxa identified, additional taxa from phyla Mollusca (bivalvia, gastropoda, aplacophora) and Crustacea (amphipoda, cumacea) were frequently identified throughout the sampled area (IOSN and potential reference area stations).

Bray-Curtis multivariate calculation (with 4th root transformation) and graphic representation was used to compare the overall benthic infaunal community similarity of the reference and disposal site station locations. The results suggested that the potential reference area and IOSN infaunal communities had little dissimilarity and REF A and REF B and station REF C-2 were most representative of the IOSN area based on benthic biodiversity (Figure 3-14), while stations REF C-1 and REF C-3 were outliers, having only approximately 55% similarity to all other stations. REF B-2 and 3 and IOSN 1, 2, 3, 4, 5, and 6 were approximately 75% similar, and REF A-1, 2, and 3, REF B-1, REF C-2, IOSN 7 and 8 displayed approximately 70% similarity, though all stations were strongly correlated. Statistical strength of these metrics in the cluster analysis of the potential reference area and IOSN stations are further indicated by the groupings in Figure 3-15. Non-metric multidimensional scaling of 4th root transformed abundance of projected similarity data showed grouping results based on Bray-Curtis similarity with both the IOSN and potential reference area stations having highly similar benthic community structures with results between 50-80%. Though >60% similar to each other, stations REF C-1 and REF C-3 were the most dissimilar from all other stations with <60% similarity to the other stations. This difference is likely attributable to the differences in sediment grain-size (higher amounts of sand and gravel with lesser percentages of fines than the other stations) and TOC as discussed in Section 3.1.1. All other stations analyzed were greater than 60% similar among and between stations.

3.3 Water Column Chemistry

Water quality samples were collected from three depths within the water column: bottom (A), pycnocline (B), and surface (C). Water column results are summarized below, and these data are also presented on Table 3-8 (metals), Table 3-9 (PAHs), and Table 3-10 (nutrients). Data for PCBs and pesticides are located within Appendix E; results of those analyses were below the method detection limit and therefore not presented as summary tables.

Water samples from IOSN 8 and REF B were analyzed for the metals listed in Section 2.2.1. Metals were detectable within these water samples; however, concentrations were less than the most conservative values for the marine surface water criteria at all depths, as presented within the NOAA screening tables (Table 3-8).

PAHs were detected infrequently and only at low levels within the water samples (Appendix E). At IOSN 8, 1-methylnaphthalene and naphthalene were detected within the surface sample (C) and phenanthrene was detected in the bottom sample (A); all PAH compounds were detected at very low concentrations, multiple orders of magnitude below the screening value. Within the REF B surface sample (C), only1-methylnaphthalene was detected at a low concentration. Table 3-9 summarizes the range of concentrations with the IOSN and potential reference area for total PAHs, total LMW PAHs, and total HMW PAHs.

Nutrients were analyzed from the bottom (A), pycnocline (B), and surface (C) from locations IOSN 8, REF A, REF B, and REF C. Analytes included total phosphorus, total nitrogen, total Kjeldahl nitrogen, Nitrate+Nitrite, and chlorophyll a (Appendix E). Total nitrogen and chlorophyll a were not detected within any site or reference samples. Table 3-10 summarizes the range of concentrations for the detected nutrients: Nitrate+Nitrite, total Kjeldahl nitrogen, and total phosphorus. The "Gibson ME Offshore" dataset that was generated for the State of Maine (Battelle, 2008) was used herein to provide a relative point of comparison for the water column nutrient data collected from IOSN. Results within the State of Maine study were averaged from 10 offshore locations spatially located approximately 25 miles offshore, spanning from Provincetown, MA to the Canadian border in northern Maine. The Gibson data were collected once a year between June and September in both 2004 and 2005.

The surface water concentration of total phosphorus at the site was 2.0 micrograms per liter (µg/L) and ranged from 2.0 to 6.0 µg/L within the potential reference areas; the mean of the surface water values within the Maine/Gibson (Battelle 2008) offshore dataset was 30 µg/L. Total phosphorus concentrations increased with depth, with a maximum concentration of 28 µg/L recorded at the bottom location within IOSN (IOSN 8-A). Total nitrogen was not detected within the site or potential reference area samples at any depth; the Gibson offshore dataset reported a surface water mean of 340 µg/L for total nitrogen for offshore locations in Maine. Nitrate+Nitrite was detected in surface water at the site at a concentration of 73 µg/L which increased to 270 µg/L at the bottom sample. Nitrate+Nitrite in potential reference area surface water ranged from 66 to 91 µg/L and increased with depth, reaching a maximum value of 270 µg/L at the REF A and REF C locations. Data presented within the Maine/Gibson dataset for offshore locations recorded a mean of 422 µg/L for Nitrate+Nitrite surface water concentrations. Total Kjeldahl nitrogen was 152 µg/L in surface water at the site and decreased in concentration to 131 µg/L at the bottom sampling location. Total Kjeldahl nitrogen ranged from 149 to 191 µg/L within the potential reference area and the maximum value of 191 µg/L was recorded at the REF C surface water location. Comparative data were not available for this metric within the Maine/Gibson offshore dataset.

3.4 Water Quality Profiles

Water quality profiles were conducted at four locations and two were co-located with the water quality sample locations. Profiles were conducted during a flood tidal stage and sampled at the approximate tidal stages displayed on Figure 3-16. Figure 3-17 displays the physical parameters (salinity, temperature, DO, pH, and turbidity) recorded at each station. Salinity, temperature, and DO data displayed a transition zone at a depth of approximately 10-20 m (33-66 feet), with gradual changes as depth at each station increased. Values for pH gradually decreased with increasing depth. Station REF C varied from the other stations with a lower surface pH than observed at the other locations. The profile collected at REF C was the first station collected in the series and the errant result may be due to a calibration or casting technique issue (field notes did not indicate a plan deviation). Additionally, this station was collected the closest to low tide, however comparable information is not available to determine if this impacted the pH result at this location. Turbidity at all stations gradually increased with depth; most notably at a depth of approximately 70-80 m (230-262 feet) at station REF B.

Table 3-1.

Summary of Grain Size Data for IOSN 2019 and 2020 Sediment Samples

Sample ID	Gravel	Sand	Silt+Clay
Site		**Percent (%)**	
IOSN 1	0.2	5	95
IOSN 2 *	0.2	5	95
IOSN 3	0.1	7	93
IOSN 4	0.0	5	95
IOSN 5	0.1	5	95
IOSN 6	0.1	13	87
IOSN 7	0.0	8	92
IOSN 8	0.0	5	95
Reference			
REF A-1	0.0	3	97
REF A-2	0.0	9	91
REF A-3	0.0	4	96
REF B-1 *	0.0	7	93
REF B-2	0.1	8	92
REF B-3	0.1	5	95
REF C-1	5	28	66
REF C-2	8	22	70
REF C-3	17	22	61

*Field Duplicate, average of two samples

Table 3-2.

Total Organic Carbon and Metal Concentrations within IOSN and Potential Reference Areas, 2019 and 2020

Sample ID Site	TOC (%)	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury
		mg/kg							
IOSN 1	1.34	**9.68**	0.065	29.9	10.1	18.5	18.9	56.7	0.035
IOSN 2*	1.47	**8.84**	0.065	29.9	10.3	18.4	19.2	57.3	0.031
IOSN 3	1.60	**9.30**	0.065	31.8	10.7	20.2	20.0	60.4	0.035
IOSN 4	1.48	**11.8**	0.089	36.6	12.7	22.9	**23.6**	71.3	0.039
IOSN 5	1.43	**8.47**	0.063	32.9	11.4	21.0	**21.0**	63.6	0.025
IOSN 6	1.33	**8.75**	0.060	31.2	10.9	20.4	20.2	59.8	0.037
IOSN 7	1.52	7.50	0.051	30.1	10.6	20.2	20.8	47.4	0.041
IOSN 8	1.44	7.51	0.060	32.2	11.2	21.5	**22.2**	50.3	0.040
Reference									
REF A-1	1.23	**9.76**	0.057	29.5	10.3	18.3	20.5	45.5	0.026
REF A-2	1.35	6.49	0.058	30.6	10.5	20.3	20.9	47.2	0.036
REF A-3	1.34	7.70	0.039	28.9	9.92	18.6	19.5	44.6	0.034
REF B-1 *	1.24	8.01	0.054	28.7	9.76	18.7	19.3	44.1	0.033
REF B-2	1.23	**8.35**	0.057	27.0	9.09	16.3	17.6	51.4	0.019
REF B-3	1.27	**8.50**	0.068	27.5	9.16	16.8	17.4	52.1	0.029
REF C-1	1.30	**11.0**	0.038	27.7	9.24	16.4	18.8	43.7	0.022
REF C-2	0.84	**20.0**	0.047	31.5	10.3	20.9	**21.3**	52.0	0.030
REF C-3	1.07	7.88	0.055	31.5	11.2	19.6	**21.6**	49.8	0.027
Regional Criteria									
ER-L		**8.20**	**1.20**	**81.0**	**34.0**	**46.7**	**20.9**	**150**	**0.15**
ER-M		**70.0**	**9.60**	**370**	**270**	**218**	**51.6**	**410**	**0.71**

Bold values are greater than the ER-L guidance value

Bold and gray values are greater than the ER-M guidance value

*Field Duplicate, average of two samples

Table 3-3.

Summary of Metals in IOSN 2019 and 2020 Sediment Samples

	Arsenic mg/kg					Cadmium mg/kg					Chromium mg/kg					Copper mg/kg			
Area	**n**	**MIN**	**MAX**	**Mean**	**Std Dev**	**n**	**MIN**	**MAX**	**Mean**	**StdDev**	**n**	**MIN**	**MAX**	**Mean**	**Std Dev**	**n**	**MIN**	**MAX**	**Mean**	**StdDev**
Site	8	7.5	12	9.0	1.4	8	0.051	0.089	0.065	0.011	8	30	37	32	2.2	8	10	13	11	0.82
Reference	9	6.5	20	9.7	4.1	9	0.038	0.068	0.053	0.0096	9	27	32	29	1.7	9	9.1	11	9.9	0.71

	Lead mg/kg					Mercury mg/kg					Nickel mg/kg					Zinc mg/kg			
Area	**n**	**MIN**	**MAX**	**Mean**	**Std Dev**	**n**	**MIN**	**MAX**	**Mean**	**StdDev**	**n**	**MIN**	**MAX**	**Mean**	**Std Dev**	**n**	**MIN**	**MAX**	**Mean**	**StdDev**
Site	8	18	23	20	1.5	8	0.025	0.041	0.035	0.0054	8	19	24	21	1.6	8	47	71	58	7.5
Reference	9	16	21	18	1.7	9	0.019	0.036	0.029	0.0057	9	17	22	20	1.5	9	44	52	48	3.5

Note:

1. Duplicates are averaged.

Table 3-4.

Summary of Total PAHs for IOSN 2019 and 2020 Sediment Samples

		Total PAHs[1] µg/kg					Total LMW PAHs[2] µg/kg					Total HMW PAHs[3] µg/kg			
Area	**n**	**MIN**	**MAX**	**Mean**	**StdDev**	**n**	**MIN**	**MAX**	**Mean**	**StdDev**	**n**	**MIN**	**MAX**	**Mean**	**StdDev**
Site	8	92.2	377	268	105	8	25.6	63.1	46.0	12.9	8	66.6	313	222	92.8
Reference	9	65.9	286	144	71.5	9	20.5	51.0	29.4	10.7	9	45.4	235	115	61.0

Notes:

1. 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). Non-detected compounds were summed using ½ the MDL.
2. Total LMW PAH is the sum of the 8 PAH compounds analyzed (1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene). Non-detected compounds were summed using ½ the MDL.
3. 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). Non-detected compounds were summed using ½ the MDL.
4. Duplicates are averaged.

Table 3-5.

Summary of Benthic Biology Community Parameters for Reference and IOSN Stations

Sample	No. of Species	Abundance (0.04m²)	Individuals/ m²	Shannon's H' (log2)	Pielou's J'	Fisher's alpha
			IOSN Stations			
IOSN 1	27	227	5,675	2.30	0.70	8.15
IOSN 2	31	315	7,875	2.66	0.77	8.63
IOSN 3	27	192	4,800	2.82	0.85	8.66
IOSN 4	28	202	5,050	2.59	0.78	9.46
IOSN 5	26	269	6,725	2.92	0.90	8.24
IOSN 6	23	125	3,125	2.51	0.80	8.35
IOSN 7	26	219	5,475	2.71	0.83	7.68
IOSN 8	37	220	5,500	3.28	0.90	15.2
Average	28	221	5,528	2.72	0.81	9.29
Minimum	23	125	3,125	2.30	0.70	7.68
Maximum	37	315	7,875	3.28	0.90	15.2
			Reference Stations			
REF A-1	26	195	4,875	2.54	0.78	8.88
REF A-2	31	181	4,525	2.96	0.86	10.8
REF A-3	32	274	6,850	2.56	0.74	9.53
REF B-1	35	303	7,575	2.72	0.77	11.1
REF B-2	26	319	7,975	2.40	0.74	6.83
REF B-3	27	247	6,175	2.36	0.72	8.04
REF C-1	37	320	8,000	3.20	0.89	13.1
REF C-2	31	131	3,275	2.92	0.85	14.1
REF C-3	33	266	6,650	2.75	0.79	10.1
Average	31	248	6,211	2.71	0.79	10.3
Minimum	26	131	3,275	2.36	0.72	6.83
Maximum	37	320	8,000	3.20	0.89	14.1

Table 3-6.

List of Major Species in Trophic Faunal Groupings
IOSN and Potential Reference Areas

Trophic Group	Taxonomic Group	Species
Suspension feeders	Bivalvia	*Periploma papyratium*
		Thyasira gouldi
		Astarte undata
		Cochlodesma leanum
	Polychaeta	*Euchone elegans*
Interface feeders	Amphipoda	*Ampelisca* spp.
		Leptocheirus spp.
	Cumacea	*Diastylis sculpta*
Surface deposit feeders	Polychaeta	*Ampharete acutifrons*
		Chaetozone setosa
		Tharyx acutus
		Aphelochaeta spp.
		Cirratulus cirratus
		Apistobranchus tullbergi
	Sipuncula	*Phascolopsis gouldii*
Omnivores/Scavengers	Polychaeta	*Scoletoma tenuis*
		Ninoe nigripes
		Nephtys incisa
Predators	Gastropoda	*Frigidoalvania carinata*
	Nemertea	*Carinomella lactea*
		Cerebratulus lacteus
	Polychaeta	*Alitta succinea*
		Ceratocephale loveni
Subsurface deposit feeders	Polychaeta	*Levinsenia gracilis*
		Terebellides stroemii
		Cossura longocirrata
		Polycirrus phosphoreus
		Heteromastus filiformis
	Bivalvia	*Nucula proxima*
		Yoldia sapotilla

Table 3-7.
Summary of Trophic Faunal Groupings at IOSN and Potential Reference Area Stations

Station	Total No. of Organisms	Suspension Feeders	Interface Feeders	Surface Deposit Feeders	Omnivore/ Scavengers	Predators	Subsurface Deposit Feeders
Disposal Site Stations							
IOSN 1	227	20	3	**130**	17	7	50
IOSN 2	315	18	0	128	29	9	**131**
IOSN 3	192	14	0	69	19	5	**85**
IOSN 4	202	13	0	**94**	22	12	61
IOSN 5	269	22	0	**148**	19	5	75
IOSN 6	125	9	0	**55**	10	8	43
IOSN 7	219	18	0	**104**	14	5	78
IOSN 8	220	16	1	**99**	22	20	62
Mean	221	16	1	**103**	19	9	73
Reference Stations							
REF A-1	195	12	2	**97**	15	12	57
REF A-2	181	16	7	**76**	16	8	58
REF A-3	274	27	2	**151**	20	4	70
REF B-1	303	33	5	**156**	11	13	85
REF B-2	319	13	4	**179**	21	9	93
REF B-3	247	17	5	**132**	14	12	67
REF C-1	320	15	14	**166**	15	18	92
REF C-2	131	15	2	**53**	18	9	34
REF C-3	266	15	2	**123**	24	8	87
Mean	248	18	5	**126**	17	10	71

Note: Most abundant faunal groups shown in bold.

Table 3-8.

Metals in Water within IOSN and Potential Reference Areas, 2020

Sample ID	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury
	µg/L							
Site								
IOSN 8-A	0.02	0.003	2.4	0.5	0.02 U	0.9	0.2 U	0.01 U
IOSN 8-B	0.05	0.006	4.2	0.8	0.03 U	4.0	2.9	0.01 U
IOSN 8-C	0.03	0.003	2.4	0.3 J	0.02 U	0.8	0.2 U	0.01 U
Reference								
REF B-WATER-A	0.2	0.003	2.2	0.4	0.02 U	0.7	0.2 U	0.01 U
REF B-WATER-B *	0.04	0.004	2.6	0.7	0.03 U	0.95	0.2 U	0.01 U
REF B-WATER-C	0.7	0.01	1.8	0.5	1.7	5.7	8.0	0.01 U
Surface Water Screening Reference(1)								
Chronic	36	8.8	27.4	3.1	8.1	8.2	81	0.94
Acute	69	40	10300	4.8	210	74	90	1.8

*Field Duplicate, average of two samples
J – Estimated
U – Not Detected (reported at 1/2 method detection limit)
A – Bottom
B – Pycnocline
C – Surface
(1)Buchman, M.F. 2008. NOAA Screening Quick Reference Tables

Table 3-9.

Total PAHs, LMW, and HMW in Water within IOSN and Potential Reference Areas, 2020

Sample ID	Total PAHs [1]	Total LMW PAHs [2]	Total HMW PAHs [3]
	µg/L		
Site			
IOSN 8-A	0.013	0.0076	0.0057 U
IOSN 8-B	0.012U	0.0059 U	0.0056 U
IOSN 8-C	0.014	0.0080	0.0056 U
Reference			
REF B-WATER-A	0.012 U	0.0059 U	0.0056 U
REF B-WATER-B *	0.012 U	0.0060 U	0.0057 U
REF B-WATER-C	0.012	0.0062	0.0056 U

*Field Duplicate, average of two samples
U – Not Detected (reported at 1/2 method detection limit)
A – Bottom
B – Pycnocline
C – Surface

1. 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). Non-detected compounds were summed using ½ the MDL.
2. Total LMW PAH is the sum of the 8 PAH compounds analyzed (1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene). Non-detected compounds were summed using ½ the MDL. 1-methylnaphthalene, naphthalene, and phenanthrene were the only LMW PAHs detected at least once.
3. 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). Non-detected compounds were summed using ½ the MDL. HMW PAHs were not detected in any of the Site or Reference samples.

Table 3-10.

Nutrients in Water within IOSN and Potential Reference Areas, 2020

Sample ID	Nitrate+Nitrite	Total Kjeldahl Nitrogen	Total Phosphorus
	µg/L		
Site			
IOSN 8-A	270	131	28
IOSN 8-B	150	147	18
IOSN 8-C	73	152	6
Reference			
REF A-WATER-A	270	184	27
REF A-WATER-B	120	146	15
REF A-WATER-C	66	149	4
REF B-WATER-A	210	132	25
REF B-WATER-B *	120	164	12
REF B-WATER-C	65	167	6
REF C-WATER-A	270	146	23
REF C-WATER-B	120	156	9
REF C-WATER-C	91	191	2

*Field Duplicate, average of two samples
A – Bottom
B – Pycnocline
C – Surface
Total Nitrogen and Chlorophyll a were analyzed but not detected in any site or potential reference area samples.

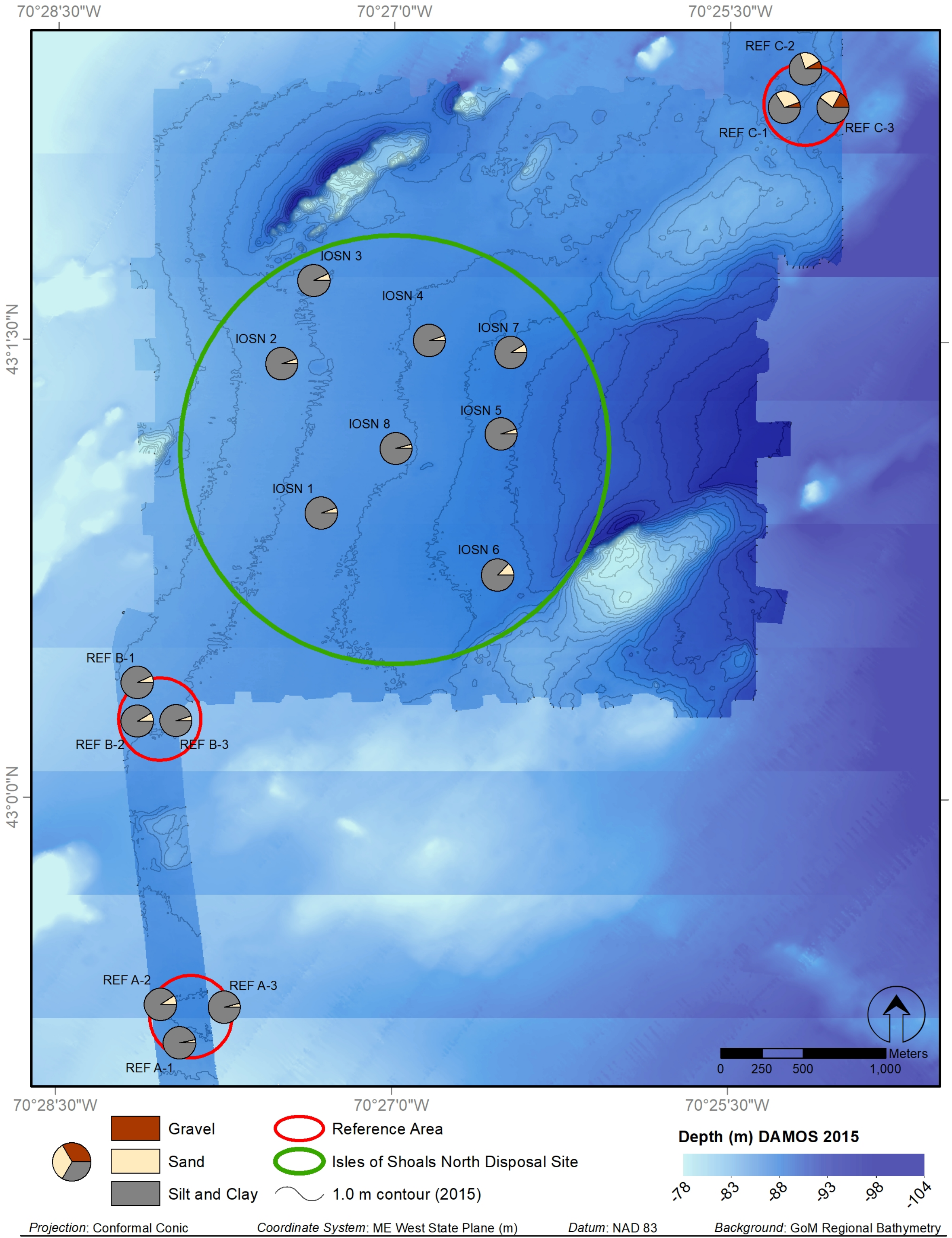


Figure 3-1. Grain size results at IOSN and potential reference areas, 2019 and 2020

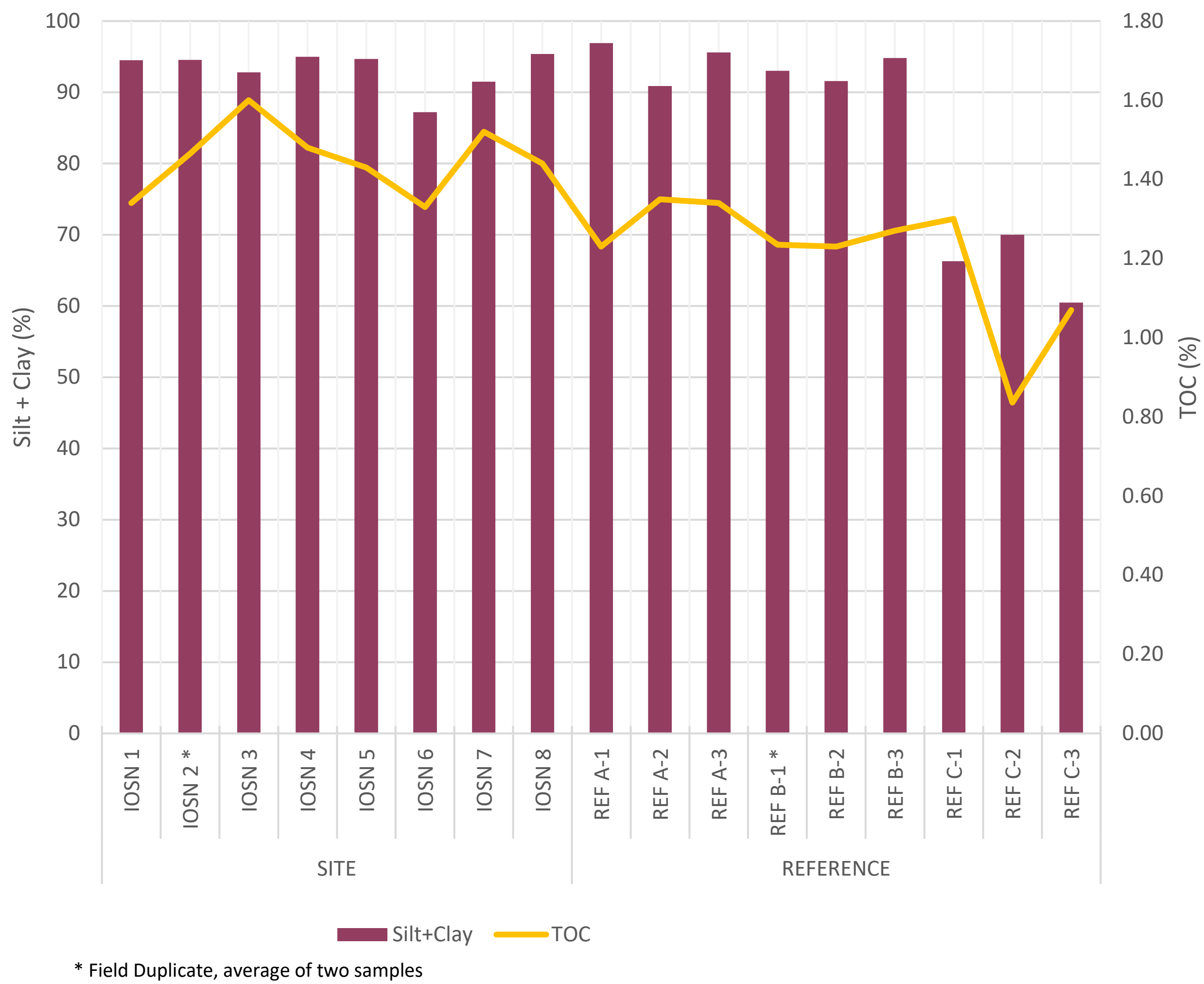


Figure 3-2. Fine sediment (silt+clay %) and TOC relationship IOSN and potential reference areas, 2019 and 2020

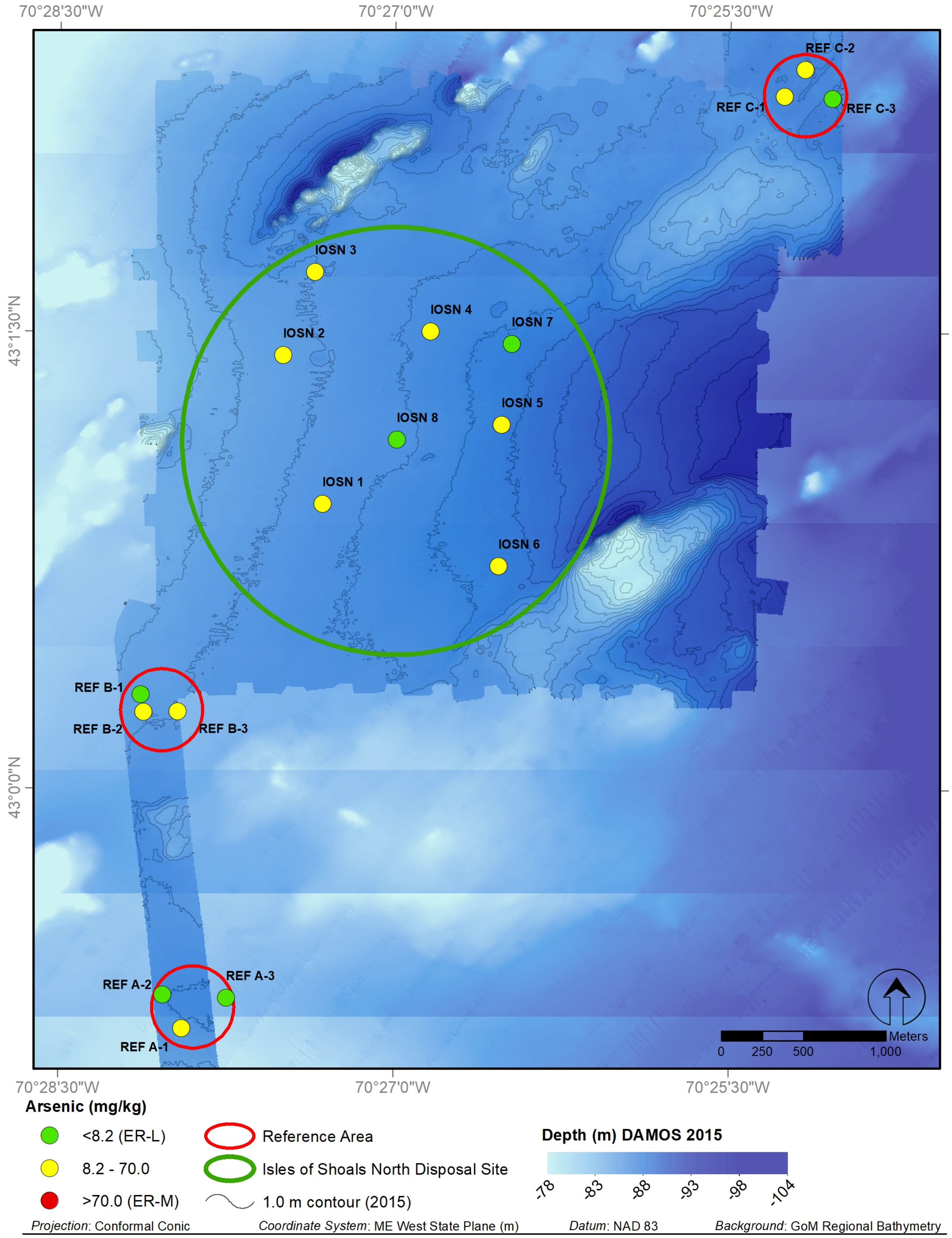


Figure 3-3. Arsenic concentrations within IOSN and potential reference areas, 2019 and 2020

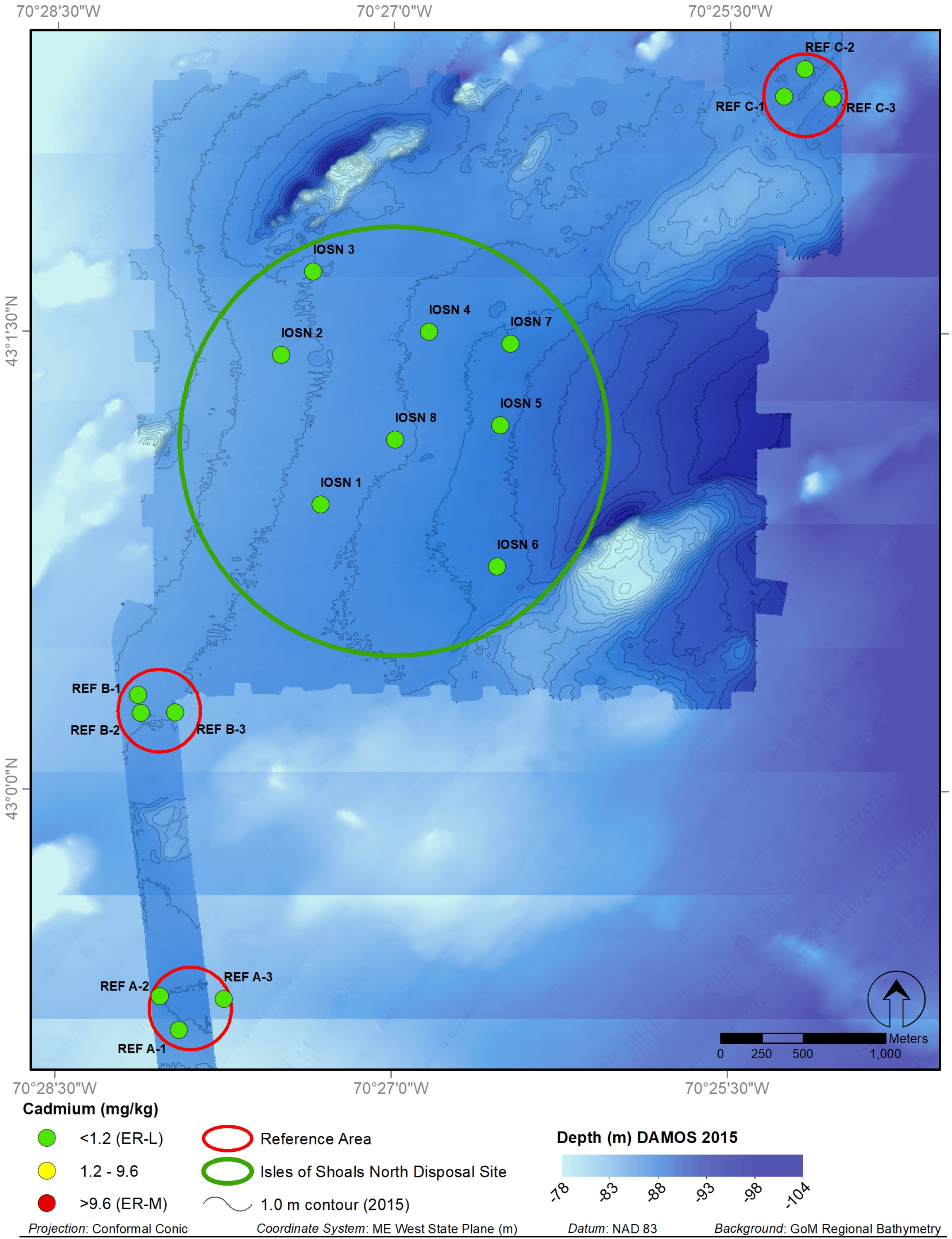


Figure 3-4. Cadmium concentrations within IOSN and potential reference areas, 2019 and 2020

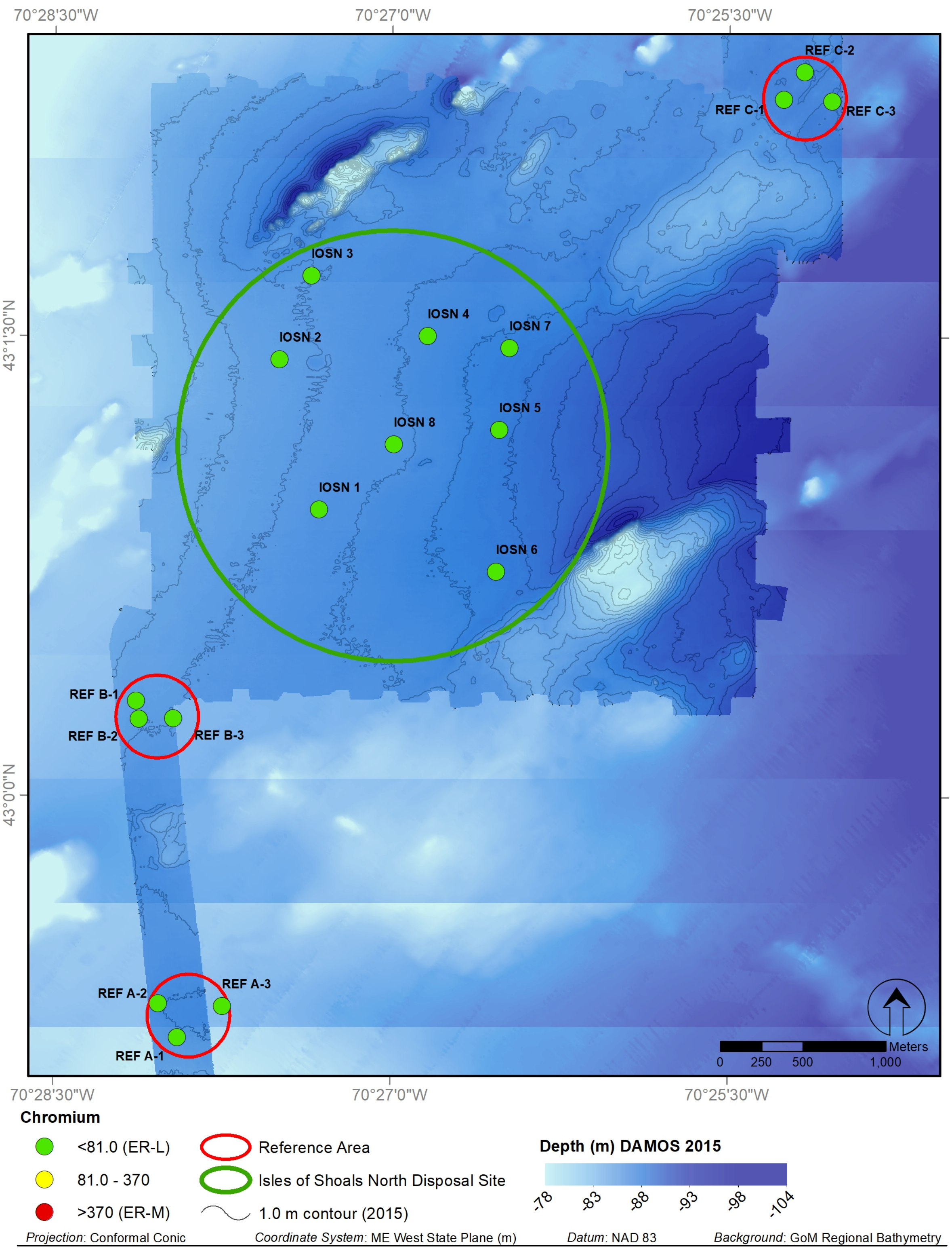


Figure 3-5. Chromium concentrations within IOSN and potential reference areas, 2019 and 2020

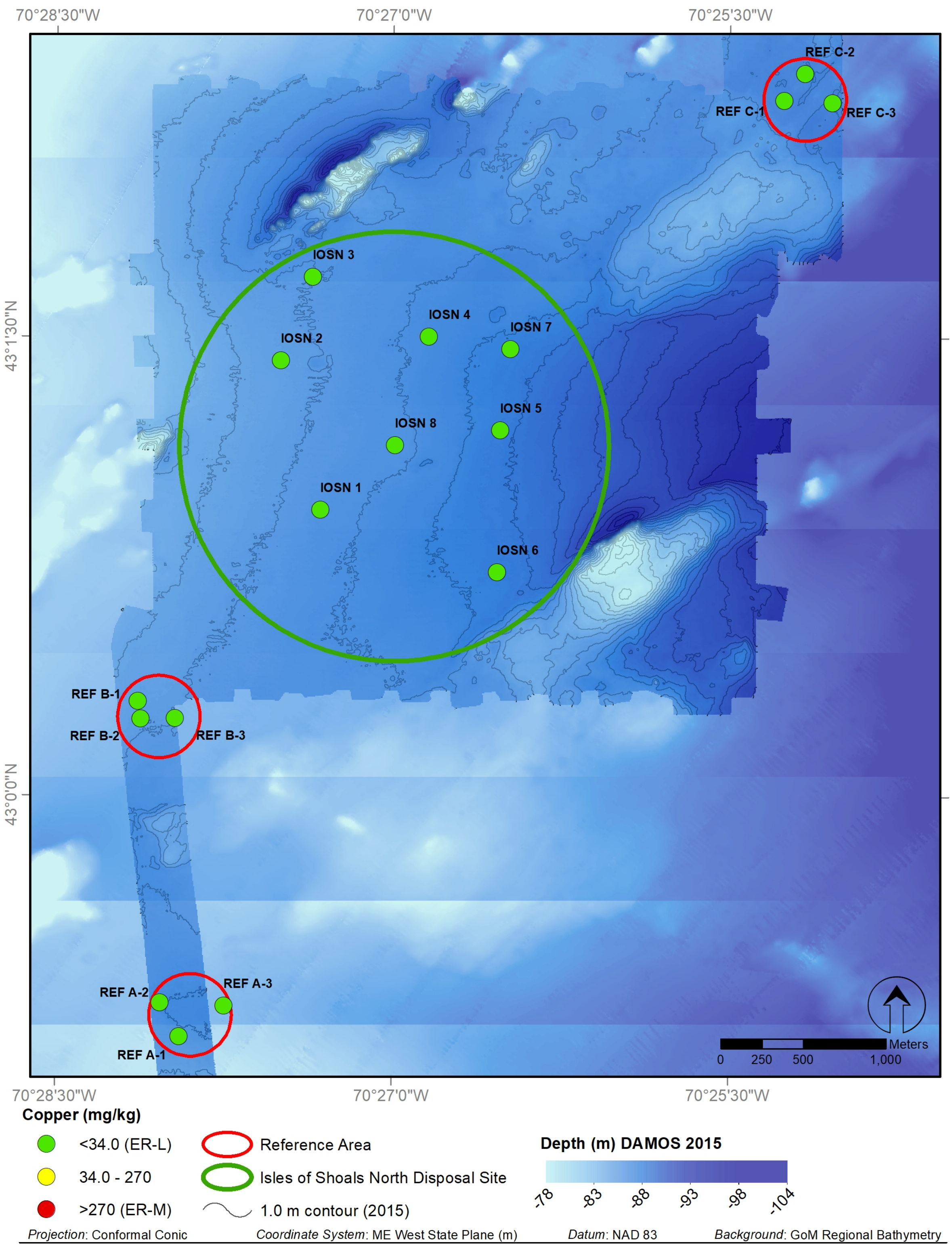


Figure 3-6. Copper concentrations within IOSN and potential reference areas, 2019 and 2020

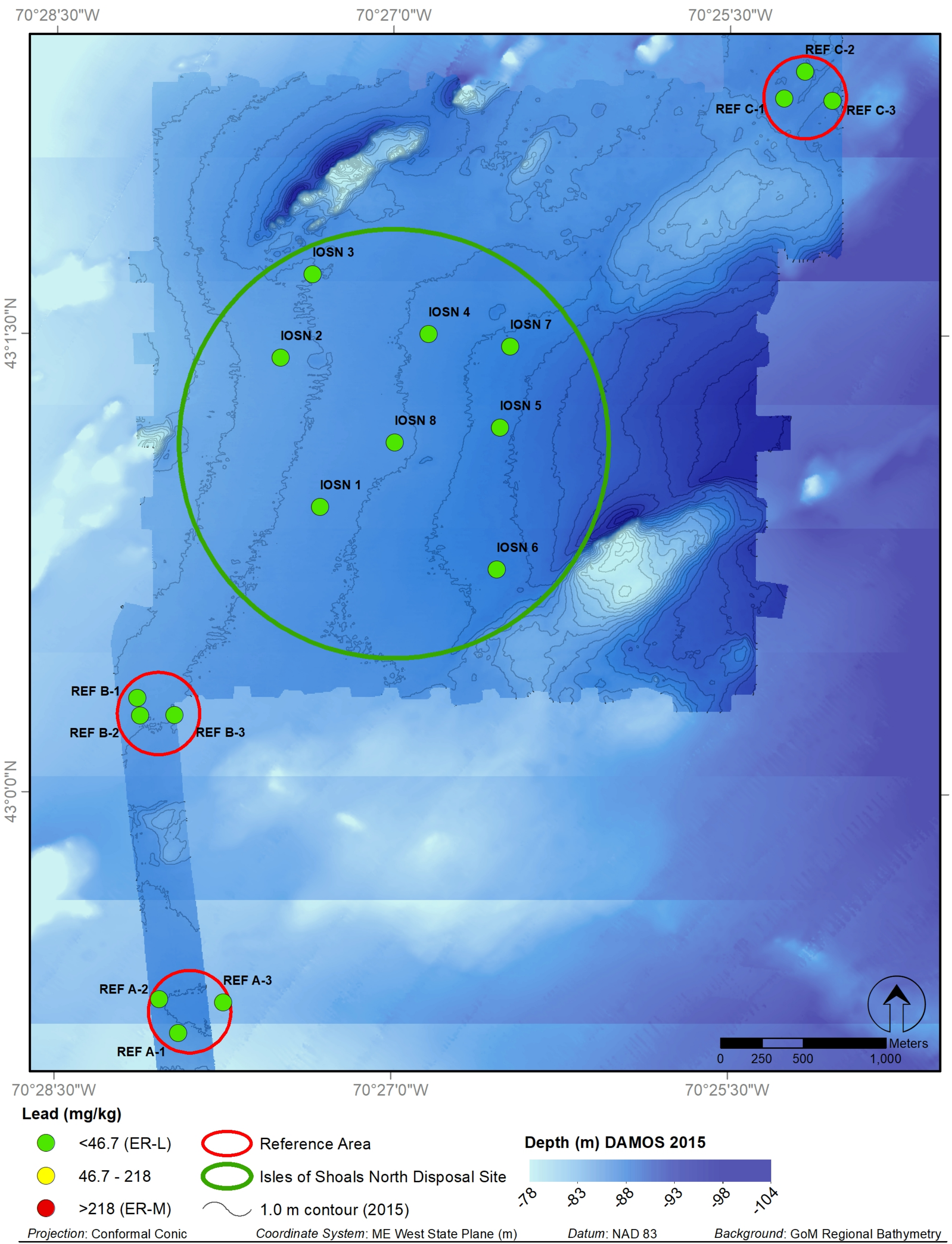


Figure 3-7. Lead concentrations within IOSN and potential reference areas, 2019 and 2020

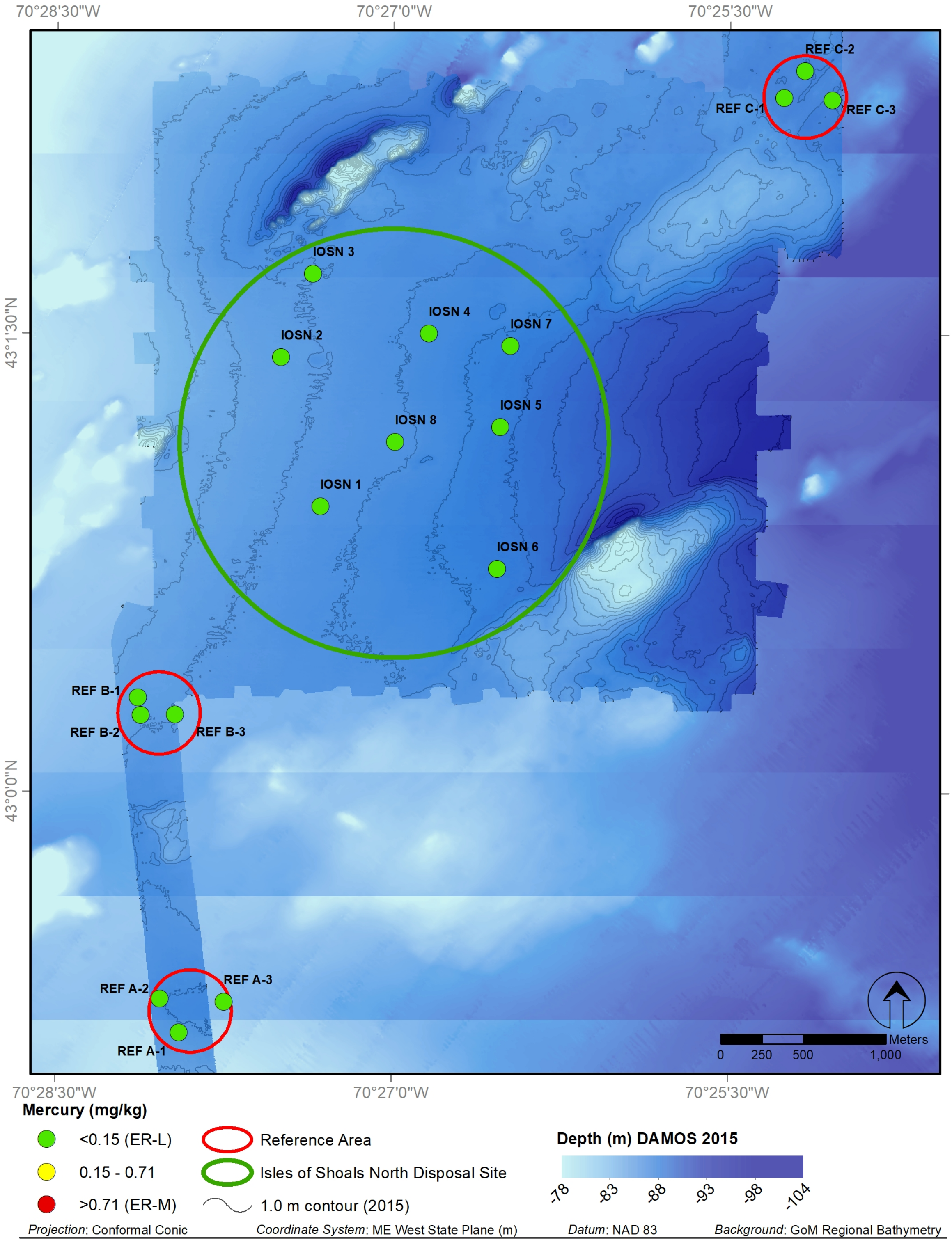


Figure 3-8. Mercury concentrations within IOSN and potential reference areas, 2019 and 2020

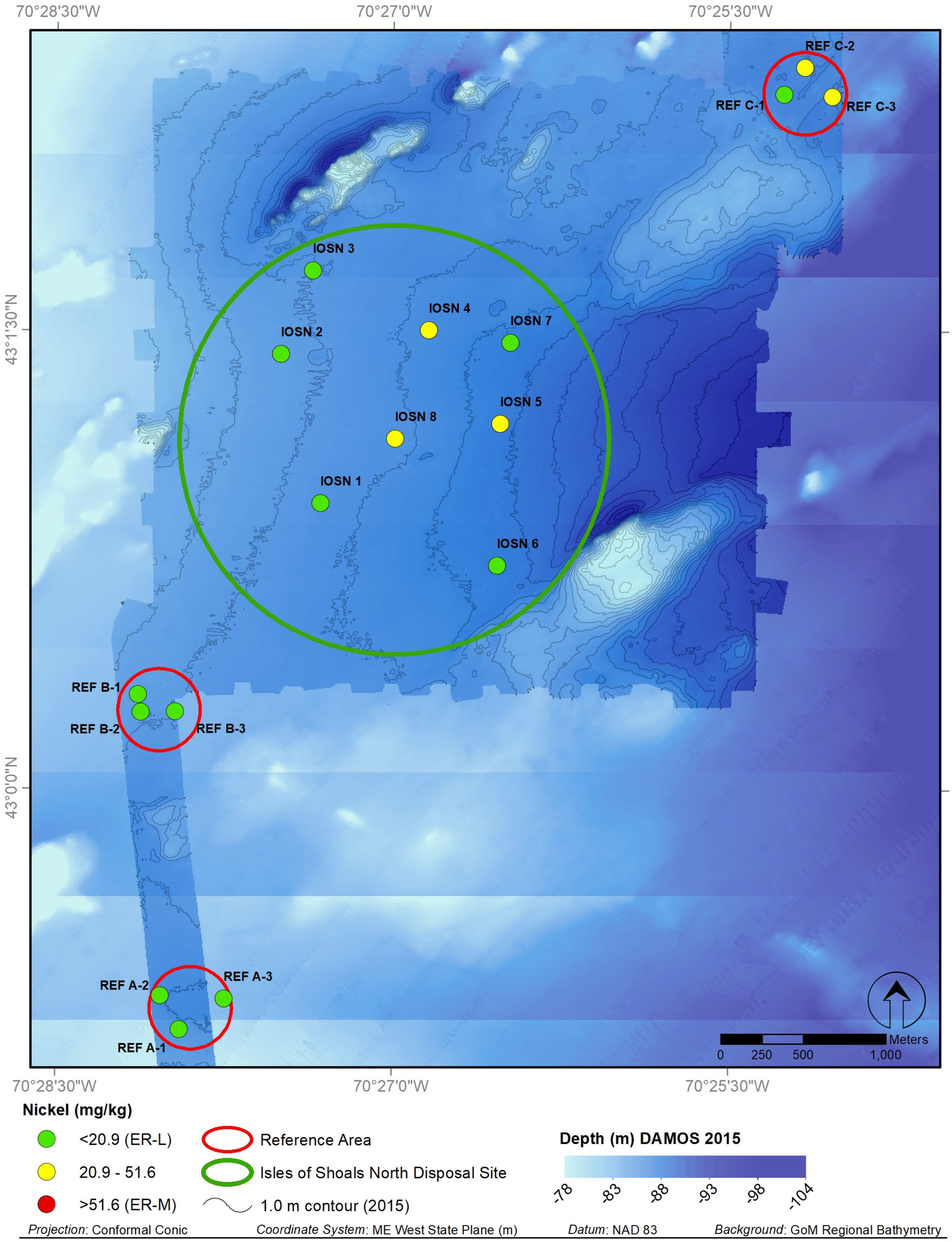


Figure 3-9. Nickel concentrations within IOSN and potential reference areas, 2019 and 2020

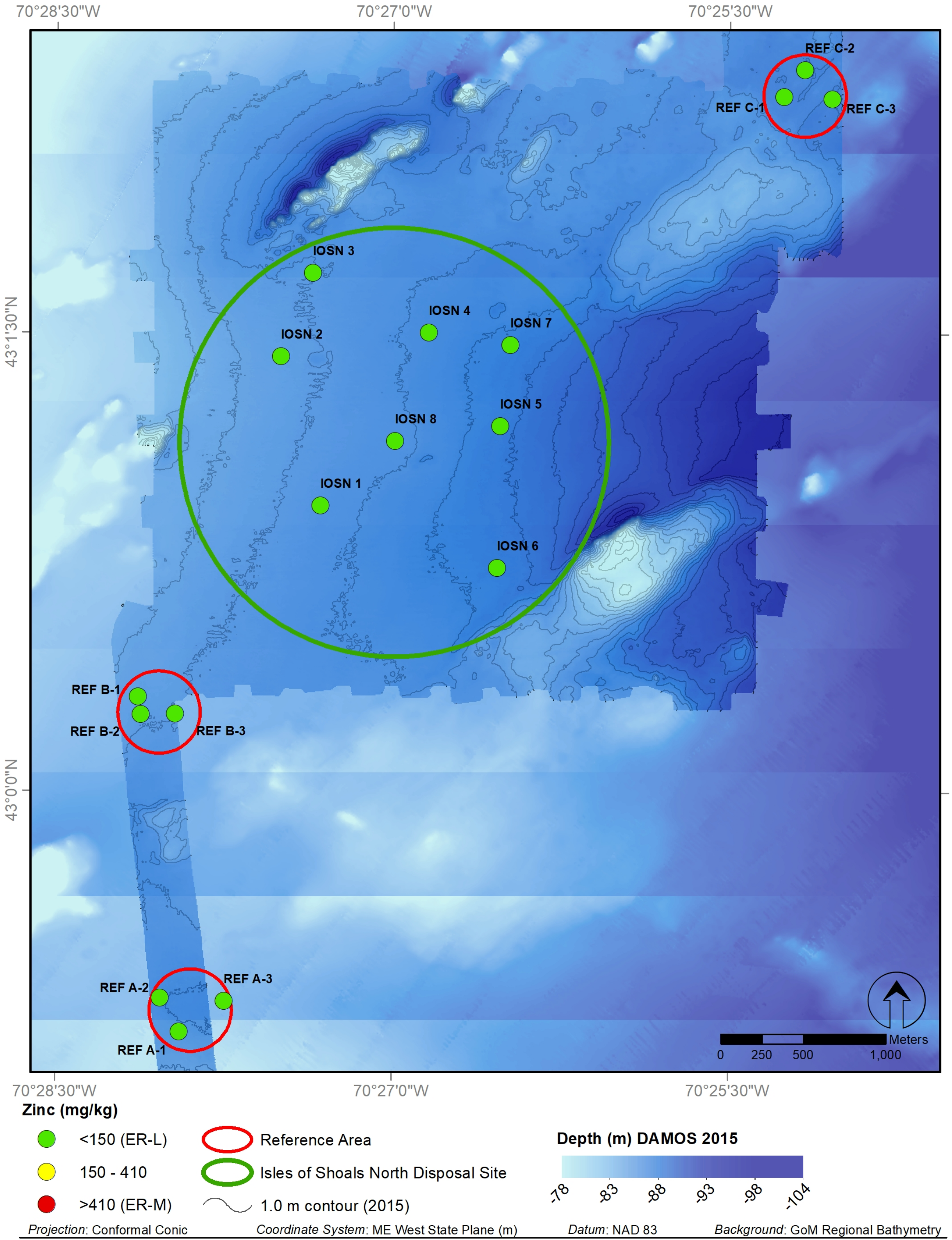


Figure 3-10. Zinc concentrations within IOSN and potential reference areas, 2019 and 2020

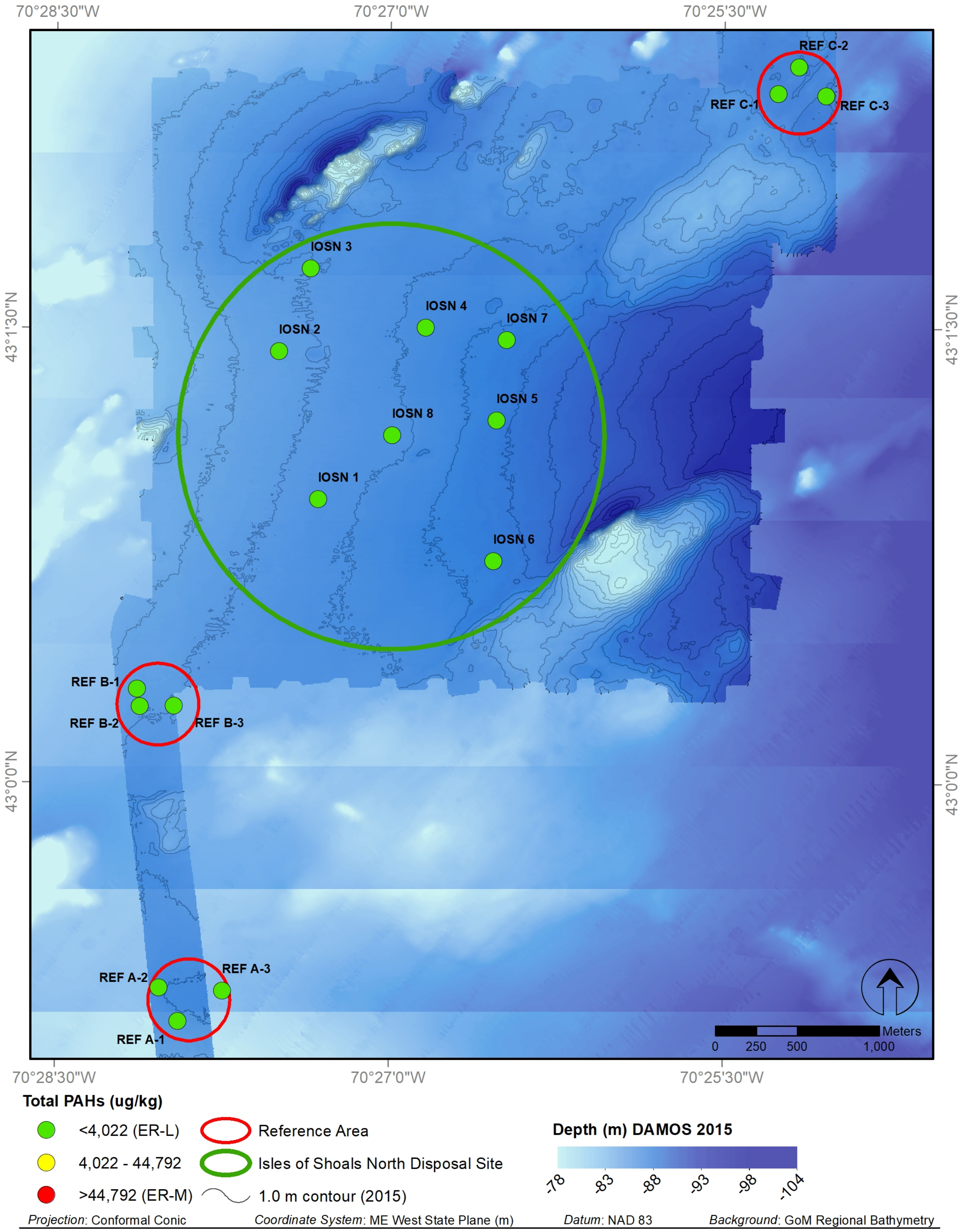


Figure 3-11. Total PAH concentrations within IOSN and potential reference areas, 2019 and 2020

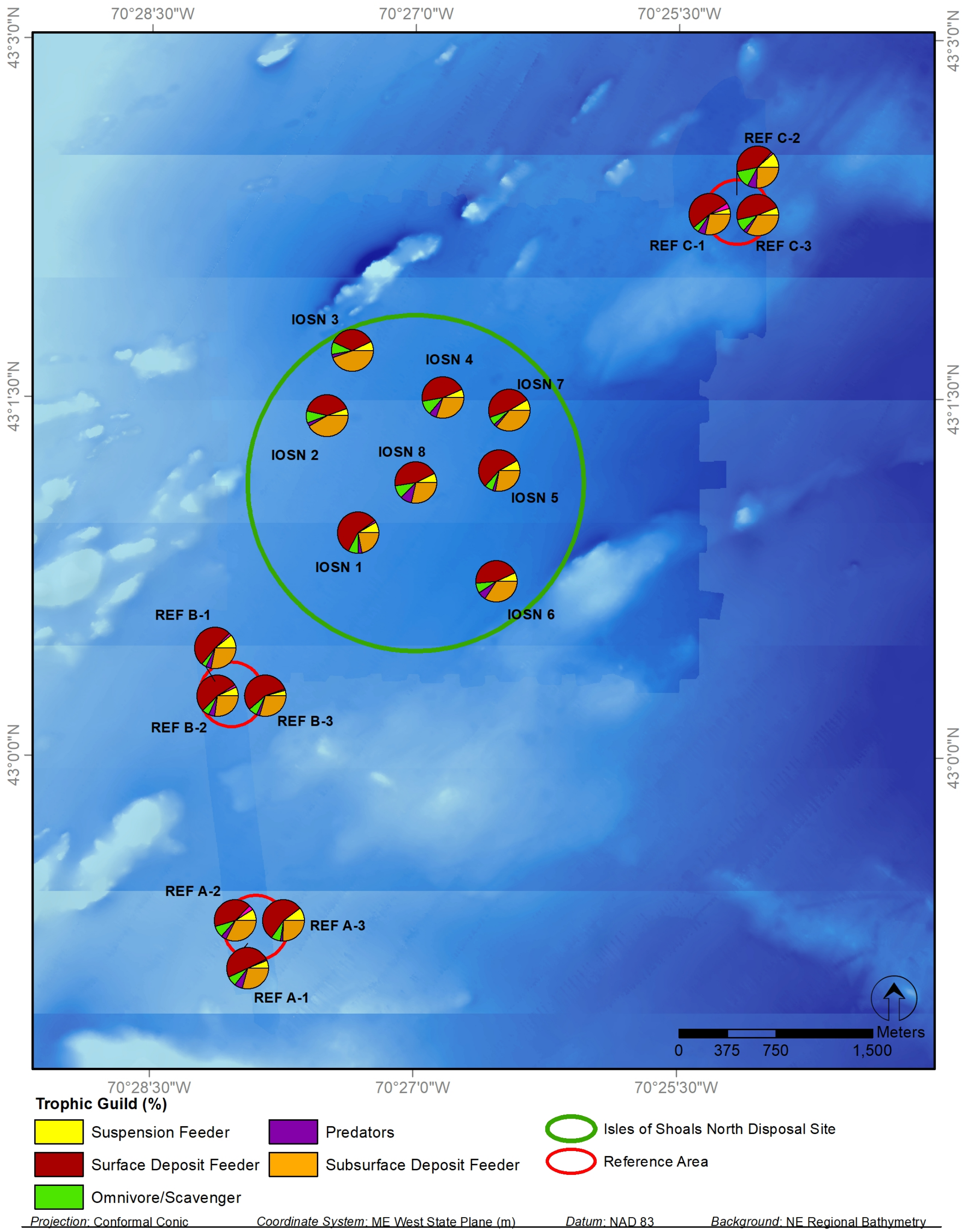


Figure 3-12. Percentage of individuals belonging to each trophic guild at IOSN and potential reference areas, 2019 and 2020

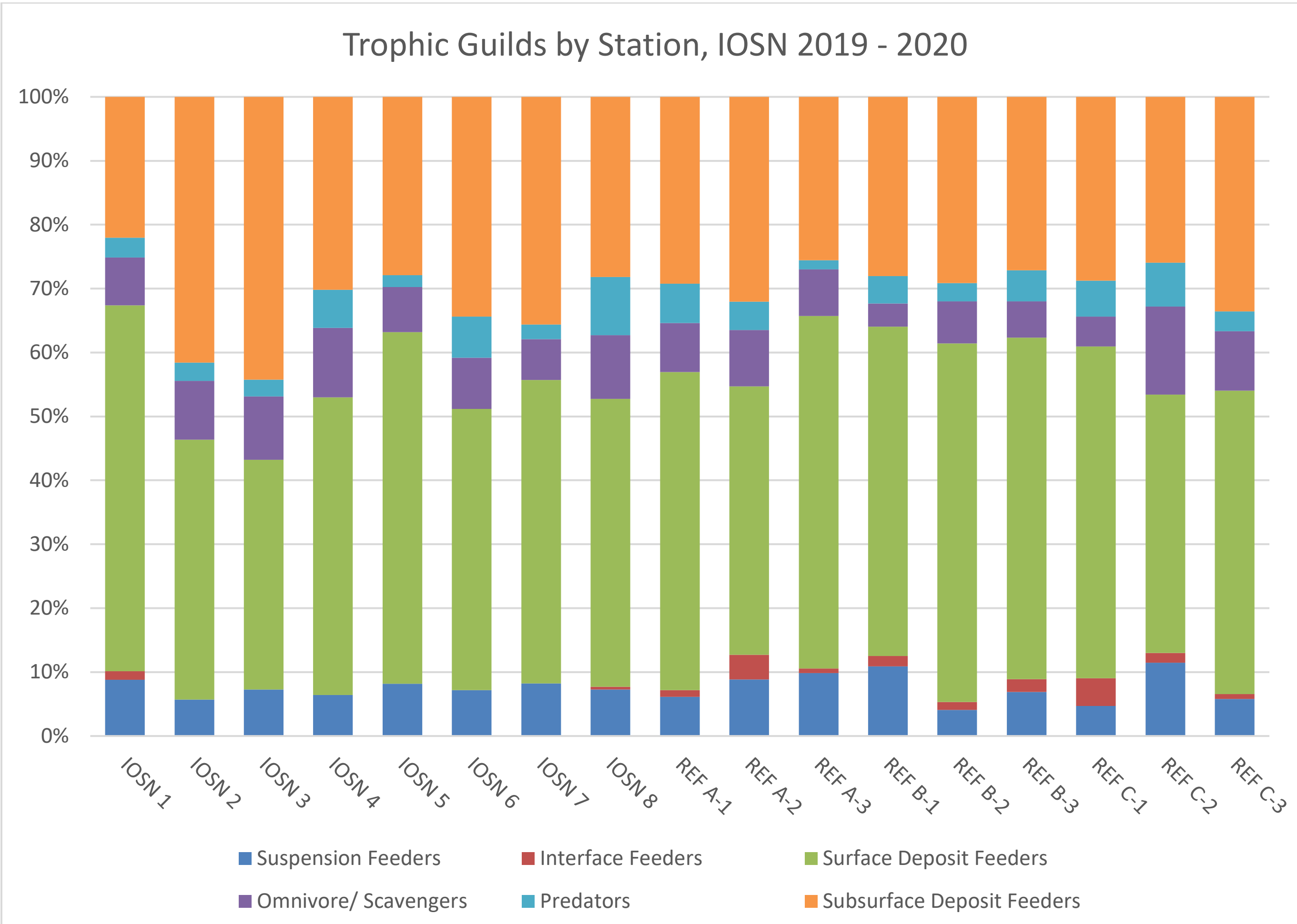
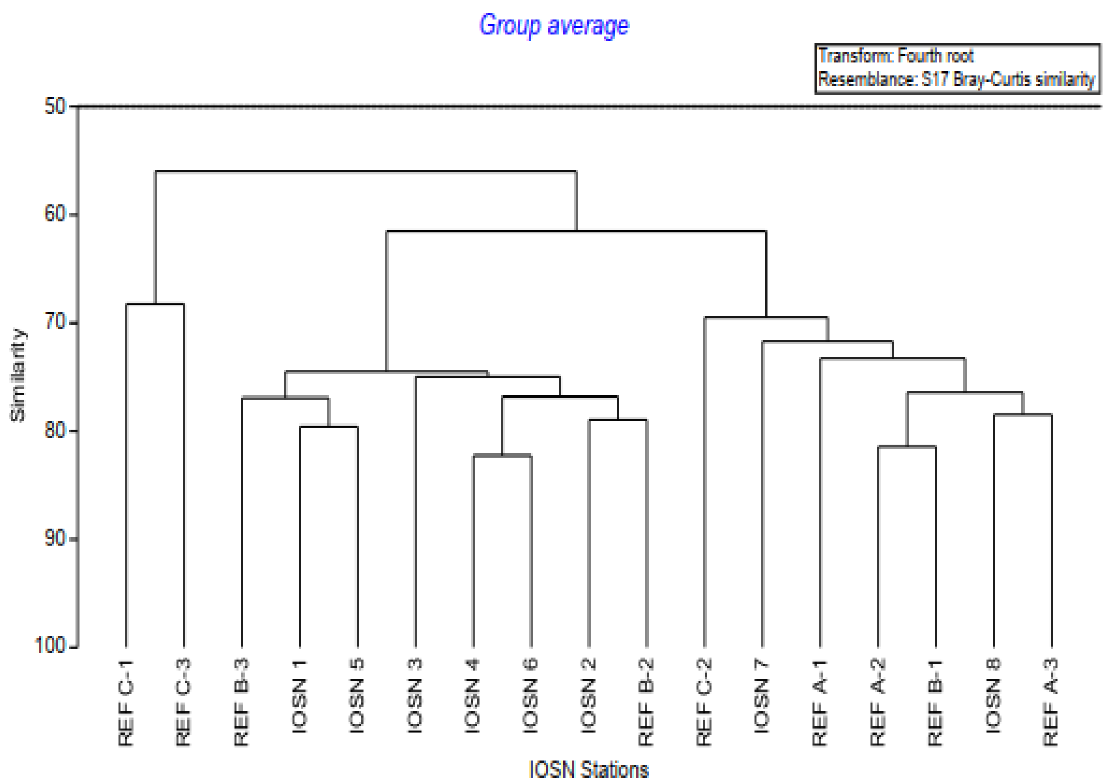
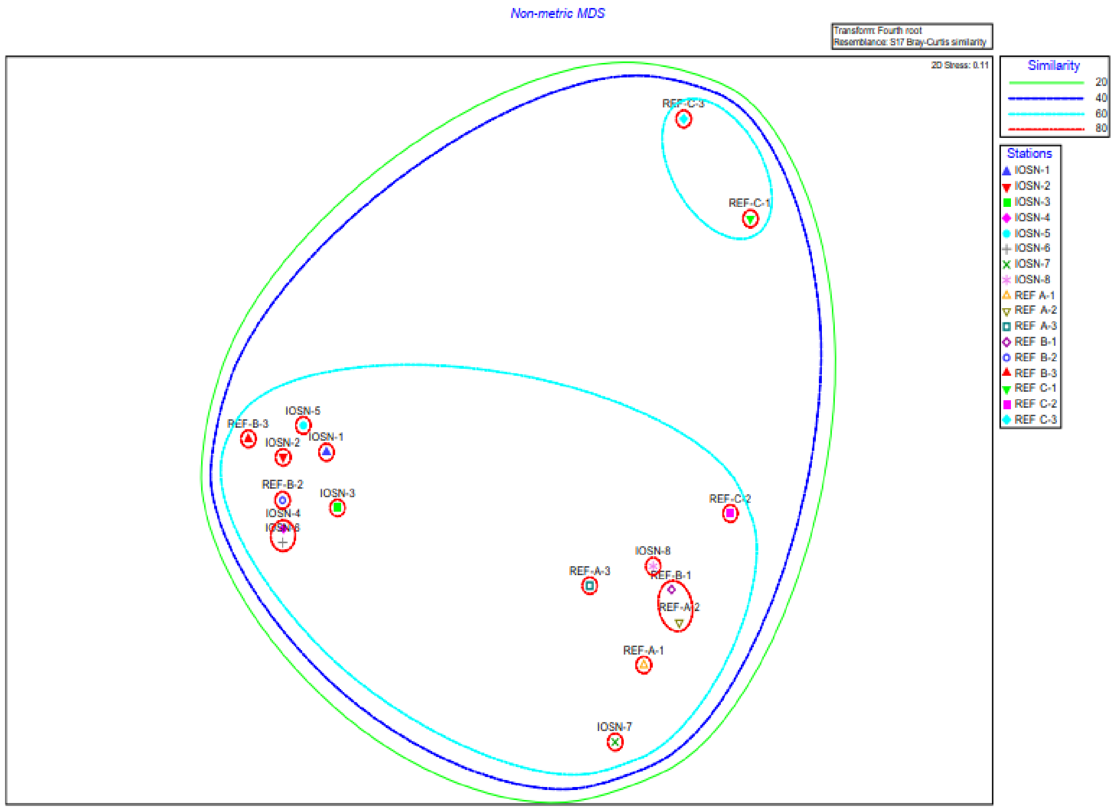


Figure 3-13. Percentage of individuals belonging to each trophic guild at IOSN and potential reference areas, 2019 and 2020



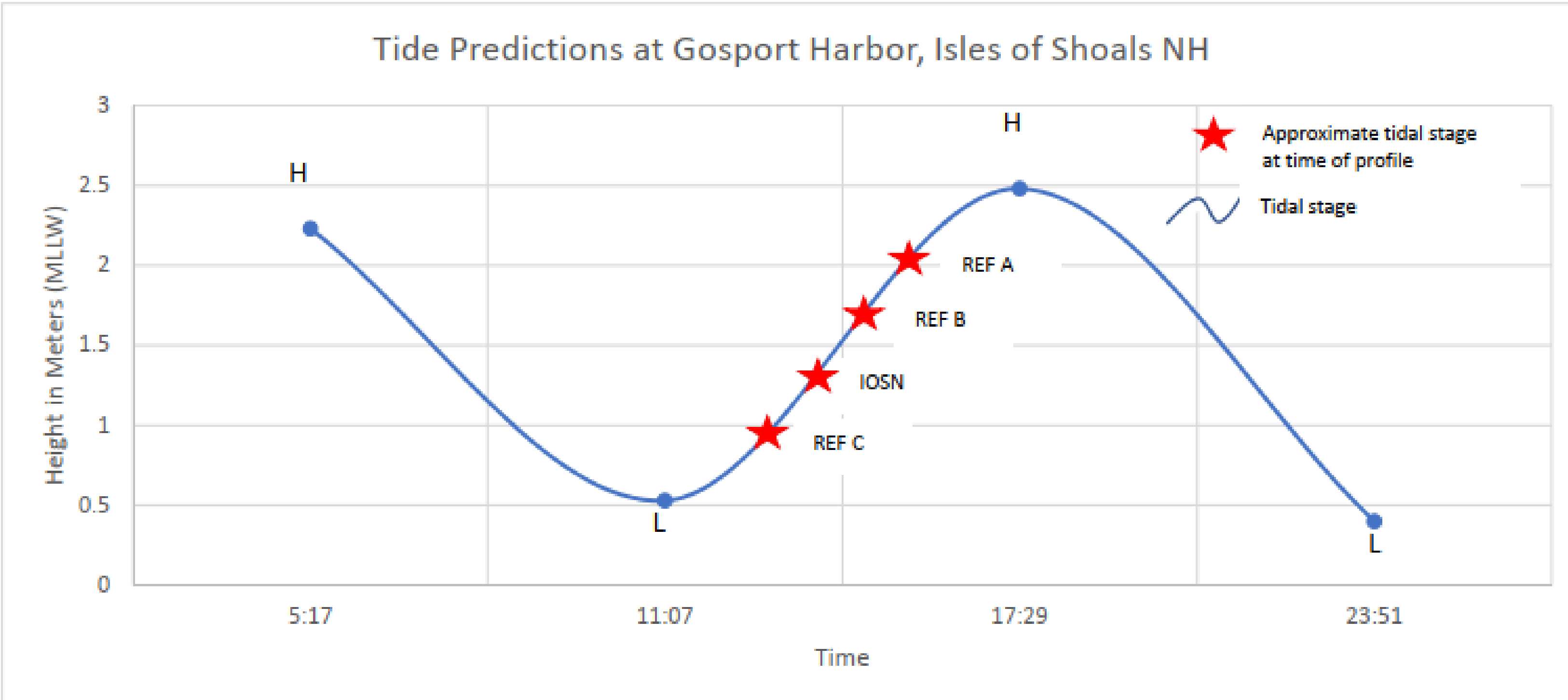
*Similarity expressed as percent (%)

Figure 3-14. Cluster analysis of IOSN and potential reference areas, 2019 and 2020



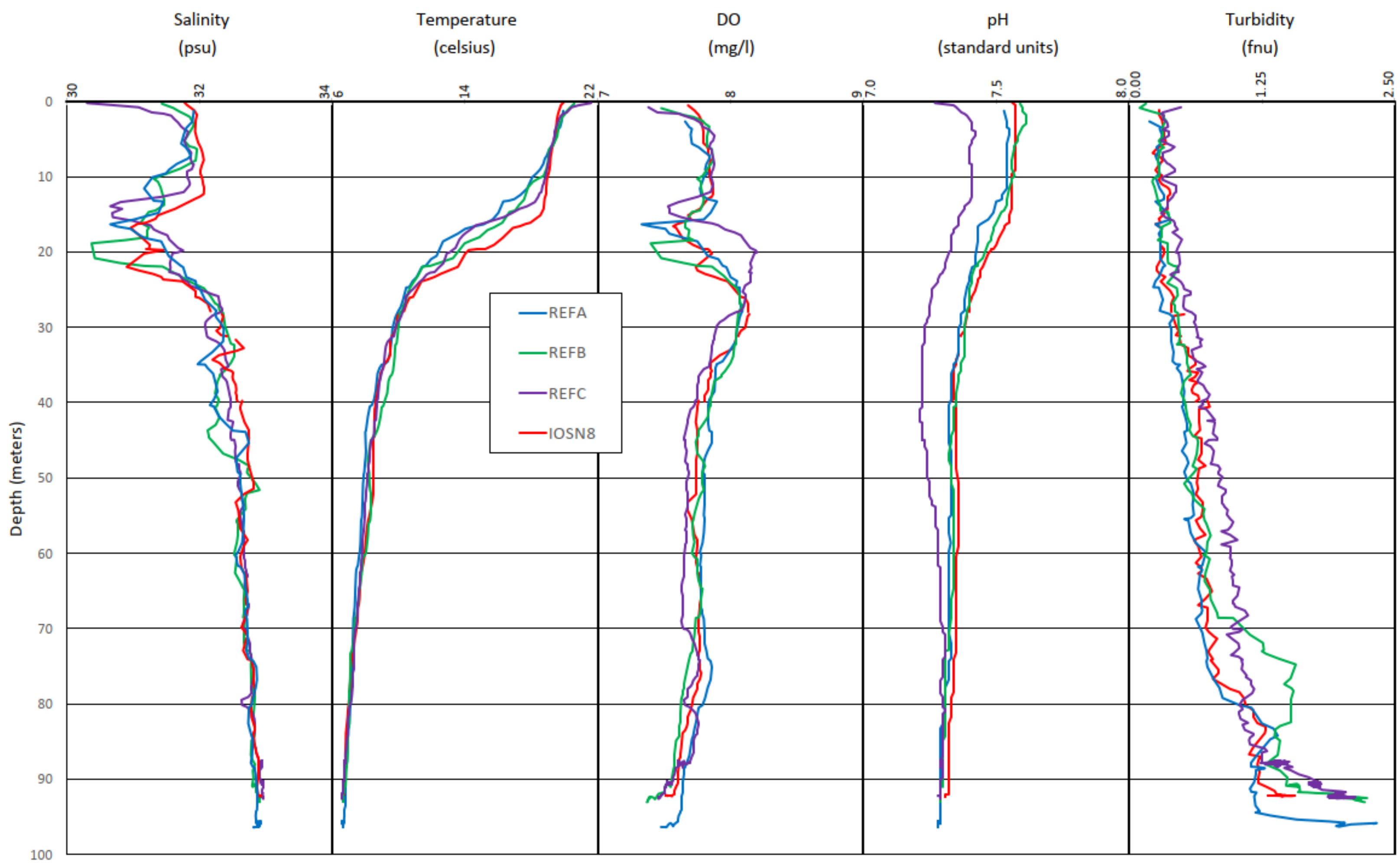
*Similarity expressed as percent (%)

Figure 3-15. Bray-Curtis cluster analysis of IOSN and potential reference area samples, 2019 and 2020



*Data input from NOAA Tides and Currents

Figure 3-16. Tidal stages on 10 September 2020, at time of water quality profiles and water quality sample collection



psu – practical salinity unit
fnu – formazin nephelometric units

Figure 3-17. Water quality profiles at IOSN and potential reference areas

4.0 CONCLUSIONS

The data from the 2015 bathymetry and SPI surveys, and the 2019/2020 sediment and water quality studies, generated a comprehensive baseline dataset for the IOSN site and three potential reference areas. Data from these baseline survey efforts provide information on the IOSN site conditions prior to any dredged material disposal and will be used as a comparative dataset for future monitoring events. Additionally, sufficient data has been collected to establish three reference areas (A, B, and C), and while minor variations were noted within reference area REF C, it is still considered to be representative of site conditions based on water depth, sediment quality, water quality, and the benthic ecosystem. The results of these baseline surveys, and the associated reference areas, should be used for future management considerations and will provide useful information to identify any environmental impacts and assess ecosystem recovery from future dredged material disposal at the IOSN.

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Appendix A

Table of Common Conversions

APPENDIX A

TABLE OF COMMON CONVERSIONS

Metric	English
Area	
1 Square Kilometer (km2)	247.12 Acres
Length	
1 Kilometer (km)	0.62 Miles (mi)
1 Kilometer (km)	0.54 Nautical Miles (nmi)
1 Meter (m)	3.28 Feet (ft)
1 Centimeter (cm)	0.39 Inches (in)
Volume	
1 Cubic Meter (m^3)	35.31 Cubic Feet (ft^3)
1 Cubic Meter (m^3)	1.31 Cubic Yards (yd^3)

English	Metric
Area	
1 Acre	0.004 Square Kilometers (km^2)
Length	
1 Mile (mi)	1.61 Kilometers (km)
1 Nautical Mile (nmi)	1.85 Kilometers (km)
1 Foot (ft)	0.30 Meters (m)
1 Inch (in)	0.03 Centimeters (cm)

Appendix B

Photographic Log of Samples

Site Visit Photo Log

IOSN – 1 (2019)

IOSN – 2 (2019)

IOSN – 3 (2019)

IOSN – 4 (2019)

IOSN – 5 (2019)

IOSN – 6 (2019)

REF-B-2 (2019)

REF-B-3 (2019)

IOSN – 7 (2020)

IOSN – 8 (2020)

REF-C-1 (2020)

REF-C-2 (2020)

REF-C-3 (2020)

REF-B-1 (2020)

REF-A-2 (2020)

REF-A-3 (2020)

***Image for REF-A-1 (2020) not available**

Appendix C

Summary of Chemistry Results

Sediment Results

Analyte	CAS Number	IOSN-1		IOSN-2		IOSN-2 DUP		IOSN-3		IOSN-4		IOSN-5		IOSN-6		IOSN-7	
		Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
GRAIN SIZE AND SOLIDS (%)																	
Cobble	27																
Gravel	28	0.2		0.1		0.2		0.1				0.1		0.1			
Sand	26	5.3		5.9		4.7		7.1		5		5.2		12.7		8.5	
Silt + Clay	29	94.5		94.0		95.1		92.8		95		94.7		87.2		91.5	
% Solids (a)	17	44.1		42.2		42.0		40.6		38.5		40.3		39.7		39.6	
TOTAL ORGANIC CARBON (%)																	
TOC In Soil (Avg)	14762744	1.34		1.45		1.48		1.6		1.48		1.43		1.33		1.52	

Analyte	CAS Number	IOSN-8		REF-A-1		REF-A-2		REF-A-3		REF-B-1		REF-B-1-DUP		REF B-2		REF B-3	
		Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
GRAIN SIZE AND SOLIDS (%)																	
Cobble	27																
Gravel	28													0.1		0.1	
Sand	26	4.6		3.1		9.1		4.4		4.4		9.6		8.3		5.1	
Silt + Clay	29	95.4		96.9		90.9		95.6		95.6		90.4		91.6		94.8	
% Solids (a)	17	40.5												44.3		44.8	
TOTAL ORGANIC CARBON (%)																	
TOC In Soil (Avg)	14762744	1.44		1.23		1.35		1.34		1.17		1.3		1.23		1.27	

Analyte	CAS Number	REF-C-1		REF-C-2		REF-C-3	
		Result	Qual	Result	Qual	Result	Qual
GRAIN SIZE AND SOLIDS (%)							
Cobble	27						
Gravel	28	5.4		8.1		17.3	
Sand	26	28.3		21.9		22.2	
Silt + Clay	29	66.3		70.0		60.5	
% Solids (a)	17	47.6		46.6		46.6	
TOTAL ORGANIC CARBON (%)							
TOC In Soil (Avg)	14762744	0.84		1.17		1.07	

Analyte	CAS Number	Screening Values (b)		IOSN-1		IOSN-2		IOSN-2 DUP		IOSN-3		IOSN-4		IOSN-5		IOSN-6	
		ERL	ERM	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
METALS (MG/KG)																	
Arsenic	7440382	8.2	70	**9.68**		**9.38**		**8.29**		**9.3**		**11.8**		**8.47**		**8.75**	
Cadmium	7440439	1.2	9.6	0.065	J	0.072	J	0.057	J	0.065	J	0.089	J	0.063	J	0.06	J
Chromium	7440473	81	370	29.9		31.5		28.2		31.8		36.6		32.9		31.2	
Copper	7440508	34	270	10.1		10.7		9.79		10.7		12.7		11.4		10.9	
Lead	7439921	46.7	218	18.5		19.3		17.4		20.2		22.9		21		20.4	
Nickel	7440020	20.9	51.6	18.9		20.1		18.3		20		23.6		21		20.2	
Zinc	7440666	150	410	56.7		60.6		54		60.4		71.3		63.6		59.8	
Mercury	7439976	0.15	0.71	0.035		0.032		0.029	J	0.035		0.039		0.025	J	0.037	

Analyte	CAS Number	Screening Values (b)		IOSN-7		IOSN-8		REF-A-1		REF-A-2		REF-A-3		REF-B-1		REF-B-1-DUP	
		ERL	ERM	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
METALS (MG/KG)																	
Arsenic	7440382	8.2	70	7.50		7.51		**9.76**		6.49		7.70		**8.33**		7.68	
Cadmium	7440439	1.2	9.6	0.05	J	0.06	J	0.06	J	0.06	J	0.04	J	0.05	J	0.06	J
Chromium	7440473	81	370	30.1		32.2		29.5		30.6		28.9		27.4		29.9	
Copper	7440508	34	270	10.6		11.2		10.3		10.5		9.9		9.3		10.2	
Lead	7439921	46.7	218	20.2		21.5		18.3		20.3		18.6		17.4		19.9	
Nickel	7440020	20.9	51.6	**20.8**		**22.2**		**20.5**		**20.9**		19.5		18.5		20.1	
Zinc	7440666	150	410	47.4		50.3		45.5		47.2		44.6		42.6		45.6	
Mercury	7439976	0.15	0.71	0.041		0.040		0.026		0.036		0.034		0.033		0.035	

Analyte	CAS Number	Screening Values (b)		REF B-2		REF B-3		REF C-1		REF C-2		REF C-3	
		ERL	ERM	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
METALS (MG/KG)													
Arsenic	7440382	8.2	70	**8.35**		**8.5**		**11.0**		**20.0**		7.88	
Cadmium	7440439	1.2	9.6	0.057	J	0.068	J	0.04	J	0.05	J	0.06	J
Chromium	7440473	81	370	27		27.5		27.7		31.5		31.5	
Copper	7440508	34	270	9.09		9.16		9.2		10.3		11.2	
Lead	7439921	46.7	218	16.3		16.8		16.4		20.9		19.6	
Nickel	7440020	20.9	51.6	17.6		17.4		18.8		**21.3**		**21.6**	
Zinc	7440666	150	410	51.4		52.1		43.7		52.0		49.8	
Mercury	7439976	0.15	0.71	0.019	J	0.029		0.022		0.030		0.027	

Analyte	CAS Number	Screening Values (b) ERL	ERM	IOSN-1 Result	Qual	IOSN-2 Result	Qual	IOSN-2 DUP Result	Qual	IOSN-3 Result	Qual	IOSN-4 Result	Qual	IOSN-5 Result	Qual	IOSN-6 Result	Qual
PESTICIDES (UG/KG)																	
4,4`-DDD	72548	2	20	0.021	U	0.0215	U	0.021	U	0.022	U	0.023	U	0.031	U	0.0235	U
4,4`-DDE	72559	2.2	27	0.0125	U	0.013	U	0.013	U	0.0135	U	0.014	U	0.019	U	0.014	U
4,4`-DDT	50293	1	7	0.0275	U	0.0285	U	0.028	U	0.029	U	0.03	U	0.041	U	0.0305	U
Total DDx		*1.58 (c)*	*46.1 (c)*	*0.061*	*U*	*0.063*	*U*	*0.062*	*U*	*0.0645*	*U*	*0.067*	*U*	*0.091*	*U*	*0.068*	*U*
Aldrin	309002			0.0695	U	0.0715	U	0.0705	U	0.074	U	0.076	U	0.104	U	0.0775	U
Alpha-BHC	319846			0.042	U	0.0435	U	0.043	U	0.045	U	0.0465	U	0.063	U	0.047	U
cis-Chlordane (alpha-Chlordane)	5103719			0.15	U	0.1545	U	0.152	U	0.16	U	0.1645	U	0.225	U	0.1675	U
Beta-BHC	319857			0.029	U	0.03	U	0.0295	U	0.031	U	0.0315	U	0.0435	U	0.0325	U
Delta-BHC	319868			0.033	U	0.034	U	0.0335	U	0.035	U	0.0365	U	0.0495	U	0.037	U
Dieldrin	60571	0.02	8	0.042	U	0.043	U	0.0425	U	0.0445	U	0.046	U	0.0625	U	0.047	U
Endosulfan I	959988			0.038	U	0.0395	U	0.039	U	0.0405	U	0.042	U	0.057	U	0.043	U
Endosulfan II	33213659			0.0195	U	0.0205	U	0.02	U	0.021	U	0.0215	U	0.0295	U	0.022	U
Endosulfan sulfate	1031078			0.0115	U	0.012	U	0.0115	U	0.012	U	0.0125	U	0.017	U	0.013	U
Endrin	72208			0.023	U	0.0235	U	0.023	U	0.0245	U	0.025	U	0.034	U	0.0255	U
gamma-BHC (Lindane)	58899			0.0625	U	0.0645	U	0.0635	U	0.067	U	0.069	U	0.094	U	0.07	U
trans-Chlordane (gamma-Chlordane)	5103742			0.042	U	0.0435	U	0.043	U	0.045	U	0.0465	U	0.063	U	0.047	U
Total Chlordane		*0.5* (f)	*6.0* (f)	*0.3165*	*U*	*0.327*	*U*	*0.3215*	*U*	*0.338*	*U*	*0.348*	*U*	*0.4745*	*U*	*0.3535*	*U*
Heptachlor	76448			0.0435	U	0.045	U	0.044	U	0.0465	U	0.048	U	0.065	U	0.0485	U
Heptachlor epoxide	1024573			0.0895	U	0.092	U	0.0905	U	0.0955	U	0.098	U	0.134	U	0.1	U
Methoxychlor	72435			0.965	U	0.995	U	0.98	U	1.03	U	1.06	U	1.45	U	1.08	U
cis-Nonachlor	5103731			0.02	U	0.021	U	0.0205	U	0.0215	U	0.022	U	0.03	U	0.0225	U
trans-Nonachlor	39765805			0.0185	U	0.019	U	0.019	U	0.0195	U	0.0205	U	0.0275	U	0.0205	U
Oxychlordane	27304138			0.086	U	0.089	U	0.087	U	0.092	U	0.0945	U	0.129	U	0.096	U
Toxaphene	8001352			1.8	U	1.86	U	1.83	U	1.925	U	1.98	U	2.705	U	2.02	U

Analyte	CAS Number	Screening Values (b) ERL	ERM	IOSN-7 Result	Qual	IOSN-8 Result	Qual	REF-A-1 Result	Qual	REF-A-2 Result	Qual	REF-A-3 Result	Qual	REF-B-1 Result	Qual	REF-B-1-DUP Result	Qual
PESTICIDES (UG/KG)																	
4,4`-DDD	72548	2	20	0.022	U	0.023	U	0.020	U	0.021	U	0.021	U	0.020	U	0.020	U
4,4`-DDE	72559	2.2	27	0.014	U	0.014	U	0.012	U	0.013	U	0.013	U	0.012	U	0.012	U
4,4`-DDT	50293	1	7	0.029	U	0.030	U	0.026	U	0.028	U	0.028	U	0.026	U	0.026	U
Total DDx		*1.58 (c)*	*46.1 (c)*	*0.065*	*U*	*0.067*	*U*	*0.058*	*U*	*0.061*	*U*	*0.062*	*U*	*0.057*	*U*	*0.057*	*U*
Aldrin	309002			0.074	U	0.076	U	0.066	U	0.070	U	0.071	U	0.065	U	0.065	U
Alpha-BHC	319846			0.045	U	0.046	U	0.041	U	0.043	U	0.043	U	0.040	U	0.040	U
cis-Chlordane (alpha-Chlordane)	5103719			0.160	U	0.164	U	0.143	U	0.151	U	0.152	U	0.141	U	0.141	U
Beta-BHC	319857			0.031	U	0.032	U	0.028	U	0.029	U	0.030	U	0.027	U	0.027	U
Delta-BHC	319868			0.035	U	0.036	U	0.032	U	0.033	U	0.034	U	0.031	U	0.031	U
Dieldrin	60571	0.02	8	0.045	U	0.046	U	0.040	U	0.042	U	0.043	U	0.039	U	0.040	U
Endosulfan I	959988			0.041	U	0.042	U	0.037	U	0.039	U	0.039	U	0.036	U	0.036	U
Endosulfan II	33213659			0.021	U	0.022	U	0.019	U	0.020	U	0.020	U	0.019	U	0.019	U
Endosulfan sulfate	1031078			0.012	U	0.013	U	0.011	U	0.012	U	0.012	U	0.011	U	0.011	U
Endrin	72208			0.025	U	0.025	U	0.022	U	0.023	U	0.023	U	0.022	U	0.022	U
gamma-BHC (Lindane)	58899			0.067	U	0.069	U	0.060	U	0.063	U	0.064	U	0.059	U	0.059	U
trans-Chlordane (gamma-Chlordane)	5103742			0.045	U	0.046	U	0.041	U	0.043	U	0.043	U	0.040	U	0.040	U
Total Chlordane		*0.5* (f)	*6.0* (f)	*0.337*	*U*	*0.347*	*U*	*0.303*	*U*	*0.319*	*U*	*0.322*	*U*	*0.298*	*U*	*0.298*	*U*
Heptachlor	76448			0.047	U	0.048	U	0.042	U	0.044	U	0.044	U	0.041	U	0.041	U
Heptachlor epoxide	1024573			0.095	U	0.098	U	0.086	U	0.090	U	0.091	U	0.084	U	0.084	U
Methoxychlor	72435			0.105	U	0.108	U	0.095	U	0.099	U	0.101	U	0.093	U	0.093	U
cis-Nonachlor	5103731			0.022	U	0.022	U	0.020	U	0.021	U	0.021	U	0.019	U	0.019	U
trans-Nonachlor	39765805			0.020	U	0.021	U	0.018	U	0.019	U	0.019	U	0.018	U	0.018	U
Oxychlordane	27304138			0.092	U	0.094	U	0.082	U	0.087	U	0.088	U	0.081	U	0.081	U
Toxaphene	8001352			1.92	U	1.98	U	1.73	U	1.81	U	1.83	U	1.70	U	1.70	U

Analyte	CAS Number	Screening Values (b) ERL	ERM	REF B-2 Result	Qual	REF B-3 Result	Qual	REF C-1 Result	Qual	REF C-2 Result	Qual	REF C-3 Result	Qual
PESTICIDES (UG/KG)													
4,4`-DDD	72548	2	20	0.0205	U	0.0195	U	0.596		0.021	U	0.019	U
4,4`-DDE	72559	2.2	27	0.0125	U	0.012	U	0.264	J	0.013	U	0.011	U
4,4`-DDT	50293	1	7	0.027	U	0.0255	U	0.025	U	0.027	U	0.025	U
Total DDx		*1.58 (c)*	*46.1 (c)*	*0.060*	*U*	*0.057*	*U*	*0.885*	*J*	*0.060*	*U*	*0.054*	*U*
Aldrin	309002			0.068	U	0.0645	U	0.063	U	0.068	U	0.062	U
Alpha-BHC	319846			0.041	U	0.0395	U	0.039	U	0.042	U	0.038	U
cis-Chlordane (alpha-Chlordane)	5103719			0.1465	U	0.1395	U	0.136	U	0.147	U	0.133	U
Beta-BHC	319857			0.028	U	0.027	U	0.026	U	0.029	U	0.026	U
Delta-BHC	319868			0.0325	U	0.031	U	0.030	U	0.033	U	0.030	U
Dieldrin	60571	0.02	8	0.041	U	0.039	U	0.038	U	0.041	U	0.037	U
Endosulfan I	959988			0.0375	U	0.0355	U	0.035	U	0.038	U	0.034	U
Endosulfan II	33213659			0.0195	U	0.0185	U	0.018	U	0.020	U	0.018	U
Endosulfan sulfate	1031078			0.011	U	0.0105	U	0.011	U	0.011	U	0.010	U
Endrin	72208			0.0225	U	0.021	U	0.021	U	0.023	U	0.020	U
gamma-BHC (Lindane)	58899			0.061	U	0.0585	U	0.057	U	0.062	U	0.056	U
trans-Chlordane (gamma-Chlordane)	5103742			0.041	U	0.0395	U	0.039	U	0.042	U	0.038	U
Total Chlordane		*0.5* (f)	*6.0* (f)	*0.309*	*U*	*0.295*	*U*	*0.288*	*U*	*0.311*	*U*	*0.282*	*U*
Heptachlor	76448			0.0425	U	0.0405	U	0.040	U	0.043	U	0.039	U
Heptachlor epoxide	1024573			0.0875	U	0.083	U	0.081	U	0.088	U	0.079	U
Methoxychlor	72435			0.945	U	0.9	U	0.090	U	0.097	U	0.088	U
cis-Nonachlor	5103731			0.0195	U	0.019	U	0.019	U	0.020	U	0.018	U
trans-Nonachlor	39765805			0.018	U	0.017	U	0.017	U	0.018	U	0.017	U
Oxychlordane	27304138			0.084	U	0.08	U	0.078	U	0.085	U	0.077	U
Toxaphene	8001352			1.76	U	1.68	U	1.64	U	1.77	U	1.60	U

Analyte	CAS Number	Screening Values (b) ERL	Screening Values (b) ERM	IOSN-1 Result	IOSN-1 Qual	IOSN-2 Result	IOSN-2 Qual	IOSN-2 DUP Result	IOSN-2 DUP Qual	IOSN-3 Result	IOSN-3 Qual	IOSN-4 Result	IOSN-4 Qual	IOSN-5 Result	IOSN-5 Qual	IOSN-6 Result	IOSN-6 Qual
PCBs (UG/KG)																	
PCB 8	34883437			0.11	U	0.1135	U	0.1115	U	0.117	U	0.121	U	0.165	U	0.123	U
PCB 18	37680652			0.08	U	0.0825	U	0.081	U	0.085	U	0.088	U	0.12	U	0.0895	U
PCB 28	7012375			0.136	U	0.1405	U	0.138	U	0.145	U	0.1495	U	0.204	U	0.152	U
PCB 44	41464395			0.1515	U	0.1565	U	0.1535	U	0.1615	U	0.1665	U	0.227	U	0.1695	U
PCB 49 x	41464408			0.148	U	0.153	U	0.1505	U	0.158	U	0.163	U	0.222	U	0.166	U
PCB 52	35693993			0.0845	U	0.087	U	0.0855	U	0.09	U	0.0925	U	0.1265	U	0.0945	U
PCB 66	32598100			0.0795	U	0.082	U	0.0805	U	0.0845	U	0.087	U	0.119	U	0.089	U
PCB 77 x	32598133																
PCB 87 x	38380028			0.0645	U	0.0665	U	0.0655	U	0.0685	U	0.071	U	0.0965	U	0.072	U
PCB 101	37680732			0.129	U	0.1335	U	0.131	U	0.138	U	0.142	U	0.194	U	0.1445	U
PCB 87 / 111 (g) x	38380028/ 39635320			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 101 / 90 (g)	37680732/ 68194070			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 105	32598144			0.116	U	0.1195	U	0.1175	U	0.1235	U	0.1275	U	0.174	U	0.13	U
PCB 118	31508006			0.1225	U	0.1265	U	0.1245	U	0.131	U	0.135	U	0.184	U	0.137	U
PCB 126 x	57465288			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 128	38380073			0.145	U	0.1495	U	0.147	U	0.1545	U	0.159	U	0.2175	U	0.162	U
PCB 138	35065282			0.0925	U	0.0955	U	0.094	U	0.099	U	0.102	U	0.139	U	0.1035	U
PCB 153	35065271			0.193	U	0.1995	U	0.196	U	0.206	U	0.2125	U	0.2895	U	0.216	U
PCB 156 x	38380084			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 169 x	32774166			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 170	35065306			0.071	U	0.0735	U	0.072	U	0.076	U	0.078	U	0.1065	U	0.0795	U
PCB 180	35065293			0.0725	U	0.075	U	0.0735	U	0.0775	U	0.08	U	0.109	U	0.0815	U
PCB 183 x	52663691			0.039	U	0.0405	U	0.0395	U	0.042	U	0.043	U	0.0585	U	0.044	U
PCB 184 x	74472483			0.08	U	0.0825	U	0.081	U	0.085	U	0.088	U	0.12	U	0.0895	U
PCB 187	52663680			0.104	U	0.1075	U	0.106	U	0.111	U	0.1145	U	0.1565	U	0.117	U
PCB 195	52663782			0.1365	U	0.141	U	0.1385	U	0.1455	U	0.15	U	0.205	U	0.153	U
PCB 206	40186729			0.139	U	0.144	U	0.141	U	0.1485	U	0.153	U	0.209	U	0.156	U
PCB 209	2051243			0.16	U	0.165	U	0.162	U	0.1705	U	0.1755	U	0.24	U	0.179	U
Total PCBs		*22.7*	*180*	*4.2*	*U*	*4.4*	*U*	*4.3*	*U*	*4.5*	*U*	*4.7*	*U*	*6.4*	*U*	*4.8*	*U*

Analyte		CAS Number	Screening Values (b)		IOSN-7		IOSN-8		REF-A-1		REF-A-2		REF-A-3		REF-B-1		REF-B-1-DUP	
			ERL	ERM	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PCBs (UG/KG)																		
PCB 8		34883437			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 18		37680652			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 28		7012375			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 44		41464395			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 49	x	41464408			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 52		35693993			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 66		32598100			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 77	x	32598133			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 87	x	38380028			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 101		37680732			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 87 / 111 (g)	x	38380028/ 39635320			0.295	U	0.282	U	0.252	U	0.279	U	0.278	U	0.269	U	0.262	U
PCB 101 / 90 (g)		37680732/ 68194070			0.295	U	0.282	U	0.252	U	0.279	U	0.278	U	0.269	U	0.262	U
PCB 105		32598144			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 118		31508006			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 126	x	57465288			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 128		38380073			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 138		35065282			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 153		35065271			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 156	x	38380084			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 169	x	32774166			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 170		35065306			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 180		35065293			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 183	x	52663691			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 184	x	74472483			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 187		52663680			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 195		52663782			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 206		40186729			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
PCB 209		2051243			0.148	U	0.141	U	0.126	U	0.139	U	0.139	U	0.135	U	0.131	U
Total PCBs			*22.7*	*180*	*5.6*	*U*	*5.4*	*U*	*4.8*	*U*	*5.3*	*U*	*5.3*	*U*	*5.1*	*U*	*5.0*	*U*

			Screening Values (b)		REF B-2		REF B-3		REF C-1		REF C-2		REF C-3	
Analyte		**CAS Number**	**ERL**	**ERM**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PCBs (UG/KG)														
PCB 8		34883437			0.1075	U	0.1025	U	0.127	U	0.129	U	0.131	U
PCB 18		37680652			0.078	U	0.0745	U	0.127	U	0.129	U	0.131	U
PCB 28		7012375			0.133	U	0.127	U	0.127	U	0.129	U	0.131	U
PCB 44		41464395			0.148	U	0.141	U	0.127	U	0.129	U	0.131	U
PCB 49	x	41464408			0.145	U	0.138	U	0.127	U	0.129	U	0.131	U
PCB 52		35693993			0.0825	U	0.0785	U	0.127	U	0.129	U	0.131	U
PCB 66		32598100			0.0775	U	0.074	U	0.127	U	0.129	U	0.131	U
PCB 77	x	32598133			-	-	-	-	0.127	U	0.129	U	0.131	U
PCB 87	x	38380028			0.063	U	0.06	U	-	-	-	-	-	-
PCB 101		37680732			0.1265	U	0.1205	U	-	-	-	-	-	-
PCB 87 / 111 (g)	x	38380028/ 39635320			-	-	-	-	0.254	U	0.258	U	0.262	U
PCB 101 / 90 (g)		37680732/ 68194070			-	-	-	-	0.254	U	0.258	U	0.262	U
PCB 105		32598144			0.1135	U	0.108	U	0.127	U	0.129	U	0.131	U
PCB 118		31508006			0.12	U	0.1145	U	0.127	U	0.129	U	0.131	U
PCB 126	x	57465288			-	-	-	-	0.127	U	0.129	U	0.131	U
PCB 128		38380073			0.1415	U	0.135	U	0.127	U	0.129	U	0.131	U
PCB 138		35065282			0.0905	U	0.0865	U	0.127	U	0.129	U	0.131	U
PCB 153		35065271			0.1885	U	0.18	U	0.127	U	0.129	U	0.131	U
PCB 156	x	38380084			-	-	-	-	0.127	U	0.129	U	0.131	U
PCB 169	x	32774166			-	-	-	-	0.127	U	0.129	U	0.131	U
PCB 170		35065306			0.0695	U	0.066	U	0.127	U	0.129	U	0.131	U
PCB 180		35065293			0.071	U	0.068	U	0.127	U	0.129	U	0.131	U
PCB 183	x	52663691			0.038	U	0.0365	U	0.127	U	0.129	U	0.131	U
PCB 184	x	74472483			0.078	U	0.0745	U	0.127	U	0.129	U	0.131	U
PCB 187		52663680			0.102	U	0.097	U	0.127	U	0.129	U	0.131	U
PCB 195		52663782			0.1335	U	0.127	U	0.127	U	0.129	U	0.131	U
PCB 206		40186729			0.136	U	0.13	U	0.127	U	0.129	U	0.131	U
PCB 209		2051243			0.156	U	0.149	U	0.127	U	0.129	U	0.131	U
Total PCBs			*22.7*	*180*	*4.2*	*U*	*4.0*	*U*	*4.8*	*U*	*4.9*	*U*	*5.0*	*U*

Analyte	CAS Number	Screening Values (b) ERL	ERM	IOSN-1 Result	Qual	IOSN-2 Result	Qual	IOSN-2 DUP Result	Qual	IOSN-3 Result	Qual	IOSN-4 Result	Qual	IOSN-5 Result	Qual	IOSN-6 Result	Qual
PAHs (UG/KG)																	
1-Methylnaphthalene	90120			1.7	U	1.85	U	1.8	U	1.8	U	1.85	U	1.7	U	1.8	U
2-Methylnaphthalene	91576	70	670	4.9	J	2.4	U	2.35	U	2.3	U	2.4	U	5	J	4.8	J
Acenaphthene	83329	16	500	1.5	U	1.6	U	1.6	U	1.6	U	1.6	U	1.5	U	1.6	U
Acenaphthylene	208968	44	640	1.2	U	1.3	U	1.3	U	1.25	U	1.3	U	1.2	U	1.25	U
Anthracene	120127	85.3	1100	8.7	J	11	J	7.5	J	14		13	J	9	J	6.4	J
Benzo(a)anthracene	56553	261	1600	18		24		23		27		27		23		23	
Benzo(a)pyrene	50328	430	1600	20		22		19		24		24		20		22	
Benzo(b)fluoranthene	205992	600 (d)	5100 (d)	37		31		34		44		42		38		36	
Benzo(g,h,i)perylene	191242	63.4 (e)	260 (e)	19		21		16		21		22		19		16	
Benzo(k)fluoranthene	207089	600 (d)	5100 (d)	14		17		14		16		16		15		13	J
Chrysene	218019	384	2800	32		29		27		35		32		29		27	
Dibenz(a,h)anthracene	53703	63.4	260	5.4	J	6.1	J	5.4	J	6.4	J	6.2	J	5.2	J	5	J
Fluoranthene	206440	600	5100	33		31		34		43		44		37		37	
Fluorene	86737	19	540	3.15	U	3.45	U	3.4	U	3.4	U	3.45	U	3.2	U	3.35	U
Indeno(1,2,3-cd)pyrene	193395	63.4 (e)	260 (e)	24		24		21		29		28		24		22	
Naphthalene	91203	160	2100	2.6	U	2.8	U	2.75	U	2.75	U	2.8	U	2.6	U	2.75	U
Phenanthrene	85018	240	1500	25		24		29		36		31		25		24	
Pyrene	129000	665	2600	53		50		47		68		58		48		44	
Total LMW PAHs		*552*	*3160*	*49*		*48*		*50*		*63*		*57*		*49*		*46*	
Total HMW PAHs		*1700*	*9600*	*255*		*255*		*240*		*313*		*299*		*258*		*245*	
Total PAHs		*4022*	*44792*	*304*		*304*		*290*		*377*		*357*		*307*		*291*	

Analyte	CAS Number	Screening Values (b) ERL	ERM	IOSN-7 Result	Qual	IOSN-8 Result	Qual	REF-A-1 Result	Qual	REF-A-2 Result	Qual	REF-A-3 Result	Qual	REF-B-1 Result	Qual	REF-B-1-DUP Result	Qual
PAHs (UG/KG)																	
1-Methylnaphthalene	90120			2.0	U	2.0	U	2.0	U	1.8	U	2.0	U	1.7	U	1.7	U
2-Methylnaphthalene	91576	70	670	2.6	U	2.6	U	2.6	U	2.3	U	2.6	U	2.2	U	2.2	U
Acenaphthene	83329	16	500	1.8	U	1.8	U	1.8	U	1.6	U	1.8	U	1.5	U	1.5	U
Acenaphthylene	208968	44	640	1.4	U	1.4	U	1.4	U	1.3	U	1.4	U	1.2	U	1.2	U
Anthracene	120127	85.3	1100	3.4	J	3.0	J	3.2	J	1.3	U	1.4	U	1.2	U	1.2	U
Benzo(a)anthracene	56553	261	1600	6.5	J	7.8	J	9.6	J	9.6	J	7.8	J	7.1	J	8.3	J
Benzo(a)pyrene	50328	430	1600	3.9	U	8.0	J	10	J	11	J	3.9	U	7.9	J	9.5	J
Benzo(b)fluoranthene	205992	600 (d)	5100 (d)	8.5	JM	12	J	16	J	17		9.6	J	11	J	13	
Benzo(g,h,i)perylene	191242	63.4 (e)	260 (e)	5.1	J	6.2	J	7.9	J	8.4	J	5.6	J	5.7	J	6.5	J
Benzo(k)fluoranthene	207089	600 (d)	5100 (d)	3.6	U	3.7	U	7.2	J	7.6	J	3.6	U	3.2	U	3.1	U
Chrysene	218019	384	2800	7.8	J	9.4	J	14	J	14	J	9.9	J	8.7	J	12	J
Dibenz(a,h)anthracene	53703	63.4	260	2.1	U	2.2	U	2.1	U	1.9	U	2.1	U	1.8	U	1.8	U
Fluoranthene	206440	600	5100	13	J	18		21		22		14	J	16		20	
Fluorene	86737	19	540	3.7	U	3.8	U	3.7	U	3.4	U	3.7	U	3.3	U	3.2	U
Indeno(1,2,3-cd)pyrene	193395	63.4 (e)	260 (e)	5.1	J	6.0	J	7.9	J	6.6	J	7.2	J	5.2	J	6.1	J
Naphthalene	91203	160	2100	3.0	U	3.1	U	3.0	U	2.8	U	3.0	U	2.7	U	2.6	U
Phenanthrene	85018	240	1500	7.8	J	11	J	12	J	11	J	7.6	J	10	J	10	J
Pyrene	129000	665	2600	11	J	14	J	26		25		17		13	J	23	
Total LMW PAHs		*552*	*3160*	*26*		*29*		*30*		*25*		*23*		*24*		*23*	
Total HMW PAHs		*1700*	*9600*	*67*		*87*		*122*		*123*		*81*		*80*		*103*	
Total PAHs		*4022*	*44792*	*92*		*116*		*151*		*148*		*104*		*103*		*127*	

Analyte	CAS Number	Screening Values (b) ERL	ERM	REF B-2 Result	Qual	REF B-3 Result	Qual	REF C-1 Result	Qual	REF C-2 Result	Qual	REF C-3 Result	Qual
PAHs (UG/KG)													
1-Methylnaphthalene	90120			1.7	U	1.8	U	1.8	U	1.8	U	1.8	U
2-Methylnaphthalene	91576	70	670	2.15	U	5.4	J	2.3	U	2.4	U	2.3	U
Acenaphthene	83329	16	500	1.5	U	1.6	U	1.6	U	1.6	U	1.6	U
Acenaphthylene	208968	44	640	1.2	U	1.25	U	1.3	U	1.3	U	1.3	U
Anthracene	120127	85.3	1100	7.9	J	7.8	J	2.6	J	1.3	U	3.0	J
Benzo(a)anthracene	56553	261	1600	17		21		4.0	J	6.4	J	6.2	J
Benzo(a)pyrene	50328	430	1600	16		20		3.5	U	3.5	U	3.5	U
Benzo(b)fluoranthene	205992	600 (d)	5100 (d)	29		36		6.7	J	11	J	11	J
Benzo(g,h,i)perylene	191242	63.4 (e)	260 (e)	13		16		2.1	U	6.6	J	5.9	J
Benzo(k)fluoranthene	207089	600 (d)	5100 (d)	12	J	13	J	3.2	U	3.3	U	3.2	U
Chrysene	218019	384	2800	20		27		5.3	J	8.8	J	8.1	J
Dibenz(a,h)anthracene	53703	63.4	260	4.3	J	4.6	J	1.9	U	1.9	U	1.9	U
Fluoranthene	206440	600	5100	27		33		9.2	J	15		15	
Fluorene	86737	19	540	3.15	U	3.35	U	3.3	U	3.4	U	3.3	U
Indeno(1,2,3-cd)pyrene	193395	63.4 (e)	260 (e)	17		21		2.0	U	6.1	J	5.2	J
Naphthalene	91203	160	2100	2.55	U	2.75	U	2.7	U	2.8	U	2.7	U
Phenanthrene	85018	240	1500	24		27		5.0	J	8.7	J	8.0	J
Pyrene	129000	665	2600	33		43		7.6	J	13	J	12	J
Total LMW PAHs		*552*	*3160*	*44*		*51*		*20*		*23*		*24*	
Total HMW PAHs		*1700*	*9600*	*188*		*235*		*45*		*76*		*72*	
Total PAHs		*4022*	*44792*	*232*		*286*		*66*		*99*		*96*	

Notes:

x - Not a NOAA18 congener.
- Not analyzed
ERL - Effects Range Low.
ERM - Effects Range Median.
HMW - High Molecular Weight PAH.
J - Estimated.
LMW - Low Molecular Weight PAH.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated biphenyls.
TOC - Total organic carbon.
U - Not Detected (reported at 1/2 method detection limit).

Totals calculated using 1/2 the method detection limit for non-detects.
Total PCBs calculated as the sum of the 18 NOAA congeners multiplied by 2.
Concentration exceeds ERL screening value.

(a) Percent solids reported from laboratory method 2540G.
(b) Marine sediment screening values obtained from Long, et al. (1995) and Buchman (2008).
(c) Value for Total DDT used.
(d) Value for fluoranthene used as a surrogate due to structural similarities.
(e) Value for dibenzo(a,h)anthracene used as a surrogate due to structural similarities.
(f) Value for chlordane used.
(g) Laboratory results report the following PCB congeners together:
PCB 87 / 111 and
PCB 101 / 90.

Appendix D

Benthic Biology Results

Table D-1. Species Abundance by Station at the IOSN Site and Reference Area

Site

Station	Rank	Species	Total Abundance	% Total
IOSN-1	1	*Ampharete acutifrons*	96	42%
	2	*Terebellides stroemii*	17	7%
	3	*Aphelochaeta* spp.	13	6%
	4	*Chaetozone setosa*	12	5%
	5	*Periploma papyratium*	8	4%
	5	*Thyasira gouldii*	8	4%
	5	*Ninoe nigripes*	8	4%
	6	*Nucula proxima*	6	3%
	6	*Yoldia sapotilla*	6	3%
	6	*Polycirrus phosphoreus*	6	3%
	7	*Levinsenia gracilis*	5	2%
	-	Remaining Species	42	19%
Species Richness	27	**Station Abundance**	227	
IOSN-2	1	*Levinsenia gracilis*	68	22%
	2	*Ampharete acutifrons*	58	18%
	3	*Chaetozone setosa*	26	8%
	4	*Aphelochaeta* spp.	23	7%
	5	*Terebellides stroemii*	17	5%
	6	*Nucula proxima*	13	4%
	7	*Tharyx acutus*	12	4%
	8	*Periploma papyratium*	11	3%
	8	*Ninoe nigripes*	11	3%
	9	*Cossura longocirrata*	9	3%
	10	*Yoldia sapotilla*	7	2%
	10	*Nephtys incisa*	7	2%
	-	Remaining Species	53	17%
Species Richness	31	**Station Abundance**	315	

Station	Rank	Species	Total Abundance	% Total
IOSN-3	1	*Ampharete acutifrons*	31	16%
	2	*Levinsenia gracilis*	29	15%
	3	*Aphelochaeta* spp.	15	8%
	4	*Nucula proxima*	14	7%
	4	*Chaetozone setosa*	14	7%
	5	*Ninoe nigripes*	8	4%
	5	*Cossura longocirrata*	8	4%
	5	*Terebellides stroemii*	8	4%
	6	*Yoldia sapotilla*	7	4%
	6	*Periploma papyratium*	7	4%
	6	*Heteromastus filiformis*	7	4%
	7	*Nephtys incisa*	6	3%
	7	*Polycirrus phosphoreus*	6	3%
	-	Remaining Species	32	17%
Species Richness	27	**Station Abundance**	192	
IOSN-4	1	*Ampharete acutifrons*	49	24%
	2	*Levinsenia gracilis*	28	14%
	3	*Chaetozone setosa*	20	10%
	4	*Aphelochaeta* spp.	14	7%
	5	*Scoletoma tenuis*	11	5%
	6	*Terebellides stroemii*	10	5%
	7	*Cossura longocirrata*	8	4%
	8	*Periploma papyratium*	7	3%
	8	*Carinomella lactea*	7	3%
	9	*Ninoe nigripes*	6	3%
	10	*Polycirrus phosphoreus*	5	2%
	10	*Tharyx acutus*	5	2%
	-	Remaining Species	32	16%
Species Richness	28	**Station Abundance**	202	

Station	Rank	Species	Total Abundance	% Total
IOSN-5	1	*Ampharete acutifrons*	80	30%
	2	*Terebellides stroemii*	22	8%
	3	*Apistobranchus tullbergi*	21	8%
	4	*Aphelochaeta* spp.	19	7%
	5	*Chaetozone setosa*	17	6%
	6	*Levinsenia gracilis*	15	6%
	7	*Periploma papyratium*	9	3%
	8	*Yoldia sapotilla*	8	3%
	8	*Thyasira gouldii*	8	3%
	8	*Heteromastus filiformis*	8	3%
	9	*Nucula proxima*	5	2%
	9	*Ninoe nigripes*	5	2%
	9	*Scoletoma tenuis*	5	2%
	9	*Cossura longocirrata*	5	2%
	-	Remaining Species	42	16%
Species Richness	26	**Station Abundance**	269	
IOSN-6	1	*Ampharete acutifrons*	31	25%
	2	*Levinsenia gracilis*	23	18%
	3	*Aphelochaeta* spp.	14	11%
	4	*Terebellides stroemii*	7	6%
	5	*Thyasira gouldii*	6	5%
	5	*Heteromastus filiformis*	6	5%
	6	*Ninoe nigripes*	5	4%
	7	*Carinomella lactea*	4	3%
	7	*Apistobranchus tullbergi*	4	3%
	8	*Chaetozone setosa*	3	2%
	8	*Tharyx acutus*	3	2%
	-	Remaining Species	19	15%
Species Richness	23	**Station Abundance**	125	

Station	Rank	Species	Total Abundance	% Total
IOSN-7	1	*Ampharete acutifrons*	42	19%
	2	*Tharyx acutus*	38	17%
	3	*Levinsenia gracilis*	22	10%
	4	*Cirratulus cirratus*	18	8%
	5	*Nucula proxima*	13	6%
	6	*Yoldia sapotilla*	8	4%
	6	*Periploma papyratium*	8	4%
	6	*Cossura longocirrata*	8	4%
	6	*Terebellides stroemii*	8	4%
	7	*Scoletoma tenuis*	7	3%
	8	*Cochlodesma leanum*	5	2%
	8	*Thyasira gouldii*	5	2%
	8	*Clymenella zonalis*	5	2%
	8	*Heteromastus filiformis*	5	2%
	9	*Ninoe nigripes*	4	2%
	-	Remaining Species	23	11%
Species Richness	26	**Station Abundance**	219	
IOSN-8	1	*Ampharete acutifrons*	50	23%
	2	*Tharyx acutus*	19	9%
	3	*Levinsenia gracilis*	15	7%
	4	*Chaetozone setosa*	12	5%
	5	*Scoletoma tenuis*	10	5%
	6	*Cirratulus cirratus*	9	4%
	7	*Terebellides stroemii*	7	3%
	8	*Frigidoalvania carinata*	6	3%
	8	*Nucula proxima*	6	3%
	8	*Thyasira gouldii*	6	3%
	8	*Carinomella lactea*	6	3%
	8	*Cossura longocirrata*	6	3%
	8	*Maldanidae* spp.	6	3%
	9	*Polycirrus phosphoreus*	5	2%
	-	Remaining Species	57	26%
Species Richness	37	**Station Abundance**	220	

Reference Area

Station	Rank	Species	Total Abundance	% Total
REF-A-1	1	*Ampharete acutifrons*	55	28%
	2	*Levinsenia gracilis*	20	10%
	2	*Chaetozone setosa*	20	10%
	3	*Cossura longocirrata*	14	7%
	4	*Tharyx acutus*	11	6%
	5	*Scoletoma tenuis*	8	4%
	6	*Nucula proxima*	7	4%
	7	*Periploma papyratium*	6	3%
	7	*Carinomella lactea*	6	3%
	7	*Alitta succinea*	6	3%
	7	*Terebellides stroemii*	6	3%
	7	*Cirratulus cirratus*	6	3%
	8	*Cochlodesma leanum*	5	3%
	9	*Nephtys incisa*	4	2%
	9	*Aricidea suecica*	4	2%
	10	*Heteromastus filiformis*	3	2%
	-	Remaining Species	14	7%
Species Richness	26	**Station Abundance**	195	
REF-A-2	1	*Ampharete acutifrons*	31	17%
	2	*Chaetozone setosa*	22	12%
	3	*Cirratulus cirratus*	15	8%
	4	*Yoldia sapotilla*	12	7%
	5	*Nucula proxima*	9	5%
	5	*Levinsenia gracilis*	9	5%
	6	*Scoletoma tenuis*	8	4%
	6	*Terebellides stroemii*	8	4%
	7	*Thyasira gouldii*	7	4%
	7	*Cossura longocirrata*	7	4%
	7	*Tharyx acutus*	7	4%
	8	*Leptocheirus spp.*	5	3%
	9	*Polycirrus phosphoreus*	4	2%
	9	*Scalibregma inflatum*	4	2%
	-	Remaining Species	33	18%
Species Richness	31	**Station Abundance**	181	

Station	Rank	Species	Total Abundance	% Total
REF-A-3	1	*Ampharete acutifrons*	98	36%
	2	*Levinsenia gracilis*	19	7%
	3	*Chaetozone setosa*	18	7%
	4	*Tharyx acutus*	15	5%
	5	*Cochlodesma leanum*	12	4%
	5	*Terebellides stroemii*	12	4%
	6	*Cossura longocirrata*	11	4%
	6	*Cirratulus cirratus*	11	4%
	7	*Scoletoma tenuis*	10	4%
	8	*Yoldia sapotilla*	9	3%
	9	*Astarte undata*	8	3%
	10	*Nucula proxima*	7	3%
	-	Remaining Species	44	16%
Species Richness	32	**Station Abundance**	274	
REF-B-1	1	*Ampharete acutifrons*	82	27%
	2	*Levinsenia gracilis*	30	10%
	2	*Chaetozone setosa*	30	10%
	3	*Cirratulus cirratus*	25	8%
	4	*Terebellides stroemii*	15	5%
	5	*Cochlodesma leanum*	14	5%
	6	*Thyasira gouldii*	13	4%
	6	*Tharyx acutus*	13	4%
	7	*Nucula proxima*	7	2%
	7	*Yoldia sapotilla*	7	2%
	8	*Cossura longocirrata*	6	2%
	9	*Scoletoma tenuis*	5	2%
	9	*Heteromastus filiformis*	5	2%
	9	*Polycirrus phosphoreus*	5	2%
	-	Remaining Species	46	15%
Species Richness	35	**Station Abundance**	303	

Station	Rank	Species	Total Abundance	% Total
REF-B-2	1	*Ampharete acutifrons*	93	29%
	2	*Levinsenia gracilis*	44	14%
	3	*Aphelochaeta* spp.	39	12%
	4	*Chaetozone setosa*	26	8%
	5	*Terebellides stroemii*	14	4%
	6	*Nucula proxima*	12	4%
	7	*Ninoe nigripes*	11	3%
	8	*Tharyx acutus*	8	3%
	9	*Thyasira gouldii*	7	2%
	9	*Cirratulidae* spp.	7	2%
	10	*Carinomella lactea*	5	2%
	10	*Spionidae* spp.	5	2%
	10	*Polycirrus phosphoreus*	5	2%
	-	Remaining Species	43	13%
Species Richness	26	**Station Abundance**	319	
REF-B-3	1	*Ampharete acutifrons*	86	35%
	2	*Chaetozone setosa*	23	9%
	3	*Levinsenia gracilis*	18	7%
	3	*Aphelochaeta* spp.	18	7%
	4	*Terebellides stroemii*	11	4%
	5	*Cossura longocirrata*	10	4%
	6	*Nucula proxima*	9	4%
	6	*Periploma papyratium*	9	4%
	7	*Ninoe nigripes*	6	2%
	7	*Polycirrus phosphoreus*	6	2%
	8	*Amphipoda* spp.	5	2%
	8	*Carinomella lactea*	5	2%
	-	Remaining Species	41	17%
Species Richness	27	**Station Abundance**	247	

Station	Rank	Species	Total Abundance	% Total
REF-C-1	1	*Ampharete acutifrons*	100	31%
	2	*Chaetozone setosa*	32	10%
	3	*Tharyx acutus*	16	5%
	4	*Terebellides stroemii*	14	4%
	5	*Nucula proxima*	13	4%
	6	*Yoldia sapotilla*	11	3%
	6	*Scalibregma inflatum*	11	3%
	7	*Astarte undata*	10	3%
	8	*Cossura longocirrata*	9	3%
	9	*Frigidoalvania carinata*	8	3%
	9	*Levinsenia gracilis*	8	3%
	10	*Maldane sarsi*	7	2%
	10	*Prionospio steenstrupi*	7	2%
	-	Remaining Species	74	23%
Species Richness	37	**Station Abundance**	320	
REF-C-2	1	*Ampharete acutifrons*	26	20%
	2	*Chaetozone setosa*	13	10%
	3	*Nucula proxima*	10	8%
	3	*Tharyx acutus*	10	8%
	4	*Astarte undata*	7	5%
	5	*Cochlodesma leanum*	6	5%
	6	*Yoldia sapotilla*	5	4%
	6	*Ninoe nigripes*	5	4%
	6	*Scoletoma tenuis*	5	4%
	6	*Terebellides stroemii*	5	4%
	7	*Exogone* spp.	4	3%
	7	*Heteromastus filiformis*	4	3%
	-	Remaining Species	31	24%
Species Richness	31	**Station Abundance**	131	

Station	Rank	Species	Total Abundance	% Total
REF-C-3	1	*Ampharete acutifrons*	76	29%
	2	*Chaetozone setosa*	18	7%
	3	*Tharyx acutus*	16	6%
	4	*Astarte undata*	15	6%
	4	*Levinsenia gracilis*	15	6%
	4	*Terebellides stroemii*	15	6%
	5	*Nucula proxima*	12	5%
	5	*Phascolopsis gouldii*	12	5%
	6	*Yoldia sapotilla*	11	4%
	7	*Exogone* spp.	10	4%
	8	*Prionospio steenstrupi*	8	3%
	9	*Scalibregma inflatum*	7	3%
	10	*Lumbrineris acicularum*	6	2%
	-	Remaining Species	45	17%
Species Richness	33	**Station Abundance**	266	

Appendix E

Surface Water Chemistry Results

Surface Water Results

Analyte	CAS Number	Screening Values (a)		IOSN-8-A		IOSN-8-B		IOSN-8-C		REF-B-WATER-A		REF-B-WATER-B		REF-B-WATER-B-DUP		REF-B-WATER-C	
		Chronic	Acute	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
METALS (UG/L)																	
Arsenic	7440382	36	69	0.020		0.050		0.030		0.020		0.040		0.040		0.690	
Cadmium	7440439	8.8	40	0.003		0.006		0.003		0.003		0.004		0.004		0.010	
Chromium	7440473	27.4 (b)	10300 (b)	2.4		4.2		2.4		2.2		2.6		2.6		1.8	
Copper	7440508	3.1	4.8	0.5		0.8		0.3	J	0.4		1.0		0.3	J	0.5	
Lead	7439921	8.1	210	0.02	U	0.03	U	0.02	U	0.02	U	0.02	U	0.04	J	1.7	
Nickel	7440020	8.2	74	0.9		4.0		0.8		0.7		1.0		0.9		5.7	
Zinc	7440666	81	90	0.2	U	2.9		0.2	U	0.2	U	0.2	U	0.2	U	8.0	
Mercury	7439976	0.94	1.8	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U

Analyte	CAS Number	Screening Values (a)		IOSN-8-A		IOSN-8-B		IOSN-8-C		REF-B-WATER-A		REF-B-WATER-B		REF-B-WATER-B-DUP		REF-B-WATER-C	
		Chronic	Acute	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PESTICIDES (UG/L)																	
4,4`-DDD	72548	0.36	3.6	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00007	U	0.00006	U	0.00006	U
4,4`-DDE	72559	1.4	14	0.00007	U	0.00007	U	0.00007	U	0.00007	U	0.00008	U	0.00007	U	0.00007	U
4,4`-DDT	50293	0.0005	0.065	0.00008	U	0.00008	U	0.00008	U	0.00008	U	0.00008	U	0.00008	U	0.00008	U
Total DDx		<0.0005	<0.065	*0.00021*	*U*	*0.00021*	*U*	*0.00020*	*U*	*0.00021*	*U*	*0.00022*	*U*	*0.00021*	*U*	*0.00021*	*U*
Aldrin	309002		0.65	0.00016	U	0.00016	U	0.00015	U	0.00016	U	0.00016	U	0.00016	U	0.00016	U
Alpha-BHC	319846			0.00005	U	0.00005	U	0.00004	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U
cis-Chlordane (alpha-Chlordane)	5103719			0.00007	U	0.00007	U	0.00007	U	0.00007	U	0.00008	U	0.00007	U	0.00007	U
Beta-BHC	319857			0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Delta-BHC	319868			0.00005	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U
Dieldrin	60571	0.00095	0.355	0.00004	U	0.00004	U	0.00004	U	0.00004	U	0.00004	U	0.00004	U	0.00004	U
Endosulfan I	959988	0.00435	0.017	0.00007	U	0.00007	U	0.00007	U	0.00007	U	0.00008	U	0.00007	U	0.00007	U
Endosulfan II	33213659	0.00435	0.017	0.00007	U	0.00007	U	0.00006	U	0.00007	U	0.00007	U	0.00007	U	0.00007	U
Endosulfan sulfate	1031078			0.00014	U	0.00014	U	0.00014	U	0.00014	U	0.00015	U	0.00014	U	0.00014	U
Endrin	72208	0.00115	0.0185	0.00008	U	0.00008	U	0.00008	U	0.00008	U	0.00008	U	0.00008	U	0.00008	U
gamma-BHC (Lindane)	58899		0.08	0.00005	U	0.00005	U	0.00004	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U
trans-Chlordane (gamma-Chlordane)	5103742			0.00003	U	0.00003	U	0.00003	U	0.00003	U	0.00004	U	0.00003	U	0.00003	U
Total Chlordane		0.002 (c)	0.045 (c)	*0.00024*	*U*	*0.00024*	*U*	*0.00023*	*U*	*0.00024*	*U*	*0.00025*	*U*	*0.00024*	*U*	*0.00024*	*U*
Heptachlor	76448	0.0018	0.0265	0.00006	U	0.00006	U	0.00005	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Heptachlor epoxide	1024573	0.0018	0.0265	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00007	U	0.00006	U	0.00006	U
Methoxychlor	72435	0.03		0.00108	U	0.00108	U	0.00104	U	0.00108	U	0.00112	U	0.00108	U	0.00108	U
cis-Nonachlor	5103731			0.00003	U	0.00003	U	0.00003	U	0.00003	U	0.00004	U	0.00003	U	0.00003	U
trans-Nonachlor	39765805			0.00005	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U	0.00005	U
Oxychlordane	27304138			0.00006	U	0.00006	U	0.00005	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Toxaphene	8001352	0.0002	0.21	0.00241	U	0.00241	U	0.00232	U	0.00241	U	0.00251	U	0.00241	U	0.00241	U

Analyte		CAS Number	Screening Values (a)		IOSN-8-A		IOSN-8-B		IOSN-8-C		REF-B-WATER-A		REF-B-WATER-B		REF-B-WATER-B-DUP		REF-B-WATER-C	
			Chronic	Acute	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PCBs (UG/L)																		
PCB 8		34883437			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 18		37680652			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 28		7012375			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 44		41464395			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 49	x	41464408			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 52		35693993			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 66		32598100			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 77	x	32598133			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 87 / 111 (d)	x	38380028/ 39635320			0.00026	U	0.00025	U	0.00024	U	0.00025	U	0.00026	U	0.00025	U	0.00024	U
PCB 101 / 90 (d)		37680732/ 68194070			0.00026	U	0.00025	U	0.00024	U	0.00025	U	0.00026	U	0.00025	U	0.00024	U
PCB 105		32598144			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 118		31508006			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 126	x	57465288			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 128		38380073			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 138		35065282			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 153		35065271			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 156	x	38380084			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 169	x	32774166			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 170		35065306			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 180		35065293			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 183	x	52663691			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 184	x	74472483			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 187		52663680			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 195		52663782			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 206		40186729			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
PCB 209		2051243			0.00013	U	0.00013	U	0.00012	U	0.00013	U	0.00013	U	0.00013	U	0.00012	U
Total PCBs			*0.030*	*0.033*	0.00494	U	0.00479	U	0.00462	U	0.00479	U	0.00500	U	0.00475	U	0.00462	U

Analyte	CAS Number	Screening Values (a)		IOSN-8-A		IOSN-8-B		IOSN-8-C		REF-B-WATER-A		REF-B-WATER-B		REF-B-WATER-B-DUP		REF-B-WATER-C	
		Chronic	Acute	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PAHs (UG/L)																	
1-Methylnaphthalene	90120			0.00023	U	0.00023	U	0.00077	J	0.00023	U	0.00023	U	0.00023	U	0.00052	J
2-Methylnaphthalene	91576		300	0.00052	U	0.00052	U	0.00052	U	0.00052	U	0.00052	U	0.00053	U	0.00052	U
Acenaphthene	83329	40	970	0.00079	U	0.00078	U	0.00078	U	0.00078	U	0.00078	U	0.00080	U	0.00078	U
Acenaphthylene	208968		300	0.00087	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00088	U	0.00086	U
Anthracene	120127		300	0.00095	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00096	U	0.00094	U
Benzo(a)anthracene	56553		300	0.00085	U	0.00084	U	0.00084	U	0.00084	U	0.00084	U	0.00086	U	0.00084	U
Benzo(a)pyrene	50328		300	0.00041	U	0.00041	U	0.00041	U	0.00041	U	0.00041	U	0.00042	U	0.00041	U
Benzo(b)fluoranthene	205992	11 (e)	300	0.00073	U	0.00072	U	0.00072	U	0.00072	U	0.00072	U	0.00073	U	0.00072	U
Benzo(g,h,i)perylene	191242		300	0.00064	U	0.00064	U	0.00064	U	0.00064	U	0.00064	U	0.00065	U	0.00064	U
Benzo(k)fluoranthene	207089	11 (e)	300	0.00058	U	0.00057	U	0.00057	U	0.00057	U	0.00057	U	0.00058	U	0.00057	U
Chrysene	218019		300	0.00046	U	0.00045	U	0.00045	U	0.00045	U	0.00045	U	0.00046	U	0.00045	U
Dibenz(a,h)anthracene	53703		300	0.00034	U	0.00033	U	0.00033	U	0.00033	U	0.00033	U	0.00034	U	0.00033	U
Fluoranthene	206440	11	40	0.00073	U	0.00073	U	0.00073	U	0.00073	U	0.00073	U	0.00074	U	0.00073	U
Fluorene	86737		300	0.00085	U	0.00084	U	0.00084	U	0.00084	U	0.00084	U	0.00086	U	0.00084	U
Indeno(1,2,3cd)pyrene	193395		300	0.00026	U	0.00026	U	0.00026	U	0.00026	U	0.00026	U	0.00026	U	0.00026	U
Naphthalene	91203	1.4	2350	0.00087	U	0.00086	U	0.00240	J	0.00086	U	0.00086	U	0.00088	U	0.00086	U
Phenanthrene	85018	4.6	7.7	0.00253	J	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00094	U	0.00092	U
Pyrene	129000		300	0.00075	U	0.00074	U	0.00074	U	0.00074	U	0.00074	U	0.00075	U	0.00074	U
Total LMW PAHs			*300*	*0.00761*		*0.00594*	*U*	*0.00802*		*0.00594*	*U*	*0.00594*	*U*	*0.00605*	*U*	*0.00623*	
Total HMW PAHs			*300*	*0.00573*	*U*	*0.00568*	*U*	*0.00568*	*U*	*0.00568*	*U*	*0.00568*	*U*	*0.00579*	*U*	*0.00568*	*U*
Total PAHs			*300*	*0.01334*		*0.01162*	*U*	*0.01371*		*0.01162*	*U*	*0.01162*	*U*	*0.01184*	*U*	*0.01191*	

Analyte	IOSN-8-A		IOSN-8-B		IOSN-8-C		REF-A-WATER-A		REF-A-WATER-B		REF-A-WATER-C		REF-B-WATER-A		REF-B-WATER-B		REF-B-WATER-B-DUP		REF-B-WATER-C	
	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
GENERAL CHEMISTRY (UG/L)	270		150		73	J	270		120		66	J	210		140		100		65	J
Nitrogen, Nitrate/Nitrite	150	U	150	U	150	U	150	U	150	U	150	U	150	U	150	U	150	U	150	U
Total Nitrogen	131	J	147	J	152	J	184	J	146	J	149	J	132	J	164	J	163	J	167	J
Nitrogen, Total Kjeldahl	28		18		6	J	27		15		4	J	25		12		11		6	J
Phosphorus, Total	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chlorophyll a	270		150		73	J	270		120		66	J	210		140		100		65	J

Analyte	REF-C-WATER-A		REF-C-WATER-B		REF-C-WATER-C	
	Result	Qual	Result	Qual	Result	Qual
GENERAL CHEMISTRY (UG/L)	65	J	270		120	
Nitrogen, Nitrate/Nitrite	150	U	150	U	150	U
Total Nitrogen	167	J	146	J	156	J
Nitrogen, Total Kjeldahl	6	J	23		9	J
Phosphorus, Total	ND		ND		ND	
Chlorophyll a	65	J	270		120	

Notes:
x Not a NOAA18 congener.
A – Bottom
B – Pycnocline
C – Surface
HMW - High Molecular Weight PAH.
J - Estimated.
LMW - Low Molecular Weight PAH.
ND – Not Detected (detection limit not provided
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated biphenyls.
U - Not Detected (reported at 1/2 method detection limit).

Totals calculated using 1/2 the method detection limit for nondetects.
Total PCBs calculated as the sum of the 18 NOAA congeners multiplied by 2.
Concentration exceeds surface water screening value.

(a) Marine surface water screening values obtained from the NOAA Screening Quick Reference Tables (Buchman, 2008).
(b) Value for trivalent chromium used as a surrogate.
(c) Value for chlordane used as a surrogate.
(d) Laboratory results report the following PCB congeners together:
PCB 87 / 111 and
PCB 101 / 90.
(e) Value for fluoranthene used as a surrogate.