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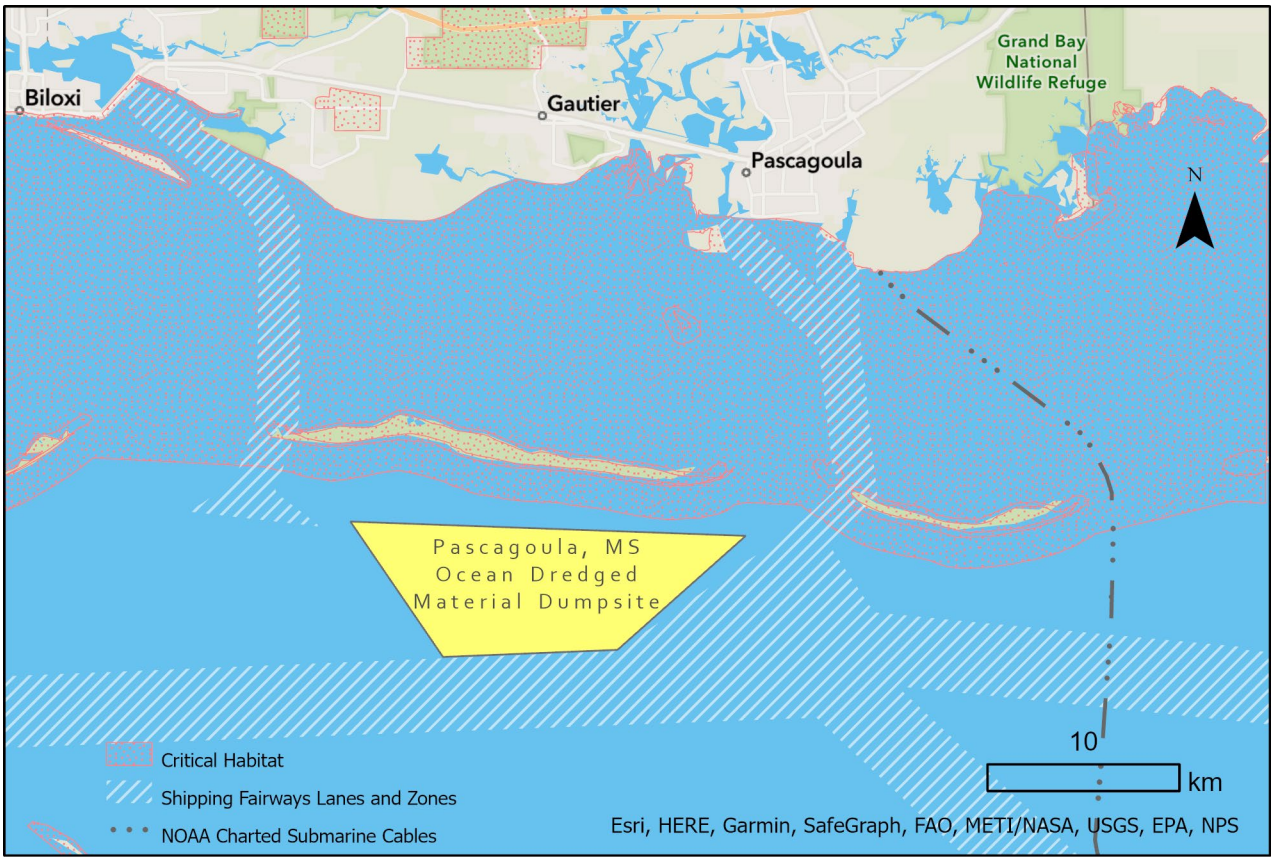
2016 National Ocean Dumping Site Monitoring Assessment Report



November 2020

2016 National
Site Monitoring Assessment Report
EPA Ocean Dumping Management Program

Executive Summary

The Marine Protection, Research, and Sanctuaries Act (MPRSA), also known as the United States Ocean Dumping Act, regulates the transportation and dumping of any material into ocean waters. Under the MPRSA, the U.S. Environmental Protection Agency (EPA) is responsible for designating and managing ocean disposal sites used for the permitted disposal of materials. The U.S. Army Corps of Engineers (USACE) is responsible for issuing ocean dumping permits for dredged material using EPA's environmental criteria and subject to EPA review and written concurrence. For all other materials, EPA is responsible for issuing ocean dumping permits. EPA, together with USACE, develops site management and monitoring plans (SMMPs) for each site designated for the disposal of dredged material. EPA's management and monitoring of these ocean sites ensures that disposal activities will not unreasonably degrade or endanger human health, welfare, the marine environment, or economic potentialities.

In Fiscal Year (FY) 2016, EPA monitored 10 of the 98 designated ocean disposal sites located off the U.S. Atlantic, Gulf of Mexico, and Pacific Coasts; and near Puerto Rico, Hawaii, Guam, and American Samoa. EPA also conducted monitoring surveys at two locations off the coast of Alaska that are used for ocean dumping of fish wastes. This National Ocean Dumping Site Monitoring Assessment Report provides a comprehensive overview of EPA's FY 2016 monitoring activities conducted in five of the seven EPA coastal Regions:

- Portland, Maine Dredged Material Disposal Site (Region 1)
- Central Long Island Sound, Connecticut Dredged Material Disposal Site (Region 1)
- Historic Area Remediation Site, New Jersey (Region 2)
- Fernandina Beach, Florida Dredged Material Disposal Site (Region 4)
- Miami, Florida Ocean Dredged Material Disposal Site (Region 4)
- Pascagoula, Mississippi Ocean Dredged Material Disposal Site (Region 4)
- Galveston, Texas Dredged Material Site (Region 6)
- Grays Harbor, Washington Eight-Mile Site (Region 10)
- Yaquina Bay, Oregon North and South Ocean Dredged Material Disposal Sites (Region 10)
- Revilla Channel and Clarence Strait, Alaska (Region 10)

Based on the results of these FY 2016 ocean disposal site surveys:

- Environmentally acceptable conditions appear to have been met and permitted disposal of dredged material under the MPRSA should be able to continue without modifications to site usage at eight of the monitored ocean disposal sites: Portland Dredged Material Disposal Site; Central Long Island Sound Dredged Material Site; Fernandina Beach Dredged Material Disposal Site; Miami Ocean Dredged Material Disposal Site;

Pascagoula Ocean Dredged Material Disposal Site; Galveston Dredged Material Site, and Yaquina Bay North and South Ocean Dredged Material Disposal Sites.

- EPA also used the data collected during these surveys to:
    - Inform future revisions to the SMMP for the Portland Dredged Material Disposal Site;
    - Inform future revisions to the SMMP for the Central Long Island Sound Dredged Material Site and focus future monitoring and management on disposal mounds with elevated levels of contaminants of concern within the site;
    - Better understand how placing additional types of material (e.g., rock) at the Historic Area Remediation Site influences the repopulation of a robust benthic community and inform future studies of the site;
    - Determine that using a combination of assessment methodologies, as compared to using individual methods separately, to measure routine survey parameters provides a more complete picture of benthic habitats and fish communities associated with ocean disposal sites; and inform planning of future surveys offshore of the Southeastern U.S. Atlantic and Gulf Coasts as well as future revisions to the SMMP for the Fernandina Beach Ocean Dredged Material Disposal Site;
    - Confirm that recent adjustments to the location of the dredged material release zone within the Miami Ocean Dredged Material Disposal Site have been successful in limiting dredged material from spreading beyond the site boundaries during disposal and inform future revisions to the site's SMMP;
    - Confirm that the SMMP for the Pascagoula Ocean Dredged Material Dumpsite is effective as well as to inform potential dredged material release locations within the site to be considered as part of future disposal permit evaluations;
    - Confirm that the existing reference area is representative of the Galveston Dredged Material Disposal Site and should continue to be used; and
    - Satisfy monitoring provisions in the SMMP for the Grays Harbor Eight-Mile Site and project that there should be no unacceptable adverse impacts to the marine environment after EPA de-designated and concludes management of this unneeded site. EPA withdrew the site designation with a Direct Final Rule published in the Federal Register on June 26, 2018.
- EPA also used data collected from Revilla Channel and Clarence Strait to assess impacts of fish waste disposal. EPA determined that additional information is needed to broaden the understanding of the physical oceanographic features that affect the response of the marine environment to ocean disposal of fish wastes.

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Acronyms and Abbreviations

2500W REF	Reference area (associated with CLDS)
4500E REF	Reference area (associated with CLDS)
aRPD	apparent redox potential discontinuity
CFR	Code of Federal Regulations
CLDS	Central Long Island Sound Dredged Material Disposal Site
CLIS REF	Central Long Island Sound Reference Area
cm	centimeter
COC	contaminant of concern
DAMOS	Disposal Area Monitoring System
DDE	Dichlorodiphenyldichloroethylene
DO	dissolved oxygen
EPA	United States Environmental Protection Agency
EREF	Eastern Reference Area (associated with PDS)
ERL	effects range-low
ERM	effects range-median
FH	fish haven
ft	feet
FVP	Field Verification Project (disposal mound within CLDS)
FY	fiscal year
GRETS	Galveston Reference Evaluation and Tissue Study
HARS	Historic Area Remediation Site
HSC	Houston Ship Channel
in	inches
m	meter
m^3	cubic meter
MDS	Mud Dump Site
mi	mile
MPRSA	Marine Protection, Research, and Sanctuaries Act
NHAV14-N	Reference area (associated with CLDS)
NHAV14-S	Reference area (associated with CLDS)
nmi^2	square nautical mile
nmi	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NR	natural reef
N/S	NOAA Ship
ODMDS	ocean dredged material disposal site
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDA	Portland Disposal Area
PDS	Portland Dredged Material Disposal Site
PRA	primary remediation area
PVI	plan view imaging/image
R/V	research vessel
SMMP	site management and monitoring plan
SPI	sediment profile imaging/image
SQG	sediment quality guideline
SREF	South Reference Area (associated with PDS)
S/V	sailing vessel
SVOC	semi-volatile organic compound
TEQ	toxicity equivalent quotient

TOC	total organic carbon
USACE	U.S. Army Corps of Engineers
USC	United States Code
yd^3	cubic yard

1.0 Introduction

The Marine Protection, Research, and Sanctuaries Act (MPRSA), also known as the Ocean Dumping Act, regulates the disposition of any material into the ocean unless expressly excluded under the MPRSA. The MPRSA prohibits or restricts (primarily in terms of material type, amount, and location) ocean dumping that would adversely affect human health, welfare, or amenities; or the marine environment, ecological systems, or economic potentialities. Section 101 of the MPRSA (33 U.S.C. 1411) generally prohibits the transportation of any material for the purpose of dumping, except as authorized by a permit.

In the United States today, the primary material (in terms of volume) disposed of in the ocean is uncontaminated dredged material, which is sediment that is excavated or otherwise removed from our nation's waterways. The removal of sediment supports a network of coastal ports and harbors that are used for commercial, transportation, national defense, and recreational purposes. In 2016, this marine transportation network, partially facilitated by the dredging of waterways, contributed more than $64 billion and 467,000 jobs to the U.S. economy (National Ocean Economics Program). Other materials that are disposed of in the ocean include fish wastes, vessels, marine mammal carcasses, and human remains for burial at sea.

Under the MPRSA, the U.S. Environmental Protection Agency (EPA) establishes environmental criteria for the evaluation of all permit applications. EPA is the permitting authority for ocean dumping of all materials other than dredged material. In the case of dredged material, the U.S. Army Corps of Engineers (USACE) issues ocean dumping permits (or, in the case of federal projects, authorizes ocean dumping of dredged material) using EPA's environmental criteria. All MPRSA permits and federal projects involving ocean dumping of dredged material are subject to EPA review and written concurrence.

EPA establishes the criteria for the designation of ocean disposal sites and is responsible for designating ocean disposal sites under the MPRSA. EPA considers specific criteria (published at 40 CFR 228.5 and 229.6) as part of any site designation evaluation. To minimize the adverse impacts of ocean dumping on human health and the marine environment, EPA designates sites based on environmental studies of the proposed site, environmental studies of regions adjacent to the proposed site, and historical knowledge of the impact of disposal on areas having similar physical, chemical, and biological characteristics. EPA analyzes these impacts through environmental assessments or environmental impact statements. In general, EPA designates sites only in areas where ocean dumping will not have a significant impact on various amenities, such as fisheries, coral reefs, and endangered species.

EPA is also responsible for managing all ocean disposal sites designated under the MPRSA. Management of ocean disposal sites involves:

- regulating the times, quantity, and characteristics of the material dumped at the site;
- establishing disposal controls, conditions, and requirements to minimize potential impacts to the marine environment; and
- monitoring the site and surrounding environment to verify that unanticipated or significant adverse effects are not occurring from historical or continued use of the ocean disposal site and that terms of the MPRSA permit are met.

In Fiscal Year (FY) 2016, EPA Regions managed 98 designated ocean disposal sites off the U.S. Atlantic, Gulf of Mexico, and Pacific Coasts; and near Puerto Rico, Hawaii, Guam, and American Samoa. All but one of the 98 ocean disposal sites are designated for the disposal of

dredged material permitted under the MPRSA. One EPA-designated site, located offshore of American Samoa, is designated for the disposal of fish processing wastes.

All designated dredged material disposal sites are required to have a site management and monitoring plan (SMMP). EPA, in conjunction with USACE, develops an SMMP for each ocean dredged material disposal site. Each SMMP includes, but is not limited to:

- a baseline assessment of site conditions;
- a monitoring program for the site;
- special management conditions or practices to be implemented at the site that are necessary for protection of the environment;
- consideration of the quantity of disposed material and the presence, nature, and bioavailability of the contaminants in the material;
- consideration of the anticipated long-term use of the site; and
- a schedule for review and revision of the SMMP.

1.1 Ocean Disposal Site Monitoring

EPA monitors environmental conditions in and around ocean disposal sites as part of its implementation of the MPRSA. Under the MPRSA and the ocean dumping regulations, EPA uses monitoring data to:

- Evaluate potential ocean disposal sites and designate ocean disposal sites (MPRSA 102(c)(1); 40 CFR 228.4(b), 40 CFR 228.6(a));
- Assess trends in environmental impact (40 CFR 228.9(a)(1));
- Evaluate disposal impact (40 CFR 228.10(a) and (b));
- Modify disposal site use (40 CFR 228.11(a) and (d));
- Prohibit dumping where necessary (MPRSA 102(c)(2)); and
- Develop an SMMP for each site, which must be reviewed and revised at least every 10 years (MPRSA 102(c)(3)).

EPA Regional Ocean Dumping Coordinators and Chief Scientists plan and conduct ocean disposal site monitoring surveys using scientifically proven principles and methods to assess the physical, biological, and chemical states of ocean disposal sites and the surrounding marine environment. EPA typically evaluates environmental impact at a site by comparing current conditions to those at the time of designation (baseline conditions) along with any other historical survey data. For example, EPA may use monitoring information to evaluate movement and deposition of the dumped material to determine whether or how to modify site use. Ocean areas near the disposal site but that are not affected by disposed materials are used for comparisons to assess the impact from disposal. The quantity and distribution of samples collected in each monitoring survey are determined based on survey- and site-specific factors. The information collected from these site assessments inform EPA’s ongoing planning and decision-making regarding the management and monitoring of sites.

As part of ocean disposal site surveys, EPA may collect a variety of data to ensure that the dumped material is being adequately tested and that there are no unexpected adverse impacts at and around disposal sites. Sediment samples, water samples, organisms from benthic trawls, sediment plan view images (PVI) (photographs of the surface of the seafloor), and/or sediment

profile images (SPI) (photographs of a cross-section of the upper 15-20 cm of the sediment-water interface) may be collected to evaluate the physical and biological state of the benthic environment in and around the disposal site and at reference areas. Parameters used to evaluate benthic habitat or benthic habitat quality include, but are not limited to: sediment grain size, depths of oxygenated sediment and apparent redox potential discontinuity (aRPD) (indicating habitat quality by measuring interactions between sediment chemistry and biological activity within sediment), and sediment penetrability (Rhoads and Germano, 1982). Benthic community health can be classified using defined successional stages and species diversity. Successional stages at a site can range from stage zero (recently disturbed) to stage three (mature), whereas species diversity is a measure that combines species richness (the number of different species) and evenness (the relative abundance of species) to give an overall indication of community structure.

EPA may also analyze sediment samples for contaminants of concern (COCs) including metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), pesticides, semi-volatile organic compounds (SVOCs), total organic carbon (TOC), solids, organotins, and/or dioxins. To evaluate the potential for disposed dredged material to have an impact on the benthic communities at or near disposal sites, EPA commonly compares contaminant concentrations in sediments collected at and around ocean disposal sites to sediment quality guidelines (SQGs), which are informal benchmarks used to relate chemical concentrations in sediments to the potential toxicity to benthic or aquatic organisms. Many EPA Regions rely on effects range low (ERL) and effects range median (ERM) national SQGs developed by the National Oceanic and Atmospheric Administration (NOAA) (NOAA, 1999). Chemical concentrations below the ERL are not likely to cause adverse effects, while chemical concentrations above the ERM are likely to cause adverse effects.

2.0 Report Objectives

In FY 2016, EPA scientists conducted surveys at ten designated ocean disposal sites (Table 1, Figure 1) to inform planning and ongoing decision-making with respect to the management and monitoring of these sites and two locations off the coast of Alaska that are used for ocean dumping of fish wastes. This national report serves as a comprehensive summary of these surveys. Specifically, the report summarizes the activities, findings, conclusions, and actions resulting from these EPA monitoring efforts.

Table 1. **Area and depth of ocean disposal sites and two fish waste disposal locations surveyed in FY 2016.**

Region	Disposal Site	Area (nmi²)	Depth (ft)
1	Portland, ME Dredged Material Disposal Site	1.00	121-230
1	Central Long Island Sound, CT Dredged Material Disposal Site	2.42	46-74
2	Historic Area Remediation Site, NJ	15.70	40-138
4	Fernandina Beach, FL Dredged Material Disposal Site	4.00	42-58
4	Miami, FL Ocean Dredged Material Disposal Site	1.00	98-230
4	Pascagoula, MS Ocean Dredged Material Disposal Site	18.50	38-52
6	Galveston, TX Dredged Material Site	6.60	33-51
10	Yaquina Bay, OR North Ocean Dredged Material Disposal Site	0.71	112-152
10	Yaquina Bay, OR South Ocean Dredged Material Disposal Site	0.71	112-152
10	Grays Harbor, WA Eight-Mile Site	1.25	140-160
10	Revilla Channel, AK	0.50	540-780
10	Clarence Strait, AK	0.80	1412-1969

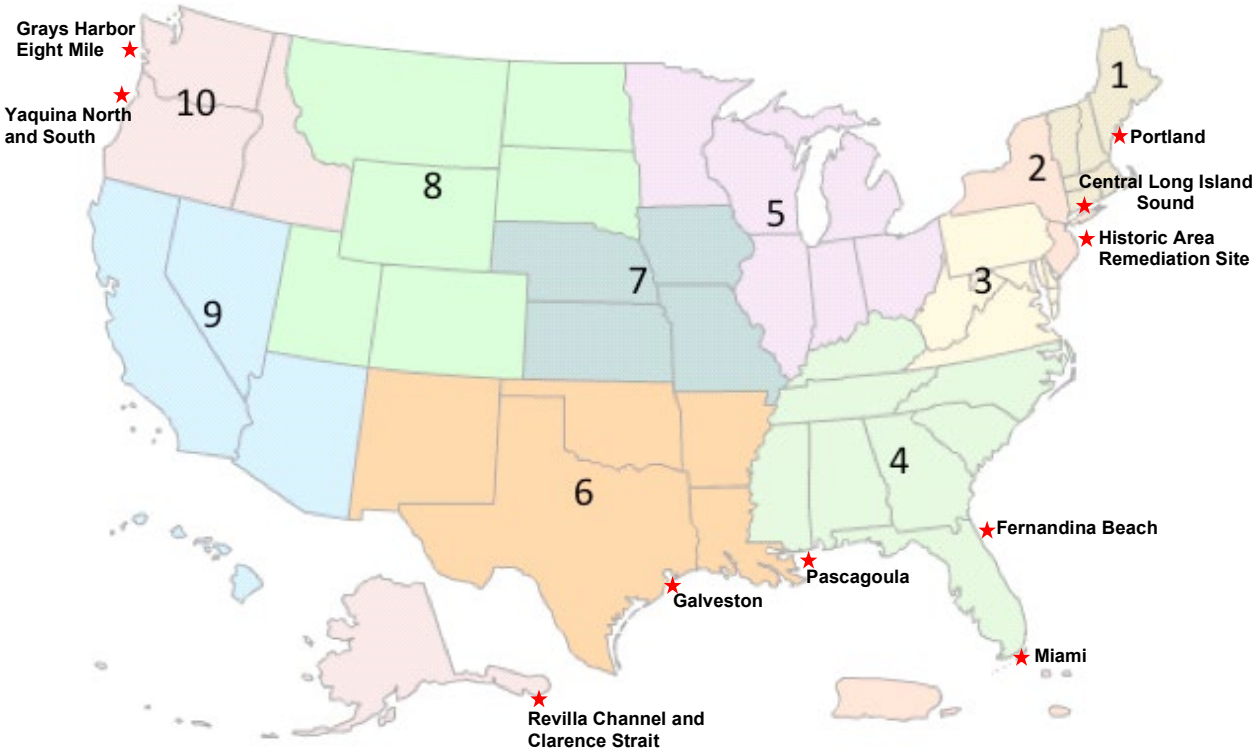

Figure 1. **Approximate locations of the ten ocean disposal sites and two fish waste disposal locations surveyed in FY 2016. Numbers indicate EPA Regions.**

3.0 Summary of Monitoring Surveys

A summary of FY 2016 survey objectives, activities, and results, as well as conclusions and recommended management actions resulting from these surveys is presented below.

3.1 Region 1 – Portland, ME Dredged Material Disposal Site

3.1.1 Background

The Portland Dredged Material Disposal Site (PDS) was designated by EPA in 1987 and is located approximately 7.1 nmi east of Dyer Point, Cape Elizabeth, Maine (Figure 2). This site has an area of 1.0 nmi^2 and an average depth of 164 ft (50 m). Sediments disposed of at the PDS originate from dredging projects in Portland Harbor, Fore River, and smaller rivers and harbors within the Casco Bay region of Maine.

The PDS has received approximately 2.5 million yd^3 (1.9 million m^3) of dredged material since the beginning of disposal activity tracking at the site in 1982. To manage disposal operations within the site, five distinct disposal mounds have been created within the PDS: Portland Disposal Area (PDA) A, PDA B, PDA 98, PDA 95, and PDS Inactive. In 2014, a survey of the PDS was conducted as part of the USACE New England District Disposal Area Monitoring System (DAMOS) Program.

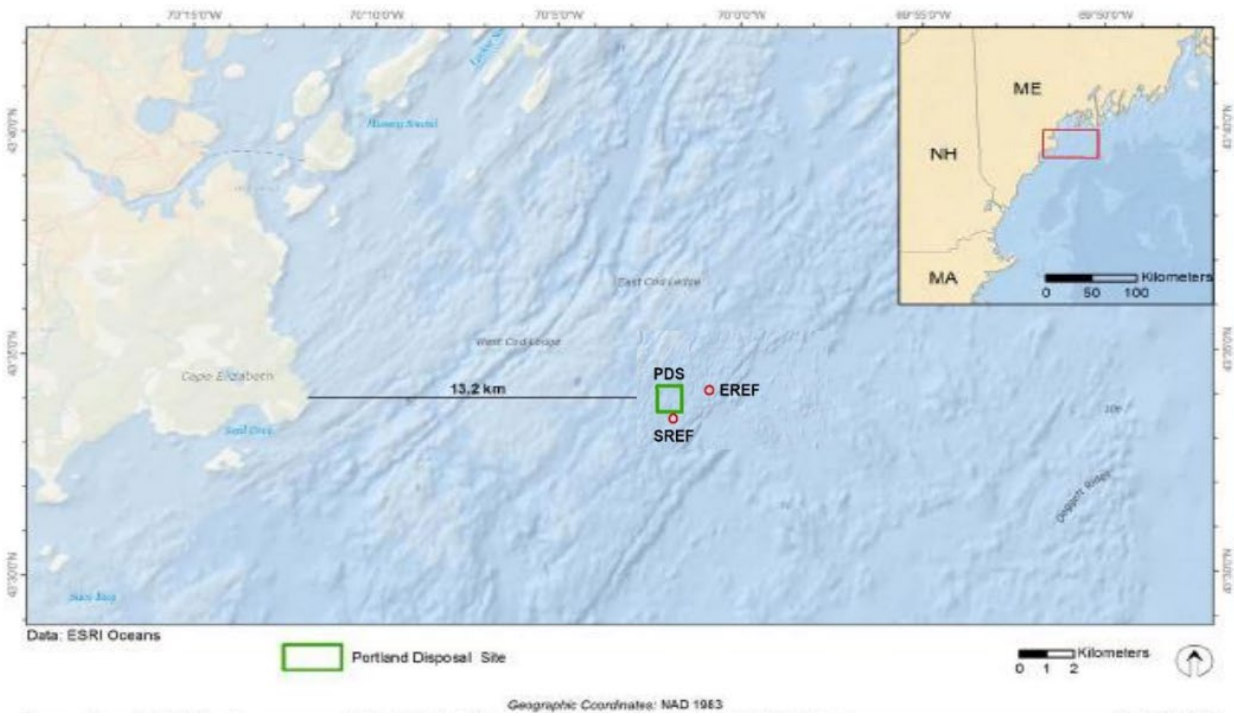

Figure 2. **Location of the Portland Dredged Material Disposal Site (PDS) and reference areas (SREF and EREF).**

3.1.2 Survey Objectives, Activities, and Findings

Region 1, in cooperation with the USACE DAMOS Program, monitored the PDS on September 7-22, 2016, aboard the Research Vessel (R/V) *Jamie Hanna*. The objectives of this survey were:

- to characterize the seafloor topography and surficial features over the most actively used portion of the PDS (PDA 95) and two reference areas (SREF and EREF) by completing a multibeam bathymetric survey (Figure 3);
- to use SPI and PVI to define the physical characteristics of surficial sediment and to assess the benthic recolonization status (community recovery of the bottom-dwelling animals) in the most actively used portion of the PDS (PDA 95), the older disposal mounds within the site (PDA A and PDS Inactive), and the reference areas (SREF and EREF); and
- to collect sediment and biological samples from the most actively used portion of the PDS (PDA 95), an older disposal mound (PDS Inactive), and the reference areas (SREF and EREF) to analyze for COCs.

Region 1 compared the depth, sediment composition, and dredged material thickness at PDA A, PDA 95, PDS Inactive, and the two reference areas using data from this survey combined with data from previous surveys. Data collected from the 2014 survey were used for PDA A and PDS Inactive, because little to no dredged material had been disposed of at these mounds since 2014. New data were collected during this 2016 survey for PDA 95 and the two reference areas, EREF and SREF. The disposal mounds and reference areas were similar in depth. The bathymetry of PDA 95 and the reference areas displayed irregular bottom topography with troughs and rock outcrops. Sediments at PDA 95, PDS Inactive, and the reference areas were primarily composed of very fine sand layered over silt-clay, while the majority of stations at PDA A were characterized by fine sand.

Dredged material thickness varied across the three disposal mounds, ranging from 2.5 in (6.4 cm) at PDA A to 6.3 in (16 cm) at PDA 95. Bathymetric results at PDA 95 in 2016, when compared to 2014 survey results at the same mound, demonstrated that dredged material accumulated within a deep basin at the center of PDA 95. Material deposited at PDA 95 appeared to be successfully contained within that mound's boundaries. PDS Inactive was found to have dredged material present and closely resembled the state of PDA 95, even though dredged material has not been disposed at PDS Inactive since 1991.

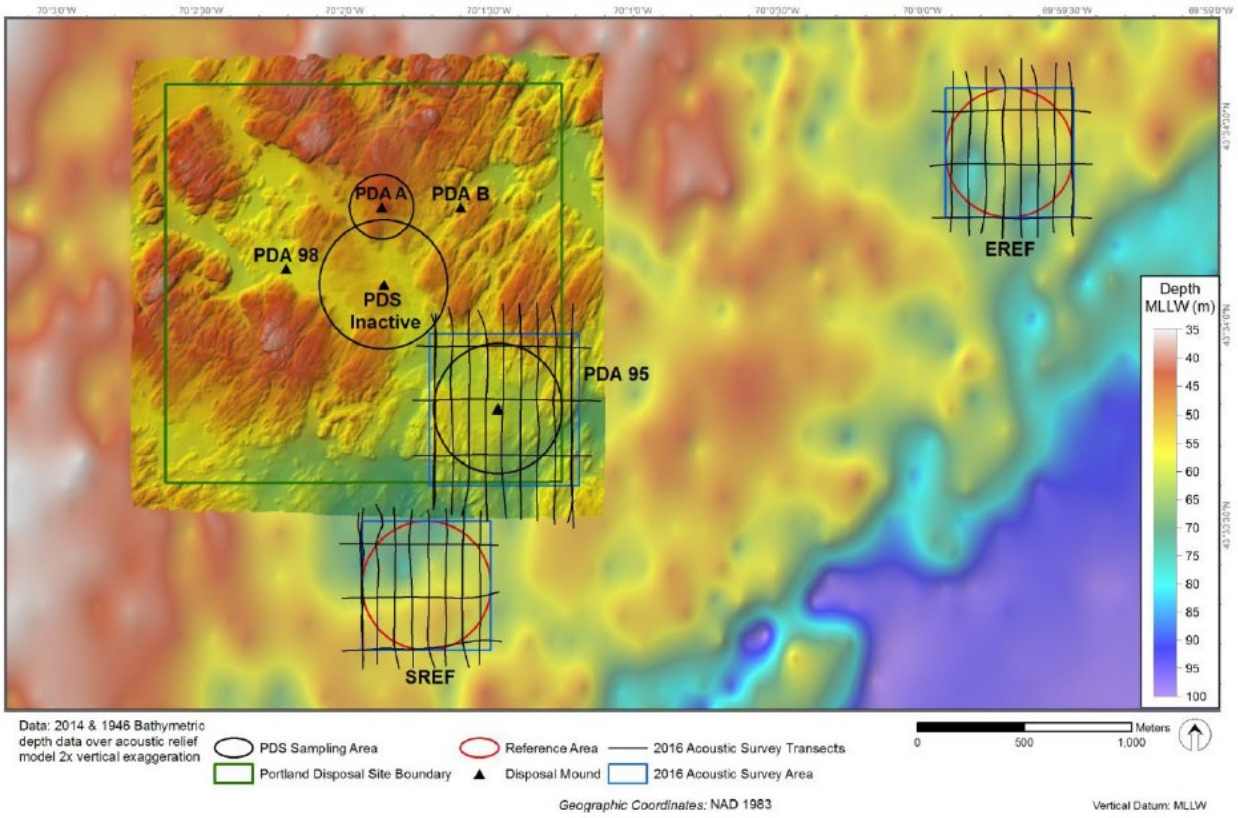

Figure 3. **Portland Dredged Material Disposal Site (PDS) acoustic survey area and tracklines.**

To evaluate benthic habitat quality, SPI and PVI were collected at 45 stations: 15 stations within PDA 95, 20 stations at PDS Inactive and PDA A, and five stations at each of the two reference areas (Figure 4). Statistical analyses were conducted to compare aRPD depth and successional stage between the disposal site and reference areas. Analyses of these images allowed Region 1 to determine the depth of apparent redox potential discontinuity (aRPD) and the benthic successional stages of the sampling stations. The depth and characteristics of the aRPD provide information about the interactions between sediment chemistry and biologic activity within the sediment, indicating habitat quality. The aRPD depths were similar across the disposal mounds and reference areas sampled. Images from all sampling stations showed that biological conditions were in transitional states. A mixture of successional stages 2 and 3 were present in the disposal site at PDA 95 and PDS Inactive, suggesting that recolonization of mature (stage 3) organisms is likely, but a full recovery has not yet occurred. Most images collected from PDA A were classified as stage 1 going to 2 or stage 2, indicating that the benthic community in this area was recovering from a disturbed state (stage 1). No fish or flora were present in the PVI across all three mounds.

Sediment samples were collected from a total of 12 stations within PDA 95, PDS Inactive, and the two reference areas (Figure 4). The samples were analyzed for grain size, TOC, metals,

PAHs, PCBs, and pesticides. At a subset of six of the sediment sampling stations, additional benthic samples were collected for analysis of benthic community structure and infauna tissue chemistry.

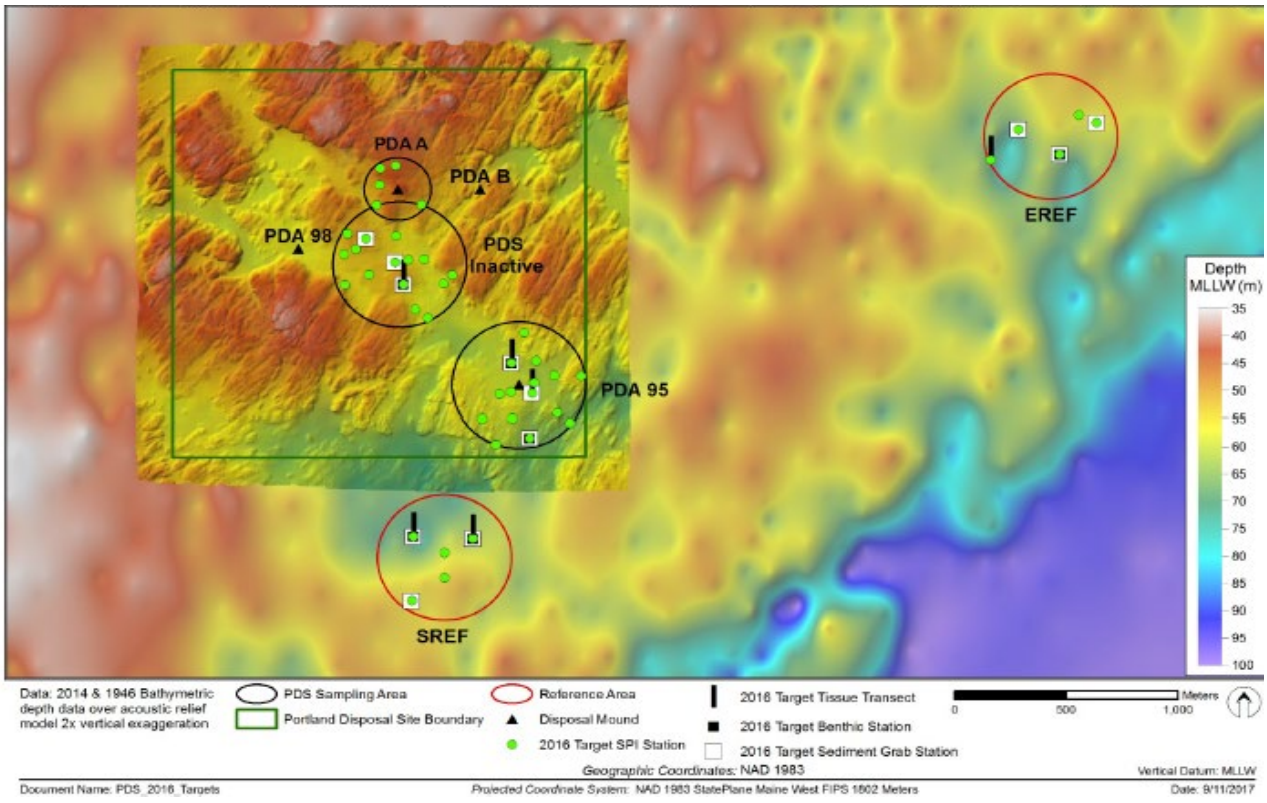

***Figure 4*. Portland Dredged Material Disposal Site (PDS) 2016 target locations for SPI, tissue, benthic, and sediment sampling.**

Grain size ranged from 19-85% silt and clay at the disposal mounds and from 14-39% silt and clay at the reference areas. Percent TOC at the disposal mounds was two to three times higher than at the reference areas.

All eight metals that were analyzed for were detected in all sediment samples collected from both the disposal mounds and reference areas. Concentrations were generally similar or lower in sediments from the reference areas. Arsenic and nickel concentrations slightly exceeded the ERL value at one PDA 95 sampling station, and mercury concentrations exceeded the ERL at one PDA 95 sampling station and one PDS Inactive sampling station; all metal concentrations were below ERM values (McKelvey et al., 2018).

PAHs were detected in all sediment samples from the reference areas and disposal mounds but were found in higher concentrations at the disposal mounds. In the sediment samples analyzed for total PCBs, half of the 18 PCB congeners were detected in samples collected from the disposal mounds. Lower PCB concentrations were detected in samples collected from the reference areas. For both PAHs and PCBs, with the exception of one sample from PDS Inactive, concentrations were below ERL values (McKelvey et al., 2018).

Nine pesticides out of 20 analyzed were detected in sediments from the disposal mounds, and three of those were detected in sediments from the reference areas. Higher concentrations were found in the disposal mounds compared to reference areas. Several chlorinated pesticides

detected at the disposal site exceeded ERL values, and another pesticide, chlordane, measured just over the ERM value (McKelvey et al., 2018).

3.1.3 Conclusions and Recommended Management Actions

With the data collected from this survey, Region 1 further characterized the seafloor topography and surficial features of the PDS for a comprehensive assessment of the sediment quality and habitat community within the disposal site and reference areas. All stations surveyed at PDA 95 in 2016 exhibited a thick layer of dredged material that has consistent evidence of biological reworking of sediment near the sediment-water interface. Although dredged material has not been disposed of at PDS Inactive since 1991, the disposal mound was found to have dredged material present. Sediments at PDS Inactive closely resembled PDA 95, with a distinct dredged material layer that has evidence of bioturbation in the upper portion of the sediment column (McKelvey et al., 2018).

The results of the SPI data indicate benthic communities at PDA 95 and PDS Inactive are ecologically equivalent to the reference areas. The equivalence suggests that the dredged material deposited at the disposal site is being rapidly colonized and contains a benthic community similar to the ambient benthic community, which is consistent with previous observations at the PDS (McKelvey et al., 2018). Due to the presence of relatively coarse sediments at PDA A, which inhibited the use of equipment to detect deep burrowing fauna, the Region was not able to determine if the same was true for PDA A.

Chemical analyses of sediments collected showed higher concentrations of certain metals, PAHs, PCBs, and pesticides at some locations within the PDS (the disposal site) than were measured in sediments collected from the reference areas. Generally, concentrations detected from all locations were below the ERL, indicating that adverse effects are not likely. One pesticide, chlordane, was measured in concentrations exceeding the ERM at one sampling location. EPA Region 1 and USACE plan to conduct additional sampling in this area during future monitoring to confirm that there are no adverse effects. Overall, the data and information demonstrate environmentally acceptable conditions at the PDS and that permitted disposal of dredged material under the MPRSA may continue at the site. Results from this survey will help inform future site management decisions, including revisions to the SMMP for the PDS. Region 1 and USACE also plan to incorporate the results from this survey into a regional sediment chemistry and benthic tissue database.

3.2 Region 1 – Central Long Island Sound, CT Dredged Material Disposal Site

3.2.1 Background

The Central Long Island Sound Dredged Material Disposal Site (CLDS) is located 5.6 nmi south of South End Point, East Haven, Connecticut, has an area of 2.42 nmi^2, and has an average depth of 67 ft (20 m) (Figure 5). This site is one of the most actively used dredged material disposal sites in New England and it has the longest known continuous record of use of any disposal site in Long Island Sound. Most of the dredged material disposed in the CLDS originates from federal navigation projects in New Haven, Stamford, Norwalk, and Bridgeport Harbors. Numerous smaller harbors also dispose dredged material at the CLDS. To maximize the capacity and containment of material at CLDS, dredged material is disposed in distinct mounds. These mounds have been monitored to assess mound stability, thickness of dredged material, and benthic recolonization relative to previous survey results and nearby reference areas.

A depth comparison between bathymetry data collected during a 2005 survey and a 2014 survey documented changes in seafloor topography at CLDS due to dredged material disposal

operations and natural processes. The comparison found the disposal mounds at CLDS demonstrated extreme stability with little or no evidence of sediment loss or compaction during this 10-year period (2005-2014). In October 2016, a survey was conducted at the CLDS to characterize seafloor topography and surficial features following disposal of approximately 122,000 yd³ (93,000 m^3) of dredged material at the site.

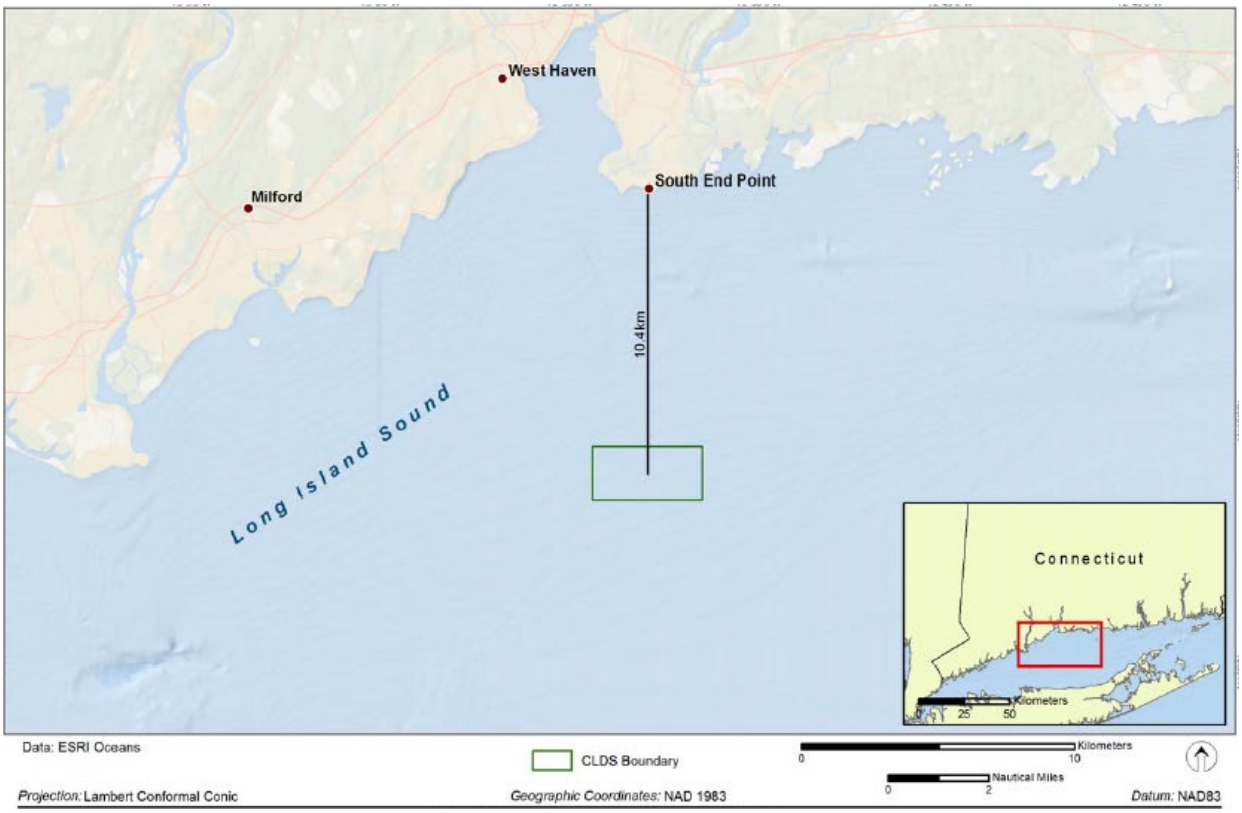

Figure 5. **Location of the Central Long Island Sound Disposal Site (CLDS).**

3.2.2 Survey Objectives, Activities, and Findings

Region 1, in cooperation with the USACE DAMOS program, surveyed the CLDS from September 26-October 12, 2016, aboard the R/V *Jamie Hanna*. The objectives of this survey were:

- to further characterize the surficial features of the CLDS; and
- to complete a comprehensive assessment of sediment quality and benthic community within the site and three reference areas in order to determine if any changes in site management or monitoring are needed (Figure 6).

Region 1 conducted an acoustic survey (bathymetric, side-scan, and backscatter) using an Odom MB Multibeam Echo Sounder to characterize seafloor features within the area of the CLDS where dredged material was recently disposed (the south-central portion of the site) and at three reference areas. The seafloor was approximately 72 ft (22 m) at the deepest portions and as shallow as 46 ft (14 m) over the tallest disposal mounds in the CLDS. The three reference areas, measured at different depths, were characterized by a relatively flat bottom with no distinct large-scale topographic features.

To evaluate benthic habitat quality, 180 SPI and PVI were collected from 60 stations, including from four older CLDS disposal mounds and two active disposal mounds within the site (“labeled

"NHAV14-N" and "NHAV14-S" in Figure 7), and from three reference areas (2500W REF, 4500E REF, and CLIS REF shown in Figure 6). As expected, biological communities were found to be in a transitional state. A mixture of successional stages 1, 2, and 3 (indicating biological conditions ranging from recently disturbed to mature benthic communities) were present in the disposal mounds along with a relatively shallow aRPD depth. aRPD depths were significantly higher in the reference areas when compared to the sampling locations within the disposal site indicating that the benthic communities in the disposal mounds have not yet reached a mature and robust state.

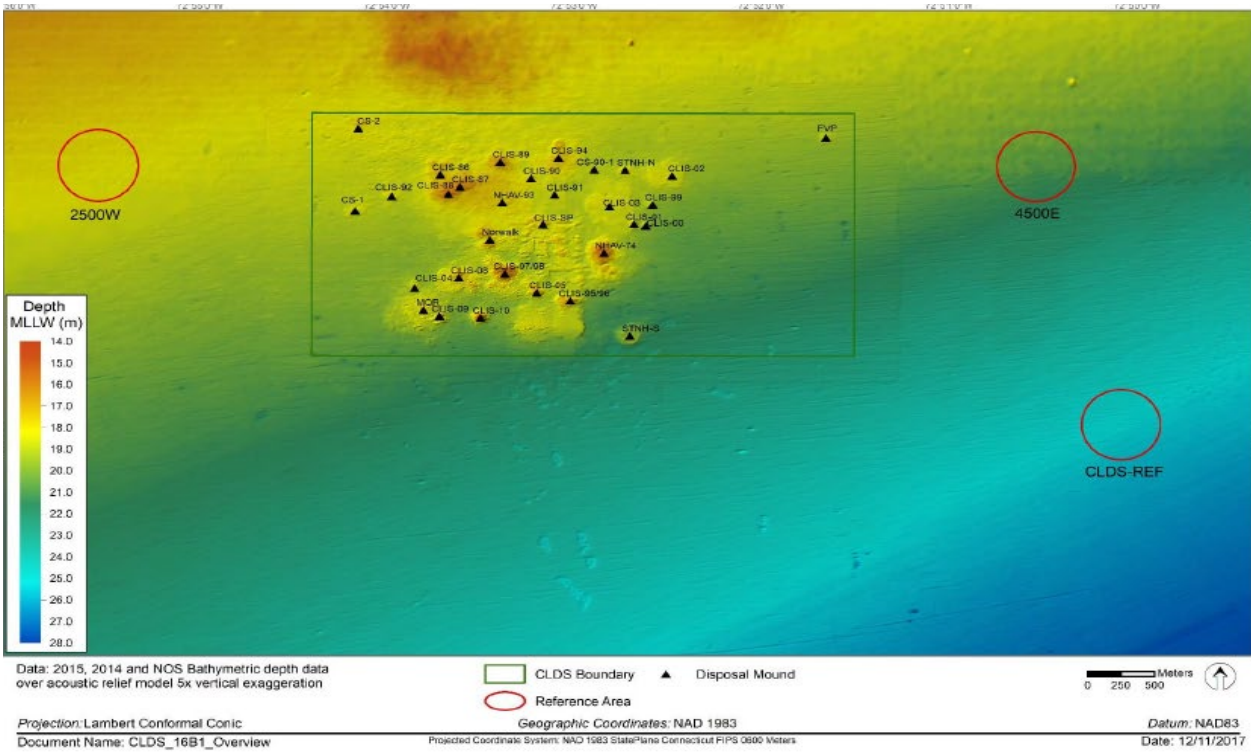

Figure 6. **Central Long Island Sound Disposal Site (CLDS) and reference areas (2500W, 4500E, CLDS-REF).**

Surface sediment samples were collected from 60 stations: 17 stations within the recent disposal areas within the CLDS, 28 stations at older disposal mounds within the CLDS, and five stations within each of the three reference areas. Sediments were analyzed for particle size, TOC, nutrients (nitrogen and phosphorus), metals, PAHs, pesticides, and PCBs. At a subset of 15 of these stations (five in the recent disposal area, six from older mounds within the CLDS, and four from reference area 4500E), additional material was collected to be analyzed for benthic community structure and infauna tissue chemistry.

All metals analyzed for (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc) were detected in every sediment sample collected from the CLDS stations and the three reference areas, with the highest concentrations of each metal found in the sediments from the disposal site (CLDS). Arsenic and nickel concentrations were highest at the active disposal mounds within the CLDS, where their concentrations exceeded the ERL. Among the other metals analyzed, the highest concentrations were found in sediments collected from the active disposal mounds and one of the older disposal mounds, FVP. At the FVP mound, cadmium and chromium concentrations exceeded the ERL. Lead and zinc concentrations exceeded the ERL in samples collected from FVP and the active disposal mounds. Copper and mercury concentrations exceeded the ERL values at all stations within the disposal site and at one of the

sampling stations within the reference areas. Copper exceeded the ERM value in one sample collected from FVP.

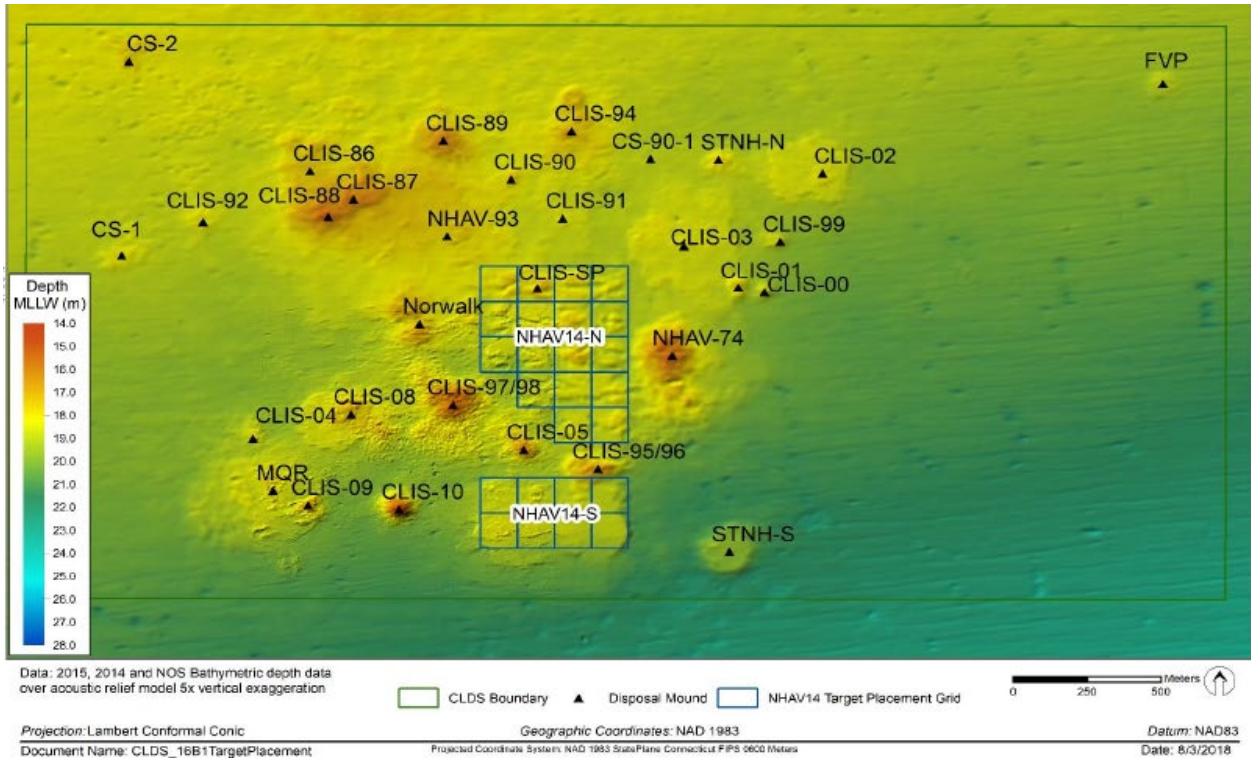

Figure 7. **Central Long Island Sound Disposal Site (CLDS) mound and disposal locations.**

PAHs were detected in all sediment samples collected from the recent and older disposal mounds within the CLDS and from the three reference areas. With the exception of a few samples collected from CLDS with elevated PAH levels, the range of total PAHs observed was similar in samples collected from within the CLDS and from the reference areas. In general, total PAHs in most sediments at CLDS were well below the ERL value. However, total PAHs in samples collected from two stations within the active disposal mounds and the older FVP mound were near or slightly above the ERL value. In samples where the concentration of total PAHs were near or above the ERL, measured concentrations were well below the ERM value.

Of the 20 chlorinated pesticides analyzed for, 12 were detected in sediment samples from the recent and older disposal mounds within the CLDS. Only five of the 12 pesticides analyzed for were detected in sediments collected from the reference areas. Pesticide concentrations found in sediments from the active disposal mounds within the CLDS were generally higher than the concentrations measured in reference area sediments.

Half of the 22 PCB congeners analyzed for were detected in sediment samples from the disposal site. As with PAHs, the highest concentrations of PCBs were observed in the samples collected from stations within the disposal site. Twenty-one of the 22 PCB congeners analyzed for were detected in samples collected from the FVP disposal mound. Total PCB concentrations exceeded the ERL in samples collected from the both the active and older disposal mounds. Samples collected from the FVP mound measured total PCB concentrations above ERM.

3.2.3 Conclusions and Recommended Management Actions

During this survey Region 1 collected data to further characterize the surficial features of the CLDS and completed an assessment of sediment quality and habitat community within the disposal site and at three reference areas.

The survey revealed relatively even distribution of material with minor elevation differences of 1-2 m within areas where dredged material was disposed. Apart from expected areas of accumulation associated with recent disposal activity and expected areas of consolidation of dredged material mounds after initial disposal, there was no evidence of significant surface sediment transport within the area surveyed.

The SPI and benthic community analysis documented the recovery of the benthic community at the older disposal mounds and recent disposal areas within CLDS. The benthic community structure present within the older disposal mounds demonstrates that benthic communities will recover following a cessation in disposal activity. While the community composition of some of the older disposal mounds within the CLDS differed from ambient communities (reference areas), functionally the benthic communities at the disposal site and reference areas were similar.

Due to the elevated concentrations of COCs found in surface sediment samples collected from the active disposal areas and from the FVP disposal mound, EPA and USACE plan to focus future monitoring and management at the CLDS on these areas.

The results from this survey will contribute to the regional sediment chemistry and benthic tissue database, initiated in 2016 by Region 1 and the USACE New England District, and will inform SMMP revisions, future monitoring studies, and any necessary future site modifications.

3.3 Region 2 – Historic Area Remediation Site, NJ

3.3.1 Background

From the 1800s until 1972, a variety of wastes were dumped in the New York Bight, including municipal and industrial waste, construction materials, sewage sludge, and dredged material. After the MPRSA was passed in 1972, EPA formally designated the Mud Dump Site (MDS) on an interim basis for the disposal of dredged material[1]. In 1984, EPA designated the MDS on a permanent basis for dredged material disposal to support regional port and harbor maintenance. However, the MDS was closed in 1996 after surveys revealed dioxin and PCB accumulation in benthic invertebrates within and around the site.

As a response to the serious threat presented to the ecosystem and human health by the material historically disposed of at the MDS, EPA designated the Historic Area Remediation Site (HARS) in 1997. The HARS is located 3.5 nmi off the coast of Sandy Hook, New Jersey and encompasses the former MDS and the area impacted by historic disposal. It has an area of 15.70 nmi^2 and an average depth of 89 ft (27 m). The management priority for the HARS is to reduce the impacts of previous disposal to acceptable levels by covering the surface of the site with uncontaminated dredged sediments. As such, EPA designated the HARS as an ocean remediation site, restricting disposal in the area solely to remediation material (a significant portion of the material placed at the HARS is rocky and glacial till material from various deepening and widening projects in the New York and New Jersey Harbors). The placement of

[1]Interim ocean disposal sites are no longer available for use. Amendments enacted in 1992 under the MPRSA now preclude the issuance of permits for ocean dumping for disposal at an EPA-established ocean disposal site, unless the site has received a final designation. In 2008, the EPA repealed expired, and therefore obsolete, provisions regarding interim ocean disposal sites.

such remediation material renders toxic sediments unavailable to marine organisms and prevents further spread of the contaminated sediments. The area targeted for remediation within the HARS is called the “Priority Remediation Area” (PRA) and is comprised of nine individual PRAs measuring approximately 1 nmi^2 in size (Figure 8). The HARS is jointly managed by EPA and USACE, and multiple stakeholders and government agencies collaborate on this effort including state and federal agencies, port authorities, non-governmental organizations, and academics.

3.3.2 Survey Objectives, Activities, and Findings

Region 2 conducted a series of short surveys in the fall of 2016 aboard its own vessel, the Sailing Vessel (S/V) *Kenneth Biglane*, in order to determine if the placement of rock at the HARS has improved fish and benthic habitat at the site. Region 2’s objectives were:

- to determine if sessile benthic communities on rocks placed at the HARS were similar to sessile benthic communities present on rocks located outside of the HARS; and,
- if quantifiable differences were present, to determine if they could be explained by physical site differences.

If rock placed at the HARS supports high quality habitat (similar to existing natural rock or artificial reefs), EPA and USACE could elect to increase habitat diversity at the HARS by tactically placing additional rock at the site.

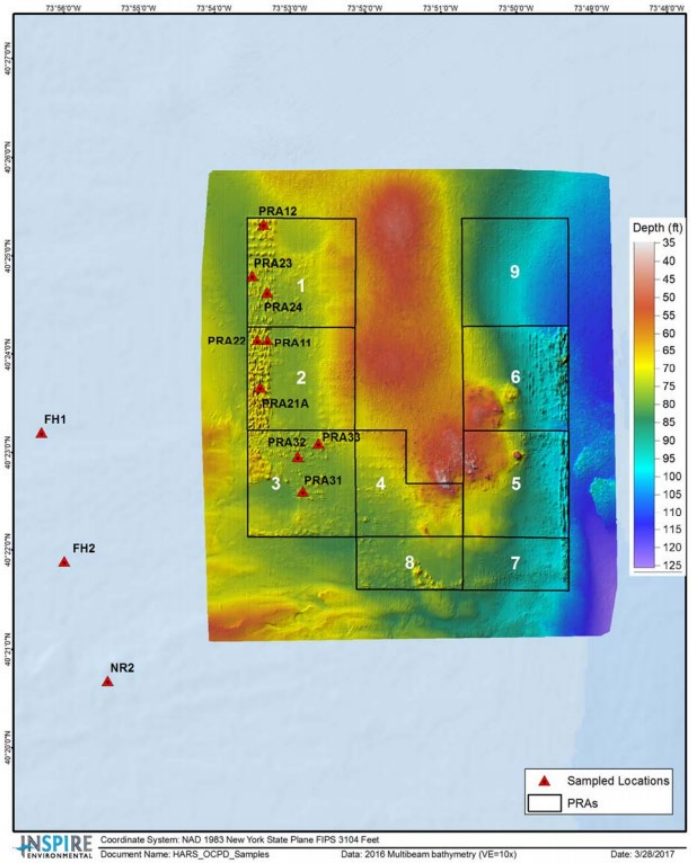

Figure 8. **Sampled locations within the Historic Area Remediation Site (PRA stations) and outside the Historic Area Remediation Site (FH and NR stations).**

Divers used cameras to capture images of rocky areas at locations in PRAs in the HARS as well as at locations in a nearby natural reef (NR) and a fish haven (FH) (Figure 8). The images were analyzed for substrate type and encrusting taxa. Mixed boulders and cobbles were the most common substrate encountered. The highest mean percent cover by encrusting taxa was observed on large boulders, followed by boulder/cobble fields. Distribution of total encrusting cover on substrates made up of a boulder/cobble mix was similar at stations both in the HARS and in the FH.

Water depths at each sampling station, as well as the number of years that had elapsed since the last disposal (based on available records), were recorded and compared to the degree of each taxa group cover, grazing cover, and the total percent cover to determine if rock placed at the HARS can provide high-quality habitat. There appeared to be a trend across depths for corals and, to a lesser extent, sponges, with higher cover at shallower depths. However, without measurement of light and/or turbidity, it is impossible to know if depth is a driving factor for the differences observed. There also appeared to be a positive relationship between the number of years since the last rock disposal and the percent cover of both corals and sponges. The cover of both was highest at the FH stations, which last had a disposal 15 years ago.

3.3.3 Conclusions and Recommended Management Actions

Region 2 achieved its survey objectives after confirming that the total encrusting cover of boulder/cobble fields was similar both within and outside the HARS and that the higher coral and sponge cover observed at fish havens outside of the HARS could be related to shallow depths, longer time periods since rock placement, or other variables that were not measured in this study. Region 2 anticipates conducting further studies at the HARS to determine if placing additional types of material will positively influence benthic repopulation of the area.

3.4 Region 4 – Fernandina Beach, FL Dredged Material Disposal Site

3.4.1 Background

The Fernandina Beach, FL Ocean Dredged Material Disposal Site (ODMDS) was designated in 1987 and is located 7.1 nmi offshore of Fernandina Beach, Florida. This site has an area of 4.0 nmi^2 and an average depth of 52 ft (16 m). Most of the dredged material disposed of at the Fernandina Beach ODMDS is maintenance material from the Kings Bay Entrance Channel and consists of silt, clay, sand, and shell.

In 2010, EPA was made aware of significant live bottom habitats present within the boundaries of the ODMDS. Since becoming aware of this habitat, disposal in that area of the site has been avoided. EPA has also incorporated preliminary acoustic and diver rapid assessments as part of its routine ODMDS monitoring.

3.4.2 Survey Objectives, Activities, and Findings

On September 1-5 and 21-27, 2016, Region 4, in partnership with NOAA's National Centers for Coastal Ocean Science, surveyed the Fernandina Beach ODMDS. Both legs of the survey were conducted aboard the NOAA Ship (N/S) *Nancy Foster*. The objectives of this survey were:

- to establish a monitoring protocol for assessing various types of benthic biological habitats and fish communities using visual assessment methods comparable to those used to evaluate artificial and/or rocky reefs; and
- to evaluate the effectiveness of using acoustic methods to measure fish density; if effective, acoustic surveys could be conducted in the future to evaluate impacts of

dredged material disposal on essential fish habitat and improve EPA's management of dredged material disposal in the South Atlantic Bight.

Three different survey methods were used to study the disposal site and surrounding area. The first involved using a hydrographic multibeam echo sounder to map the study area, characterize seafloor complexity, and identify locations for dive surveys. Previous research surveys conducted by Region 4 provided high-resolution seafloor bathymetry of approximately 30% of the ODMDS. In early September 2016, the remaining portion of the ODMDS, including a buffer zone outside the managed area, was surveyed. Region 4 used the complete bathymetry data to identify locations for biological sampling later in September 2016 (Figure 9).

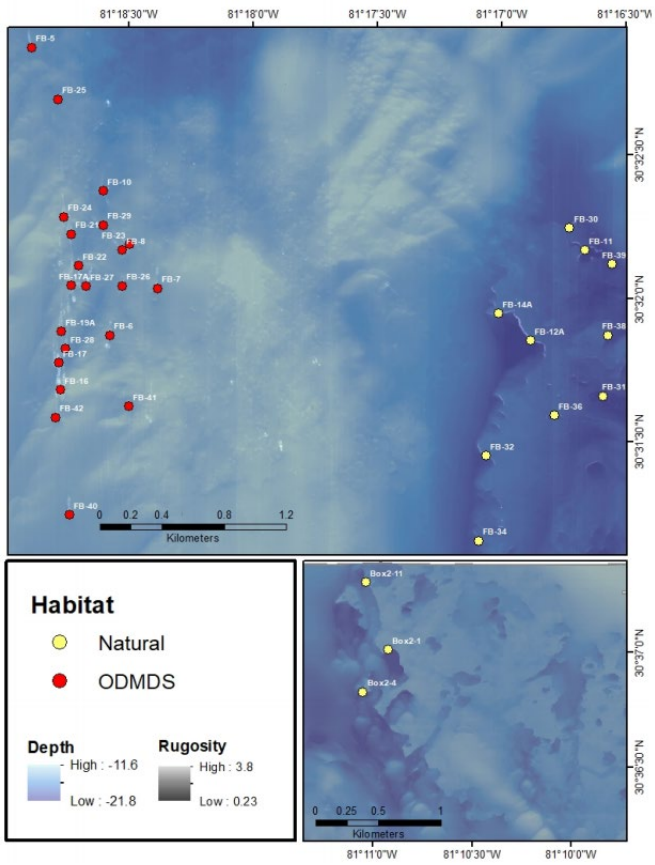

Figure 9. **Sampled locations inside (red dots) and outside (yellow dots) the Fernandina Beach, FL ODMDS. The lower right panel shows the natural ledge sampled north of the ODMDS.**

The second survey method involved in-water diver surveys at each of the sampling locations to conduct visual assessments of benthic habitats. From these assessments, Region 4 found that overall percent live cover did not vary significantly between the natural ledges and the ODMDS sampled locations, although the physical appearances were quite different: continuous natural ledges with undercuts versus rocky, jetty-like features at the ODMDS. The physical structures of natural features were often higher than those in the ODMDS. There was no difference between total organism density at the ODMDS versus natural rocky habitats. The ODMDS and natural ledges surveyed had similar height, relief, and rugosity measurement ranges, but this could possibly be the result of the difference in sample size between the two habitat types (21 ODMDS locations versus 13 natural locations surveyed).

Region 4's third method used acoustics to remotely assess distribution of fish densities in the ODMDS for comparison to the natural hardbottom habitats in the study area. Region 4 conducted acoustic surveys at night and during the daytime. The acoustic surveys conducted at night showed significantly higher densities of medium and small fishes in the east and southeast of the study area, in close proximity to the natural ledge and mixed hardbottom features. Fish densities at the sampled locations within the ODMDS were lower and more sparsely distributed; however, most of the ODMDS and a prominent ledge feature were not included in the study area.

Daytime acoustic surveys were conducted at locations within the ODMDS where disposal activity had occurred and at locations outside the ODMDS above natural rocky ledges. Overall fish density varied considerably across sampled stations during the daytime. Fish densities on natural ledges were significantly higher on average than at sampled stations within the ODMDS, although some locations within the ODMDS where disposal had occurred had densities comparable to those found at the natural ledges. The high variation in fish density was most often related to the presence of fish schools when a location was being sampled during the daytime; fish schools were not encountered frequently but, when they were, relatively high densities of fish were observed. Fish schools were higher in number and density over habitats that had higher relief, suggesting that such locations in the ODMDS may provide higher habitat value to fishes.

3.4.3 Conclusions and Recommended Management Actions

Despite substantial challenges related to weather and sea state conditions (visibility) that Region 4 faced during this September 2016 survey, the Region achieved its survey objectives. Bathymetry data collected in this survey were used to develop a new base map that delineates rocky hard bottom from unconsolidated sediments and maps the rugosity and slope of the study area. Region 4 also completed the first comprehensive survey of a dredged material ocean disposal site using fishery acoustics to monitor benthic habitats and fish communities. Use of acoustic methods allowed Region 4 to overcome some of the visibility limitations experienced during the survey due poor weather and sea state conditions. The acoustic survey method, however, presented several challenges including difficulties identifying fish species from the acoustic data alone. Without being able to identify fish at the species level, this method was limited in its ability to adequately measure fish community structure (i.e., fish species abundance and diversity). For this reason, EPA anticipates continuing to use a combination of acoustic and visual assessments to obtain a complete picture of fish community structure, benthic habitat use, and potential habitat value. Additionally, findings from this survey will be used by Region 4 to assess potential impacts to essential fish habitat due to dredged material disposal, and to improve EPA's overall dredged material disposal management in the South Atlantic Bight.

3.5 Region 4 – Miami, FL Ocean Dredged Material Disposal Site

3.5.1 Background

The Miami, FL ODMDS, located offshore of Miami Beach, was first designated as an interim site[1] in 1990 and then formally designated in 1996 for the disposal of dredged material. This site is 1.0 nmi[2] in area and has an average depth of 607 ft (185 m). Leading up to 2016, dredged material from the Miami Harbor Phase II (1995-1999 and 2005) and Phase III (2013-2015) Deepening Projects, as well as from maintenance dredging in 2006, was disposed at the Miami ODMDS. The dredged material consists of silt, sand, limestone gravel, rock, and mud. A survey conducted in May 2006 found dredged material outside of the ODMDS; that is, the footprint of dredged material was observed northward of disposal site boundaries. As a result, in 2008 EPA changed the release zone (i.e., the area where dredged material can be released from a barge

or scow) within the ODMDS in an effort to prevent dredged material from being transported outside of the designated ODMDS boundaries during disposal.

3.5.2 Survey Objectives, Activities, and Findings

Region 4 conducted a survey on December 3-6, 2016, aboard the N/S *Nancy Foster* to document the effectiveness of the modified disposal zone in maintaining the disposal footprint within the ODMDS boundaries. To meet this survey objective, EPA mapped the spatial distribution of sediments on the seafloor and characterized the physical changes of the seafloor resulting from disposal of dredged material. An additional survey goal was to assess the overall condition of the benthic habitat in the ODMDS and surrounding areas by comparing benthic habitat conditions within the disposal site to adjacent areas outside of the disposal site boundary.

Region 4 collected bathymetric data, SPI, and PVI from stations within the ODMDS, near the ODMDS, and from a nearby reference area (Figure 10). SPI and PVI were used to determine sediment grain size and type as well as the presence, thickness, and spatial distribution of the dredged material footprint. Region 4 also used the SPI and PVI to evaluate benthic habitat recovery by measuring surface boundary roughness, methane gas and dissolved oxygen (DO) levels, aRPD depth, infaunal successional stage, and benthic habitat type.

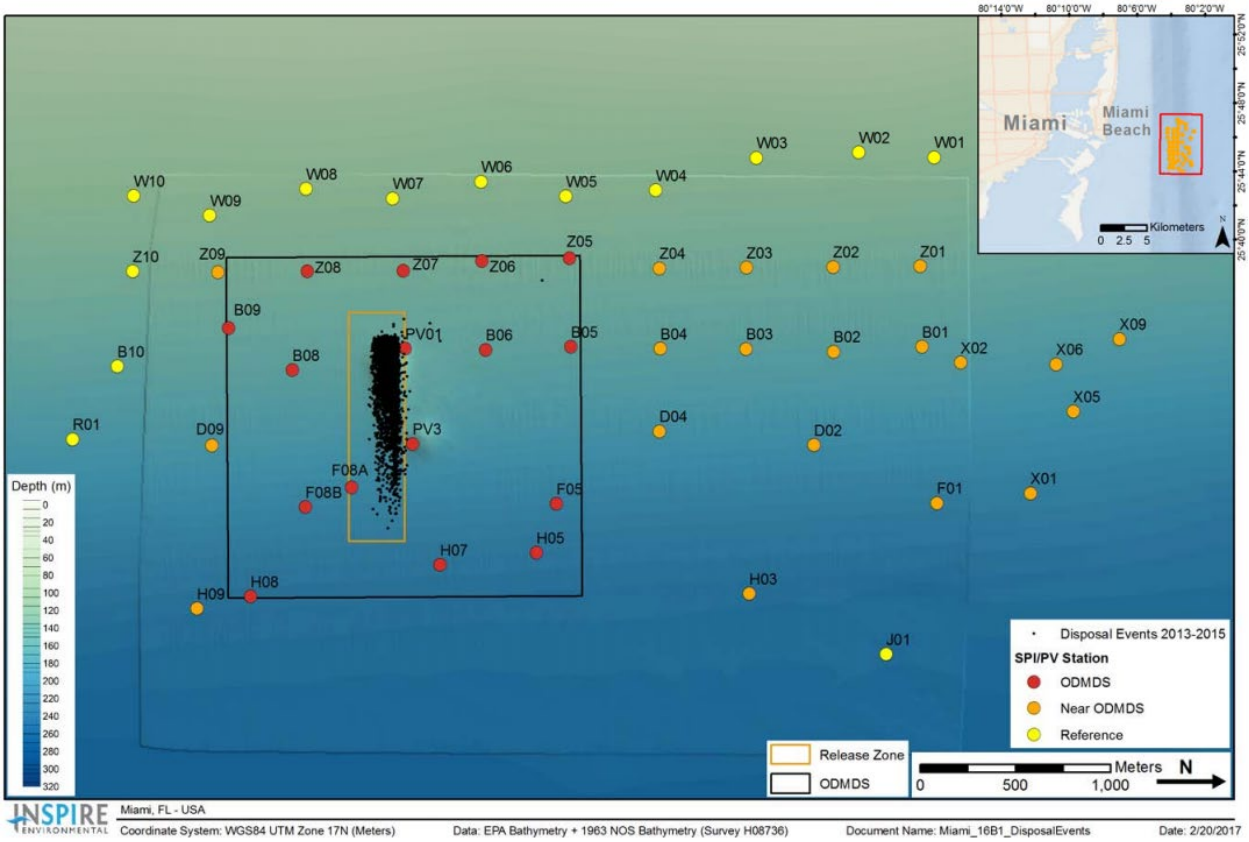

Figure 10. **Stations sampled in the Miami, FL ODMDS (red dots), near the ODMDS (orange dots), and farther from the ODMDS (yellow dots). Small black dots indicate the location of disposal events from 2013-2015.**

Data collected from within the release zone showed a distinct, oblong, topographic high from recent disposal activity. The sediments in this area were characterized as limestone gravel. Outside of the release zone, dredged material of varying thicknesses characterized as fine to

medium sand and often layered with ambient sediment was observed. The dredged material footprint was found to extend north of the ODMDS, and evidence of trace dredged material was observed at the most northern stations. However, the dredged material observed outside of the site boundaries was located beneath a depositional layer of ambient sediment. The lack of evidence of more recent dredged material deposits on the seafloor surface at the sampling stations north of the ODMDS suggests that EPA modification of the disposal release zone in 2008 (so that the disposed dredged material would be retained within the site boundaries) has been successful.

Based on SPI and sediment analyses, EPA found neither evidence of excess organic enrichment (to the point where subsurface methane gas was present) nor of low DO concentrations in the benthic boundary layer at any of the locations sampled. The aRPD depths at stations in and around the Miami ODMDS indicate healthy conditions. Images from all sampling stations showed that infaunal communities were in transitional states. A mixture of successional stages 1 and 2 were present in samples that contained dredged material while images collected outside of the ODMDS showed evidence of successional stage 3 taxa.

3.5.3 Conclusions and Recommended Management Actions

Recent adjustments to the location of the Miami ODMDS release zone appear to have been successful in limiting dredged material from spreading beyond the site boundaries during disposal. At sampling stations outside the ODMDS where dredged material has been found during past surveys, no evidence of new disposal was observed; at these sampling locations, the dredged material was present beneath a depositional layer of ambient sediment.

Additionally, despite recent dredged material disposal activity at the ODMDS, there was evidence of rapid benthic recovery and recolonization within the site. High water column current velocities in the area may mean that the benthic community is well adapted to disturbances, and thus more likely to recover quickly following disposal activity. The quick recovery indicates that there are no apparent long-term adverse impacts to the in-faunal community associated with dredged material disposal, and most stations with evidence of dredged material have recovered or are on their way to recovery. EPA Region 4 anticipates using the results from this survey to inform future monitoring and any future revisions to the SMMP for this site.

3.6 Region 4 – Pascagoula, MS Ocean Dredged Material Disposal Site

3.6.1 Background

The Pascagoula, MS ODMDS has an average depth of 46 ft (14 m) and an area of 18.5 nmi^2. The site is located offshore of Mississippi, west of the Pascagoula Entrance Channel and south of Horn Island. Historically, the ODMDS has been used approximately every other year for disposal of maintenance material dredged from the Pascagoula Entrance Channel and Naval Station Pascagoula, however from 2007 through 2014 several million cubic yards of dredged material from nearby channel and port expansion projects were disposed of at the ODMDS.

3.6.2 Survey Objectives, Activities, and Findings

The survey of the Pascagoula ODMDS was conducted on March 15-23, 2016, aboard the N/S *Gordon Gunter*. The objective of this survey was to determine if any changes to the Pascagoula SMMP were needed to prevent adverse impacts from the disposal of dredged material. In order to achieve this objective, Region 4 conducted water, sediment, and biota sampling and collected SPI from within and around the ODMDS.

Two sediment samples were collected from each of the 28 stations distributed inside and outside of the ODMDS (Figure 11). One sample from each station was analyzed for PCBs, pesticides, semi-volatile organic compounds (SVOCs), metals, and particle size distribution. With the exception of arsenic, metal concentrations measured from sediment and water samples were very low or non-detectable. Arsenic was slightly elevated at several sampling stations both inside and outside the ODMDS. There were no detectable levels of PCBs, SVOCs, or pesticides in sediment or water samples collected from inside or outside the ODMDS. Particle size was highly variable within the ODMDS, with stations located on the east side of the ODMDS consisting primarily of sand. Stations farther west and south, both inside and outside the ODMDS, had primarily fine material (silts, clays, and very fine sand). Stations between the ODMDS and Horn Island, located north of the ODMDS, had a mix of fine material and sand.

The second sediment sample from each station was collected and processed for marine macroinvertebrate analyses. A total of 1,453 organisms were identified from stations within the ODMDS and 1,391 organisms were identified at stations outside the ODMDS. Annelids were the dominant taxa group, both inside and outside the disposal site. There was no significant difference in biomass, taxa richness, or taxa density between stations inside and outside the disposal site. Region 4 compared these results to the results of a 2006 survey and found that in 2006, the taxa richness and density inside the ODMDS were much lower than outside the disposal site. There were no other significant differences in the benthic macroinvertebrate community between 2006 and 2016.

Temperature, DO, and salinity of the water column were measured from three stations within the ODMDS. Parameters measured were found to be similar at all three stations. Temperature was relatively uniform from the surface to the seafloor. DO concentrations tended to be depressed on the surface and bottom due to higher salinities and tended to increase in the middle of the water column.

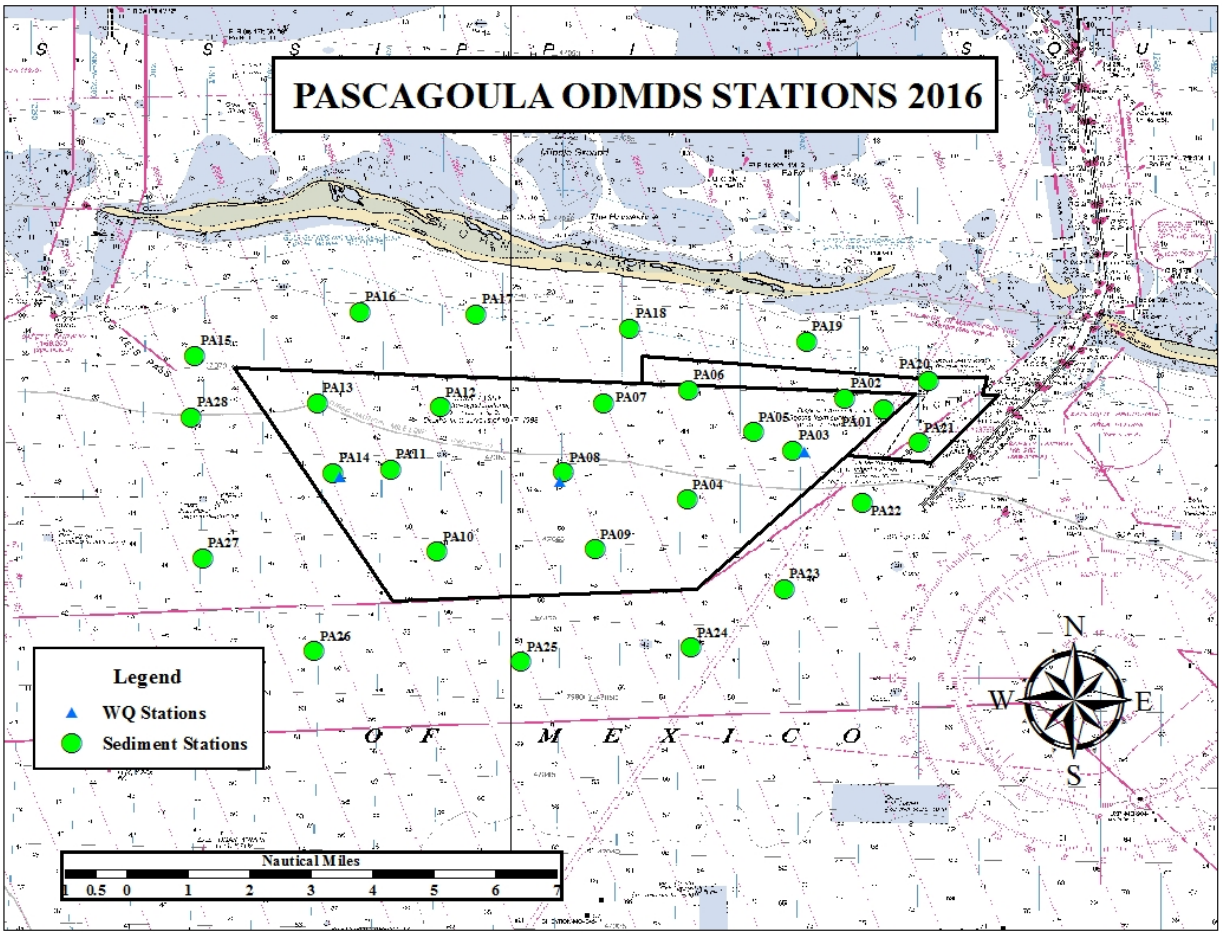

Figure 11. **Location of the Pascagoula, MS ODMDS and sites of water quality and sediment sampling within and around the ODMDS.**

SPI were collected from 75 locations (Figure 12) to assess the overall condition of the benthic habitat and the presence of dredged material on the seafloor. Results from SPI analysis indicated the presence of sediments that resemble dredged material outside of the eastern boundary of the ODMDS. The sediments in the western portion of the ODMDS, which has never been used for disposal, was similar to the sediments found outside of the ODMDS, although some evidence of thin layers of dredged material or potentially lighter material moved by sediment transport processes was observed at several stations outside of the ODMDS. Despite differences in sediment type throughout the study area, the aRPD depths measured were similar throughout and around the ODMDS, indicating little to no disturbance.

Early stages of recolonization or intermediate recolonization were found primarily within the dredged material footprint in the ODMDS. Early stage benthic communities were only observed at stations where disposal activity was documented, with one exception at a station outside of the site. These results suggest that, on average, the benthic conditions within the dredged material disposal footprint were less mature than those outside of the site. In comparison to data collected in 2006, the benthic community appeared to have matured overall on the eastern (used) portion of the site. There was no evidence of long-term adverse effects on the benthic community.

3.6.3 Conclusions and Recommended Management Actions

The survey demonstrated environmentally acceptable conditions at the Pascagoula ODMDS. Results from water, sediment, and benthic biota sample analyses confirm that the SMMP for this site is effective and no modifications to the SMMP appear necessary at this time.

The survey did reveal that a thin layer of dredged material may be present outside of the eastern boundary of the ODMDS. The sediments at that location are likely from a prior disposal area located on the eastern boundary of the site. Modification to the SMMP, however, does not seem necessary to address the presence of dredged material from outside of the site but in the future, EPA is likely to identify with greater specificity the location for disposal inside the ODMDS in review of future USACE permits for EPA concurrence. Additionally, the data collected from this survey will be considered when identifying trends in future site status.

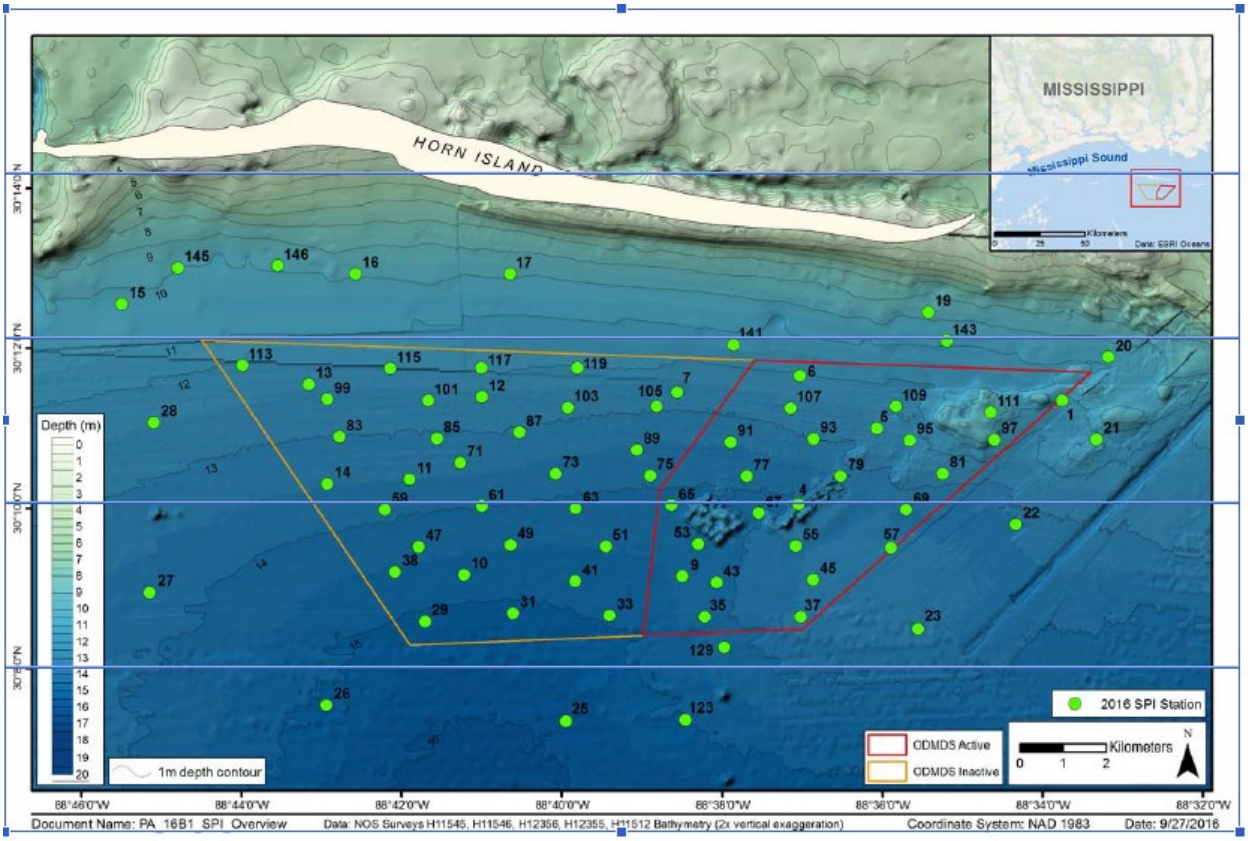

Figure 12. **SPI stations within and around the Pascagoula, MS ODMDS.**

3.7 Region 6 – Galveston, TX Dredged Material Site

3.7.1 Background

The Galveston, TX Dredged Material Site is located offshore of Galveston, Texas, just outside the mouth of the Galveston Harbor Entrance Channel. It has an area of 6.6 nmi^2 and an average depth of 42 ft (13 m). The dredged material disposed of at this site originates from the Houston Ship Channel (HSC), the Galveston Harbor Channel, and the Galveston Jetty and Entrance Channel. The reference area is located northeast of the ODMDS (Figure 13).

In October 2014, EPA conducted the Galveston Reference Evaluation and Tissue Study (GRETS). The results showed that the Galveston reference site may be a sink for dioxin- and/or furan-laden sediments migrating from the HSC system. Based on these results, EPA planned further studies of the Galveston reference area to evaluate whether the site was in an appropriate location. EPA determined that additional data were needed before considering relocation of the reference area, including characterization of sediments in the vicinity of the Galveston Entrance Channel and evaluation of sediment transport patterns.

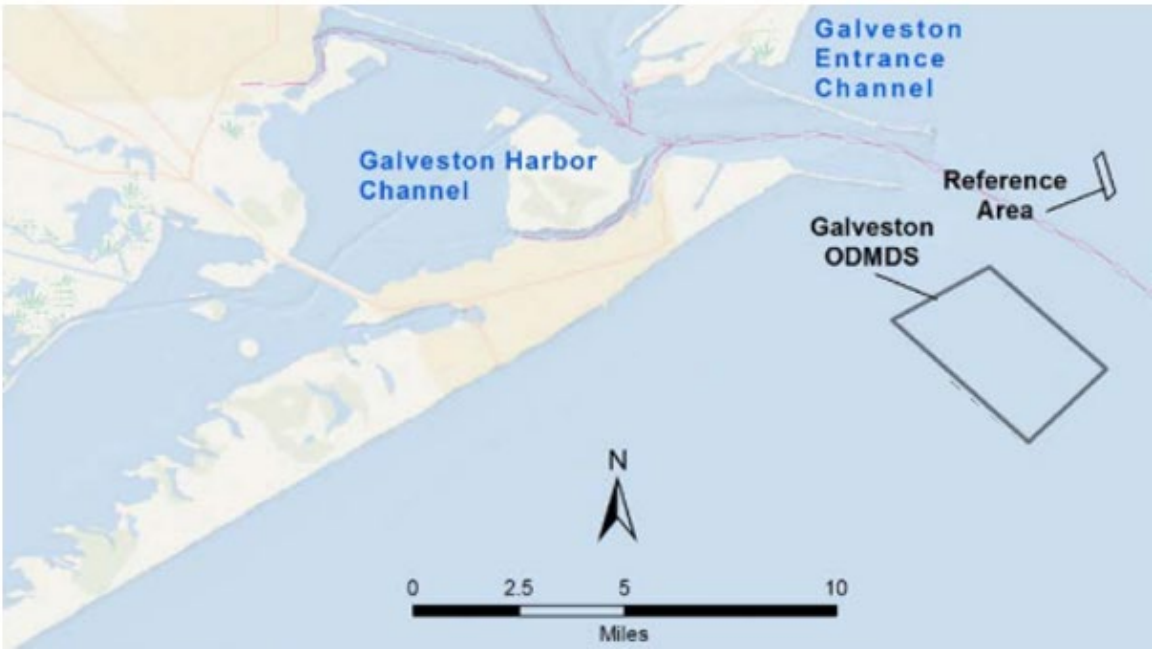

Figure 13. **Lower Houston Ship Channel system including the Galveston ODMDS and reference area.**

3.7.2 Survey Objectives, Activities, and Findings

Region 6 conducted a survey of the Galveston, TX Dredged Material Site, July 18-19, 2016, aboard the Texas A&M University Galveston's R/V *Trident*. The objective of this survey was to collect surficial sediment samples offshore of Galveston that were representative of background conditions (i.e., outside of the influence of the ODMDS, any contaminated sediments associated with the HSC System, and other potential point sources).

Sediment samples were collected from 25 stations within a 20 mi radius of the Galveston Entrance Channel (Figure 14). To ensure comparability with the ODMDS and reference area, the study area was limited to water depths of 36-52 ft (11-16 m) and areas with bottom substrate classified as "mud-dominant" or "mud-subdominant" (i.e., substrate that is made up of at least 20% mud). Sediment samples were analyzed for several physical and chemical parameters including grain size, TOC, metals, PCB congeners, pesticides, PAHs, and dioxins/furans.

Sediments within the study area were generally fine-grained and consisted primarily of sand, silt, and clay. Stations south and west of the mouth of the HSC generally had higher percentages of silt and clay compared to stations to the north and east. TOC concentrations across the study area followed a similar pattern as grain size. Sediments were analyzed for 13 metals, and all 13 were detected in all samples. All but one of the metals (antimony) were found in higher concentrations near the entrance channel and to the south and west compared to

samples collected north and east. No PCB congeners or pesticides were detected above the method detection limit in any of the sediment samples. PAHs were detected in all samples; however, most concentrations were below the reporting limit. In general, total PAH concentrations were higher south and west of the entrance to the HSC. Higher concentrations of high molecular weight PAH compounds than low molecular weight PAH compounds were detected at each station.

Dioxin/furan data were converted to toxicity equivalent quotients (TEQs). TEQs are a weighted quantity measure based on the toxicity of each member of a dioxin and dioxin-like compound category relative to the most toxic member of the category. The highest TEQs were found south and west of the HSC and the lowest TEQs were found north and east (the current in the area runs from northeast to southwest, or upgradient to downgradient). However, TEQs at the two stations closest to the current reference area and the Galveston ODMDS also showed elevated TEQs. Pairwise tests were used to compare mean TEQ concentrations from the 2016 survey to the 2014 GRETS data in four areas: upgradient (north and east of the current reference area), downgradient (south and west of the current reference area), reference (the location encompassed by the reference area), and vicinity (an area in close proximity to the reference area). TEQ concentrations in the upgradient dataset were significantly lower than associated mean TEQ concentrations measured in the reference, vicinity, and downgradient samples. In pairwise comparisons between the reference, vicinity, and downgradient samples, the mean TEQ concentrations were comparable.

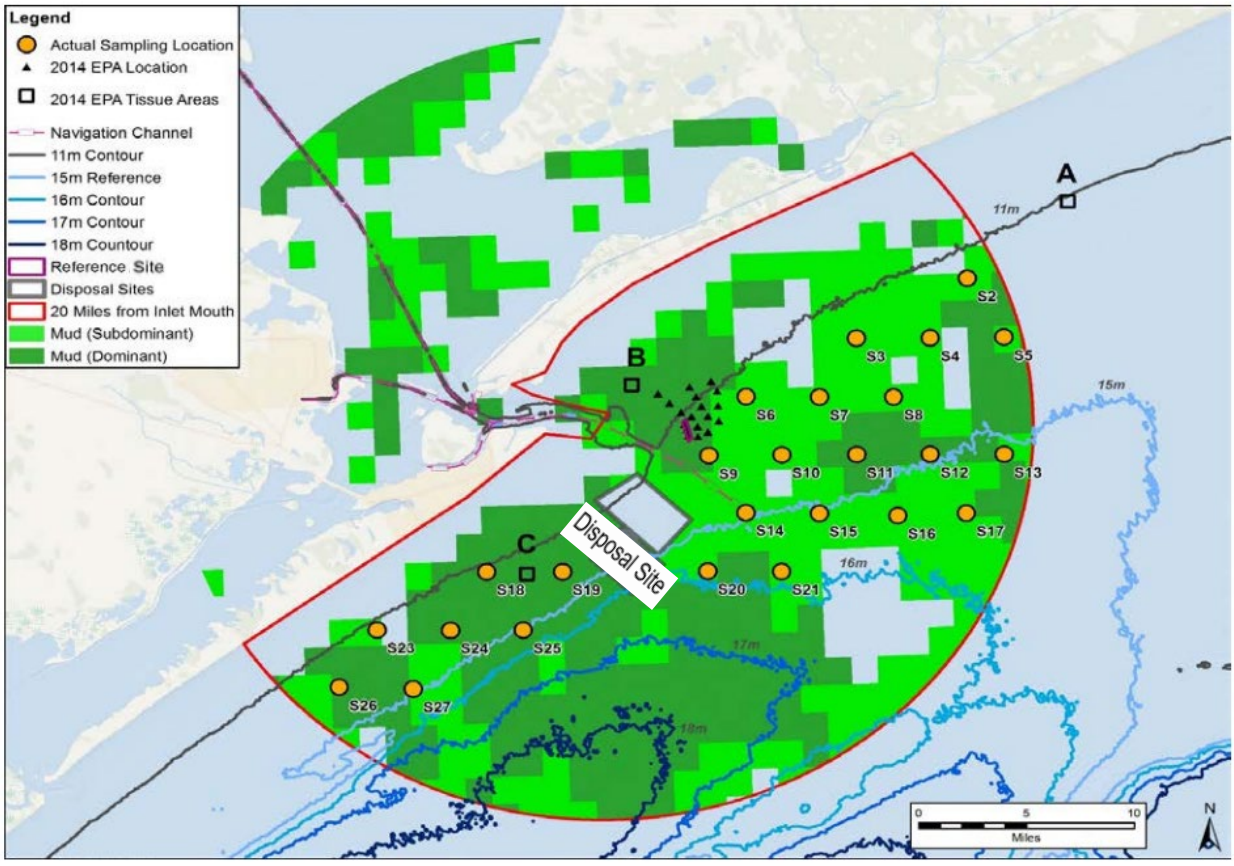

Figure 14. **Sediment collection sites around the Galveston, TX Dredged Material Site and reference site.**

3.7.3 Conclusions and Recommended Management Actions

Higher silt/clay percentages, TOC concentrations, metal concentrations, PAH concentrations, and dioxin/furan TEQs were found near the mouth of the Galveston Channel and downgradient (to the southwest), which is consistent with predominant sediment transport in the study area. Based on the results of this and previous studies, the Galveston reference area appears to be located in an area influenced by sediment and associated contaminants entering the Gulf of Mexico from the HSC system. Due to flood and storm events that result in sediment transport, however, these levels of silt/clay, TOC, metals, PAHs, and dioxins/furans conditions are often typical throughout the entire surrounding area. Therefore, the current location of the reference area appears suitable and relocating the reference area would be unnecessary at this time.

3.8 Region 10 – Yaquina Bay, OR North and South Ocean Dredged Material Disposal Sites

3.8.1 Background

The Yaquina Bay North and South ODMDSs are located offshore of the entrance to the Yaquina River in Oregon. The North Site is located 1.7 nmi northwest of the entrance to the river, and the South Site is located 2 nmi southwest of the river entrance. USACE primarily uses the North and South Sites for disposal of dredged material originating from the Yaquina federal navigation channel. The North Site was used for disposal exclusively from 2001-2011, while the South Site was first used in 2012 and is still in use as of 2016. Baseline surveys were conducted in the area of the North and South ODMDS in 1999, 2000, and 2002. Additional surveys of the North and South ODMDSs were conducted in in June, August, and September of 2008. Data collected in 2008 showed that the benthic infaunal community was different (both in density of organisms and species richness) inside versus outside of the Yaquina North Site in June, with a less pronounced difference in August. The 2008 data collected at the Yaquina South Site served as an updated baseline for that site, because the site had not yet been used for disposal.

3.8.2 Survey Objectives, Activities, and Findings

Region 10 monitored the Yaquina North and South Sites on September 8-13, 2016, aboard the Oregon State University's R/V *Elakha*. This monitoring survey was conducted to satisfy the requirements for appropriate site management described in the SMMP for the Yaquina North and South ODMDSs, which states that ecological monitoring of benthic and epibenthic invertebrates must occur every five years, as EPA resources allow. The primary objective of the study was to determine whether the disposal of dredged material has resulted in an adverse impact on the benthic habitat. In order to achieve this objective, Region 10 collected sediment samples, conducted benthic trawls, and took in-situ water quality measurements. The Region planned to use data collected to provide a basis of comparison for future monitoring efforts.

Sediment samples were collected stations located within outside of the boundaries of the North and South sites (Figure 11) using a 0.1 m^2 Gray-O'Hara modified box core. Sediment samples were analyzed for sediment grain size, TOC, and benthic infauna. Sediments at both the North and South ODMDSs were found to be comprised of medium- and fine-grained sands, consistent with grain sizes present in coastal offshore environments. Samples from the northern portion of the South ODMDS, where disposal had occurred immediately prior to sampling, contained slightly higher percent fines.

Benthic infauna was more abundant at the North ODMDS than the South ODMDS. Additionally, benthic infaunal abundance, diversity, and richness were lower inside than outside the South ODMDS. However, recent dredged material disposal is not anticipated to significantly impact the long-term recovery of the benthic community.

For almost every benthic box core collected, a subsample was collected using a 10 cm diameter subcore tube. The subcores were analyzed independently of the rest of the box core to allow Region 10 to conduct a comparative analysis of sample size. The subsample analysis was generally consistent with the whole sample when looking at abundance trends across a given site. However, the smaller sample size of the subcore had much lower statistical power and reliability, and resulted in under-representation of community richness and, in some cases, exceptional over-representation of infaunal density relative to the box core samples. Region 10 found the 0.1 m^2 box core to be the most appropriate collection method for sampling sediments and benthic infauna, concluding that continued use of standardized sampling equipment will allow for more reliable comparisons of the benthic community over time and between locations.

Additionally, sediment samples from within the South Site, from outside the South Site, and from Puget Sound (the latter to serve as a reference sample) were analyzed for dioxin/furans. Concentrations of dioxin/furan congeners were low at all locations.

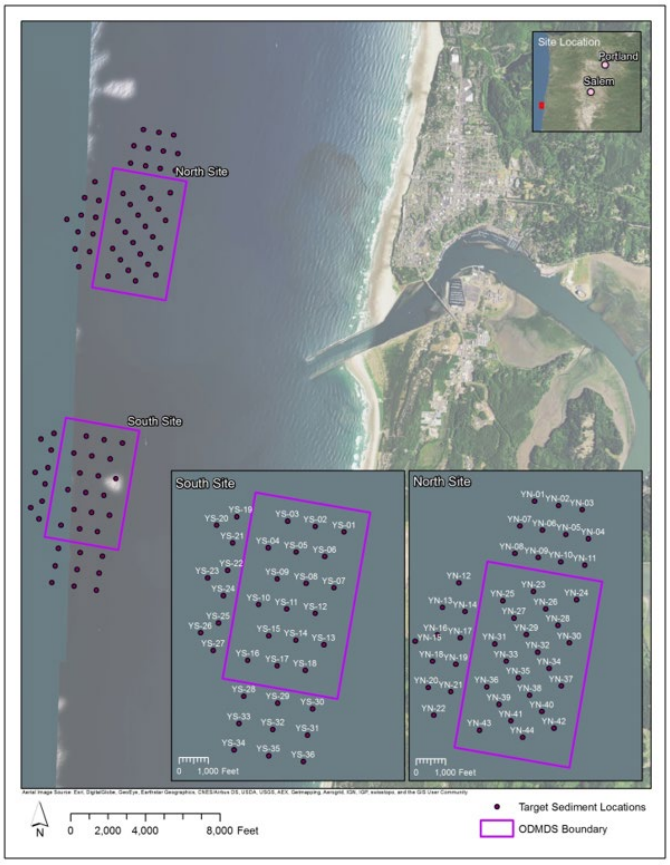

Figure 15. **Survey area and targeted sediment locations within and around the Yaquina North and South ODMDSs.**

Benthic trawls were used to sample the epibenthic invertebrate and demersal fish communities inside and outside of each disposal site. The invertebrate and fish communities were found to be typical for the nearshore habitat of the Oregon coast and to have similar or greater abundance than in August 2008. Cancer crab (*Glebocarcinus oregonensis*) abundance was lowest inside the South Site and greatest outside the South Site, likely due to the recent disposal event. This difference was likely the result of crabs moving out of the site in response to the disturbance or crabs being temporarily displaced because of limited prey resources. The abundance of Cancer crabs of all sizes was relatively consistent with the 2008 monitoring event.

Lastly, near-bottom water quality measurements were collected in the vicinity of where biological organisms were also collected; the water quality parameters measured were found to be typical of September conditions for the region and consistent with NOAA monitoring data.

3.8.3 Conclusions and Recommended Management Actions

The results from this 2016 survey reveal found environmentally acceptable conditions support continuing long-term use of the Yaquina ODMDSs. The use of the site since designation does not appear to have caused an unacceptable adverse impact to the benthic habitat or the organisms present. The disposal sites will continue to be monitored to assess impacts to epibenthic organisms at five-year intervals as recommended for appropriate site management in the SMMP.

While the data collected during this survey was adequate to inform site management actions, there are several adjustments that EPA Region intends to incorporate in future monitoring activities. Region 10 plans to increase the number of benthic trawls transects to gather a more robust dataset allowing for stronger statistical analysis of the biological data. Region 10 plans to continue to collect and sort the entire sample from the Gray-O'Hare box core because the sub-core analysis did not produce the same results for the benthic community metrics which were analyzed. Additionally, Region 10 may reconsider measuring in-situ water quality parameters and instead use NOAA water quality monitoring data from this area if available. The State of Oregon also has identified a concern regarding impacts to the young-of-year groundfish that use the disposal sites as nursery grounds by using a beam trawl rather than an otter trawl, which warrants further consideration.

3.9 Region 10 – Grays Harbor, WA Eight-Mile Site

3.9.1 Background

The Grays Harbor Eight-Mile Site is located 7.1 nmi offshore of Grays Harbor, WA (Figure 16). This site is circular, covers an area of approximately 0.5 nmi^2, and has an average depth of 149 ft (45 m). EPA designated this site in 1990 specifically for the disposal of dredged material from a deepening project in Grays Harbor. Upon designation, EPA intended to de-designate the site after dumping had been completed and monitoring had indicated that material had stabilized. Disposal took place late in 1990, when 2.8 million yd^3 (2.1 million m^3) of dredged material was dumped. Of this volume, 307,000 yd^3 were fine-grained material with low levels of dioxins/furans.

Following disposal, several surveys were conducted. In 1991 a bathymetric survey was completed that identified the presence of the disposal mound within the middle of the ODMDS. Sediment samples and additional bathymetric data were collected in 1992 to meet the monitoring requirements outlined in the SMMP and provide the information necessary for Region 10 to de-designate the site. Results from the sediment analyses showed that the dioxins/furans measured at the site were not present in high enough concentrations to be a risk to the marine environment. Bathymetric data showed that the disposal mound was still present within the site however the data were not high enough in resolution to determine the size and shape of the disposal mound and confirm whether sediment transport was taking place.

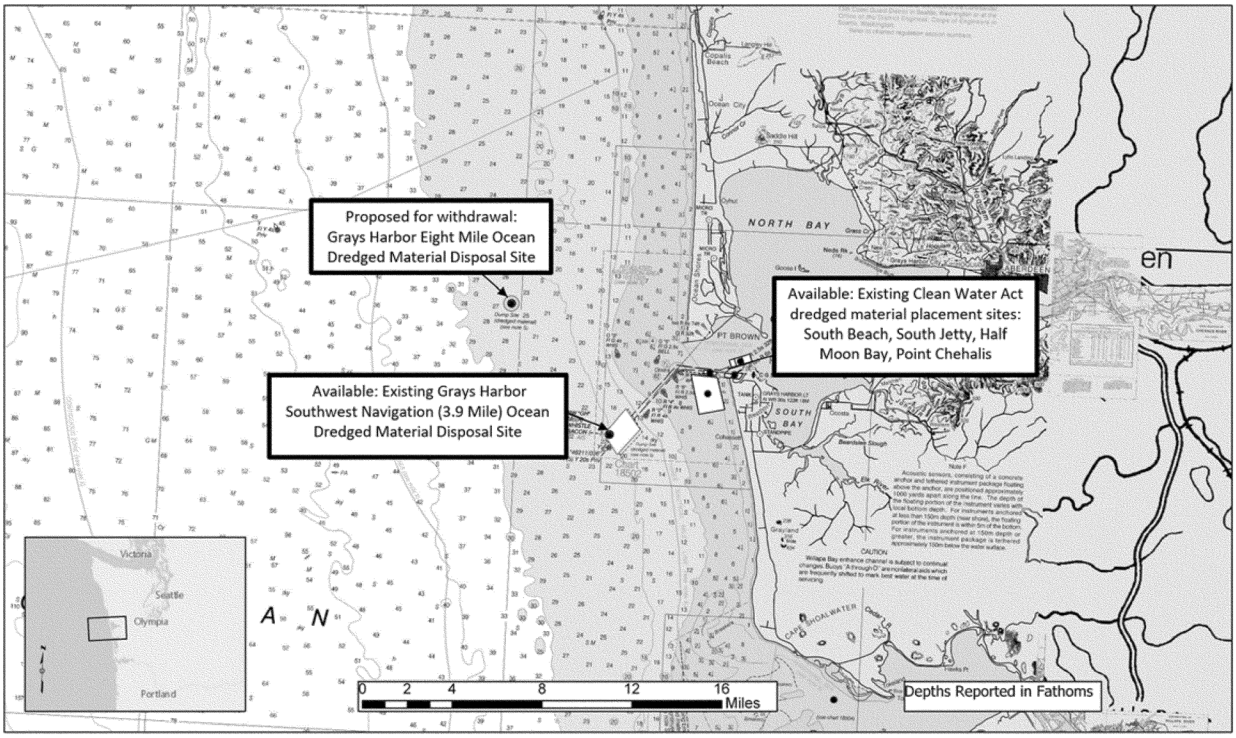

Figure 16. **Location of the Grays Harbor Eight-Mile Site relative to the location of the existing Grays Harbor Southwest Navigation ODMDS, offshore of Grays Harbor, WA.**

3.9.2 Survey Objectives, Activities, and Findings

Prior to 2016, the requirements for appropriate site management as laid out in the SMMP for the Grays Harbor Eight-Mile Site had not been met. Thus, on June 19, 2016, Region 10 conducted a survey onboard eTrac's S/V *Spectrum* with the objectives of:

- using a high-resolution multi-beam echo sounder to assess mound height, seafloor substrate type, and potential marine debris within and around the Grays Harbor Eight-Mile Site; and
- determining whether the site could be withdrawn from designation.

A remote-sensing acoustic survey was conducted to characterize the height and aerial extent of the disposal mound and to identify any natural and anthropogenic features of interest. Along with standard high-resolution multibeam data, backscatter data were also logged and processed with bathymetry data to create a surface sediment classification map.

The disposal mound present in the ODMDS ranged in height from 1-7 ft (0.3-2.1 m) above ambient seafloor depths. The height of the mound does not pose a threat to navigation safety, because it is less than 10% of the water depth. Some dredged material was found slightly outside the northeast portion of the ODMDS, but it is likely from movement of sediment by near-bottom currents post-disposal, as opposed to ongoing sediment transport. Unconsolidated coarse sediment (potentially sandy gravel) was observed at the center of the ODMDS. This material was surrounded by an area of unconsolidated finer sediments (potentially fine sand) which was then surrounded by consolidated ambient seafloor sediments (likely coarse sand). The range of grain sizes found within the ODMDS, likely from disposal, was limited in aerial extent and to a discrete area. Thus, any potential lasting effects on epibenthic fish and

invertebrates which feed on the infauna were negligible given the limited area that was affected by disposal.

3.9.3 Conclusions and Recommended Management Actions

During this survey, sufficient data were collected to satisfy the monitoring provisions in the SMMP for the Greys Harbor Eight Mile ODMDS. The dredged material was contained within the disposal site, the height of the mound did not threaten navigation safety, and relatively few objects were found within the ODMDS. Data and information collected support the projection that no adverse impacts to the marine environment after the site was de-designated; the site need no longer be actively managed. Region 10 withdrew the Grays Harbor Eight-Mile Site from designation with a Direct Final Rule published on June 26, 2018, which took effect on September 24, 2018.

3.10 Region 10 – Revilla Channel and Clarence Strait, AK

3.10.1 Background

Ketchikan-based seafood processing facilities dispose of seafood processing wastes at two locations in Revillagigedo (Revilla) Channel and Clarence Strait, both of which are located offshore of Ketchikan, Alaska (Figure 17). Trident Seafoods Corporation manages barge disposal at these locations for its own facility as well as for other facilities in Ketchikan. The Revilla Channel disposal location is located 11.3 nmi southeast of Ketchikan, covers an area of 0.5 nmi^2, and has been used as an ocean disposal location for seafood processing waste since 2003. The Clarence Strait disposal location is located 13.0 nmi northwest of Ketchikan, covers an area of 0.8 nmi^2, and has been used as an ocean disposal location for seafood processing waste since 2014. Both disposal locations are deep – the depth of the disposal site in Revilla Channel is 540-780 ft (165-235 m), and depths at Clarence Strait range from about 1410-1970 ft (400-600 m). Revilla Channel is a relatively sheltered location situated between two islands, while Clarence Strait is a more high-energy, exposed environment.

Under the MPRSA and the implementing regulations (40 CFR 220.1(c)), “no permit hereunder shall be required for, the transportation for the purpose of dumping or the dumping in ocean waters of fish wastes unless such dumping occurs in: 1) harbors or other protected or enclosed coastal waters; or 2) any other location where the Administrator [of the United States Environmental Protection Agency (EPA)] finds that such dumping may reasonably be anticipated to endanger health, the environment, or ecological systems.” In the past, EPA has issued MPRSA special permits and MPRSA research permits for the ocean dumping of fish processing wastes offshore of American Samoa. In many cases, seafood processing wastes have been dumped into the ocean without an MPRSA permit based on the statutory exclusion from the permitting requirement.

3.9.2 Survey Objectives, Activities, and Findings

Region 10 conducted a survey of Revilla Channel and Clarence Strait on October 10-17, 2016, in order to assess whether the historical and current practice of ocean disposal of seafood processing waste has resulted in adverse effects to the benthic environment in ocean waters near Ketchikan, AK. The objective of this survey was to assess the potential impacts of organic and inorganic seafood processing waste disposal (specifically offal and bones) on benthic environments.

Region 10 collected data in each disposal location, in areas adjacent to each disposal location, and at reference locations (Figure 18 and Figure 19). SPI, PVI, and towed video footage were collected to provide information about the extent of seafood processing waste and oxygen

depletion indicators, sediment characteristics, and the benthic and epibenthic communities in each location. Additional PVI were collected in Revilla Channel after salmon carcasses were observed at one of the stations. Sediment grab samples were collected to provide information about the benthic infaunal communities and sediment chemistry in each location.

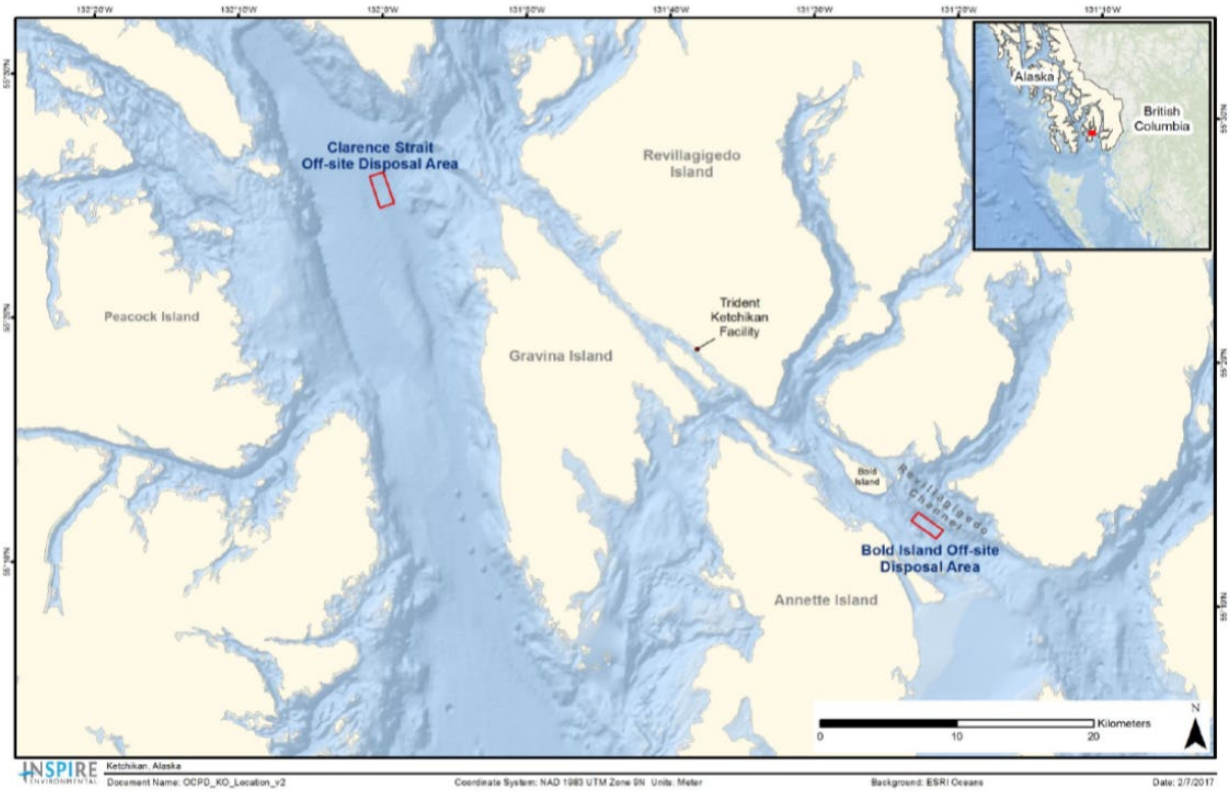

Figure 17. **Two ocean locations for the disposal of seafood processing wastes offshore of Ketchikan, AK. The Revilla Channel (southeast) location, labeled "Bold" in this figure, is 11.3 nmi from Ketchikan. The Clarence Strait (northwest) location is 13.0 nmi from Ketchikan.**

In addition to the benthic infaunal, sediment chemistry, and SPI and PVI analyses, EPA analyzed the towed video including still frames captured from this footage from each disposal location to verify habitat classification results and assess the impacts of seafood processing waste and associated oxygen depletion indicators on four categories of epifauna (benthic fish, pelagic fish, shrimp, and crabs).

While seafood processing waste in the form of fish bones and offal (primarily salmon) was observed on the seafloor in both disposal locations, it was not observed in the adjacent or reference locations surveyed. However, oxygen depletion indicators associated with seafood processing waste disposal were observed on the seafloor in both disposal locations and the areas adjacent to each disposal location. The Region did not observe oxygen depletion indicators associated with seafood processing waste disposal at the reference locations surveyed. Seafood processing waste and oxygen depletion indicators were observed at more stations and in larger quantities at the Revilla Channel disposal location compared with the Clarence Strait disposal location. This is consistent with differences in recent disposal activities at the two disposal locations—seafood processing wastes were disposed of in greater quantities, with higher frequencies, and had larger diameters (i.e., whole fish) at the Revilla Channel disposal location in comparison to the Clarence Strait disposal location in 2016, especially late in the seafood processing season.

Benthic habitats at the Revilla Channel and Clarence Strait disposal locations were similar; both habitats were predominately characterized by soft sediments with low shear strength and diverse, mature epifaunal and infaunal communities. Sediment texture appeared rough and disturbed in areas containing whole fish parts (primarily at Revilla Channel), whereas the sediment appeared mostly smooth in areas that did not contain visible seafood processing waste.

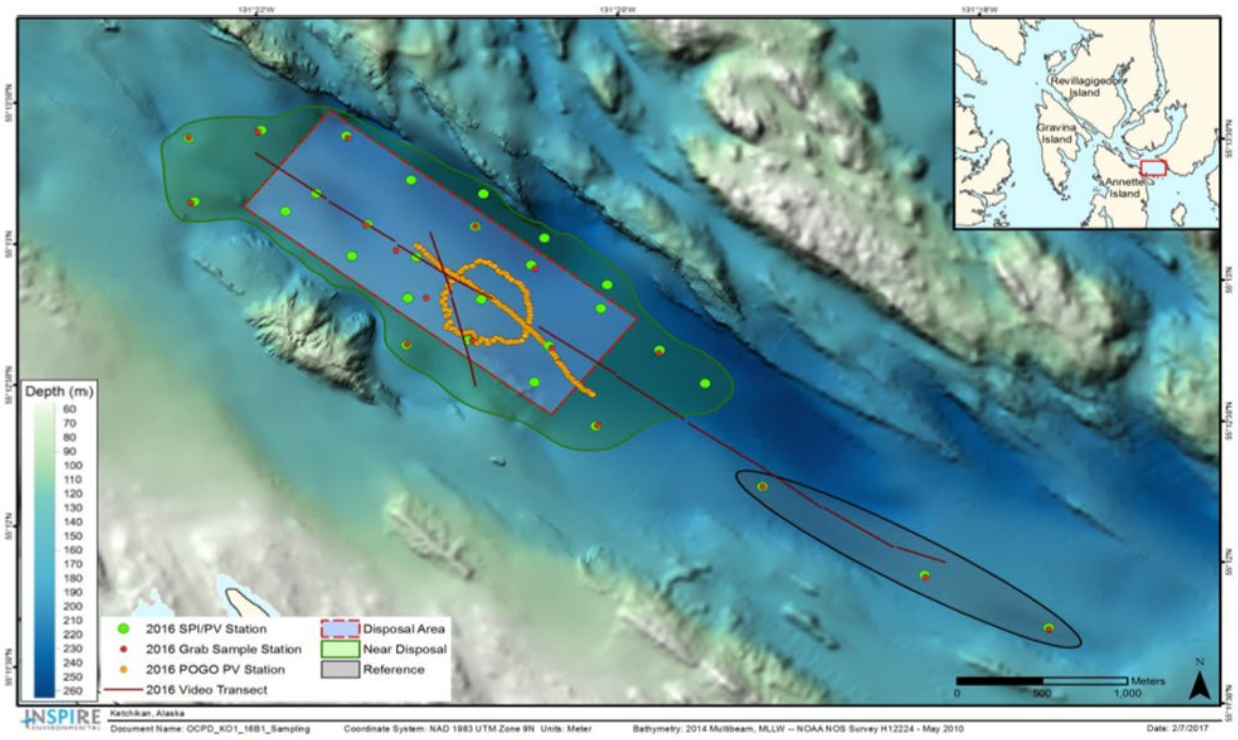

Figure 18. **Sampling design at Revilla Channel.**

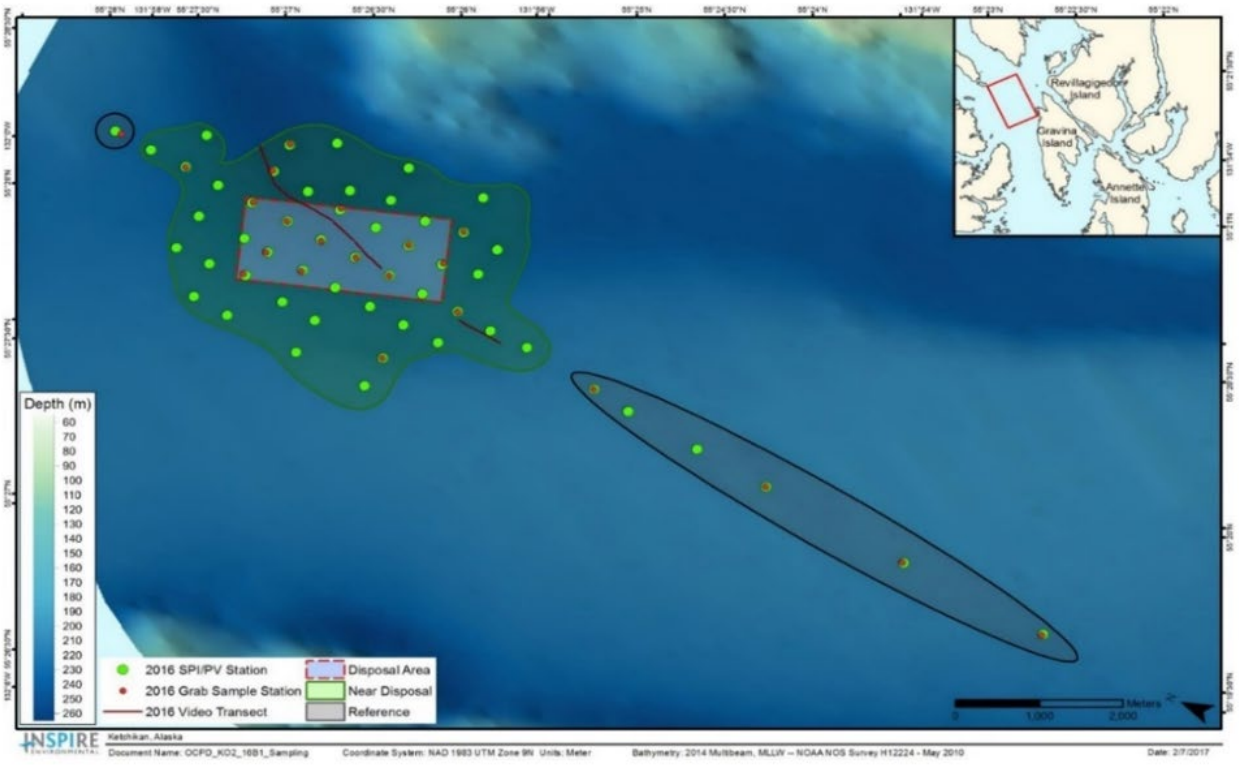

Figure 19. **Sampling design at Clarence Strait.**

At both disposal locations, most chemicals assessed were found to be below detection limits, including all PCB analytes and most pesticides. Measurable levels of the pesticide 4,4'-DDE and analyzed metals were observed, but all were low, and most comparisons among the disposal, adjacent, and reference locations revealed no differences. However, cadmium concentrations were significantly elevated in both disposal locations relative to adjacent and reference locations, and zinc concentrations in the Revilla Channel disposal location were elevated relative to the adjacent and reference locations. Overall, higher concentrations of metals were observed in the Revilla Channel disposal location than in the Clarence Strait disposal location. Revilla Channel also contained higher nutrient and TOC concentrations than Clarence Strait, suggesting greater loading of organic material. Fish bones are naturally rich in zinc and can accumulate cadmium; so the elevated metal concentrations and organic constituents at Revilla Channel relative to Clarence Strait are consistent with greater volumes of seafood processing waste disposed of in the Revilla Channel disposal location in 2016. Nevertheless, means and ranges of analytes measured at both Revilla Channel and Clarence Strait were low in comparison to screening levels.

Functionally, benthic infaunal communities and epifaunal communities observed in each disposal location were similar to those found in adjacent and reference locations. The presence of seafood processing waste and oxygen depletion indicators did not appear to have caused anoxic conditions in the water column as epifauna were frequently observed on the benthos within and around piles of seafood processing waste. Shrimp and crabs were observed in high densities clustered around seafood processing waste.

3.9.3 Conclusions and Recommended Management Actions

Despite the difficulties of collecting of a robust data set in a remote and logistically challenging environment, Region 10 accomplished the survey objectives. Changes to the fish processor's

disposal activities, including type of waste (stickwater, ½-inch waste, or whole fish body parts), frequency of disposal, volume of disposal per disposal trip, and duration of disposal appear to have impacted the seafloor ecosystems. The Region recommends obtaining additional information about fish waste disposal in ocean waters.

4.0 Next Steps

EPA conducts oceanographic surveys to monitor the impacts of regulated dumping at ocean disposal sites and to inform management and monitoring decisions in accordance with EPA roles and responsibilities under the MPRSA and the ocean dumping regulations. EPA monitors to ensure that dumping will not unreasonably degrade or endanger human health or the environment, to verify that unanticipated adverse effects are not occurring from past or continued use of the site, and to ensure that terms of ocean dumping permits are met.

Based on the results of these FY 2016 ocean disposal site surveys:

- Environmentally acceptable conditions appear to have been met and permitted disposal of dredged material under the MPRSA should be able to continue without modifications to site usage at eight of the monitored ocean disposal sites: Portland Dredged Material Disposal Site; Central Long Island Sound Dredged Material Site; Fernandina Beach Dredged Material Disposal Site; Miami Ocean Dredged Material Disposal Site; Pascagoula Ocean Dredged Material Disposal Site; Galveston Dredged Material Site, and Yaquina Bay North and South Ocean Dredged Material Disposal Sites.
- EPA also used the data collected during these surveys to:
    - Inform future revisions to the SMMP for the Portland Dredged Material Disposal Site;
    - Inform future revisions to the SMMP for the Central Long Island Sound Dredged Material Site and focus future monitoring and management on disposal mounds with elevated levels of contaminants of concern within the site;
    - Better understand how placing additional types of material (e.g., rock) at the Historic Area Remediation Site influences the repopulation of a robust benthic community and inform future studies of the site;
    - Determine that using a combination of assessment methodologies, as compared to using individual methods separately, to measure routine survey parameters provides a more complete picture of benthic habitats and fish communities associated with ocean disposal sites; and inform planning of future surveys offshore of the Southeastern U.S. Atlantic and Gulf Coasts as well as future revisions to the SMMP for the Fernandina Beach Ocean Dredged Material Disposal Site;
    - Confirm that recent adjustments to the location of the dredged material release zone within the Miami Ocean Dredged Material Disposal Site have been

successful in limiting dredged material from spreading beyond the site boundaries during disposal; and inform future revisions to the site's SMMP;

- Confirm that the SMMP for the Pascagoula Ocean Dredged Material Dumpsite is effective as well as to inform potential dredged material release locations within the site to be considered as part of future disposal permit evaluations;
- Determine that the existing reference area is representative of the Galveston Dredged Material Disposal Site and should continue to be used; and
- Fulfill monitoring requirements established in the SMMP for the Grays Harbor Eight-Mile Site and confirm there would be no unacceptable adverse impacts to the marine environment once EPA de-designated and no longer managed this unneeded site. EPA withdrew the site designation with a Direct Final Rule published in the Federal Register on June 26, 2018.

- EPA also used data collected from Revilla Channel and Clarence Strait to assess impacts of fish waste disposal. EPA determined that additional information is needed to broaden the understanding of the physical oceanographic features that affect the response of the marine environment to ocean disposal of fish wastes.

5.0 Acknowledgements

This report is based on the monitoring surveys conducted, analyses performed, and conclusions drawn by EPA Regional offices 1, 2, 4, 6, and 10 during FY 2016. This report was developed with the support of Ocean Dumping Management Program staff from EPA Headquarters and all coastal Regional offices.

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