



**US Army Corps  
of Engineers®**  
Portland District

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# **Oregon International Port of Coos Bay**

## **Proposed Section 204(f)/408 Channel Modification Project**

### **Sub-Appendix 10**

**Dredged Material Disposal Sites**

**June 2024**

## **EXECUTIVE SUMMARY**

The Oregon International Port of Coos Bay (OIPCB) seeks to modify the Coos Bay, Oregon Federal Navigation Channel (FNC); the channel modifications assessed in this evaluation are referred to as the 2023 Proposed Alteration (2023 PA) Plan. The 2023 PA consists of widening the channel to a nominal 450 feet (ft) and deepening it to -57 ft Mean Lower Low Water (MLLW) at the entrance to the Coos Bay FNC and to a depth of 45 ft MLLW from inside the entrance through approximately River Mile (RM) 8.2.

The evaluation of the dredged material disposal and placement sites is part of the engineering studies to address potential effects due to the proposed channel modifications. The U.S. Army Corps of Engineers (USACE) disposes of dredged material from annual operation and maintenance (O&M) at Ocean Dredged Material Disposal Site (ODMDS) F, ODMDS H, Site G, and Site 8.4. ODMDS E is also a designated site, although it has been unused for the past ten years. Appendix A, Sub-appendix 10 evaluates existing disposal sites. The 204/408 Report Appendix B, Dredged Material Management Plan (DMMP) covers the evaluation and selection of new beneficial use and disposal sites for the construction material from the channel deepening (USACE, 2019).

Implementation of the 2023 PA Plan is anticipated to result in physical changes to ODMDS E and Site G, as well as increase the annual disposal quantities. Extending the navigation channel offshore under the 2023 PA Plan will result in channel overlap with ODMDS E. The existing site has an area of 116 acres, which would be reduced to 93 acres under the 2023 PA Plan. Site G is located adjacent to the Coos Bay FNC; channel deepening, followed by side slope equilibration, may deepen the bathymetry within Site G. Finally, the disposal volumes at ODMDS F are expected to increase due to increased shoaling within the channel. Presently, about 832,000 cy/yr of medium-grained sand is dredged from the channel. This volume is expected to increase to 1,166,000 cy/yr under the 2023 PA Plan.

The dispersal capacity of ODMDS F, ODMDS E, and Site G was evaluated by investigating historic bathymetry surveys and material disposal records. ODMDS F “Nearshore” has an estimated dispersal capacity of approximately 500,000 cy/yr (McMillan 2018), which was verified by plotting material placements versus accumulated sediment; ultimately, these plots showed that sediment accumulation did not result from average placements of 500,000 cy/yr. Plotting material disposal and sediment accumulation within a temporarily designated site within the ODMDS F “Offshore” during its use from 1991 to 1996 exhibited a dispersal rate of approximately 400,000 cy/yr. Therefore, the total dispersal rate from ODMDS F is approximately 900,000 cy/yr. Plotting accumulated sediment volumes at ODMDS E from historic bathymetry revealed an exponential decay relationship in which the annual change in volume is a function of the sediment available at the site and the annual disposal; a model to encompass this relationship was developed from the site. Finally, investigating historic bathymetry near Site G does not show accumulation, even after a year in which ~60,000 cy were placed. This analysis confirmed the site’s dispersive designation.

The static capacity of ODMDS F Offshore and of ODMDS E were calculated based on simulating wave propagations under different sediment mound conditions. USACE criteria holds that material disposal may impact navigation if the resultant mounding causes a change in the wave climate of

more than 10% (USACE 2003). By simulating several different mound scenarios, the static capacity at each site was found to be 10 mcy at ODMDS F and 457,000 cy at ODMDS E.

The long-term use of ODMDS F was estimated based on the predicted disposal volumes under each condition. For volumes less than 900,000 cy/yr on average (i.e., approximately 1000 cy greater than the average current disposal rate), the site is expected to have an indefinite lifetime since the dispersal rate exceeds the material disposal rate. For disposal volumes above 900,000 cy/yr, the excess would be assumed to accumulate in ODMDS F Offshore, and the service life of the site was calculated as the static capacity (10 mcy) divided by the accumulation. As Table ES-1 notes, ODMDS F is expected to provide a service life of approximately 38 years under the 2023 PA Plan, respectively. Site F’s service life could be extended if the Corps of Engineers decided to continue to utilize the Port’s beneficial reuse site for O&M placement following the completion of project construction in the years that Site F’s dispersive capacity is exceeded.

**Table ES-1  
ODMDS F Disposal Volumes and Service Life Estimate**

Description	Existing Condition	2023 PA
Placement (cy/yr)	832,000	1,166,000
Accumulation (cy/yr)	-	266,000
Lifespan (yr)	Indefinite	~38

At ODMDS E, the overlap with the navigation channel leads to a reduction in the static capacity to 322,000 cy under the 2023 PA Plan. The annual capacity represents the volume that could be placed each year, over a service life of 50 years, such that the static capacity is not exceeded. It was calculated using the exponential decay relationship, assuming that dispersal is ongoing over the 50-year period. This calculation yielded an annual capacity of 72,000 cy/yr under the Existing Condition and WOP, which decreased to 51,000 cy/yr under the 2023 PA Plan. These volumes can be seen in Table ES-2. These annual capacities exceed the annual average volume that has been placed at the site since the last channel deepening in 1998, which is less than 5,000 cy/yr.

**Table ES-2  
ODMDS E Disposal Capacity**

<b>Condition</b>	<b>Static capacity (cy)</b>	<b>Annual Capacity (cy/yr – assumes 50-year life)</b>
Existing Condition	457,000	72,000
2023 PA	322,000	51,000

Evaluation of Site G focused on the dispersive capability of the site. Analysis of the placement history and historic cross sections shows that the site has a dispersive capacity of at least 55,000 cy/year. While side slope equilibration associated with the 2023 PA Plan has the potential to deepen the location of the site, it is not anticipated to affect the dispersive capacity of Site G. It is anticipated that USACE will be able to use Site G consistent with its present use of the site without effecting the federal navigation project.

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## ACRONYMS AND ABBREVIATIONS

2D	Two-dimensional
3D	Three-dimensional
3d HD	3D Hydrodynamic
ac	Acres
ADCP	Acoustic Doppler Current Profilers
AIS	Automatic identification system
AMD	Advanced Maintenance Dredging
ASA(CW)	Assistant Secretary of the Army for Civil Works
ATON	Aids to Navigation
BMPs	Best Management Practices
BOE	Basis of Estimate
BW	Boussinesq Wave
CBNS	Coos Bay North Spit
CDF	Confined Disposal Facility
CDIP	Coastal Data Information Program
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CMOP	Coastal Margin Observation and Protection
CMS	Coastal Modeling System
CRA	Cost Risk Analysis
CSZ	Cascadia Subduction Zone
CWA	Clean Water Act
cy	Cubic yards
cy/yr	Cubic yards per year
CZMA	Coastal Zone Management Act
DBB	Design-Bid-Build
DDR	Design Documentation Report
DEA	David Evans and Associates, Inc.
DHI	Danish Hydraulic Institute
DMMP	Dredged Material Management Plan
DOGAMI	Oregon Department of Geology and Mineral Industries
DTM	Digital Terrain Model
EC	Engineering Circular
EIS	Environmental Impact Statement
ENSO	El Niño/Southern Oscillation
ER	Engineer Regulations
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
ETL	Engineer Technical Letter
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FM	Flexible Mesh
FM HD	Flexible Mesh Hydrodynamic
FNC	Federal Navigation Channel
FR	Federal Register
ft	Foot or feet
FY	Fiscal Year
gpm	Gallons per minute
GRI	Geotechnical Resources, Inc.
HCSS	Heavy Construction Systems Specialists
HOWL	Highest Observed Water Level
HRA	Habitat Restoration Area

## ACRONYMS AND ABBREVIATIONS

HSE	Health, safety and environment
IG	Infragravity
ILS	Instrument Landing System
in.	Inches
IWP	Industrial Waste Pond
JCLNG	Jordan Cove LNG Export Facility
lf	Linear feet
LiDAR	Light Detection And Ranging
LNG	Liquefied natural gas
LNGC	Liquefied natural gas carrier
LOA	Length Overall
LSB	Log-spiral Bay
LST	Longshore Transport
M&N	Moffatt & Nichol
MCR	Mouth of the Columbia River
MCX	Mandatory Center of Expertise
mcy	Million cubic yards
MHHW	Mean Higher High Water
MHW	Mean High Water
mi	Miles
MLLW	Mean Lower Low Water
MLW	Mean Low Water
mm	Millimeters
MMR	Major Maintenance Report
MOF	Material Offloading Facility
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSL	Mean Sea Level
MTL	Mean Tide Level
MTO	Material takeoffs
NAIP	National Agricultural Imagery Program
NAVD88	North American Vertical Datum of 1988
NDBC	National Data Buoy Center
NED	National Economic Development
NEPA	National Environmental Policy Act
NGDC	National Geodetic Data Center
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRC	National Research Council
NTPro	Navi Trainer Pro 5000
NW	Northwest
O&M	Operations and Maintenance
OCMP	Oregon Coastal Management Program
ODEQ	Oregon Department of Environmental Quality
ODLCD	Oregon Department of Land Conservation and Development
ODMDS	Ocean Dredged Material Disposal Site
ODSL	Oregon Department of State Lands
OESA	Oregon Endangered Species Act
OGMT	Oregon Gateway Marine Terminal
OIPCB or Port	Oregon International Port of Coos Bay
OPC	Opinion of probable costs

## ACRONYMS AND ABBREVIATIONS

OPRD	Oregon Parks and Recreation Department
OSU	Oregon State University
PA	Proposed Alteration
POT	Peak-Over-Threshold
PRG	Project Review Group
PRG	Project Review Group
psi	pounds per square inch
PSU	Practical salinity unit
QC	Quality control
RAO	Response Amplitude Operators
RFP	Roseburg Forest Products
RM	River mile
RMS	Root-mean-squared
ROD	Record of Decision
SDPP	South Dunes Power Plant
SEF	Sediment Evaluation Framework
SELFE	Semi-implicit Eulerian-Lagrangian Finite Element
SHPO	Oregon State Historic Preservation Office
SL	Screening levels
SLC	Sea level change
SLR	Sea-level Rise
SMMP	Site Management/Monitoring Plan
SOORC	Southern Oregon Ocean Resource Commission
SSE	Safe Shutdown Earthquake
SW	Spectral Wave
SWORA	Southwest Oregon Regional Airport
TCX	Technical expertise
the "Project"	Coos Bay Section 204(f) Channel Modification Project
TIN	Triangular irregular networks
TSP	Tentatively Selected Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USBLM	U.S. Bureau of Land Management
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USGS	U.S. Geological Survey
VFR	Visual flight rules
WIIN	Water Infrastructure Improvements for the Nation
WNW	West-northwest
WOP	Without Project
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act
WSP	Western Snowy Plover
WSW	West-southwest

## **1. INTRODUCTION**

The Oregon International Port of Coos Bay (OIPCB or Port) is home to the second largest deep-draft coastal harbor between San Francisco and the Puget Sound, based on the tonnage of cargo transported through the Port between San Francisco and the Puget Sound, based on the tonnage of cargo transported through the Port. Access to the Port's facilities is provided by the Coos Bay Federal Navigation Channel (FNC), a federal channel that was first dredged in the early 1900s. The channel was last improved in 1998, when the channel was deepened by 2 feet (ft) from 35 ft to 37 ft. Since 1998, vessels calling at the Port have substantially increased in size.

### **1.1 Overview**

The OIPCB seeks approval to modify portions of the Coos Bay, Oregon Federal Navigation Project, under the authority granted by Section 204(f) of the Water Resources Development Act (WRDA) of 1986, as amended by Section 1014(b) of the Water Resources Reform and Development Act (WRRDA) of 2014 and Section 1127 of Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 (also referred to as WRDA 2016, hereinafter referred to as WIIN Act of 2016). Section 204 delegates authority to the Assistant Secretary of the Army for Civil Works (ASA(CW)) to approve requests by non-federal entities to design and construct non-federal improvements to federal navigation projects, and to assume federal responsibility for maintenance of those improvements after non-federal construction is completed. The proposed action also requires permission to modify the existing Coos Bay Federal Navigation Project under Section 14 of the Rivers and Harbors Appropriation Act of 1899, 33 United States Code (USC) 408 (Section 408).

### **1.2 Study Area Description**

Coos Bay is located in Coos County, Oregon, on the southern Oregon coast, about 200 miles (mi) south of the mouth of the Columbia River (MCR) and 445 mi north of San Francisco Bay. It is the navigational approach to Charleston, Empire, North Bend, Glasgow, Coos Bay, and Eastside (Figure 1-1 and Figure 1-2). The bay is formed by the junction of Isthmus Slough, Coos River, South Slough, Kentuck Slough, Haynes Slough, and Winchester Creek, and is located at the foot of the Coast Range. Deep-draft navigation is limited to the lower 15 mi of the estuary.

The surface area of the Coos Bay estuary is about 12,000 acres (ac) (about 19 square mi). Tidelands, located from River Mile (RM) 0 through 15 comprise 20 percent to 30 percent of the estuary area. The inlet to the estuary, referred to as the Entrance Channel, is fully exposed to waves.

The Coos Bay estuary drains directly into the Pacific Ocean. The nearshore zone adjacent to the Entrance Channel is composed of fine- to medium-grained sediments and intermittent rock outcroppings. The coastal shelf within 8 mi of the inlet has a roughly 100:1 (Horizontal:Vertical) slope. Cape Arago, a headland that limits sediment transport and marks the southern boundary of the littoral cell, is located 2.5 mi south of the inlet.

The topography of the lower Coos River area is a combination of rugged mountain terrain, extensive sand dunes adjacent to the ocean, and relatively flat pasture land along the river. The terrain of the area is quite rugged, because the mountains are relatively young, denoted by the typical narrow, sinuous valleys and steep side slopes. Relief varies from sea level to just under 3,000 ft; however, most of the land lies between 500 ft and 1,500 ft in elevation.

Geotechnical investigations indicate the subsurface conditions in the channel typically vary from relatively clean sand to siltstone and sandstone sedimentary rock. The sedimentary rock is present near the mudline from about RM 2 to RM 6 and at Guano Rock from about RM 0.7 to RM 0.9.

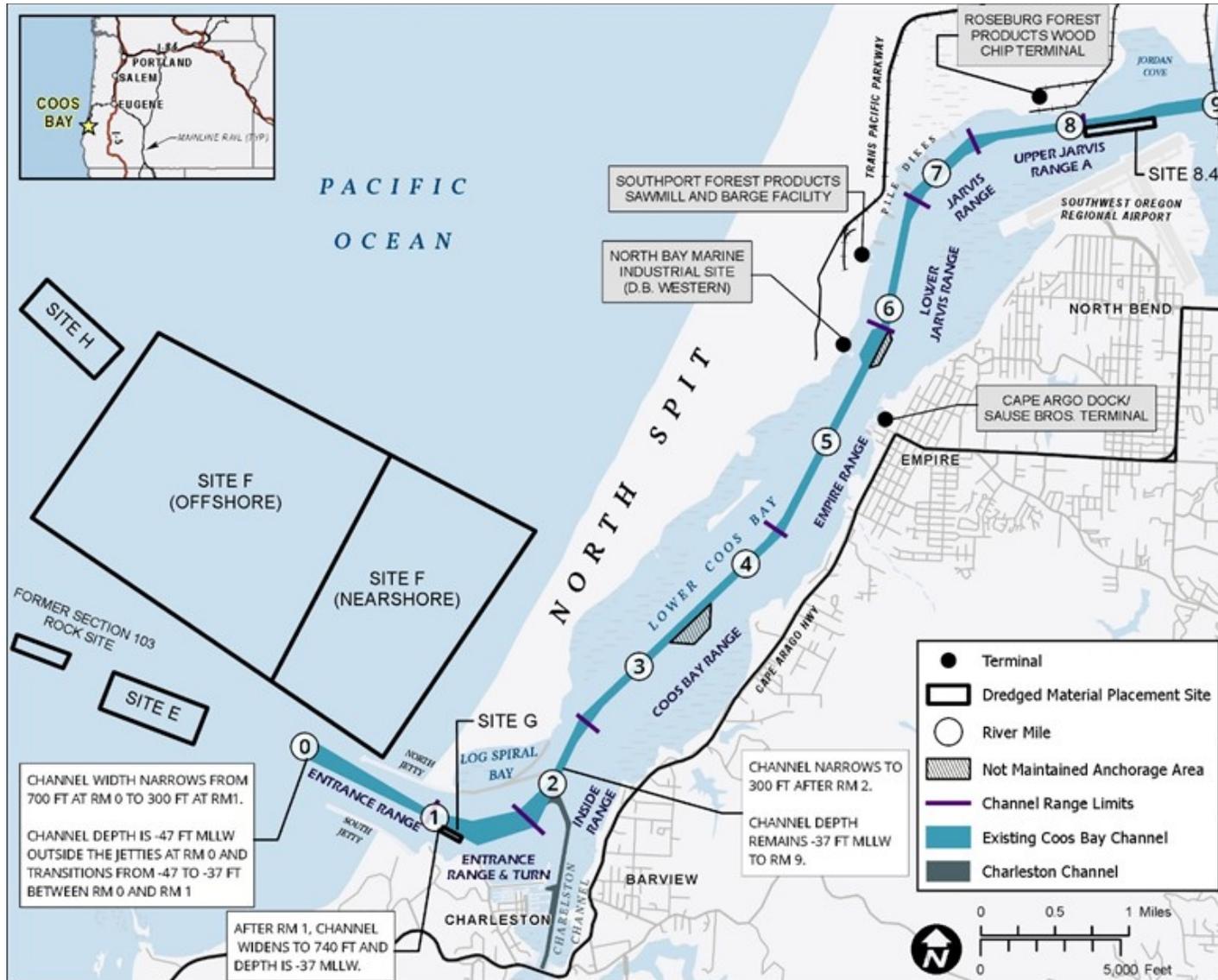


Figure 1-1  
Coos Bay Project Vicinity Map, Lower Bay

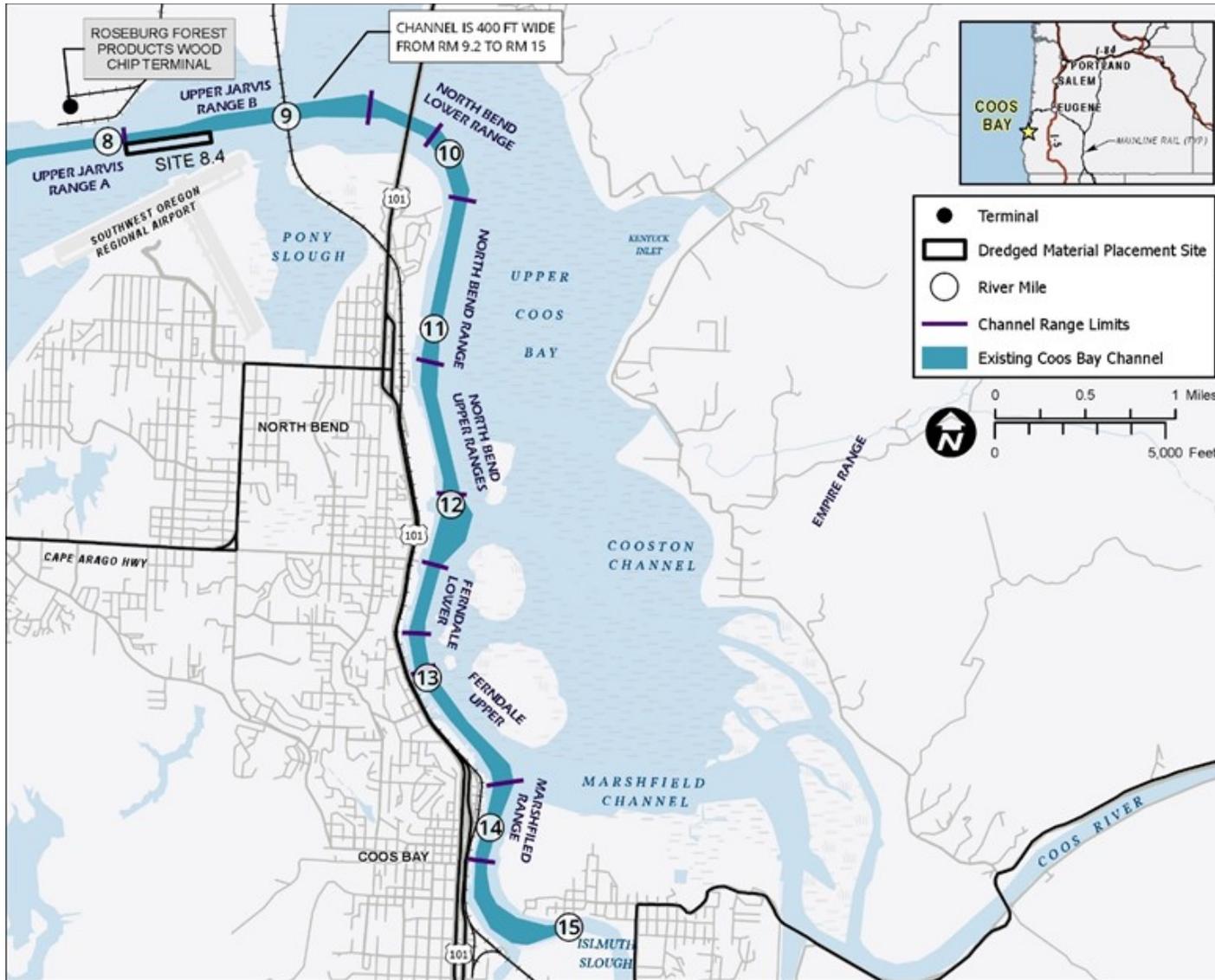


Figure 1-2  
Coos Bay Project Vicinity Map, Upper Bay

### 1.3 Existing Navigation Channel

The Coos Bay Federal Navigation Project was first authorized by the Rivers and Harbors Appropriation Act of March 3, 1899, and has been subsequently modified in 1919, 1937, 1951, 1952, 1979, and 1998. The 1979 project represents the completion of the 1970 authorization, which directed the USACE to deepen and maintain the Entrance Channel at -45 ft Mean Lower Low Water (MLLW) and the inner channel to -35 ft MLLW. The most recent project modification was authorized in the fiscal year (FY) 1996 Energy and Water Development Appropriations Act, Public Law 104-46, which provided for deepening the channel by 2 ft to -47 ft MLLW from the ocean entrance to Guano Rock at RM 1, and to -37 ft MLLW from RM 1 to RM 15. Public Law 104-46 also provided for deepening the turning basin at RM 12 by 2 ft and expanding it by 100 ft, from 800 ft by 1,000 ft to 900 ft by 1,000 ft.

The U.S. Army Corps of Engineers (USACE) Federal Navigation Project consists of the following federally authorized elements:

- North Jetty (9,600 ft long) and South Jetty (3,900 ft long), located on either side of the Entrance Channel, including the two relic structures that extend from the root of the North Jetty, one of which extends into Log-spiral Bay (LSB) and the other of which extends into the estuary.
- An Entrance Channel with an authorized depth of -47 ft MLLW, which decreases from a nominal width of 700 ft at RM 0 to a nominal width of 300 ft at RM 1.
- An inner channel (from RM 1 to RM 15) that has an authorized depth of -37 ft MLLW, a nominal width of 300 ft from RM 1 to RM 9, and a nominal width of 400 ft from RM 9 to RM 15.
- Two (2) turning basins, both of which are 1,000 ft long. The first is located at RM 12, and has a width of 900 ft. The other, located at RM 14, has a width of 730 ft. Both have a depth of -37 ft MLLW, consistent with the channel depth.
- Five (5) pile dikes between RM 6.4 and RM 7.3 in the main channel.
- Continuation of the main channel beyond RM 15 (in the Isthmus Slough) with a width of 150 ft and a depth of -22 ft MLLW.
- A 150-ft-wide Charleston Access Channel that has a depth that varies from -17 to -14 ft MLLW.
- A breakwater and bulkhead at Charleston.
- Charleston Small Boat Basin (10 feet deep) constructed by USACE in 1956 and maintained by the OIPCB.
- Advance maintenance dredging (AMD) of the channel extends offshore to RM -0.55, where the width of maintenance is 1,060 ft. Authorized AMD is 5 ft of depth in the Entrance Channel (RM -0.55 to RM 1) and 1 ft of depth upstream of RM 1.

The USACE maintains the above elements (with the exception of the Charleston Small Boat Basin) to provide navigational access to Coos Bay. USACE maintenance of the main navigation channel and jetty features ensures ongoing deep-draft navigation access to Coos Bay.

**1.4 Description of the 2023 Proposed Alteration (2023 PA)**

To accommodate larger deep draft vessels and provide local, state, and federal economic benefits, the Port proposes navigation channel improvements to the Coos Bay Navigation Channel. These proposed channel improvements are hereinafter referred to as the 2023 Proposed Alteration (2023 PA) and they are summarized as follows:

- *Coos Bay Inside Range*: the channel from RM 1.3 to RM 2.8 on the red side of the channel was widened. The range heading of the Coos Bay Inside Range was changed by 1° from 28.0° - 208.0° to 27.0° - 207.0°.
- *Bend Widener at RM 4.0*: a bend widener was included in the 2023 PA to add an additional 50 ft on the green side in the turn from Coos Bay Range to Empire Range.
- *Post Panamax Generation 3 (PPX3) Containership Turning Basin at RM 5.0*: a larger turning basin at the container facility is needed to accommodate the PPX3 containership. Based on the vessel’s dimension, the proposed turning basin is 2,000 feet long (parallel to the channel) and 1,600 feet wide. The turning basin’s design bottom elevation is -45 ft MLLW, the same as the 2023 PA channel.
- *Capesize Turning Basin at RM 8.0*: a Capesize turning basin was added at RM 8.0 to replace the turning basin that was removed at RM 7.5. Operationally, this turning basin will be used by inbound empty vessels. Therefore, the turning basin’s design bottom elevation is -37 ft MLLW. The deeper navigation channel (450-ft wide at -45 ft MLLW) continues through the length of the turning basin.

The above improvements are shown in Table 1-1 and Table 1-2; no dredging is proposed beyond the boundaries in these tables. The project vicinity is represented graphically in Figure 1-3. In this figure, the channel is labeled by RM. Figure 1-3 also shows the location of the adjacent federal infrastructure: the two jetties that run parallel to the channel from RM 0 to RM 1 and the pile dikes located along the north bank of the channel from RM 6.4 to RM 7.5.

**Table 1-1**  
**Channel Footprint for Existing Authorized Project and 2023 PA**

Range(s) and RM	Existing Conditions	2023 PA
<b>Offshore Extent</b>		
<b>Offshore Limit including Advanced Maintenance Dredging</b>	RM -0.55 <sup>1</sup>	RM -1
<b>Offshore Limit of Navigation Channel</b>	RM 0 <sup>1</sup>	RM -0.9
<b>Channel Width (ft)</b>		

Range(s) and RM	Existing Conditions	2023 PA
<b>Offshore Inlet Offshore Limit of Navigation Channel to RM 0.3</b>	700 narrowing to 550	1,280 narrowing to 600
<b>Entrance Range RM 0.3 to 1.0</b>	550 narrowing to 300	600
<b>Entrance Range RM 1.0 to 2.0 and Turn</b>	Varies up to 740	Varies up to 1,140
<b>Inside Range RM 2.0 to 2.5</b>	300	500
<b>Coos Bay Range RM 2.5 to 4.3</b>	300	450
<b>Empire Range RM 4.3 to 5.9</b>	300	450
<b>Post Panamax Generation 3 Turning Basin RM 4.7 to 5.6</b>	None	2,000 x 1,600
<b>Lower Jarvis Range RM 5.9 to 6.8</b>	300	450
<b>Jarvis Turn RM 6.8 to 7.3</b>	400	500
<b>Upper Jarvis Range RM 7.3 to 8.2</b>	300	450
<b>Capesize Turning Basin RM 7.6 to 8.0</b>	None	2,000 x 1,100

Notes:

1. The authorized FNC starts at RM 0. However, advanced maintenance dredging (AMD) occurs further offshore, typically from the channel entrance to RM -0.55. The channel width at RM -0.55 is approximately 960 ft.

**Table 1-2**  
**Channel Depth for Existing Authorized Project and 2023 PA**

Range(s) and RM	Navigation Bottom Elevation (ft, MLLW)		Advance Maintenance Dredging <sup>1</sup> (ft)	
	Existing Conditions	2023 PA	Existing Conditions	2023 PA
<b>Offshore Inlet Offshore Limit of Navigation Channel to RM 0.3</b>	-47	-57	5	6
<b>Entrance Range RM 0.3 to 1.0</b>	-47 decreasing to -37 <sup>2</sup>	-57 decreasing to -45 <sup>3</sup>	Varies 5 to 1 <sup>4</sup>	Varies 1 or 6 <sup>5</sup>
<b>Entrance Range and Turn RM 1.0 to 2.0</b>	-37	-45	1	1
<b>Inside Range RM 2.0 to 2.5</b>	-37	-45	1	1
<b>Coos Bay Range RM 2.5 to 4.3</b>	-37	-45	1	1
<b>Empire Range RM 4.3 to 5.9</b>	-37	-45	1	1
<b>Post Panamax Generation 3 Turning Basin RM 4.7 to 5.6</b>	None	-45	None	1
<b>Lower Jarvis Range RM 5.9 to 6.8</b>	-37	-45	1	1
<b>Jarvis Turn RM 6.8 to 7.3</b>	-37	-45	1	1
<b>Upper Jarvis Range RM 7.3 to 8.2</b>	-37	-45	1	1
<b>Capesize Turning Basin RM 7.6 to 8.0</b>	None <sup>6</sup>	-37 <sup>6</sup>	None	1

## Notes:

- Capital dredging consists of the navigation depth plus AMD plus a rock buffer plus a portion of overdepth.
- For the existing channel, the navigation depth decreases from a depth of -47 to 37 ft MLLW between RM 0.4 and RM 0.7. The channel is dredged farther offshore to obtain AMD depth.
- For the 2023 PA, the navigation depth decreases by 12 ft between RM 0.3 (a depth of 57 ft MLLW) and RM 1.0 (a depth of 45 ft MLLW).
- AMD of 5 ft starts at the offshore daylight line, approximately RM -0.6, and continues to RM 0.7.
- AMD of 6 ft starts at the offshore daylight line. The AMD will be 1 ft in areas where Guano Rock is present (RM 0.7 to RM 1).

6. Under the Existing Conditions, there is no formal turning basin; vessels that visit Roseburg Forest Products turn in existing deeper water at this location. Under the 2023 PA, incoming vessels will enter the channel and turn under ballast load, so it is not necessary to dredge beyond a depth of 37 ft MLLW.

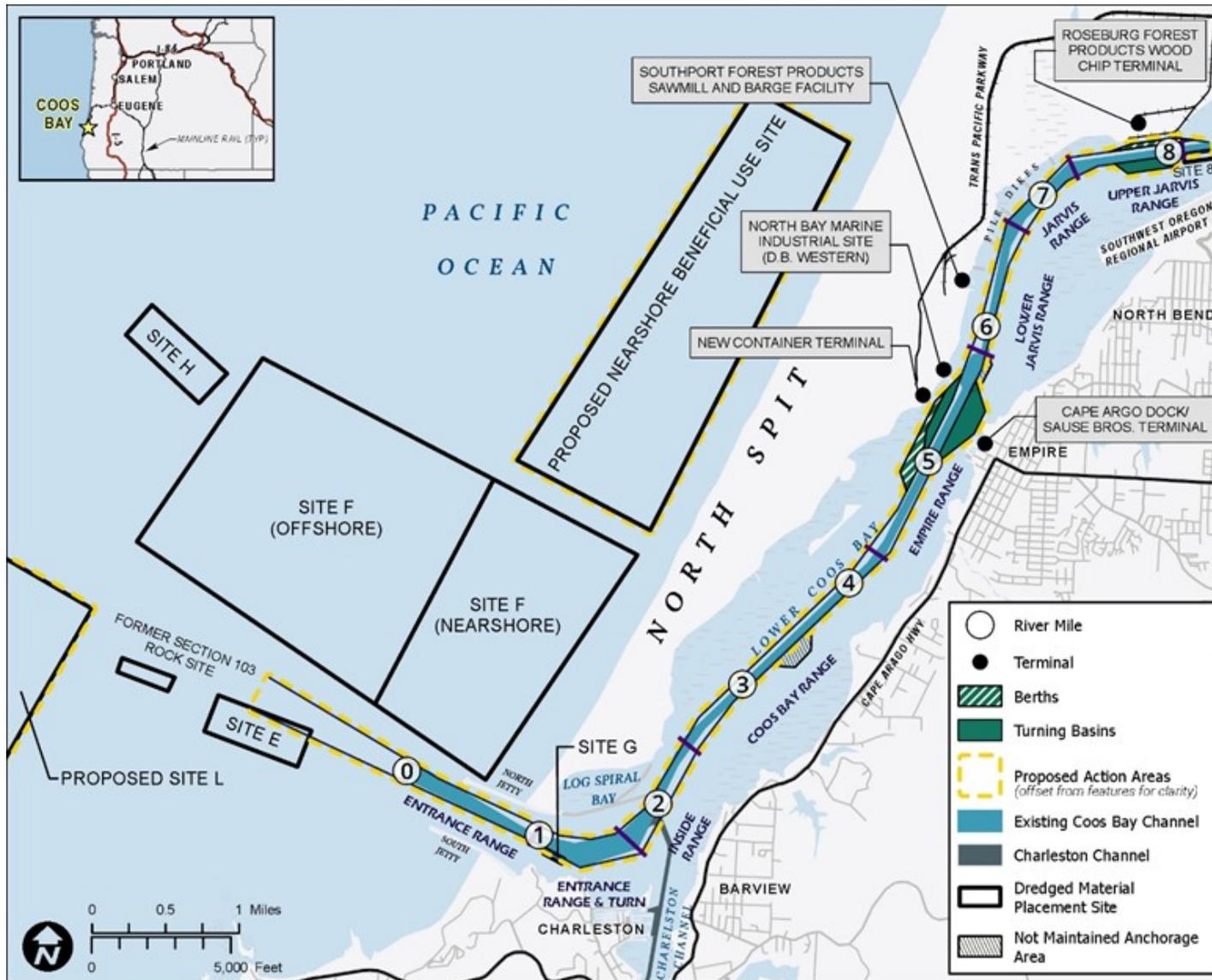


Figure 1-3  
Summary of the 2023 Proposed Alteration

## 1.5 Previous Studies

The capacity of Ocean Dredged Material Disposal Site (ODMDS) F was investigated for both the *Tentatively Selected Plan (TSP) Report* (June 2015) and the *30% Design Documentation Report* (January 2016). Both reports concluded that ODMDS F could be used for disposal of the project dredge quantities, although the long-term capacity and estimated life expectancy of the ODMDS varied between the two reports. The conclusions from each phase are summarized below. Quantification of impacts to ODMDS E and Site G was not performed during prior analyses.

### 1.5.1 Alternative Evaluation and the Tentatively Selected Plan

The 2015 Tentatively Selected Plan Report investigated the wave climate under three different mound conditions at ODMDS F. The analysis concluded that placing material into isolated mounds did not have a significant impact on wave climate relative to existing bathymetry. Placing fill to a uniform offshore elevation caused waves to focus at the site, increasing wave heights in the immediate vicinity of ODMDS F but decreasing wave heights at the shoreline.

The report concluded that the offshore portion of ODMDS F has a capacity of 38 mcy and that the dispersal capacity of this portion of the site is negligible. The nearshore portion of the site was estimated to have an annual capacity of 500,000 cubic yards (cy). This report assumed that capital dredging for the TSP (currently referred to as the 2023 PA) could be annualized to 30,000 cy per year (cy/yr) over 50 years, and that future operations and maintenance (O&M) would increase by 334,000 cy/yr on top of a baseline of 832,000 cy/yr. Based on site capacity of 38 mcy and the assumption that the nearshore portion of the ODMDS would continue to be used, the life expectancy of the site was estimated to be 50 years for the TSP/2023 PA. This estimate was further refined during detailed design.

### 1.5.2 30% Design

During 30% Design, additional wave modeling was performed to determine the maximum mound height that would not adversely impact navigation. Impacts to navigation were quantified by the USACE criterion that navigation is not adversely impacted if the change in wave climate between a mounded condition and the baseline condition is less than 10 percent from the baseline. This analysis indicated that a mound top elevation of -95 ft MLLW would be acceptable and estimated the total volume capacity to be 8.8 mcy.

This report includes an evaluation of historic bathymetries and disposal volumes that yielded a dispersal rate of 700,000 cy/yr in the nearshore area, and a dispersal rate of about 50 percent of volume disposed in the offshore portion of the site (based on historic bathymetry changes). At this phase of the project, the total volume of sediment during capital dredging was estimated to be 6.8 mcy. It was assumed that 2.1 mcy would be placed in the nearshore site, and that 4.7 mcy would be disposed of offshore. 2.3 mcy of this 4.7 mcy were expected to disperse, leaving an additional 2.4 mcy at the site. Therefore, it was deemed possible to use ODMDS F for disposal of capital dredge material, as well as continued use for ongoing O&M dredging.

### 1.5.3 60% Design

The 60% Design report contained an analysis of overlap with ODMDS E, potential effects to Site G, dispersion and capacity analyses for ODMDS E, dispersion and capacity analyses for ODMDS F, and a description of sediment recycling from ODMDS E into the channel. This

report updates these analyses with new quantities and addresses responses to comments on the 60% Design Report from USACE.

## 1.6 Objective

An evaluation of the existing disposal sites is part of the engineering studies to address potential effects of the proposed modification to the Coos Bay Navigation Channel. Changes to disposal practices under the 2023 PA Plan may have the effect of reducing the life-cycle of ODMDS F. This report also investigates the effect of the 2023 PA overlapping onto ODMDS E, decreasing the capacity of ODMDS E.

ODMDS E and F have been used for dredged material disposal since 1977. To verify that the ODMDS have been and can be used in a manner consistent with their life-cycle objectives, this evaluation considers the following questions regarding physical aspects of the sites:

1. Can assumptions on the dispersive capacity of ODMDS E and F be supported by an analysis of historical bathymetric data?
2. What effects might the disposal of dredged material in ODMDS E and F have on the wave environment at Coos Bay?
3. What is the static capacity of ODMDS E and F based on the above? Might there be unexpected constraints for future site capacity?
4. How long will ODMDS F be viable under current maintenance dredging? How much sediment can be placed in ODMDS E or a constrained ODMDS E such that the static capacity is not exceeded in 50 years?
5. Could ODMDS F fulfill the disposal needs under projected construction and maintenance dredging resulting from channel modifications?
6. What portion of the material placed in ODMDS E is likely to recycle into the navigation channel?

The following analysis was used to approach these questions.

- Question #1 was assessed with a comparison of material disposal versus sediment accumulation based on analysis of historic disposal records and bathymetric surveys within ODMDS E and F during the last 24 years of material disposal.
- Question #2 was assessed with a numerical model that simulates offshore wave transformation approaching Coos Bay Entrance.
- Question #3 was addressed using the results of the numerical modeling and the recent bathymetric data to calculate the capacity of the ODMDS.
- Questions #4 and #5 consider the results of the previous analysis (Question #3) to estimate capacity and dispersal rates to determine the potential use of ODMDS E and F for construction and future maintenance needs.
- Question #6 was addressed historical correlations of disposal practices and dredge volumes to estimate how sediment moves from the ODMDS into the channel.

## 1.7 Report Organization

The report is organized as follows:

- **Section 2** describes the disposal sites, including their physical characteristics, historic use, and management practices.
- **Section 3** describes the physical effects of the 2023 PA on disposal sites, explaining why the channel was designed to overlap with ODMDS E, the potential deepening of Site G, and the increase in disposal volumes for maintenance dredging.
- **Section 4** describes the sediment transport in the Coos Bay entrance and vicinity based on previous studies, a review of historic bathymetry, and numerical modeling. This section quantifies sediment dispersal from ODMDS E and F.
- **Section 5** presents the capacity of the existing sites, using wave modeling to determine the static capacity of the sites and the dispersal analysis to define the annual capacity.
- **Section 6** summarizes the suitability of ODMDS F for disposal of capital and maintenance dredged material. This section also summarizes recommendations for the continued use of ODMDS E.

## 2. OVERVIEW OF EXISTING DISPOSAL SITES

The Coos Bay ODMDS were designated by the U.S. Environmental Protection Agency (USEPA) for interim use in 1977 (USACE 2011) and for long-term use in 1986 (USEPA & USACE 1986). This section provides an overview of the existing disposal sites, including the three ODMDS mentioned above as well as flow-land Site G and re-handle Site 8.4.

### 2.1 Disposal site description

The locations of ODMDS E, ODMDS F, ODMDS H, Site G and Site 8.4 are presented in Figure 1-3. A description of these sites is provided in Table 2-1 and Table 2-2.

**Table 2-1  
Existing ODMDS Description**

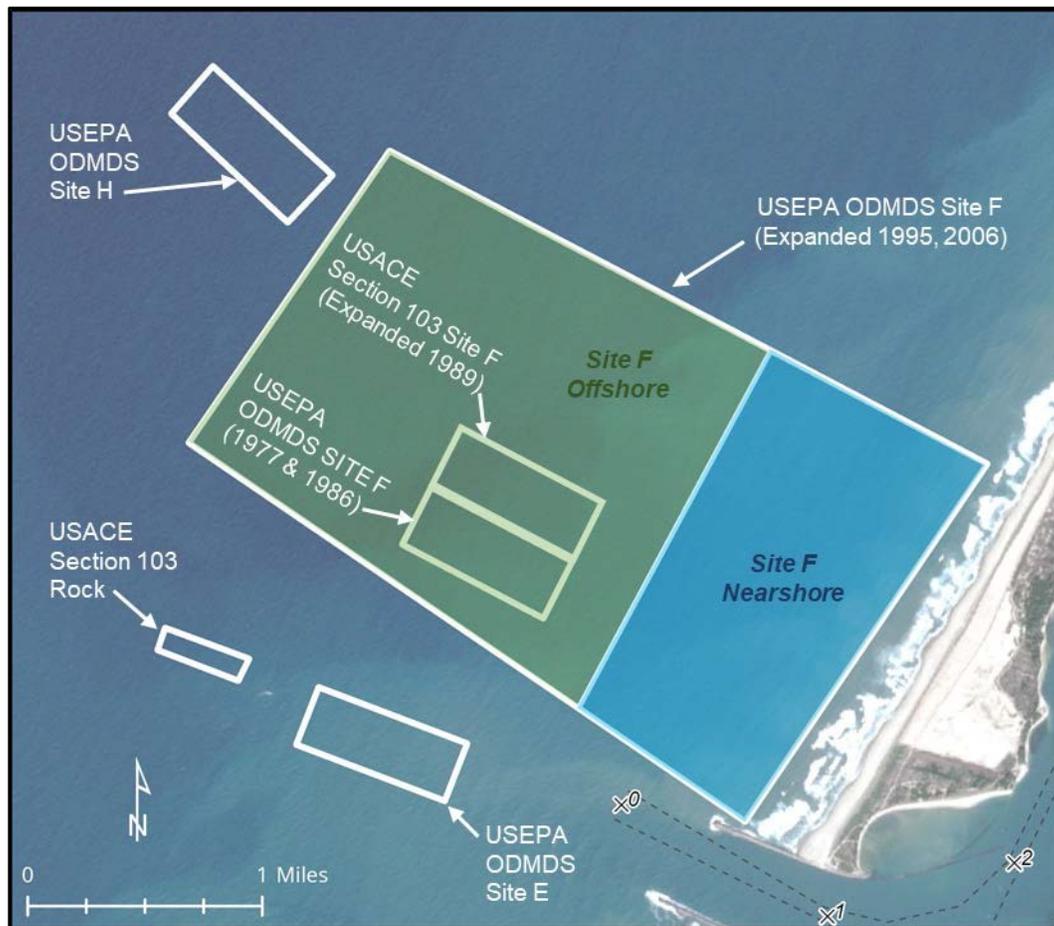
Disposal Site	Location (Distance/ Direction from Entrance Channel)	Material Type/Dredge Location	Dimensions Length x Width (ft)	Area (ac)	Average Depth (ft, MLLW)
ODMDS E	~1.5 miles southwest		3,600 x 1,400	116	-56
ODMDS F (Offshore and Nearshore)	~0.6 miles northwest	Sand (RM -1 to RM 12)	Trapezoidal (14,600 x 8,000 x 9,650)	3,075	-20 to -160
ODMDS H	~3.7 miles northwest	Finer-grained sand and silt (RM 12 to 15)	3,600 x 1,450	120	-180

**Table 2-2  
Existing In-bay Placement Site Description**

Site	Type	Location	Material Type/ Dredge Location	Dimensions Length x Width (ft)	Area (ac)	Average Depth (ft, MLLW)
Site G	Flow-lane	RM 1 (south side of channel)	Charleston Channel, Lower Navigation Channel	1,000 x 200	4.6	-40 to -45
Site 8.4	Re-handle	RM 8.4 (south side of channel)	Upper Channels	2,500 x 300	17	-30 to -35

## 2.2 Summary of Designation and Historical Use

Figure 2-1 shows the site original site boundaries from the 1986 designation. The area near ODMDS E and F was selected to receive coarse-grained material from the entrance and lower estuary locations. ODMDS H was selected for disposal of fine-grained material dredged above RM 12. In 1989, ODMDS F was doubled in size under USACE Section 103 authority in response to mounding in the original area. The site was expanded to the north. Mounding continued in the expanded area. In 1995, ODMDS F was further expanded. USACE designated a new ODMDS F at Coos Bay in 2006; this defines the present boundaries of ODMDS F.



**Figure 2-1**  
**Location of ODMDSs**

In recent years, dredged material has been disposed of predominantly in ODMDS F; the annual average volume placed in ODMDS F over the last ten years has been approximately 700,000 cy. Approximately 500,000 cy are placed in the nearshore portion of Site F (McMillan, 2018), and the remaining 200,000 cy are disposed of in the offshore portion of the site.

During FYs 1976-1984 (9 years), 6.6 mcy were placed in ODMDS E, an average of 735,000 cy/yr (USACE 2012b). During this period, the site experienced mounding throughout due to lower than predicted dispersion rates. ODMDS E is still open and available for use when littoral drift conditions indicate that material will not re-enter the channel (USACE 2015a). Except for 80,000

cy that was placed in 2006 (when use of ODMDS F was being re-evaluated), ODMDS E has not been used since 1990.

ODMDS H is currently used for disposal of fine-grained material dredged from above RM 12 (USACE 2012b & USACE 2015b). Documentation provided by the USACE indicates that the site has been used three times in the ten years between 2004 and 2013, for a total volume of 1.3 mcy; the vast majority of this (1.1 mcy) was dumped in 2009.

Authorization for Sites G and H resulted from the 1986 Ocean Disposal Site Designation and EIS (USEPA & USACE 1986). Site 8.4 is a re-handling site that is used for temporary storage of material dredged by USACE's *Yaquina* hopper dredge for later ocean disposal through contracted mechanical dredging. Material is placed occasionally at flow-lane Site G when Entrance Channel conditions are too hazardous for the dredge to access the ODMDS or when hydraulic cutterhead (pipeline) dredging occurs.

### **2.2.1 Material Disposal History**

Table 2-3 shows the history of material disposal at the ODMDS sites. Table 2-4 shows the distribution of dredged material disposed within the various sub-areas of ODMDS F. Since the last channel deepening in 1998, on average, 770,000 cy/yr has been disposed in ODMDS F, 140,000 cy/yr in ODMDS H, and under 5,000 cy in ODMDS E. This represents disposal under the Existing Condition. At ODMDS E, the Existing Condition assumes no annual disposal volume since it is only used for emergency disposal when it is not possible to access other ODMDS.

**Table 2-3  
Coos Bay ODMDS Dredged Material Disposal History**

Year	USACE Volumes (thousands of cy)			Year	USACE Volumes (thousands of cy)		
	Site E	ODMDS F	Site H		Site E	ODMDS F	Site H
1976	1,120.1	840.6	0	1996	0	1,760.1	248.9
1977	847.8	405.5	0	1997*	0	609.4	1,347.4
1978	901.3	872.7	0	1998**	0	965.9	20
1979	902.8	1,161.9	0	1999#	0	774.6	836.6
1980	207.3	1,014.4	0	2000	0	903.8	0
1981	660.7	0	0	2001	0	789.1	127.1
1982	919.2	0	0	2002	0	1,313.9	0
1983	336	104.8	0	2003	0	768	0
1984	720.6	629.3	0	2004	0	425.8	0
1985	0	0	0	2005	0	564	262.8
1986	309.1	1,193	413.4	2006†	79.9	487.5	0
1987	116.4	1,033	39.9	2007	0	1,122.6	0
1988	0	965.8	658.1	2008	0	791.5	0
1989	127.2	440.5	0	2009	0	938.9	1,081.8
1990	25	637.7	401.7	2010	0	690.2	0
1991	0	1,247.7	21.4	2011	0	812.7	0
1992	0	742.6	757.2	2012	0	637.9	0

Year	USACE Volumes (thousands of cy)			Year	USACE Volumes (thousands of cy)		
	Site E	ODMDS F	Site H		Site E	ODMDS F	Site H
1993	0	719.9	898.9	2013	0	608.0	0
1994	0	722.3	401.2	2014	0	496.6	0
1995	0	686.6	545.9				
TOTAL (1976– 2014) :					7,273.4	28,878.8	8,062.3

Notes:

\* In 1997, a total of 181,090 cy of material was dumped into a one-time use area known as the “Rock Site.” This site was selected to receive rock excavated as part of the Coos Bay Channel Deepening Project.

\*\* In 1998, a total of 90,970 cy of material was disposed of under permit; 70,970 cy went to the original ODMDS F and 20,000 cy to Site H.

# In 1999, a total of 39,610 cy of material was disposed of under permit; 22,010 cy went to the original ODMDS F and 17,600 cy to Site H.

† Under their MPRSA Section 103 authority, USACE Portland substantially expanded Site F in 1995; this iteration of Site F had a footprint just slightly smaller than present-day Site F. In 2006, use of the 103 site ended (per regulation). Prior to the new (expanded) ODMDS F Section103 designation, by agreement with USEPA, 79,927 cy of material was placed in Site E and 106,507 cy of material was placed at the former ODMDS F. In 2006, after USEPA designated the new ODMDS F, an additional 381,003 cy of material was placed in the nearshore portion of the 2006 ODMDS F, for a total of 487,510 cy placed within the 2006 USEPA 103 ODMDS F.

**Table 2-4  
Dredged Material Disposal Volumes within the Sub-areas of ODMDS F, in cy  
(2004-2014)**

Year	DISPOSAL SITE		
	ODMDS F (Nearshore)	ODMDS F (Offshore)	Original ODMDS F (before 2006 designation) †
2004	-	-	425,800
2005	-	-	518,600
2006	403,200	-	84,300
2007	723,400	297,750	22,730

Year	DISPOSAL SITE		
	ODMDS F (Nearshore)	ODMDS F (Offshore)	Original ODMDS F (before 2006 designation) †
2008	553,300	228,860	9,380
2009	312,360	626,540	-
2010	569,160	121,720	-
2011	492,130	321,620	-
2012	543,680	94,200	-
2013	425,670	182,340	-
2014	402,570	93,980	-

† Under their MPRSA Section 103 authority, USACE Portland substantially expanded Site F in 1995; this iteration of Site F had a footprint just slightly smaller than present-day Site F. In 2006, use of the 103 site ended (per regulation). Prior to the new (expanded) ODMDS F Section 103 designation, by agreement with USEPA, 79,927 cy of material was placed in Site E and 106,507 cy of material was placed at the former ODMDS F. In 2006, after USEPA designated the new ODMDS F, an additional 381,003 cy of material was placed in the nearshore portion of the 2006 ODMDS F, for a total of 487,510 cy placed within the 2006 USEPA 103 ODMDS F.

As these tables show, disposal of dredged material was initially divided between ODMDS E and ODMDS F until the late 1980s, when ODMDS F became more heavily used. The next major change in placement practices occurred in 2006, when the USACE prioritized the nearshore portion of the ODMDS over the offshore portion of the ODMDS; this prioritization aims to retain sediment within the littoral cell.

Material placement data at Sites G and 8.4 are limited. USACE placement history is available at Site G from 1990-2018 and is presented in Table 2-5.

**Table 2-5  
USACE Placement History at Site G, 1999-2018**

Year	Volume (cy)	Placement Method
1991	21,867	Yaquina (hopper)
1992	42,744	Yaquina (hopper)

<b>Year</b>	<b>Volume (cy)</b>	<b>Placement Method</b>
1994	20,639	Yaquina (hopper)
1995	11,446	Yaquina (hopper)
1997	3,467	Yaquina (hopper)
1999	19,000	Yaquina (hopper)
2000	39,603	Yaquina (hopper)
2001	1,329	Yaquina (hopper)
2005	20,070	Yaquina (hopper)
2005	27,190	Contractor Pipeline
2007	1,994	Yaquina (hopper)
2008	6,115	Yaquina (hopper)
2009	7,042	Yaquina (hopper)
2011	9,146	Yaquina (hopper)
2011	46,106	Contractor Pipeline
2013	17,840	Yaquina (hopper)
2014	10,313	Yaquina (hopper)
2015	1,011	Yaquina (hopper)
2016	5,982	Yaquina (hopper)
Annual Average	18,406	Hopper and Pipeline
Maximum Annual*	55,252**	Hopper & Pipeline

Note:

\*Maximum annual includes material disposed in one year for all equipment used.

\*\*Dredging from 2011 was 9,146 cy with a hopper and 46,106 cy with a pipeline for a total of 55,252 cy.

Site 8.4 was used four times from 2000-2017: 17,666 cy were placed in 2000, 87,752 cy were placed in 2004, 25,502 cy were placed in 2005, and 5,916 cy were placed in 2013.

## **2.2.2 Site Management**

### **2.2.2.1 ODMDS F**

ODMDS F is the largest of the Coos Bay ODMDS authorized for use by USACE for the disposal of clean sand and silt removed through maintenance dredging of the Coos Bay channel, and by other specially permitted non-USACE projects. ODMDS F has been expanded three times (1989, 1995, and 2006), primarily due to concerns related to mounding per the 2011 Coos Bay Environmental Impact Study (EIS).

The USACE Portland District manages the disposal of dredged material to avoid or minimize mounding effects and to maximize the use of the more active nearshore littoral zone. A grid system was developed in accordance with the SMMP, consisting of dump plans that govern where sediment will be placed to distribute the dredged material in a manner that avoids mounding. As an example, the USACE developed seven dump plans in 2007 to distribute 1.1 mcy of dredged material at ODMDS F. In 2009, four plans were used to place 940,000 cy of material, and multiple dump plans for nearshore and offshore were used in 2010 and 2011.

The use of the grid system and dump plans allows USACE to maximize placement in the nearshore portion of the site, which effectively maintains the sediment in the littoral system. This portion of the site has been used since its preliminary designation in 1995 to retain sediment in the nearshore zone.

### **2.2.2.2 ODMDS E**

During FYs 1976-1984 (9 years), 6.6 mcy were placed in ODMDS E, an average of 735,000 cy/yr (USACE 2012). However, the site experienced mounding throughout its area due to lower than predicted dispersion rates.

The dispersal of sediment mounds and the present stable bathymetry are attributable in part to restrictions on site use. Since 1987, placement of dredged material at ODMDS E has been limited to a maximum of 150,000 cy annually because of its proximity to the entrance channel, relatively shallow depth (USEPA & USACE 2006), and tendency for mounding when subject to large placement volumes. Except for the placement of 79,900 cy in 2006, which occurred because ODMDS F was undergoing re-authorization (the previous EPA 103 designation of Site F had expired), no material has been placed at ODMDS E since 1990. In addition, the site goal for ODMDS E is to place material to maximize dispersal southward, in the portions of the site located furthest away from the navigation channel (USEPA & USACE 2006).

The OIPCB understands that the USACE continues to retain the option to use ODMDS E for emergency situations. Additionally, placement in Site E has occurred only twice during the 30-year period during which the restriction has been imposed, indicating that situations requiring use of Site E are infrequent, and that placement in ODMDS E is avoided because of its unfavorable characteristics (mounding and dispersal of disposed sediments back into the navigation channel).

### **2.2.2.3 ODMDS H**

ODMDS H is used for placement of finer-grained material dredged from above RM 12 and will not receive any material from the channel modifications, which only extend to RM 8.2. In addition, ODMDS H is outside the envelope of physical effects from side slope equilibration or from

changes to the wave climate. Therefore, ODMDS H will not be affected and no further analysis was conducted.

#### 2.2.2.4 Site G

Site G is used when ocean conditions are too hazardous for a hopper dredge to access the ODMDS or when hydraulic cutterhead (pipeline) dredging is conducted in the Charleston Access Channel and Marina.

USACE placement history is available at Site G from 1990-2018 (Table 2-5). Maintenance material has been placed in Site G in 17 of the last 27 years. Pipeline dredging of the Charleston Access Channel has a large influence on the amount of material placed at Site G. Average placement per dredging year by the Hopper Dredge *Yaquina* is 14,100 cubic yards. Average pipeline placement for the two years that the Charleston Access Channel was dredged is 36,600. Placement in Site G has been highly variable during the last 29 years, ranging from zero in 10 years, less than 10,000 in seven years, to a maximum of 55,252 cy combined from two separate placement events in 2011. The principal causes of annual variability in the use of Site G are sea conditions at the bar, which can restrict hopper dredge access to the ocean, and whether pipeline dredging of the Charleston Access Channel occurs in a given year.

Site G is a dispersive site, as described in the Biological Opinion on the Annual Maintenance dredging Program for the Oregon Coastal Projects by the USACE (USACE 2009). Site G's capacity for dispersal is based on the type and amount of material, the method of disposal, and the frequency of disposal. USACE requires that material discharged via pipeline is placed during ebb tides to facilitate flow lane dispersal of the material to the ocean. The Biological Opinion for the Maintenance Dredging Program for the Oregon Coastal Projects (USACE 2009) indicates that material placed in dispersive sites is typically transported out of these locations into the littoral zone by tidal flow, and therefore contributes to the sediment budget of the Coos littoral cell.

#### 2.2.2.5 Site 8.4

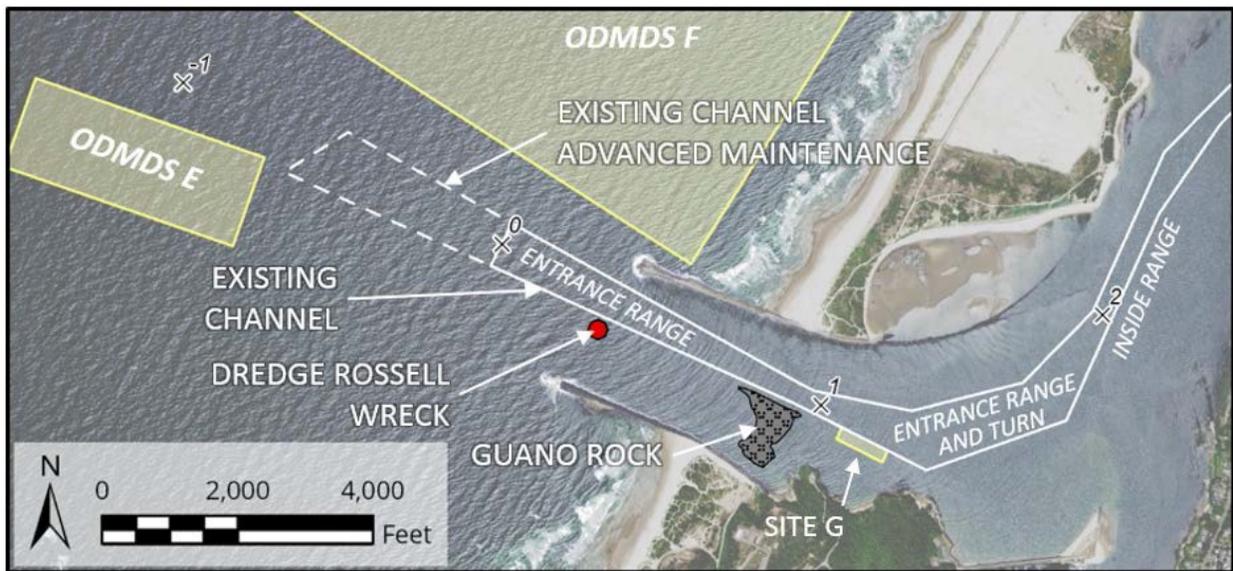
Site 8.4 is a re-handle site that will continue to be used for temporary storage of material dredged by the USACE's *Yaquina* hopper dredge for later ocean placement through contracted mechanical dredging. Placement of material at this site allows for more effective use of the *Yaquina* by reducing its non-productive time hauling loads to the ODMDS. No effects to Site 8.4 or its use are expected. Therefore, additional analysis for Site 8.4 is not provided.

### 3. PHYSICAL EFFECTS OF THE 2023 PA PLAN

Implementation of the 2023 PA Plan could result in changes to the bathymetry of ODMDS E and Site G, as well as the total volume anticipated for disposal. This section provides an overview of these potential changes.

#### 3.1 Design Constraints

The design of the 2023 PA Plan channels both create an overlap with the existing ODMDS E and deepen the bathymetry at Site G; this sub-section explains the rationale behind the channel design. The selected alignment of the 2023 PA entrance channel represents a best-fit solution to the navigational and structural constraints in this area. These constraints are imposed by the presence of ODMDS E, the North Jetty, the submerged shipwreck *Dredge Rossell*, and Guano Rock (Figure 3-1).



**Figure 3-1**  
**Constraints to Entrance Channel Alignment, with Existing Advance Maintenance Footprint**

The Engineering Appendix to the 204(f)/408 Report explains how these constraints factored into the selected channel footprint. To summarize, three potential options were evaluated for the alignment of the offshore portion of the Entrance Channel:

- Shift the Entrance Channel north, at the risk of further impacts to the North Jetty.
- Rotate the channel clockwise so that vessels approach Coos Bay from a more southerly direction. This would require vessels to turn in the Entrance Channel, which may significantly reduce the navigability of the channel.
- Overlap with ODMDS E.

The North Jetty is already in deteriorated condition and shifting the channel towards the North Jetty head to avoid ODMDS E would exacerbate forces on the North Jetty head and might trigger significant impacts to navigation and channel maintenance.

The second option, rotating the channel, was not considered viable from a navigation safety standpoint by the Coos Bay pilots. Navigation studies and ship simulations to date indicate that the entrance channel reach causes the most significant challenges to navigation due to the presence of waves and high current velocities. During ship simulations, larger vessels already require tug assist at the entrance turn; consequently, pilots have suggested enhancements to the channel layout at this location. Therefore, the 2023 PA channel alignment seeks to make this portion of the channel as easily navigable as possible and to not exacerbate existing navigational challenges in this reach.

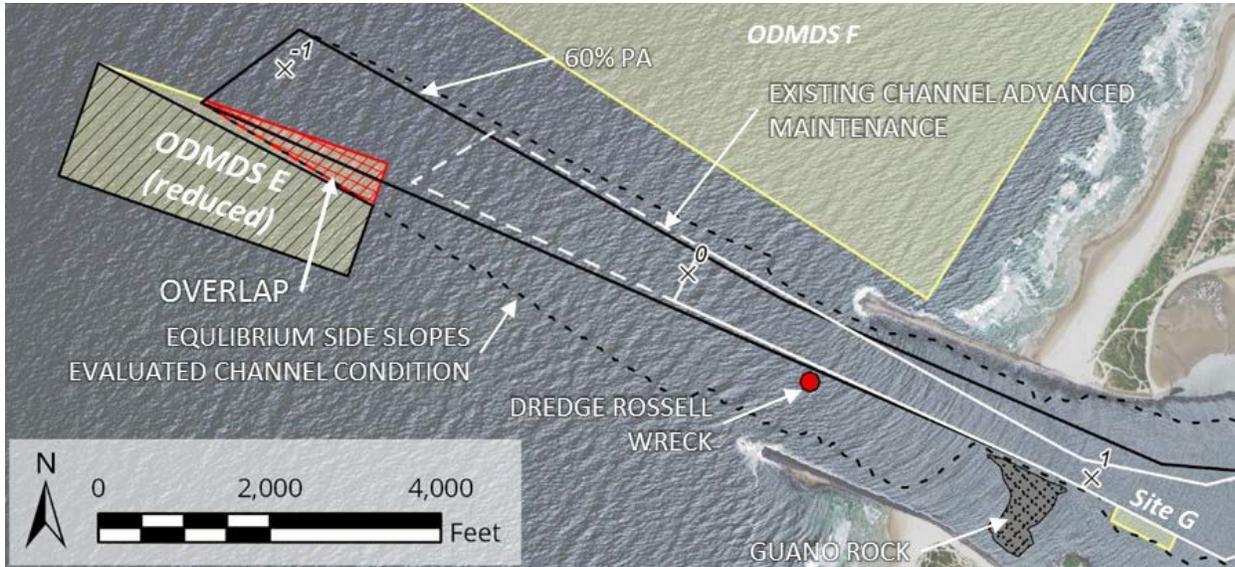
The third alternative - partial overlap with ODMDS E - was considered as an acceptable tradeoff to minimize impacts to the North Jetty, while still providing an approach channel alignment with minimal required navigation maneuvers. Ultimately, it was decided that effects to the capacity of ODMDS E was less detrimental than impacts to the North Jetty or to navigation.

### **3.2 ODMDS E Overlap**

Figure 3-2 presents the locations of ODMDS E, the authorized Federal Navigation Channel (FNC), and the 2023 PA Plan. The offshore extent of the FNC and the 2023 PA Plan is defined by the location where the depth of the channel intersects the seafloor depth contour. The Entrance Channel depth of the 2023 PA, which was designed in accordance with EM 1110-2-1613, was determined to be 63 ft relative to MLLW (design depth of -57 ft MLLW with 6 ft AMD). Based on this depth, the channel extends to RM -1.0, where it intersects the existing seafloor contour.

Figure 3-2 also identifies the overlap between the proposed channel with ODMDS E. This overlap is approximately 200 ft by 1,480 ft (6.8 ac), compared to the total size of ODMDS E which is 1,400 ft by 3,600 ft (116 ac). The overlap of the 2023 PA channel with the ODMDS E footprint encompasses approximately 6 percent of the site. Accounting for potential side slope equilibration (and using a 16:1 Horizontal: Vertical slope associated with the Evaluated Channel Condition), the overlap increases to an area of 14.5 ac, or 12.5 percent of the total ODMDS E area.

Figure 3-2 also shows a reduced footprint of ODMDS E so that emergency placement of material at ODMDS E could continue as needed under the 2023 PA Plan. The reduced footprint has an area of 93 acres. The orientation was selected to maintain the long axis of the site, which is a preferred orientation. Meetings with USACE technical staff have indicated that disposal vessels place sediment via long, shore- perpendicular tracks such as that maintained by the reduced ODMDS E footprint. The expected overlap with ODMDS E and the area of the reduced ODMDS E for the 2023 PA are presented in Table 3-1.



**Figure 3-2**  
**Location of Existing FNC and Proposed (2023 PA) Navigation Channel, ODMDS F, ODMDS E, and Site G**

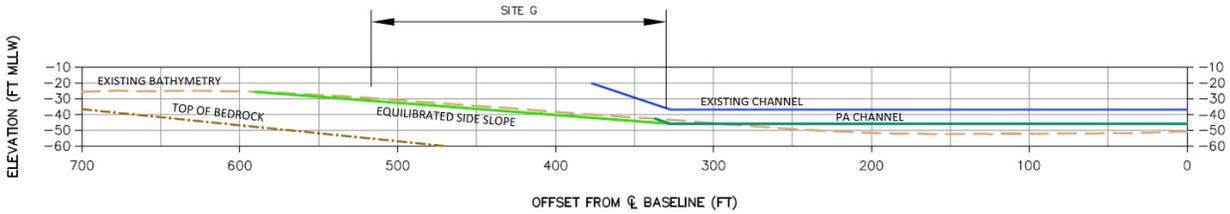
**Table 3-1**  
**ODMDS E Overlap and Reduced Site Area for With-project Conditions**

Condition	Overlap (ac)	Site Area (ac)
Existing Condition	N/A	116
2023 PA	14.5	93

### 3.3 Site G Deepening

The 2023 PA Plan navigation channel is adjacent to Site G (the same as the Existing Condition). After dredging, side slope equilibration may mobilize the material underlying Site G, causing the site to deepen and increasing the volume of Site G by the amount of material that is mobilized. As noted in Sub-appendix 6, *Channel Side Slope Analysis*, the equilibrium side slope along this edge of the channel has a grade of 13:1 (Evaluated Channel Condition). Figure 3-2 shows that side slope equilibration may deepen the entire area of Site G.

Cross-sections through Site G are presented in Sub-appendix 13, Stations 1+05+00 through 1+12+00. Site G is located on a sloped surface with its right (north) boundary at the toe of the existing channel. A typical cross section at Site G can be seen in Figure 3-3. As this figure shows, Site G is presently located on a sloped surface adjacent to and below the toe of the existing channel. The bathymetry along the majority of the channel is naturally deeper than the 2023 PA channel, and the thalweg has a depth of -55 ft MLLW. Under the 2023 PA, the location of the channel does not change; Site G will still be located at the toe of the channel. After dredging the deeper channel, the side slopes in the area of Site G will equilibrate. Site G is ultimately located on these equilibrated slopes, which have the same angle as the existing bathymetry. As a result, the effect of dredging is to deepen Site G by up to five ft on the side slopes.



**Figure 3-3**  
**Typical Cross Section at Site G**

**3.4 Projected Coarse Grained Disposal Volumes**

The jetty and channel modifications are expected to result in changes to the annual shoaling patterns within the channel. Changes to shoaling patterns in the Entrance Channel are described in Sub-appendix 4, *Offshore and Ocean Entrance Dynamics*, and changes to shoaling patterns in the inner channel are described by Sub-appendix 3, *Estuarine Dynamics*. The projected increase in shoaling, and the resultant estimate for material disposal, can be seen in Table 3-2. It should be noted that the “Existing Condition” placement volume only refers to ODMDS F, as this site is the only site that is regularly used for placement (ODMDS E is only used in emergency situations and has only been used once since 1990).

**Table 3-2**  
**Increase in Average Annual Sediment Dredge Volumes**

Description	Existing Condition	2023 PA
Dredge Volumes (cy/yr)	832,000	1,166,000
Increase over Existing Condition (cy/yr)	N/A	334,000

#### 4. SEDIMENT DISPERSAL AT ODMDS E AND F

This section presents a review of available dredging records and historic bathymetry offshore of the Coos Bay Entrance Channel, and their implications for the rate at which sediment disperses from ODMDS E and F and the direction in which it travels.

USACE has conducted single-beam bathymetric surveys at the disposal site since 1990. A review of long-term bathymetric changes in ODMDS F based on the surveys provided by the USACE was performed. Table 4-1 lists the bathymetric surveys used in the analysis and their respective coverage areas. Surveys were grouped together in the analysis by coverage area.

**Table 4-1  
List of Available Bathymetric Surveys by Coverage Area**

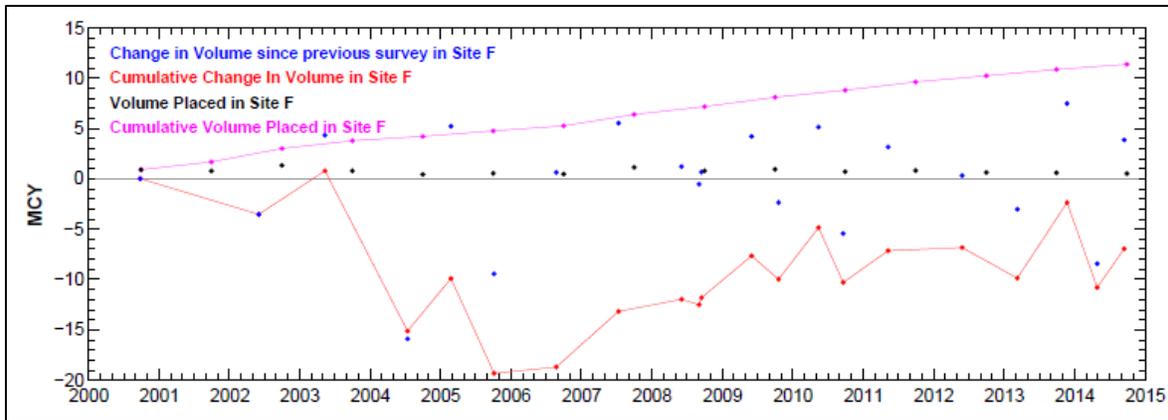
Coverage on Either Side of Inlet Including ODMDS F	Expanded (1989) ODMDS F	Present ODMDS F	Present ODMDS F – Nearshore Only	Present ODMDS F – Offshore Only	ODMDS E	Other
Aug. 1992	June 1990	Sep. 2000	Sep. 1999	Apr. 1998	July 1985	Aug. 1999
July 1993	May 1993	June 2002	July 2004	Sep. 1999	Sep. 1986	Aug. 2002
July 1994	Sep. 1993	Feb. 2003	Sep. 2008		May 1987	Oct. 2002
Aug. 2000	May 1996	May 2003			Dec. 1988	
July 2004	Oct. 1998	July 2004			Apr. 1989	
Aug. 2005	Sep. 1999	Feb. 2005			May 1990	
Oct. 2006	Feb. 2003	Oct. 2005			May 1992	
Sep. 2007	May 2006	Aug. 2006			May 1993	
Aug. 2008		July 2007			Oct. 1995	
June 2009		June 2008			May 1998	
Aug. 2010		Sep. 2008			June 1999	
Aug. 2011		June 2009			Sep. 2000	
Aug. 2012		Oct. 2009			July 2005	
July 2013		May 2010			Feb. 2006	
June 2014		Sep. 2010			July 2007	
		May 2011			July 2008	
		May 2012			June 2009	
		Mar. 2013			May 2010	
		Nov. 2013			May 2011	
		Apr. 2014			June 2012	
		Sep. 2014			June 2013	
					Sep. 2014	
					May 2015	

## 4.1 Overall Dispersal Capacity of ODMDS F

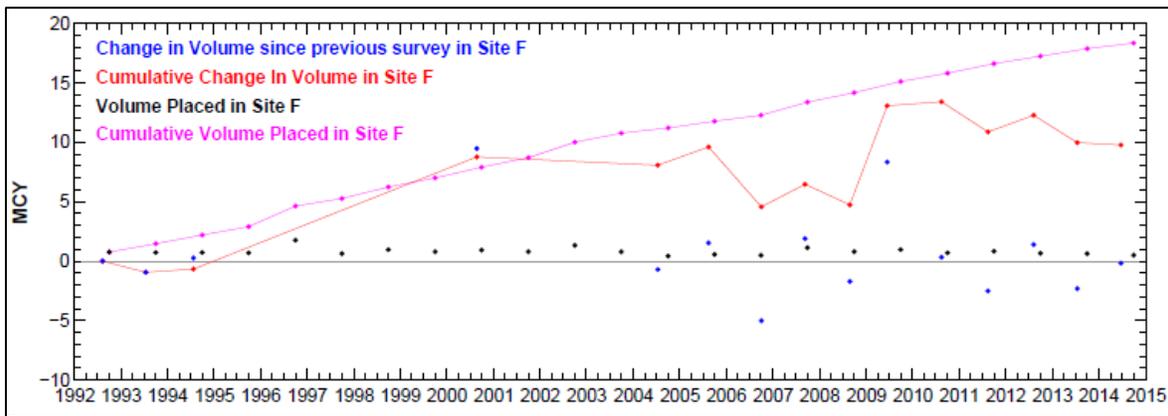
The data from the single-beam transects for each survey were interpolated using triangular interpolation onto a grid covering the entire ODMDS F. The interpolated data from the different surveys were then compared to compute the estimated sediment volume change within ODMDS F over time. Figure 4-1 shows the cumulative change in sediment volume over the present ODMDS F calculated from all the surveys with ODMDS F coverage only (condition surveys; third column of Table 4-1), along with the volume placed in ODMDS F over time, details of which are presented in Table 2-3. The first conclusion from this data set alone would be that, despite placement of material in the ODMDS, dispersal of material means that the capacity is increasing over the long-term. Secondly, the year-to-year changes in volume can be a much greater magnitude than the annual volume of placed material. There is also a large variability in the sign (positive indicating accretion and negative indicating erosion). This indicates that the surveys may have too much uncertainty for year-to-year comparisons, and may only be valid over a longer time period, when these inter-annual changes can average out.

Using the surveys with coverage beyond ODMDS F (approach surveys, first column of Table 4-1) and computing the volume changes within ODMDS F, a similar plot of the evolution in volumes over time is shown in Figure 4-2. Figure 4-2 shows a large increase in sediment volume from 1994 to 2000, and only a small net increase since. Similar to Figure 4-1, there is again a large inter-annual variability in volume change at the site. A comparison of Figure 4-1 and Figure 4-2 shows the long-term potential of the site to move sediments from ODMDS F to the surrounding areas.

The difficulty of estimating the cumulative volume change over ODMDS F using the available bathymetric surveys is clearly illustrated by the large differences between the results obtained when these volumes are computed from datasets collected for different purposes and with different coverages, as in Figure 4-1 and Figure 4-2. For instance, the cumulative volume change between August 2000 and June 2014 is +1 mcy based on Figure 4-2, and the change over the same area between September 2000 and September 2014 is -6.95 mcy based on Figure 4-1. One possible explanation for this divergence is the uncertainty in the data, which could lead to large volume differences. Another possible explanation is the occurrence of large seasonal changes in the volume of sediment that could dwarf any change over the long term. In this particular case, the signal-to-noise ratio of the bathymetric changes is low, meaning, as mentioned before, that the signal representing the volume placed is generally too small compared to the variability in volume changes associated with other factors. Because of this, the results of the analysis likely indicate that the bathymetry is in a dynamic long-term equilibrium at the site and has not been significantly affected by the annual placement.



**Figure 4-1**  
**Comparison of Volume Changes Over Present ODMS F (from surveys with ODMS F coverage only) With Reported Volumes Placed in ODMS F**

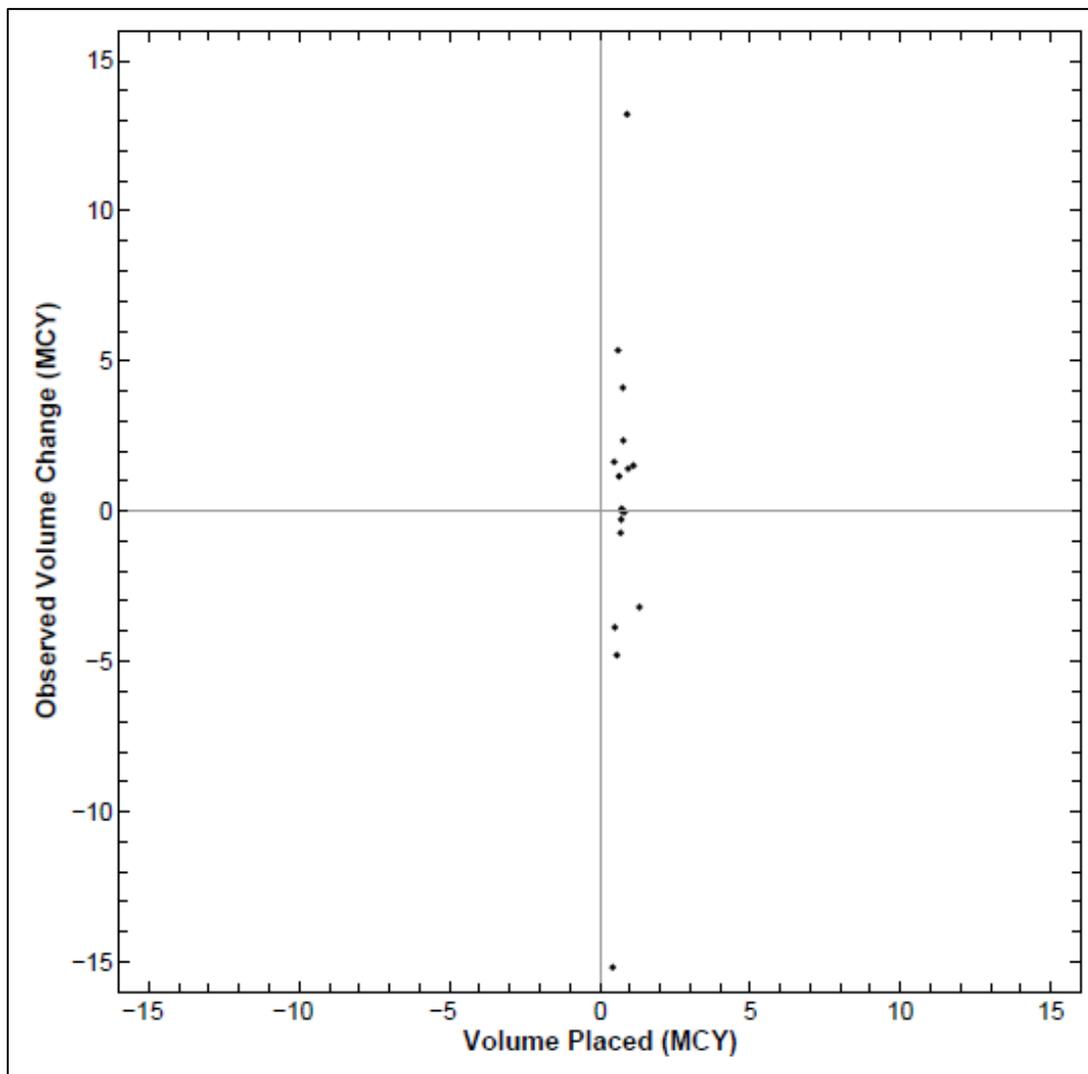


**Figure 4-2**  
**Comparison of Volume Changes Over Present ODMS F (from surveys with coverage beyond ODMS F) With Volumes Placed in ODMS F**

Delineating the processes leading to the large sediment accumulation from 1994 to 2000 is limited by the unavailability of survey data between those years and by lack of information regarding a specific process during that period that could be responsible for the large change identified by the bathymetric comparison. However, as explained further below, it is difficult to associate this change with the volume placed between those years. Possible causes for this observed change include the result of the strong 1997–1998 El Niño,<sup>1</sup> other large meteorological events, or a discrepancy or bias in the survey data. Other studies have also pointed to a large inter-annual variability in the beach profiles at the Oregon coast (Komar 1992) and an intra-annual variability in the mean sea level (MSL) that is exacerbated during periods of El Niño events (Ruggiero et al. 2012), which might contribute to the large variability among surveys if this effect is not correctly considered during data collection and comparison of the surveys.

<sup>1</sup> It has been reported by Komar (1992) and others that during strong El Niño years, both wave direction and magnitude change from the typical year, which could produce different sediment transport regimes in some areas of the Oregon coast.

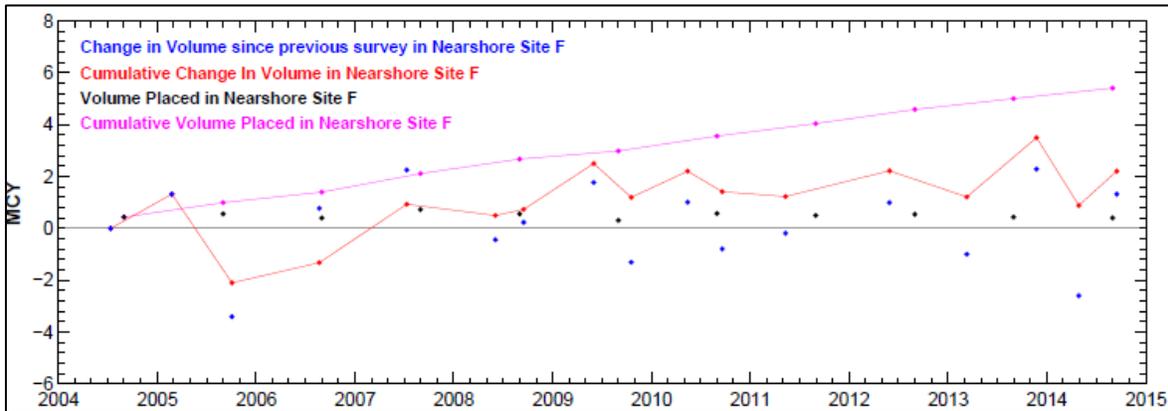
To help understand how the volume of sediments placed in ODMDS F might affect the observed change in volume over ODMDS F, a scatter plot of the observed annual change in volume against the volume placed in that year was created (Figure 4-3). It is obvious that there is no correlation between the quantity of sediment placed and the observed change in the overall site. As previously mentioned, it is also observed that the average magnitude of annual changes occurring at the site (3 to 4 mcy) is much larger than the average volume placed annually (approximately 0.8 mcy). This plot shows that the data on the y-axis (the observed volume change) shows no dependence on the data on the x-axis (the volume placed). This would indicate that placing material at ODMDS F does not impact the long-term capacity of the ODMDS. The USEPA SMMP states that for the existing placement rate, Site F has “virtually unlimited capacity,” however, an increased annual placement rate may exceed the annual dispersal rate of the site and reduce its lifespan. The 2019 DMMP suggests that the USACE pursue the option of using the Proposed North Spit Nearshore Littoral Placement Site post-construction as a supplemental placement site for future maintenance material.



**Figure 4-3**  
**Scatter Plot of Annual Volume Changes Over ODMDS F with Corresponding Volumes Placed in ODMDS F**

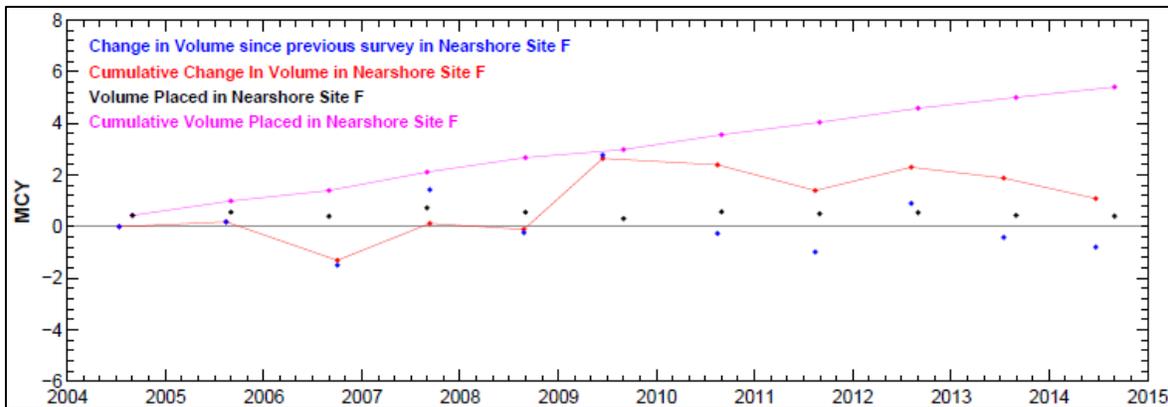
**4.2 Dispersal Capacity of ODMDS F Nearshore**

Records of annual volumes placed in the nearshore part of ODMDS F are available since 2004. Figure 4-4 shows the comparison of the cumulative placement volume with the volume change over the same area computed using the surveys with ODMDS F coverage only (condition surveys).



**Figure 4-4**  
**Comparison of Volume Change Over Nearshore ODMDS F (from surveys with ODMDS F coverage only) With Volume Placed in Nearshore ODMDS F**

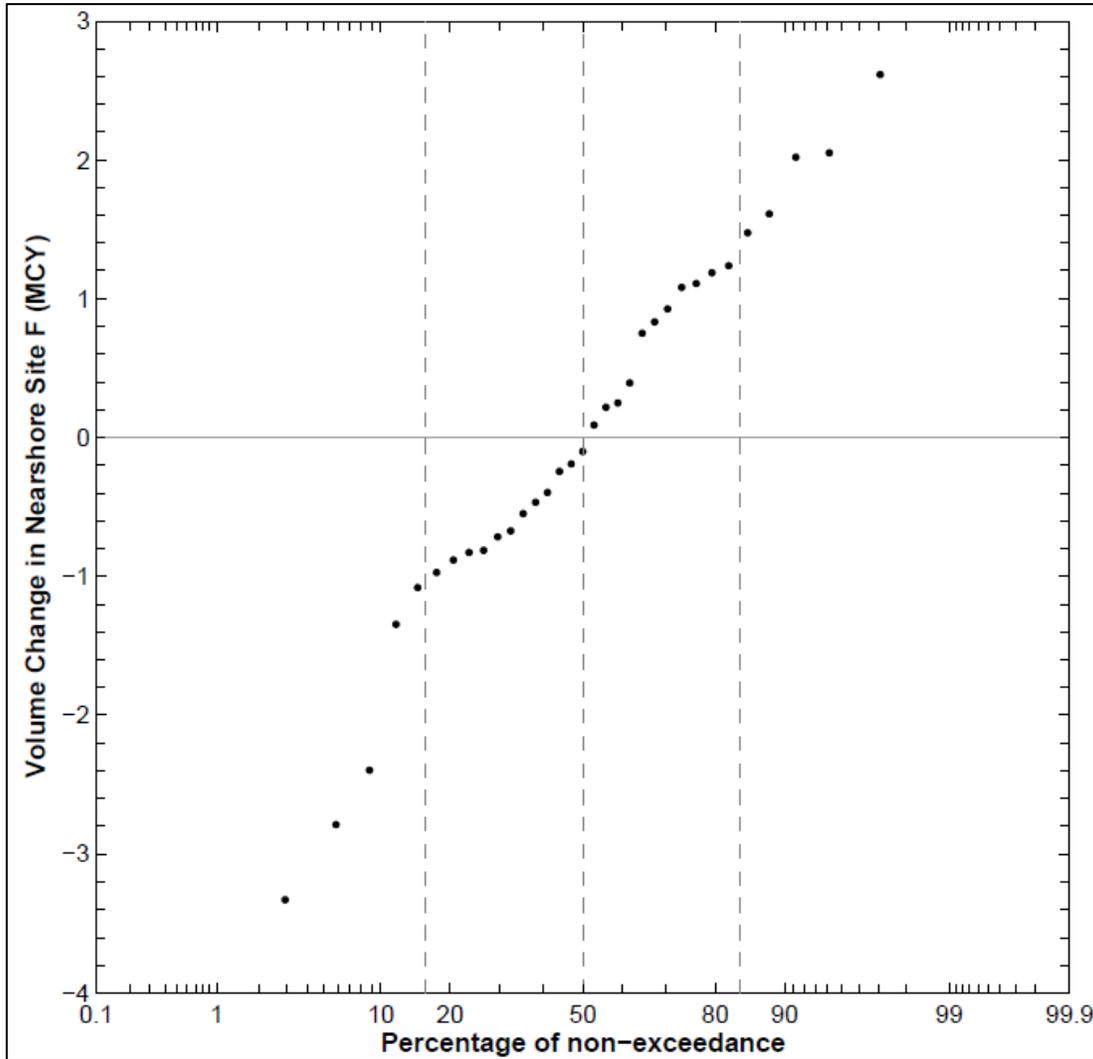
Figure 4-5 shows a similar comparison, but with volume changes computed based on the surveys with coverage beyond ODMDS F (approach surveys). Both figures show a relatively small net accumulation of about 1 to 2 mcy of sediments over 10 years, which is still within the range of annual variability of sediment volume in the site.



**Figure 4-5**  
**Comparison of Volume Change Over Nearshore ODMDS F (from surveys with coverage beyond ODMDS F) With Volume Placed in Nearshore ODMDS F**

The probability distribution of historical volume changes over a 20-year period computed at this site is shown in Figure 4-6. The probability distribution provides an indication of the variability in

the data and the mean trends in the data. The interpretation of the probability distribution indicates that the total sediment volume in this site has remained unchanged on average (mean and median values of the distribution are practically zero), and the observed inter-annual or inter-seasonal changes typically have ranged from -1 to 1 mcy (standard deviation of the distribution).



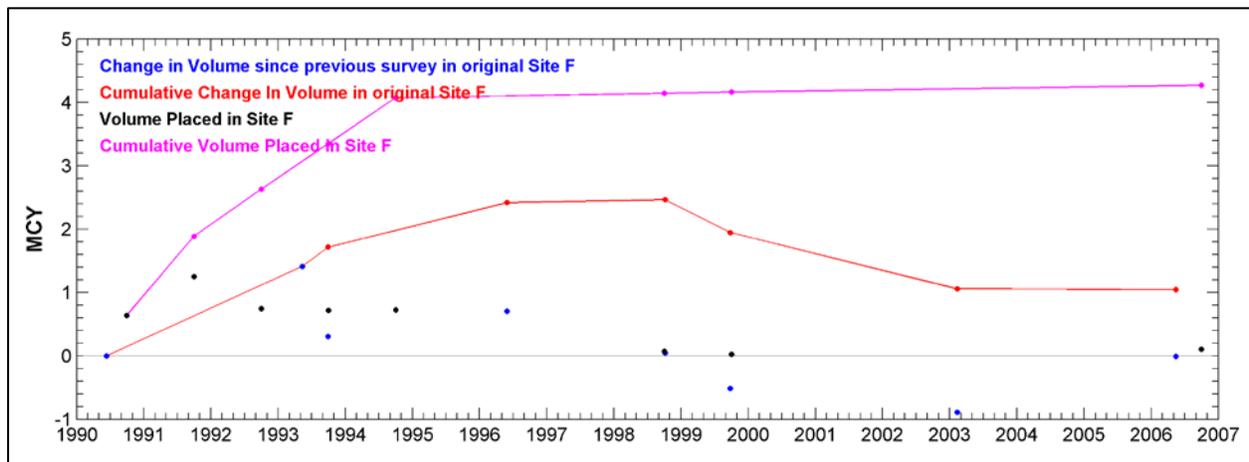
**Figure 4-6**  
**Cumulative Probability Distribution of Observed Volume Changes in the Nearshore ODMDS F**

The conclusion that the total volume in ODMDS F nearshore has been stable indicates that the existing practices have not caused accumulation within the ODMDS. This is a result of the volumes placed within the ODMDS and management practice (i.e., the dump plans) used by USACE to guide dredged material placement. During this period, the average placement volume into ODMDS F Nearshore has been 492,000 cy, ranging from 312,000 cy to 723,000 cy (Table 2-4). The standard deviation is 122,000 cy. Therefore, it is expected that continuing to place 370,000-613,000 cy/yr, distributed evenly throughout the site, should not lead to significant mounding or other adverse effects to navigation.

### 4.3 Dispersal Capacity of ODMDS F Offshore

The expanded ODMDS F (1989) was used for disposal from 1989 to 1994, but has received relatively limited use since, making it an ideal subject for a case study to understand the dispersal over time of a sediment mound dumped offshore. Bathymetric surveys for this site, from the earliest in 1990 to the latest in 2006, were used to estimate volume changes over the site. The results, shown in Figure 4-7, indicate steady accumulation over the duration of sediment disposal; the site initially retained up to 50 percent of the sediments disposed. From 1991 to 1996 (no surveys occurred during 1994 or 1995), about 2 mcy of the volume disposed between 1991 and 1994 left the site – this corresponds to a dispersion rate of 400,000 cy/yr. From 1999 to 2003, 1.4 mcy of the 2.4 mcy accumulated at the site were dispersed. This translates to an average dispersal rate of 13.5 percent per year, a rate that decreases over time if no new material is deposited. The recovery plateaued around 2003, and the site retained approximately 1 mcy, or about 40 percent, of the accumulated sediments.

These results could be used as guidelines for anticipating the expected volume accumulation post-disposal and the dispersal rate after a disposal site is no longer in use. The guidelines would be applicable to material dumped at the northern half of the site, closer to the northern boundary of ODMDS F, where the sediment will disperse outside of the bounds at a dispersion rate similar to that observed at the smaller original ODMDS F area.



**Figure 4-7**  
**Evolution of the Expanded ODMDS F (1989) Over Time**

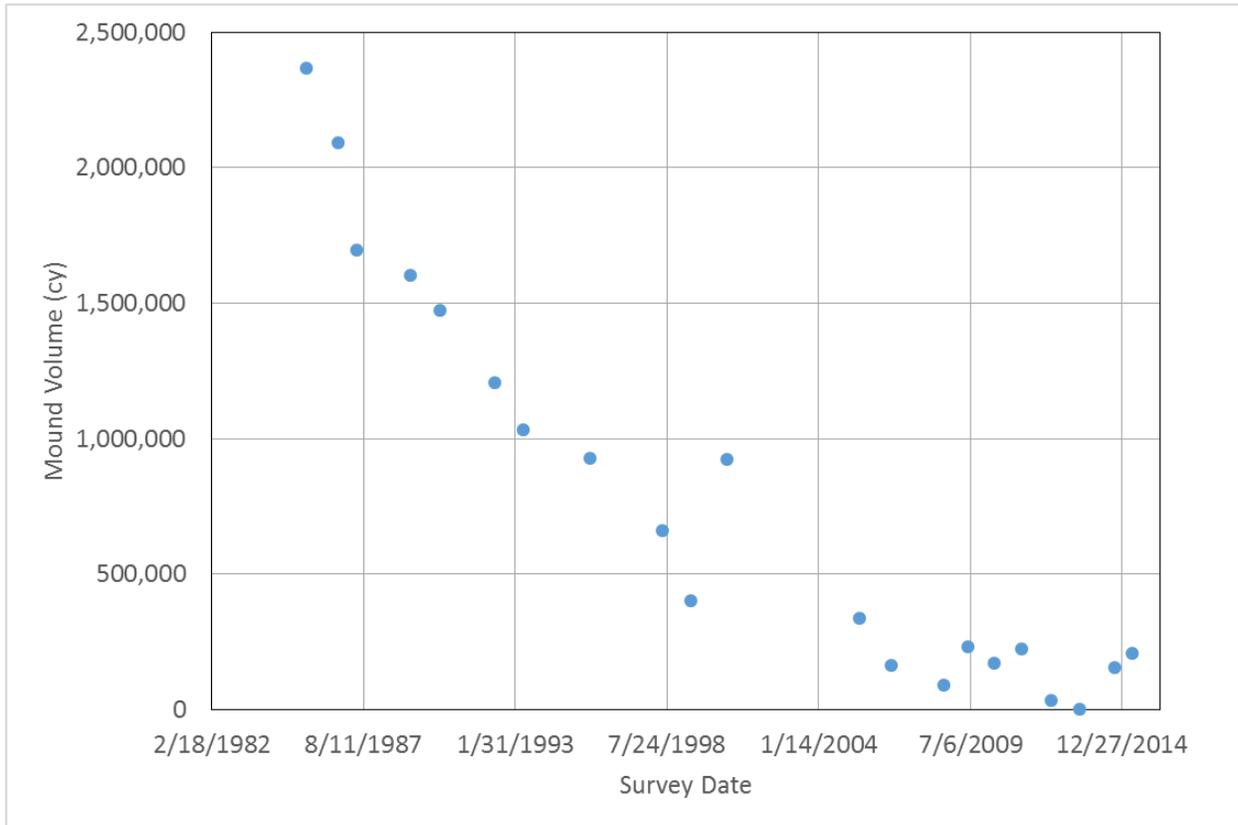
### 4.4 Dispersal Capacity of ODMDS E

Surveys that encompass ODMDS E are listed in Table 4-1. The exact coverage changed from year to year, but generally included the entirety of the site (with limited coverage outside of the site boundaries). Each survey was digitized and used to determine the rate at which sediment disperses from ODMDS E.

Bathymetric monitoring of ODMDS E in July 1982 indicated mounding of dredged material to depths less than 48 ft MLLW (survey not provided – information provided by USACE 2012b). By 1986, the top of the mound had reached a depth of 42 ft MLLW. Subsequent surveys, listed above, provide sufficient temporal coverage to estimate the volume and location of the mound on a year-

to-year basis. To analyze the development of the mound, the survey that showed the deepest bathymetry/lowest volume (6/13/2013) was selected as the baseline.

For each year, the mound volume was calculated as the difference in volume between the historic surveys and the baseline (2013) survey. Only the area within 50 ft inside of the ODMDS E boundary was considered (i.e., the area considered is slightly less than the entire ODMDS E area) to reduce the effects of interpolation at the boundary of ODMDS E. The mound volume for each survey date can be seen in Figure 4-8. As this figure shows, the mound volume appears to decay exponentially. The figure also shows that the volume of the “stable” mound varies. As noted above, USACE noted that the mound has been stable since 2006; between 2006 and 2015, the volumes at ODMDS E varied by nearly 250,000 cy (note that this may be an indication of uncertainty in the surveys).



**Figure 4-8**  
**ODMDS E Mound Volume Relative to 2013 Bathymetry**

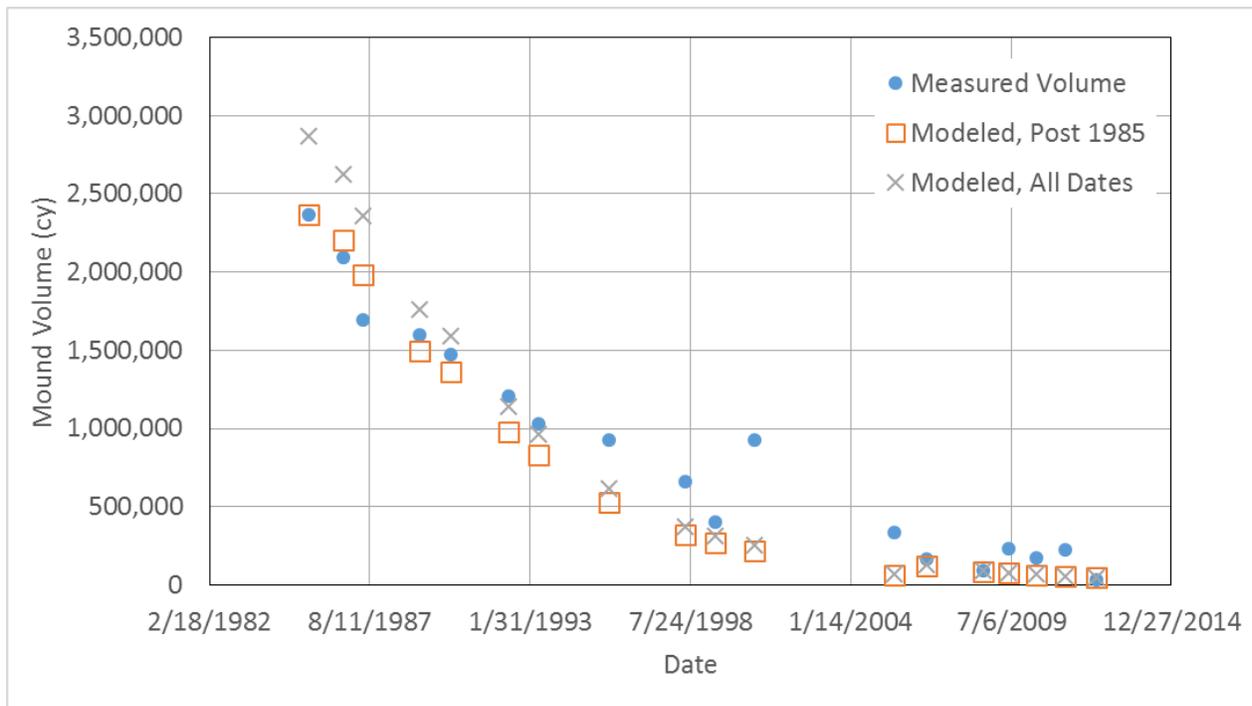
The equation below was used to examine whether exponential decay reasonably predicts changes in mound volumes. A year-to-year calculation simulating this process by adding placement volume (Table 2-3) each year and allowing the mound to dissipate at a rate proportional to the total volume. For each period between surveys, the change in volume is calculated to be:

$$dV = V_{placement} - k \times V \times t$$

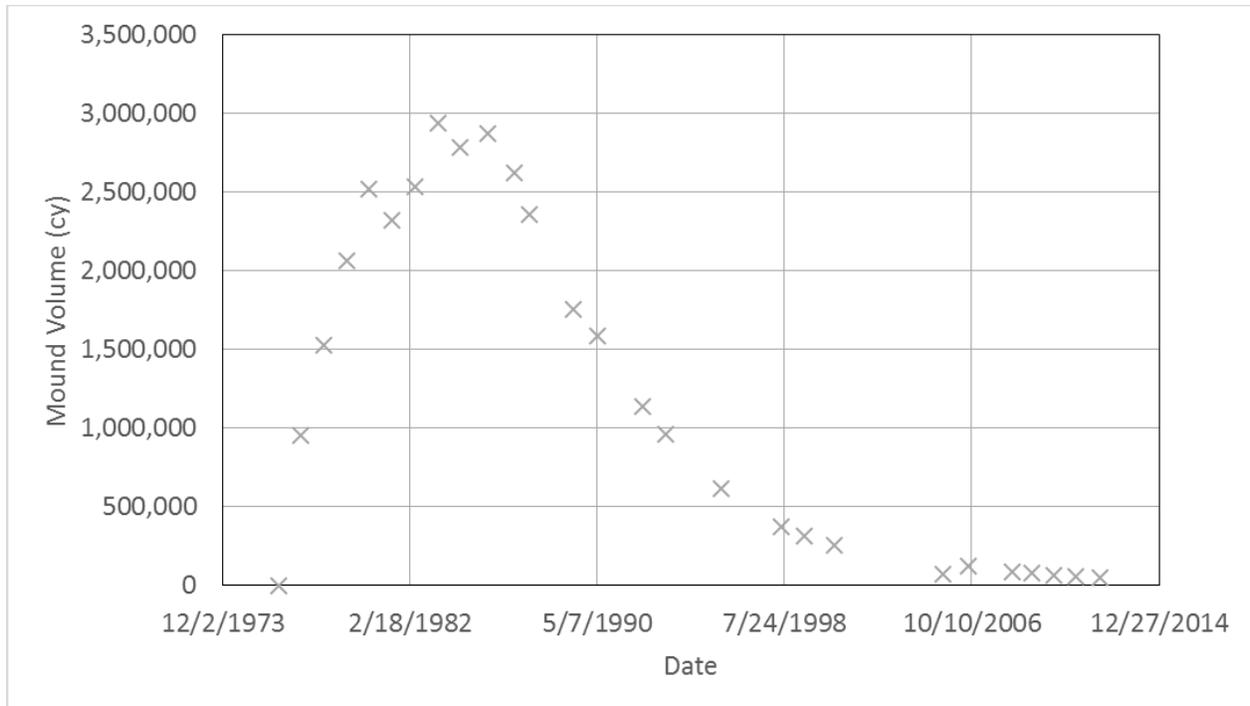
Where V is the mound volume [cy],  $V_{placement}$  is the volume of sediment placement that occurred between adjacent surveys [cy], t is the time between surveys [days], and k is the decay constant [ $days^{-1}$ ]. A wide range of k values were tested for both periods; for each value, an adjusted  $R^2$

value was calculated by comparing the difference between the measured and the expected mound volume. A k value of 0.00041/days was selected.

The hypothesis that the mound volumes decay exponentially was tested from 1985-2012, corresponding to the dates for which survey data was available. Figure 4-9 shows the measured ODMDS E volume in blue circles, versus the volume calculated using exponential decay (orange squares and grey x's). The orange squares are based on the initial (1985) measured volume, while the grey x's simulate the entire life of the site (starting from an initial volume of 0 in 1976). This yielded an adjusted R<sup>2</sup> value of 0.95 and 0.92 for the orange squares and grey x's, respectively. Thus, this value results in a good fit between measured and calculated mound volumes. Figure 4-10 shows the entire record of volumes calculated for the grey x's.



**Figure 4-9**  
**Comparison of Measured and Modeled Mound Volumes, 1985-2012**



**Figure 4-10**  
**Modeled Mound Volume, 1976-2012**

Using the modeled relationship, the formation and dispersal of the mound was modeled; Figure 4-10 shows the mound volume from 1976, when the site was first used, through 2012. As this figure shows, the mound volume increased steeply as placement started, reached a peak volume just under 3 mcy from 1983 – 1985, and then began to dissipate volume. From the context of placement, the timing of this peak is reasonable. From 1976 through 1982, the average annual placement volume was 790,000 cy. After 1982, the annual placement volume did not reach that value (Table 2-3).

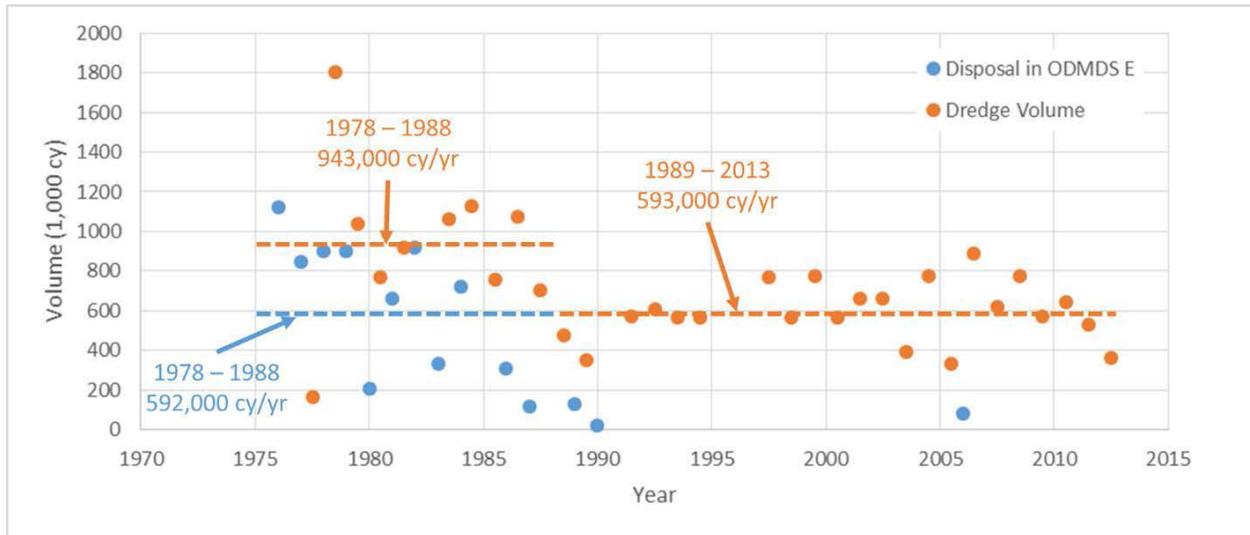
Ultimately, the exponential decay model of mound volume at ODMDS E performed relatively well compared to measured volume and provides insight to the behavior of the mound before survey data is available (pre-1985). This relationship can be used to approximate how future placement of material may behave.

#### 4.4.1 Fate of Material Placed in ODMDS E

Historic data describing sediment placement and dredging records were compared to determine whether use of ODMDS E affects dredging within the Entrance Channel; the comparison is plotted in Figure 4-11. As this figure shows, the average volume of placement is ODMDS E from 1978 to 1988 was 592,000 cy/yr; during this time, the average entrance channel dredge volume was 943,000 cy/yr. After placement into ODMDS E was restricted, the average channel dredge volume fell to 593,000 cy/yr. In addition, it should also be noted that the largest dredge event during the 1989-2013 period occurred in 2007, immediately following the 2006 placement in ODMDS E.

After placement in ODMDS E ceased, the average dredging rate decreased by 350,000 cy/yr; this volume represents 60 percent of the material placed in ODMDS E. This is consistent with the

longshore transport finding above that 60 percent of the material placed in ODMDS E travels north; ultimately, this northward-bound sediment is deposited in the entrance channel.



**Figure 4-11**  
**Comparison of Placement in ODMDS E and Entrance Channel Dredging**

The conclusion that 60 percent of the material placed in ODMDS E is recycled into the channel suggests that ODMDS E may not represent an efficient or effective disposal location. In addition to the stated concern with mounding (USACE 2012b, 2015), using ODMDS E results in increased dredging. The annual placement volumes of 72,000 and 58,000 cy under the existing condition and 2023 PA (as stated above) may increase shoaling by 43,000 and 35,000 cy, respectively.

At first, it may seem counter-intuitive that up to 60 percent of the material placed in ODMDS E is transported into the channel, even though the material has been observed to spread out radially. This discrepancy is explained by the time of placement into ODMDS E and the seasonal wave climate. Material is typically placed during September/October when waves generally approach Coos Bay from the west. Immediately after placement, the wave climate can move sediment towards the channel. The sediment that is noted to spread out radially from the ODMDS may represent the 40 percent of sediment that is not transported into the navigation channel.

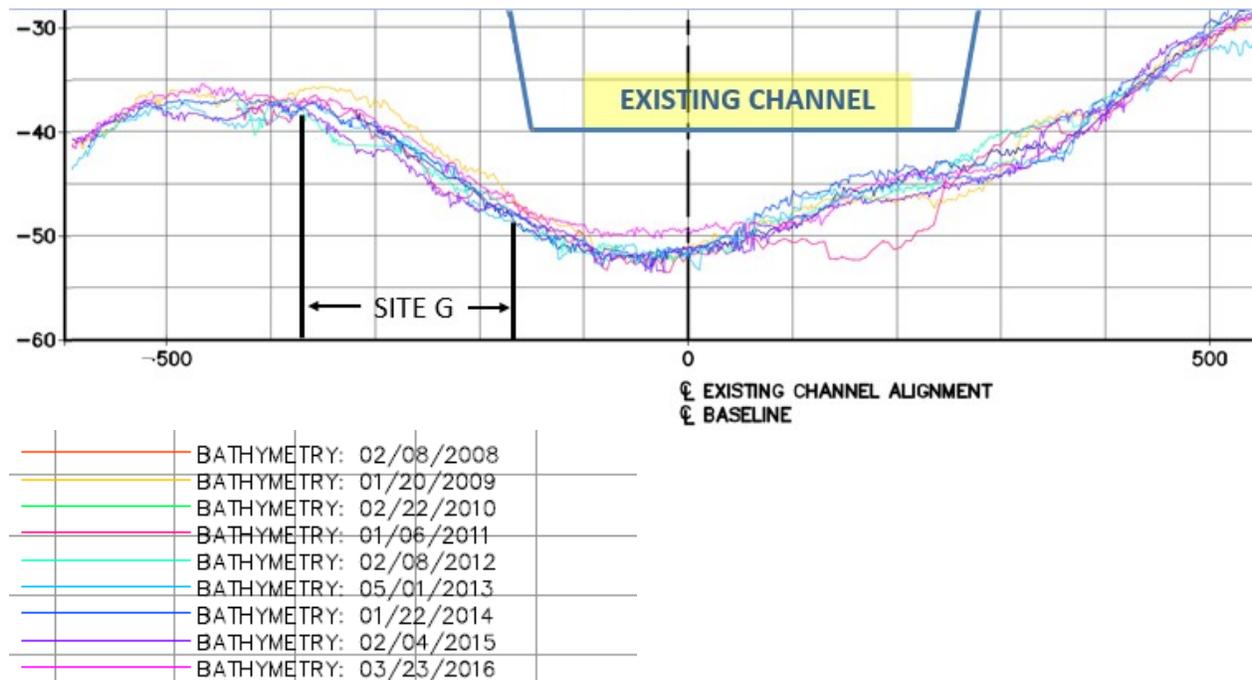
As noted by USACE (2015b), the bathymetry in the vicinity of ODMDS E has been relatively stable since 2006. This is also reflected by the existing ODMDS E volumes as presented in Figure 4-8 through Figure 4-10. Therefore, ODMDS E does not represent a significant source of sediment that would be mobilized in response to dredging of the 2023 PA. However, as Figure 4-11 shows, 60 percent of any sediment placed into ODMDS E may be transported into the existing or proposed channel.

#### 4.5 Dispersal at Site G

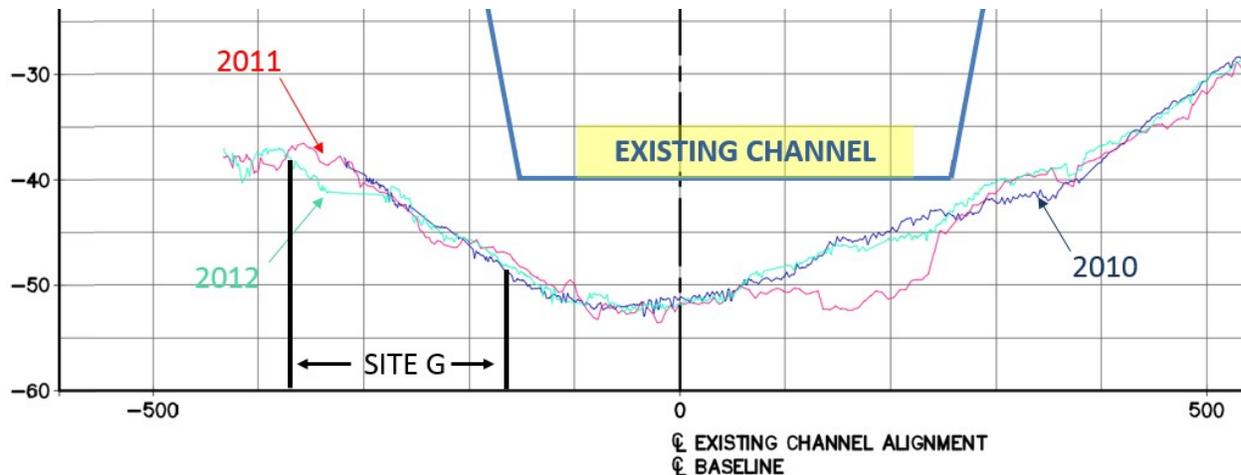
The dispersive nature Site G is confirmed through annual surveys plotted from USACE data. Figure 4-12 shows surveyed cross sections at Station 1+04+00 (just upstream of Site G) over 9 years (this is the only cross section for which multiple years of survey data are available). During this period, approximately 98,000 cy of material was placed at Site G. The cross sections do not

show any trend of sediment accumulation; sediment does not accumulate at Site G nor does it appear to slough to the bottom of the channel.

Figure 4-13 shows a plot for the same cross section, focusing on years 2010-2012. These three years were selected because they were years immediately preceding, and then following, placements of 9,146 cy via hopper, and 46,106 via pipeline in 2011 (Table 2-5). The figure does not show notable differences in the channel contours between 2010, 2011 or 2012, following disposal of 55,252 cy of material, the largest annual disposal volume in the period of record. This indicates that Site G has a dispersal capacity of at least 55,252 cy/yr. It should be noted that the existing channel centerline is offset from the 2023 PA channel alignment (denoted as x = 0) in Figure 4-12 and Figure 4-13.



**Figure 4-12**  
**Surveyed Cross Sections at Station 1+04+00, 2008-2016**

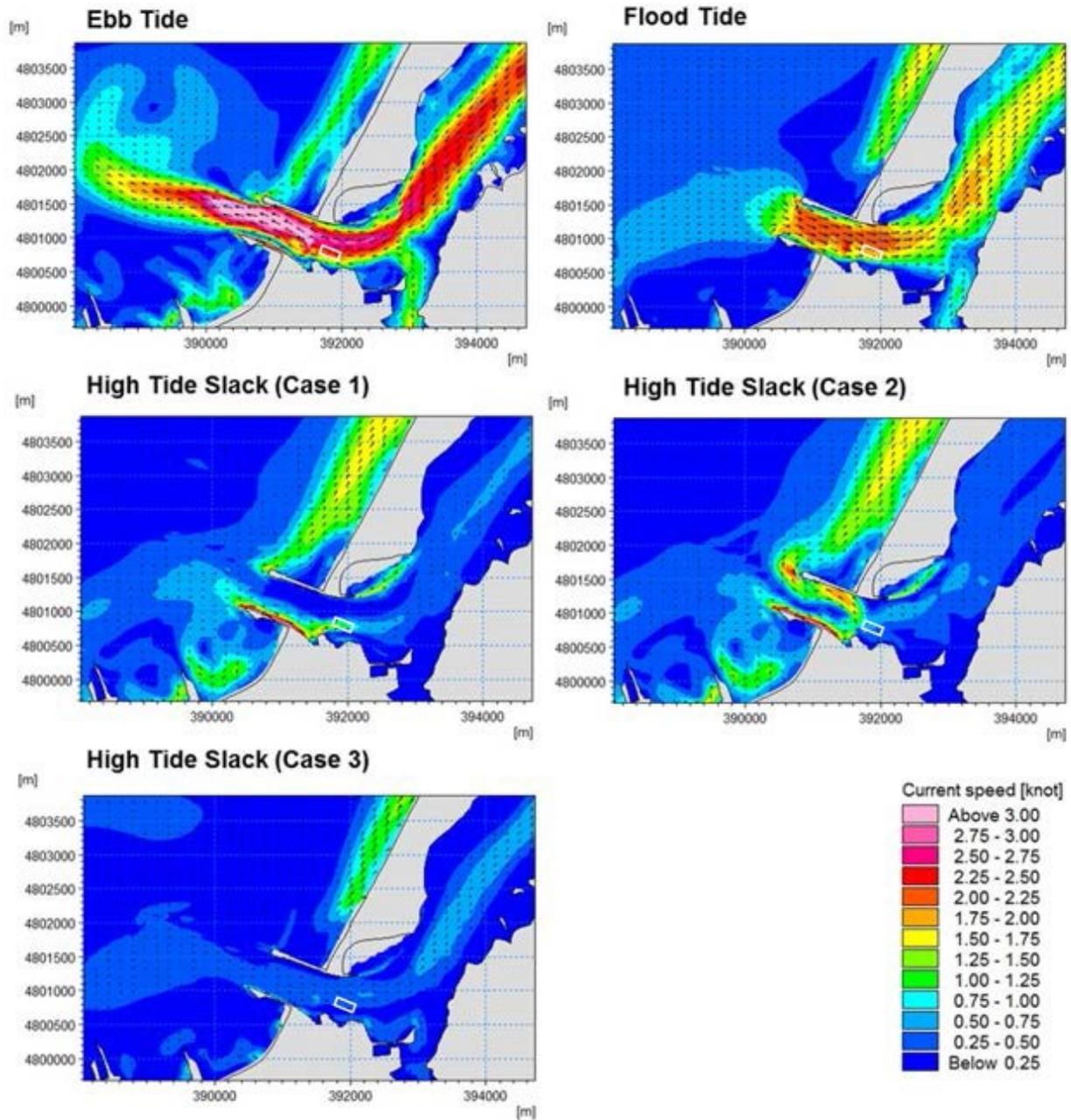


**Figure 4-13**  
**Surveyed Cross Sections at Station 1+04+00, 2010-2012**

The lack of sediment accumulation at Site G or in the deepest segment of the natural bathymetry is consistent with the general hydrodynamics of the area. The natural bathymetry of the Entrance Turn is between -50 ft MLLW and -55 ft MLLW deep. This is a self-scouring area where strong currents transport sediment elsewhere. Site G is ideally located on the outer bank of the turn, where current speeds are highest.

The fate of sediment placed in Site G can be estimated from velocity vector plots. Figure 4-14 shows that currents at Site G run parallel to the channel; therefore, sediment is dispersed offshore during ebb tides and into the Bay during flood tides. There are no cross currents pushing sediment from Site G into the channel.

Analysis of dredged material placement data (Table 2-5), pre- and post-placement bathymetry (Figure 4-12 and Figure 4-13), and current direction and velocities (Figure 4-14) supports the conclusion that Site G is dispersive for the volumes of material historically placed at the site and that the dispersed material does not settle laterally into the FNC.



**Figure 4-14**  
**Illustrative Entrance Currents through the Tidal Cycle, Multiple High Tide Slack**  
**Cases shown to Highlight Variability, WOP Condition (Site G outlined in White)**

## 5. ODMDS CAPACITY EVALUATION

This section presents an estimate of the existing and future capacity of ODMDS E and F. The volume capacity is based on the maximum volume of sediment that may be contained above the existing sea floor without impacts to navigation. The static capacity is based on wave field simulations using the MIKE-21 flexible mesh Spectral Wave (SW) model to assess wave field impacts and resulting effects on navigation due to ODMDS sea floor changes.

The annual capacity represents the volume that may be disposed of each year such that the static capacity is not exceeded within the project lifetime. It assumes that sediment is transported out of the ODMDS, as described in Section 4, and a 50-year project life.

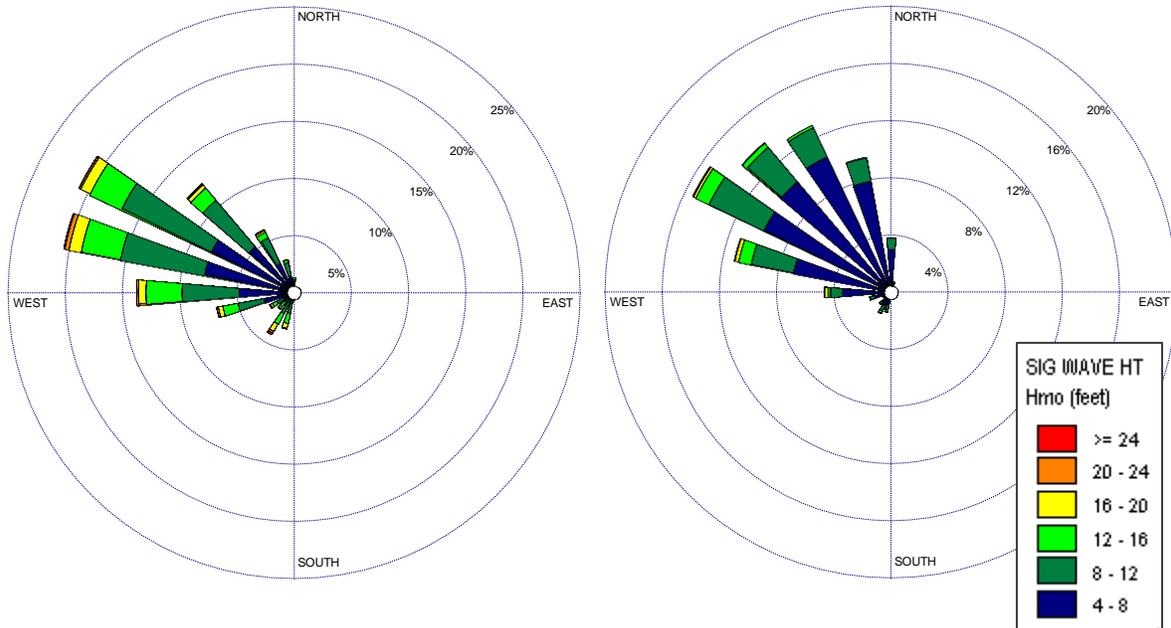
### 5.1 Evaluation of Wave Environment and Total ODMDS Volume

The static capacity of the ODMDS (without considering any dispersal of sediment) was determined based on how the sediment deposited in these areas affects the wave field near the ODMDS and in the navigation channel. Effects to the wave field were based on simulations using the MIKE-21 SW.

#### 5.1.1 Offshore Wave Climate

For this report, offshore conditions were based on wave data from National Data Buoy Center (NDBC) Buoy 46015 at Port Orford, located 50 mi south of Coos Bay. This buoy was selected because previous literature (USACE 2012a) indicated that it shows a wave climate similar to Coos Bay. Directional wave data from this buoy is available from May 2007 through December 2016. It should be noted that for other reports, wave modeling is based on offshore data at Coastal Data Information Program (CDIP) buoy 139p1. As Figures 2-14 through 2-17 of Sub-appendix 4, *Offshore and Ocean Entrance Dynamics*, show, all buoys from Port Orford through the Mouth of Columbia River show similar wave statistics.

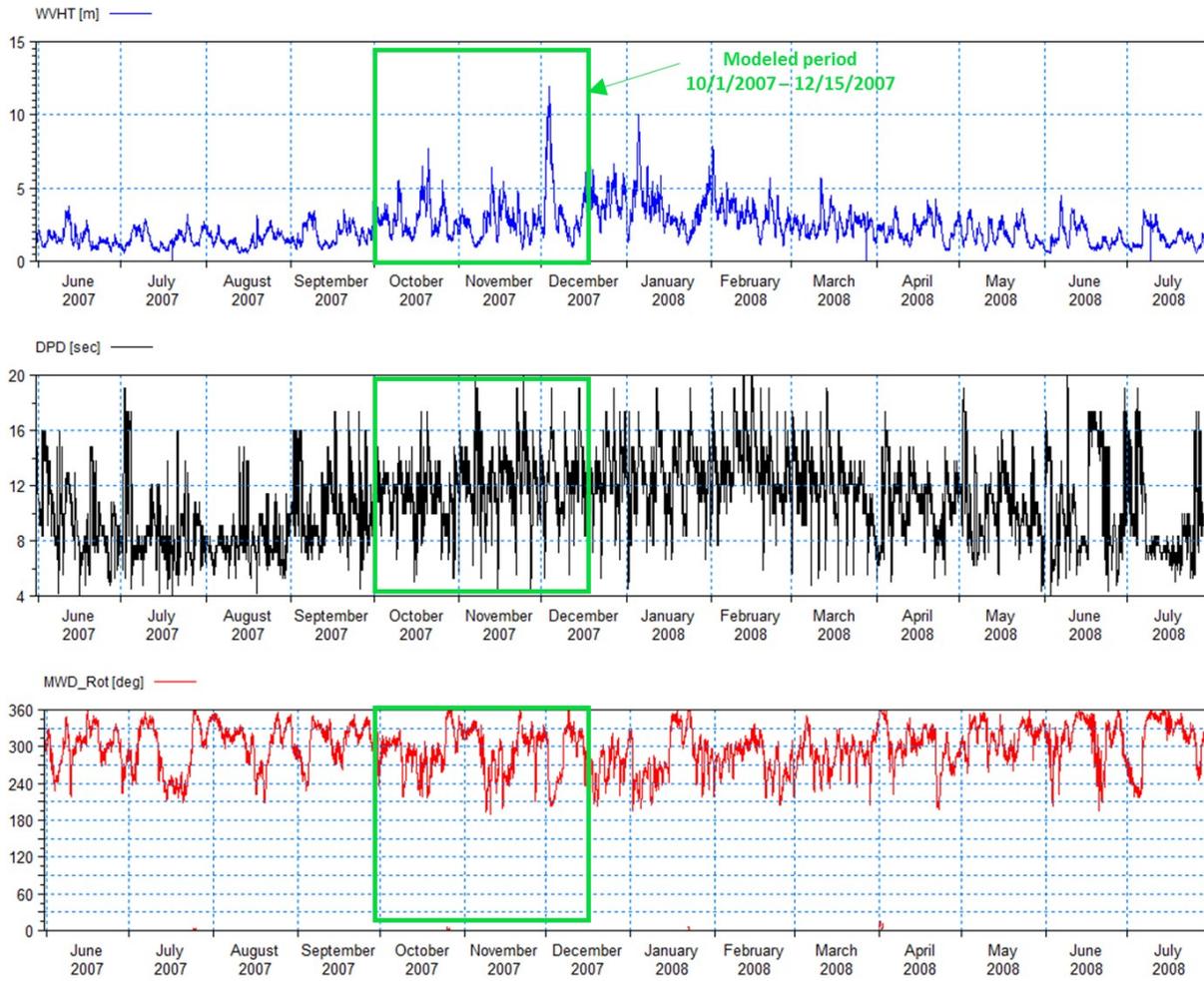
Figure 5-1 illustrates seasonal wave roses measured at Port Orford. Most offshore waves originate from a westerly and northwesterly direction (prevailing direction). Wave heights from the dominant directional sectors occur most frequently within the 1-4 m (3-13 ft) range. The winter storms have two directional peaks: the majority of waves approach from west to west-northwest, and there is a secondary peak from the southwest. The west to west-northwest waves are long period swell waves with periods on the order of 16 to 20 seconds generated by distant storms, while the southwest waves originate from nearby storms with periods generally less than 15 seconds. This southwest peak accounts for the highest storm waves. The maximum recorded wave height is 11.3 m (37.1 ft) from 270° (directly west) on December 10, 2015.



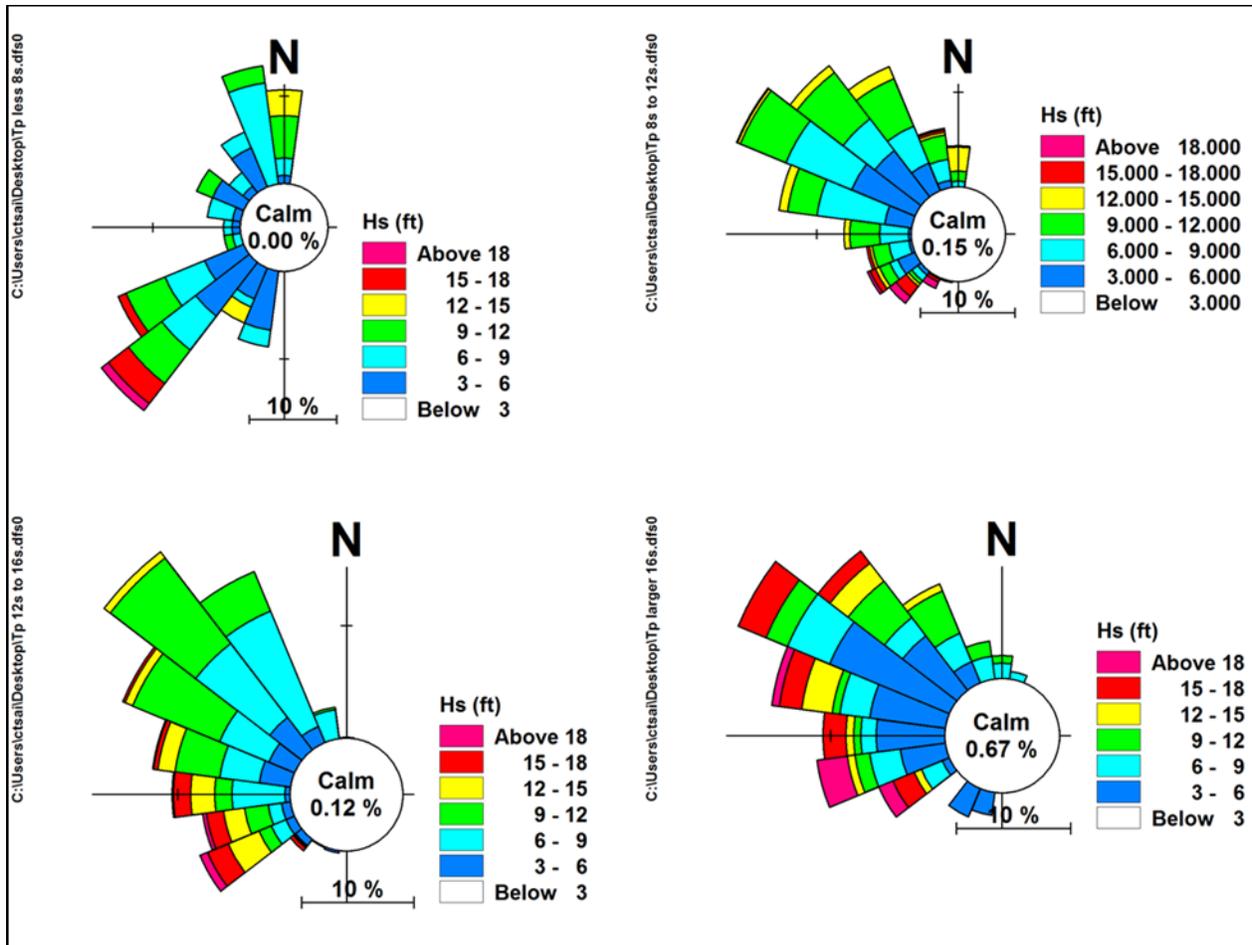
**Figure 5-1**  
**Seasonal Wave Roses for Buoy 46015, Port Orford, Left Rose: Winter, Right Rose: Summer**

At the Coos Bay inlet, the shoreline is oriented to the NW and the net drift is to the north. The nearshore part of ODMDS F is north of the North Jetty and is less susceptible to shoaling since this area was initially subject to erosion after jetty construction, until reaching its new equilibrium state. The direction of littoral drift also varies seasonally; during material placement in September and October (i.e., transition from summer to winter conditions), waves tend to approach more from the west. These waves drive northward sediment transport. Complete details of wave-driven longshore transport are presented in Sub-appendix 4, *Offshore and Ocean Entrance Dynamics*.

Wave data are input to the model based on measured wave data from October 1 through December 15, 2007; this data can be seen in Figure 5-2. Applicable wave roses for the period of analysis can be seen in Figure 5-3. This period of wave data was considered representative of the entire record of offshore wave data available from 2007 through 2016, both in terms of large storm conditions and normal rough weather navigation. Wave directions typically range from the southwest to the NW, and offshore wave heights typically range from 10 to 39 ft (3 to 12 m). Similarly, both long- and short-period waves were observed. All waves smaller than  $H_{m0} = 11.5$  ft were filtered out of this analysis (even though they are presented in the wave roses in Figure 5-3); such waves do not generally challenge navigation; therefore, a change in the nearshore behavior of these waves may not significantly impact the navigability of the channel.



**Figure 5-2**  
**Offshore Wave Conditions Simulated**



**Figure 5-3**  
**Wave Roses for the Variable Wave Periods: 10/1/07 Through 12/15/07 (NDBC 2013), Clockwise from top left:  $T_p > 8s$ ,  $8s < T_p < 12s$ ,  $12s < T_p < 16s$ ,  $T_p > 16s$**

The wave roses show that the majority of waves originate from WNW, while the majority of large storm waves approach from the west-southwest (WSW). This period of October to December 2007 featured a reasonable fraction of large swell waves from the southwest; the fraction of large waves from this direction in the entire record is smaller. Although this southwest swell component did exceed the average wave conditions, it represents a conservative condition that should be considered in the analysis. Local wind-generated waves within the model domain were not included because of the relatively short fetch.

### 5.1.2 Wave Modeling Near the ODMDS

The model used for this task is based on the MIKE-21 SW model that was developed and calibrated described in the North Jetty Major Maintenance Report (USACE 2012a). Note that the grid was updated for this study to provide additional resolution in the vicinity of ODMDS F and ODMDS E.

This model simulates the growth, decay, and transformation waves in coastal areas. For this application, wave data was applied to the offshore boundary of the model and propagated towards shore; the presence of mounded sediment causes wave shoaling and refraction as waves travel

across the ODMDS. Wave propagation is simulated on a two-dimensional (2D) grid (in x-y space) and output includes significant wave height (Hm0), wave period (Tp), and wave direction (Dp) throughout the grid. MIKE-21 SW is a time-dependent model that solves the governing equation at each grid location for each time step. A 0.3-second time step was used.

All modeling was based on an x-y grid projected to the coordinate system, Universal Transverse Mercator (UTM-10), and the vertical bathymetric coordinates were relative to the North American Vertical Datum of 1988 (NAVD88). All units were meters. The results have been converted to the MLLW datum, consistent with the other reports that comprise the Section 204/408 analysis.

The USACE criterion for navigation impact of waves in a channel indicates that navigation may be affected if a sediment disposal activity changes the incoming significant wave heights by more than 10 percent relative to a baseline condition. Therefore, the static capacity of a disposal site can be determined by simulating waves over mounded bathymetry and determining the mound volume that does not change incoming waves by more than 10 percent. The wave modeling is used to compute the following wave change ratio:

$$\frac{\text{significant wave height for mounded condition}}{\text{significant wave height for baseline condition}}$$

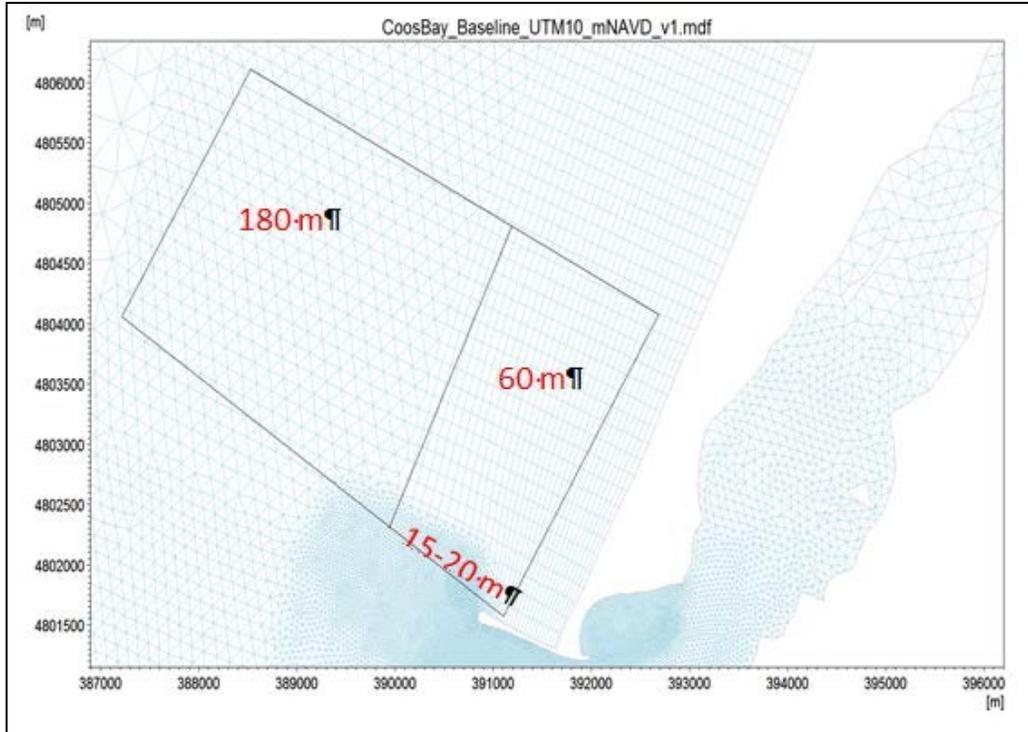
USACE recommends a ratio between 0.9 and 1.1 everywhere within the ODMDS and the navigation channel to avoid impacts to navigation.

The simulation covered the period October to December 2007, which was found to be representative of the winter wave climate at Coos Bay. The results of the existing condition and the mounded conditions were divided by the results of the baseline condition at each grid location and each time step. For each location, the maximum percent change (including both increase and decrease) was recorded.

## 5.2 ODMDS F Capacity Evaluation

### 5.2.1 Mesh and Bathymetric Conditions Investigated in MIKE-21 SW

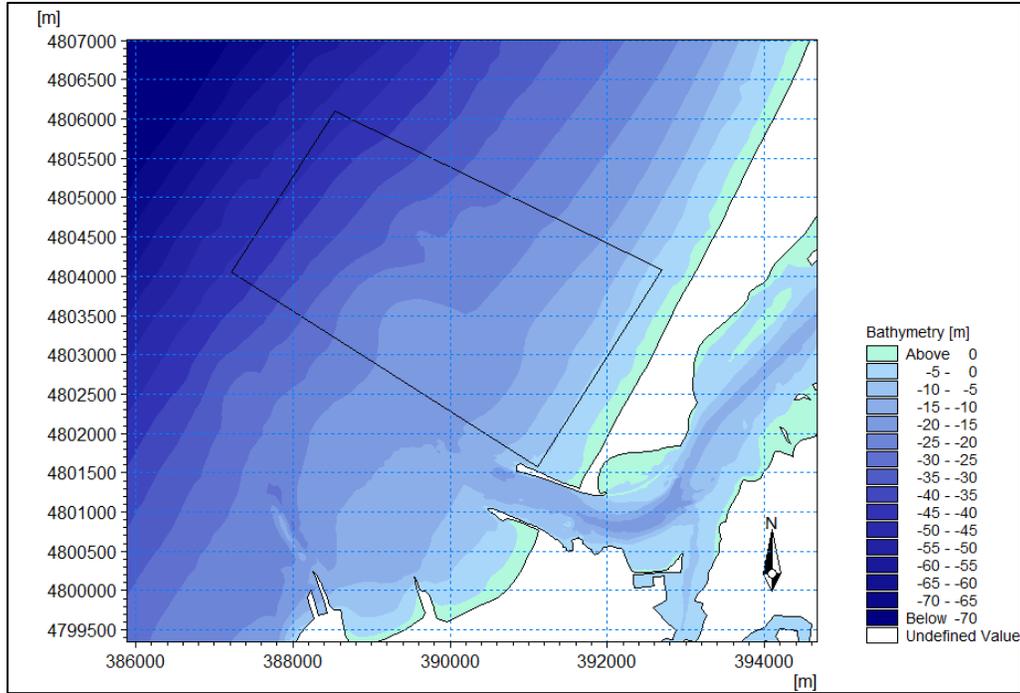
The x-y grid resolution used for the simulations range from 180 meters (590 ft) for ODMDS F offshore, to 60 meters (197 ft) for the nearshore, to 15-20 meters (49-65 ft) near the North Jetty. The grid used for ODMDS F simulations is shown in Figure 5-4.



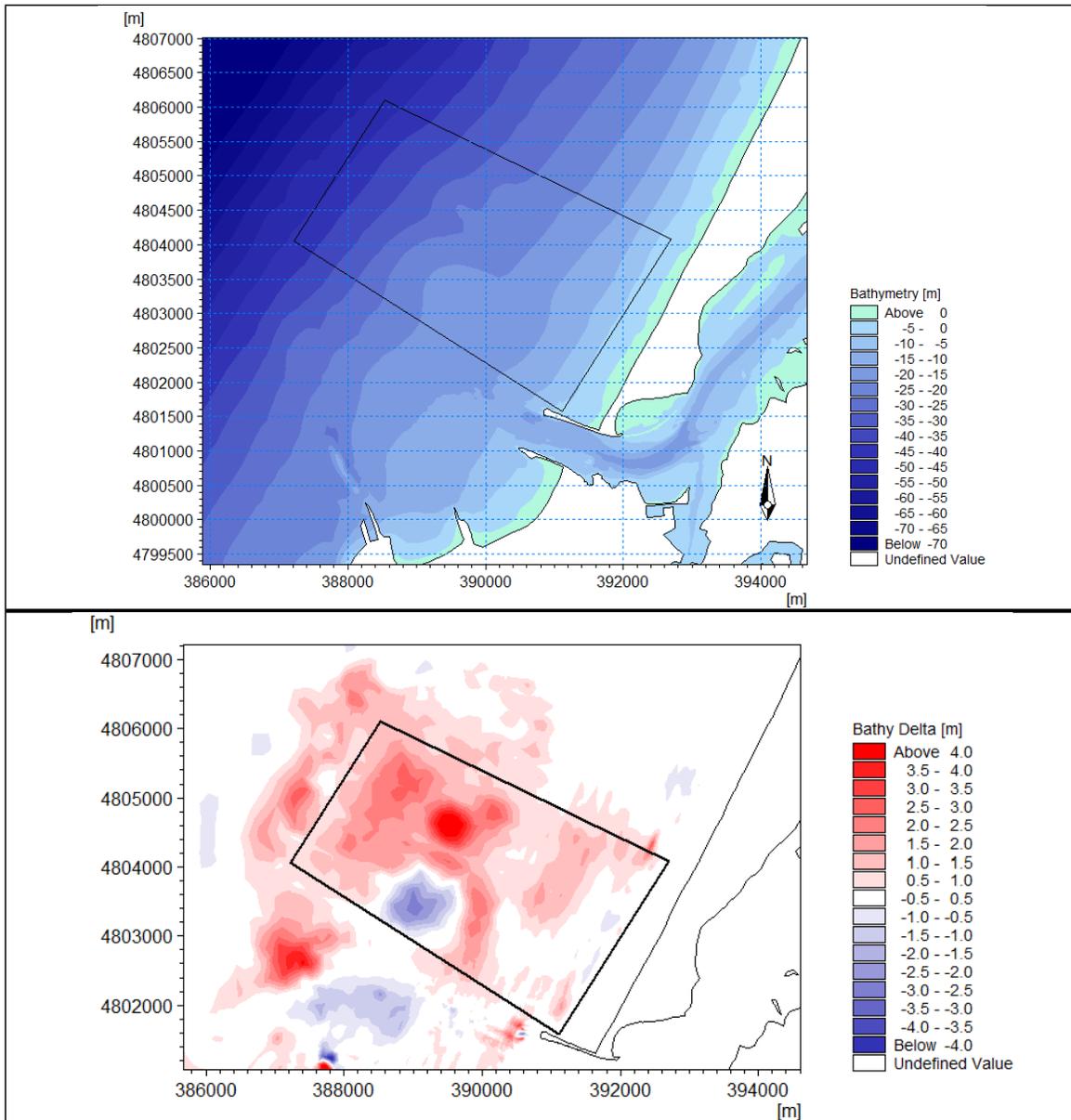
**Figure 5-4**  
**X-Y Grid Used for Wave Simulations for ODMDS F**

Several distinct bathymetric conditions were investigated: a baseline condition, an existing condition, and several mounded conditions at each ODMDS. The mounded conditions were developed to determine thresholds of fill volume that would satisfy the USACE navigation criterion.

The baseline condition was selected by the USACE and uses the 1994 bathymetry surveyed by USACE on July 25, 1994, as shown in Figure 5-5. The existing condition bathymetry is based on a survey conducted on March 15, 2015. This existing condition bathymetry, as well as the change from the baseline condition, is shown in Figure 5-6.



**Figure 5-5**  
**Baseline Condition Bathymetry (July 1994)**



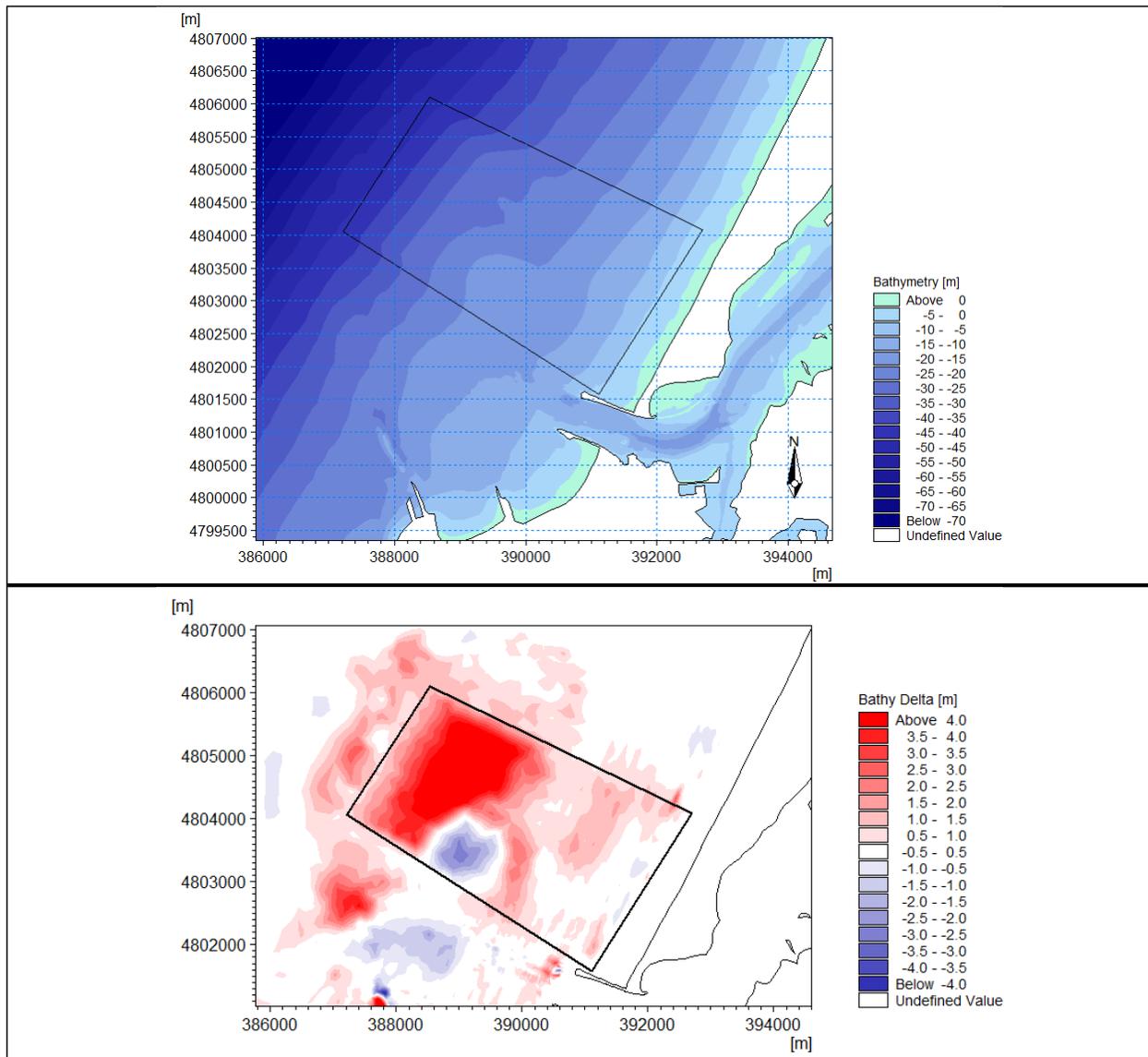
**Figure 5-6**  
**Existing Condition Bathymetry (top) and Comparison of Existing and Baseline**  
**Conditions (bottom; red indicates shallower under Existing Condition)**

Comparison of the baseline and existing bathymetric maps shows that the existing condition is characterized by accretion between 1994 and 2015, except in the location of the original ODMDS E. At the ODMDS E, the mound present in 1994 appears to have moved northwards.

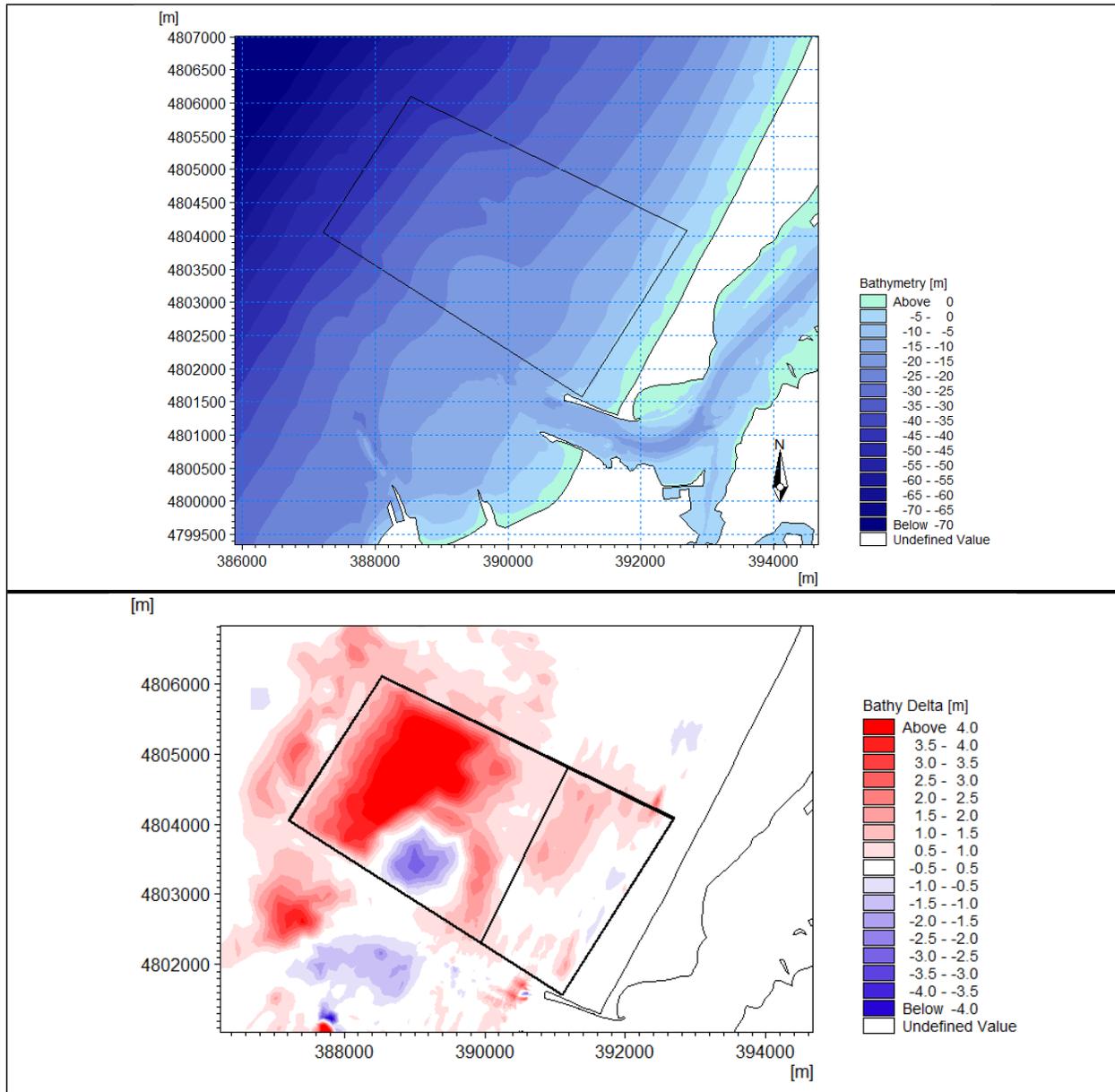
At ODMDS F, two mound configurations were modeled. In the first, the entire area of the ODMDS was raised to a uniform elevation. In the second, the entire area at ODMDS F was raised by a uniform amount. The USACE generally fills the site by running shore-perpendicular transects, over which sediment is discharged at a uniform rate. Therefore, the second configuration may be a more accurate reflection of disposal practices.

The range of mound top elevations selected for further analysis was based on relative effects to the wave field. Several mound top elevations were investigated, ranging from mound tops at -85 ft MLLW to -105 ft MLLW. The results of four mounded conditions are presented as the following scenarios in this report: mound tops were located at -85 ft MLLW, -90 ft MLLW, -95 ft MLLW, and -105 ft MLLW. For the selected scenarios, the mound was located on the existing bathymetry. Also, in these scenarios, fill sloped from the bottom of ODMDS F at a slope of 65:1 – the steepest slope permissible pursuant to the USACE Portland District – to the top of the mound, where it leveled off and intersected the existing bathymetry. These bathymetries in meters, as well as the change from the baseline condition, can be seen in Figure 5-7 through Figure 5-10.

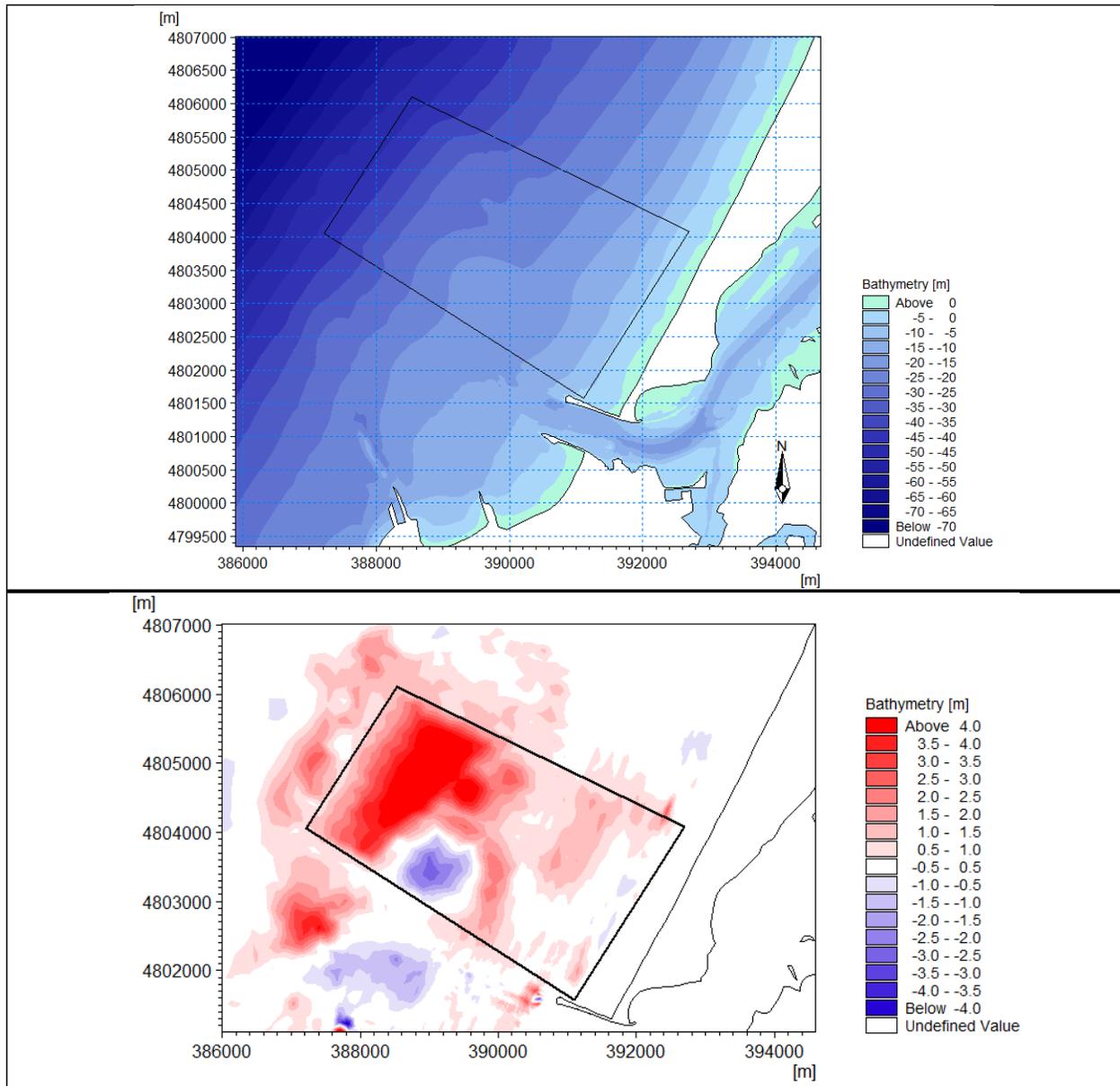
A sample cross section of the sediment mound that has a mound top elevation of -90 ft MLLW and faces south can be seen in Figure 5-11.

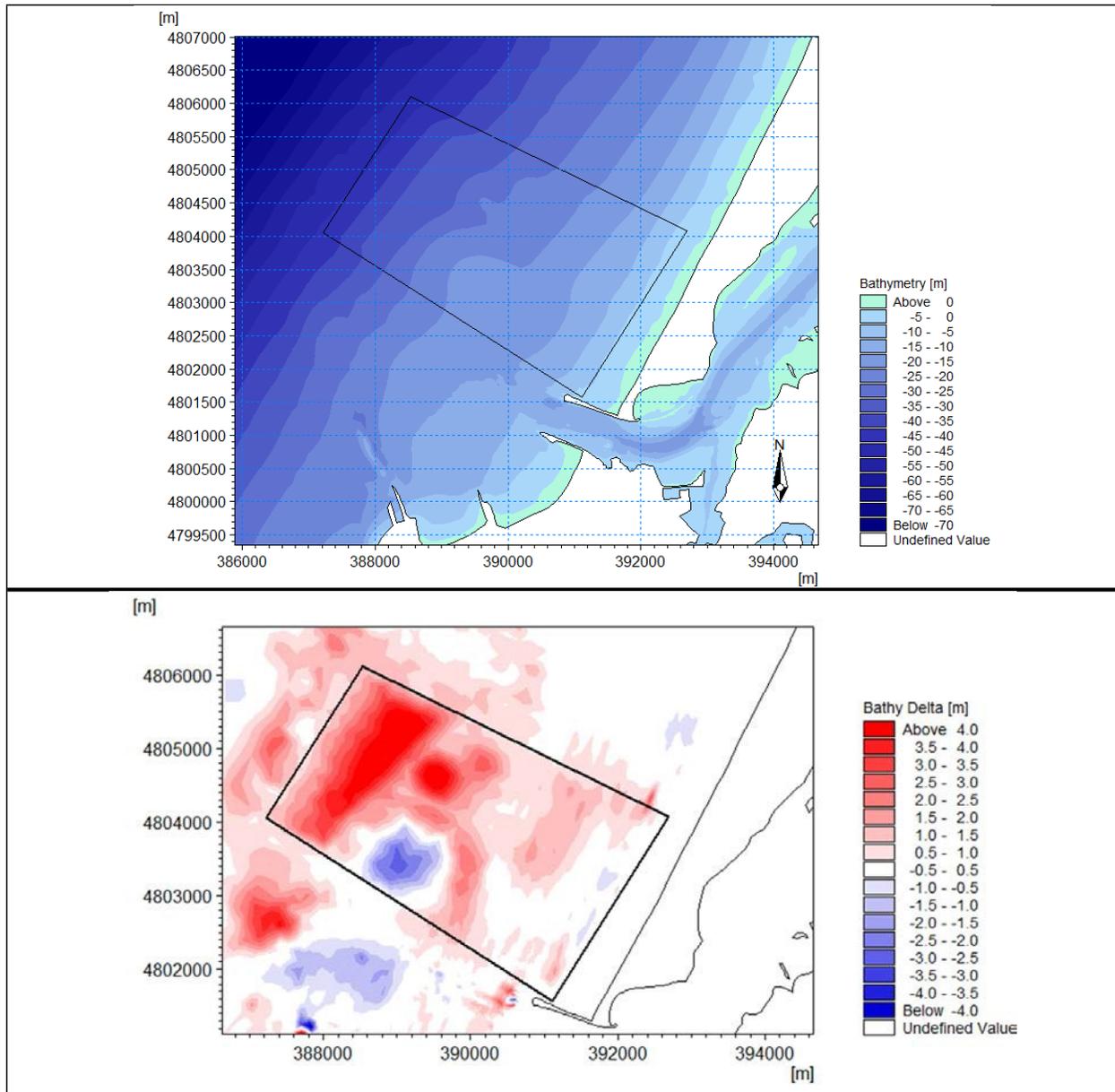


**Figure 5-7**  
**Top Panel: -85 ft MLLW Mounded Condition Bathymetry; Bottom Panel: Difference in Elevation Between -85 ft MLLW Mounded and Baseline Conditions**

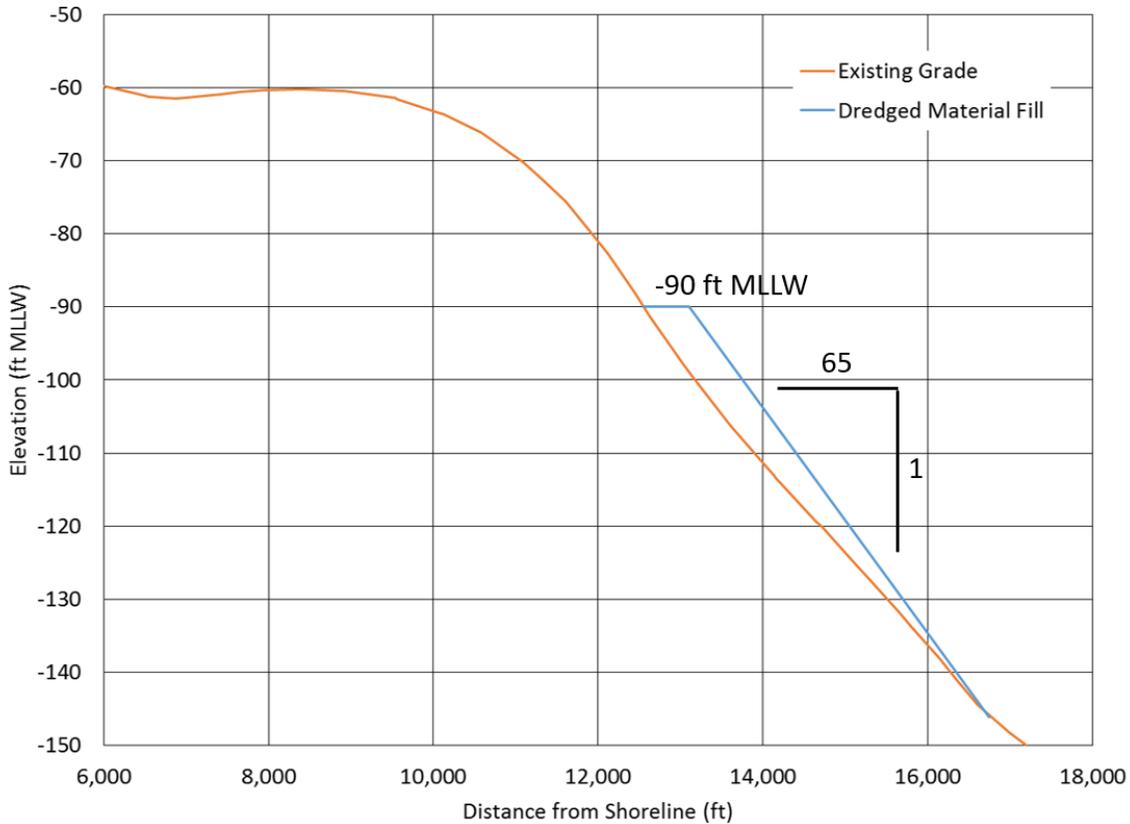


**Figure 5-8**  
**Top Panel: -90 ft MLLW Mounded Condition Bathymetry; Bottom Panel:**  
**Difference in Elevation Between -90 ft MLLW Mounded and Baseline Conditions**





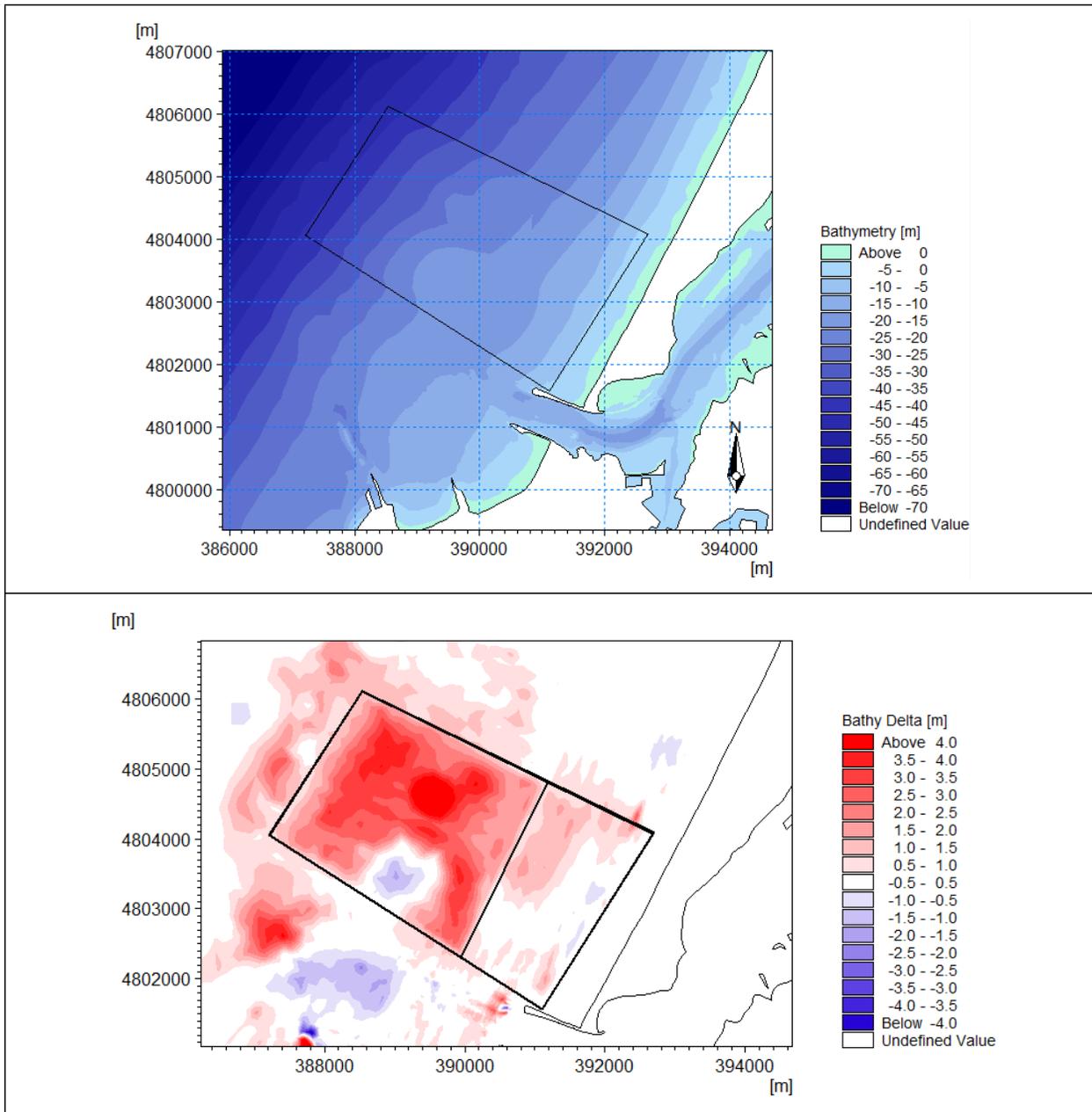
**Figure 5-10**  
**Top Panel: -105 ft MLLW Mounded Condition Bathymetry; Bottom Panel:**  
**Difference in Elevation Between -105 ft MLLW Mounded and Baseline Conditions**



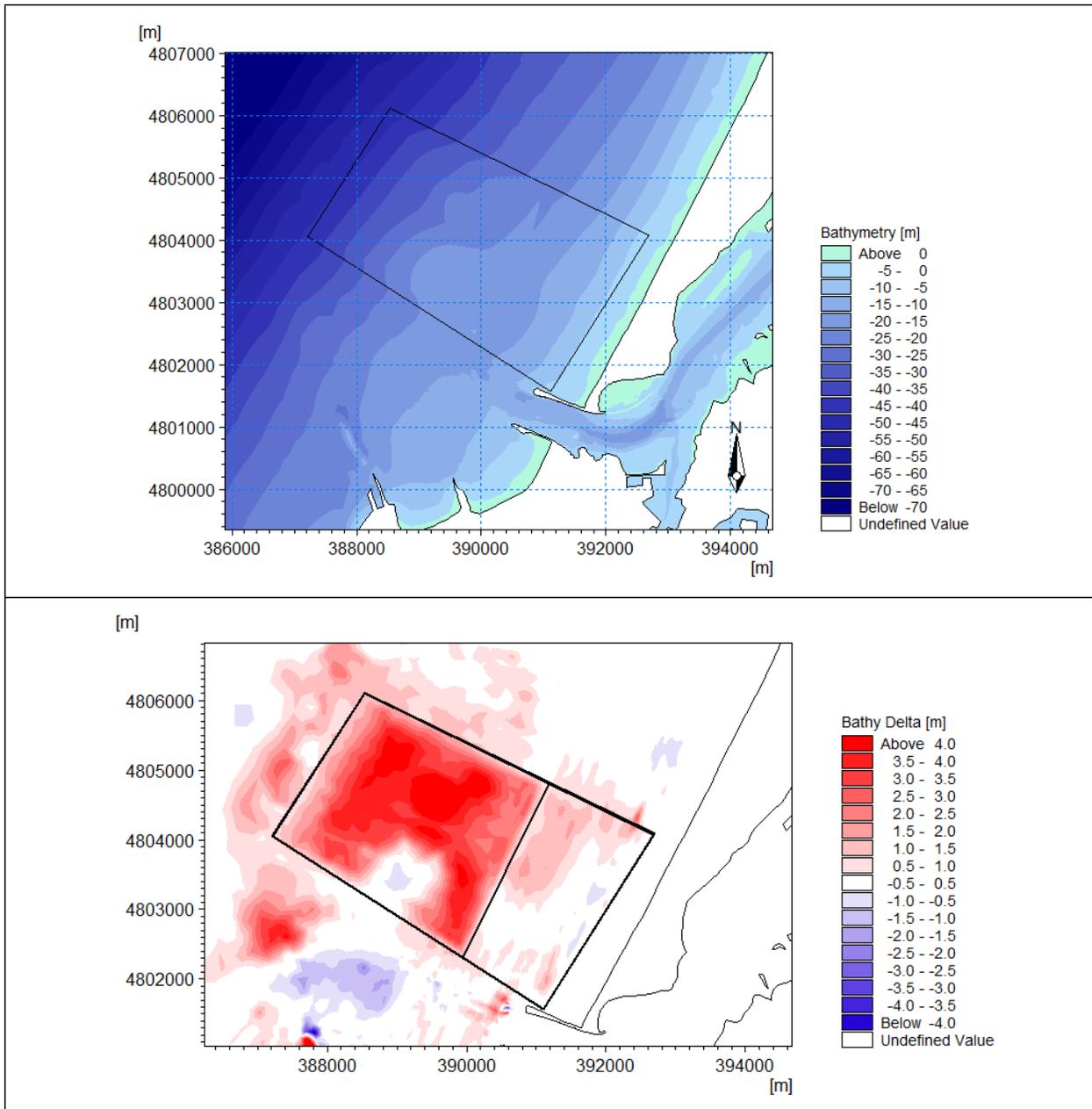
**Figure 5-11**  
**Sample Mound Cross Section, Facing South**

The second mound configuration investigated at ODMDS F raised the elevation of the site by a uniform amount, sloping the edges to the site boundary at a 65:1 slope. Several mound heights were investigated, ranging from 2 to 8 ft. The results of three heights are presented as the following scenarios in this report: 4 ft, 6 ft, and 8 ft. For the selected scenarios, the mound was placed on the existing bathymetry. Also, in these scenarios, fill sloped from the bottom of ODMDS F at a slope of 65:1 – the steepest slope permissible by the USACE Portland District – to the top of the mound. These bathymetries in meters, as well as the change from the baseline condition, can be seen in Figure 5-12 through Figure 5-14.

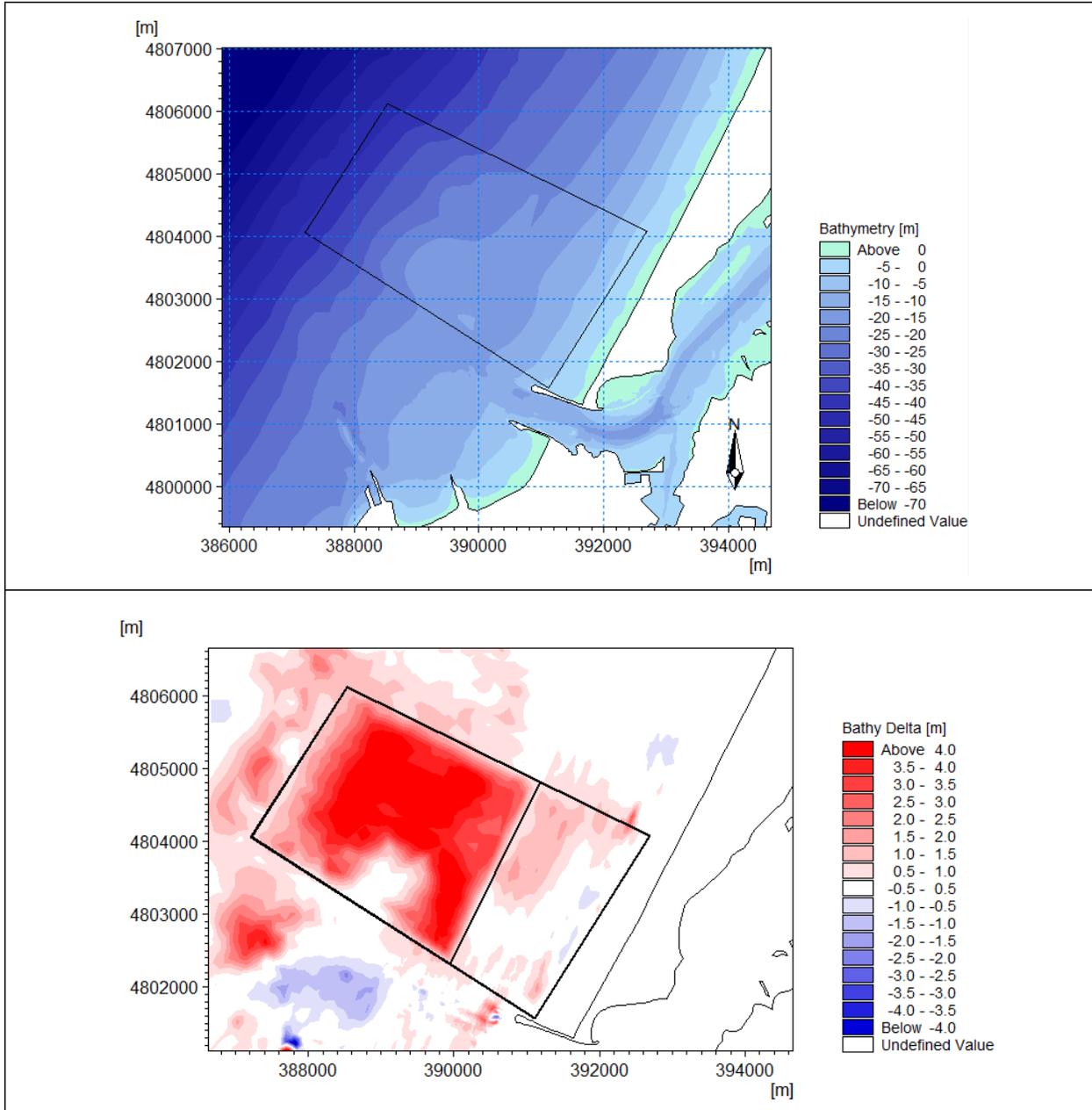
A sample cross section of a 4 ft mound, facing south, can be seen in Figure 5-15.



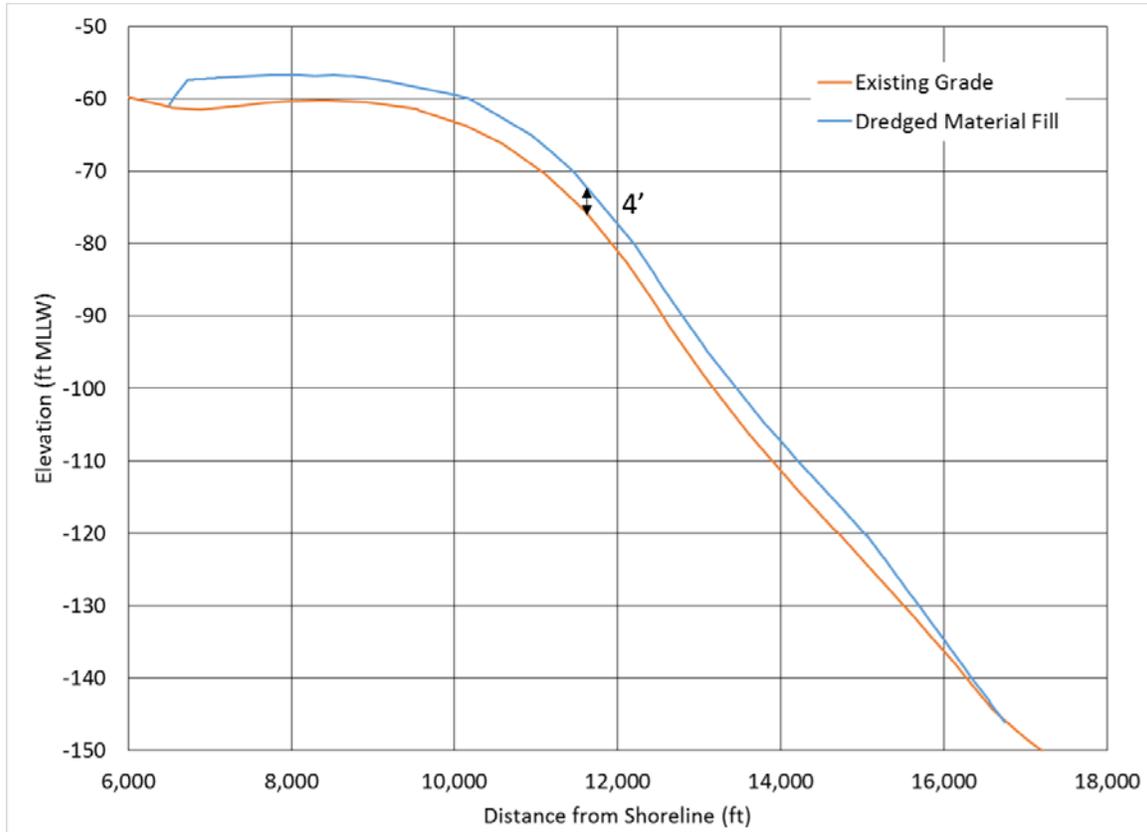
**Figure 5-12**  
**Top Panel: 4 ft Mound Condition Bathymetry; Bottom Panel: Difference in Elevation Between 4 ft Mound and Baseline Conditions**



**Figure 5-13**  
**Top Panel: 6 ft Mound Condition Bathymetry; Bottom Panel: Difference in Elevation Between 6 ft Mound and Baseline Conditions**



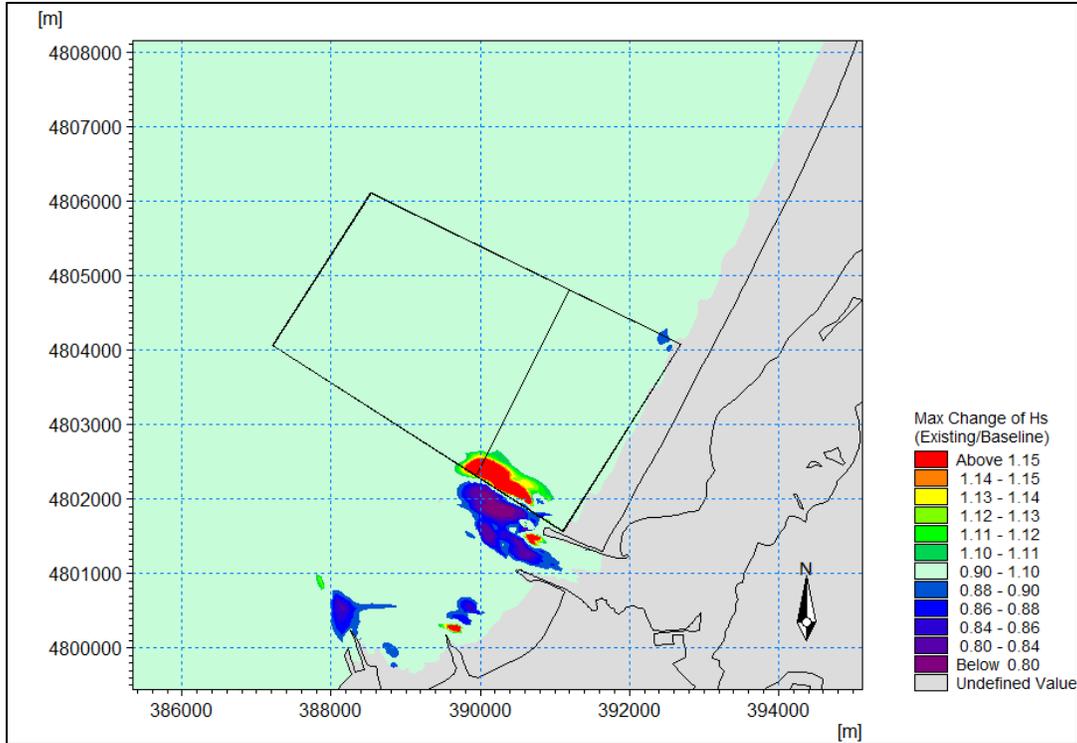
**Figure 5-14**  
**Top Panel: 8 ft Mound Condition Bathymetry; Bottom Panel: Difference in Elevation Between 8 ft Mound and Baseline Conditions**



**Figure 5-15**  
**Sample Mound Cross Section, Facing South**

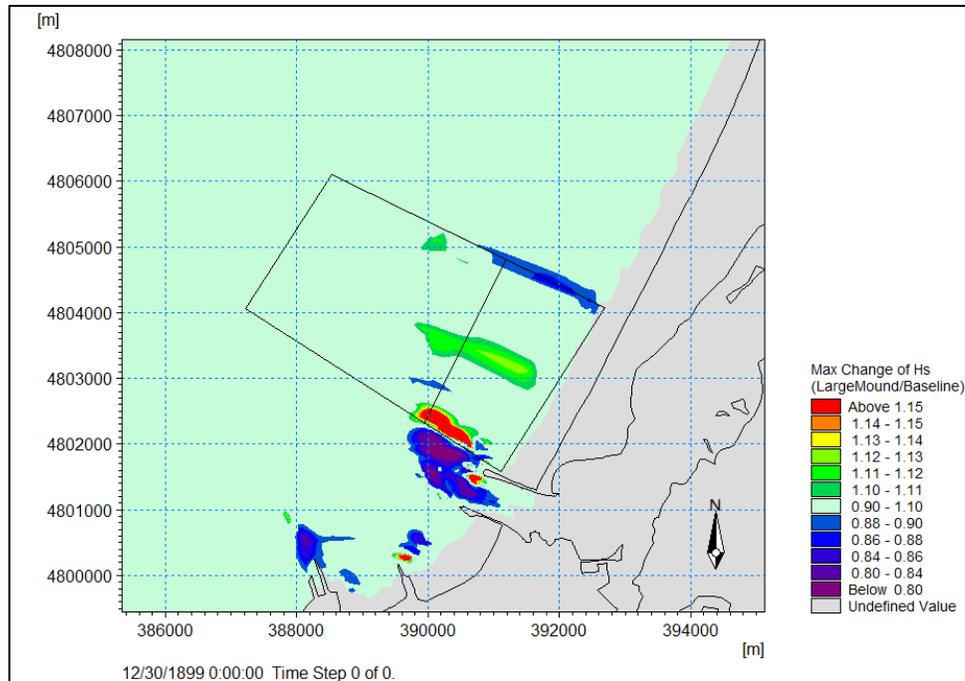
**5.2.2 Wave Modeling Results**

The maximum significant wave height ratio between the baseline and existing bathymetries can be seen in Figure 5-16. This figure shows that significant wave heights increase considerably along the southwest portion of ODMDS F nearshore, and decrease considerably in the Entrance Channel and at ODMDS E. The increases and decreases in significant wave heights are related to existing bathymetry in the area, and it is expected that these changes will be present in the mound conditions as well when compared to the same baseline condition.

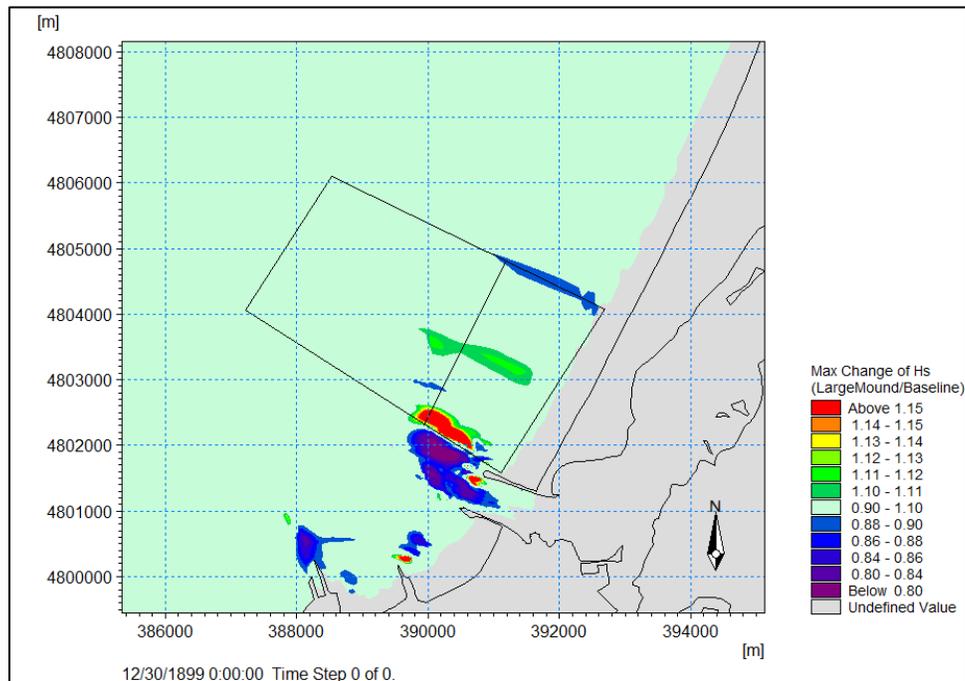


**Figure 5-16**  
**Maximum Significant Wave Height Change Between Existing and Baseline**  
**Conditions, ODMDS F**

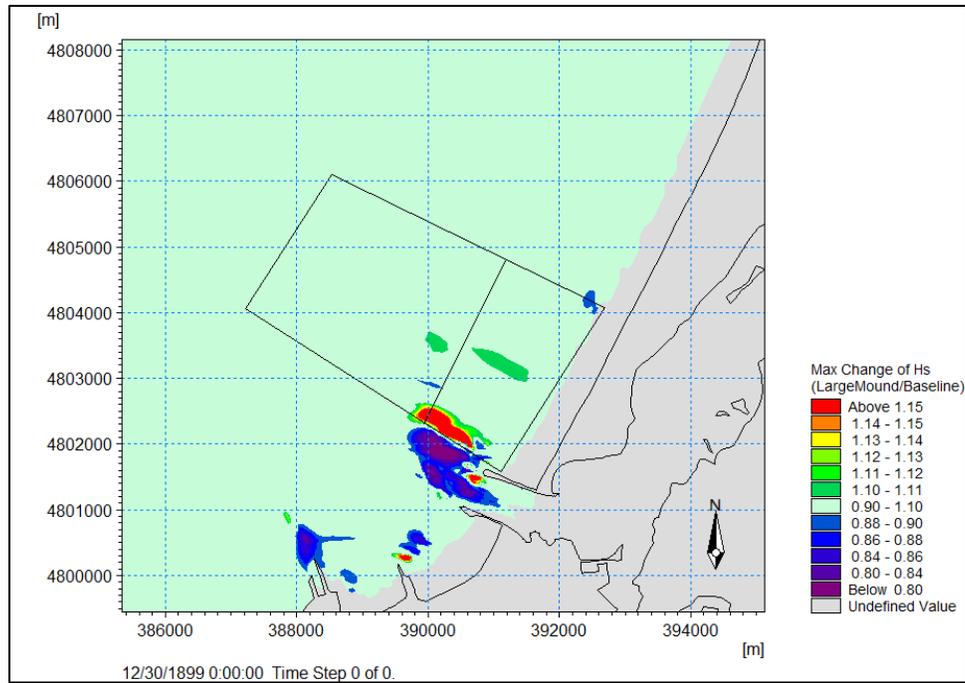
The maximum changes in significant wave height ratio for the various mounded conditions at ODMDS F can be seen in Figure 5-17 through Figure 5-23. The change in wave height ratio for the -105 ft MLLW mounded condition resembles the change in ratio for the existing condition. The other mounded conditions resulted in ratios (compared to baseline) within additional localized areas of ODMDS F that exceed the USACE criterion. Shallower mounds exhibit larger areas of increase within ODMDS F—mainly in the nearshore. The wave change for the -95 ft MLLW mound and the 4-ft mound are limited to isolated areas in the middle of the ODMDS, and do not appear to significantly alter the ratio (relative to existing conditions) in the vicinity of the Entrance Channel, where vessel navigation is most concentrated. In fact, the 4-ft mound condition slightly decreases the area of increased ratio at the southern corner of ODMDS F (seen in Figure 5-21).



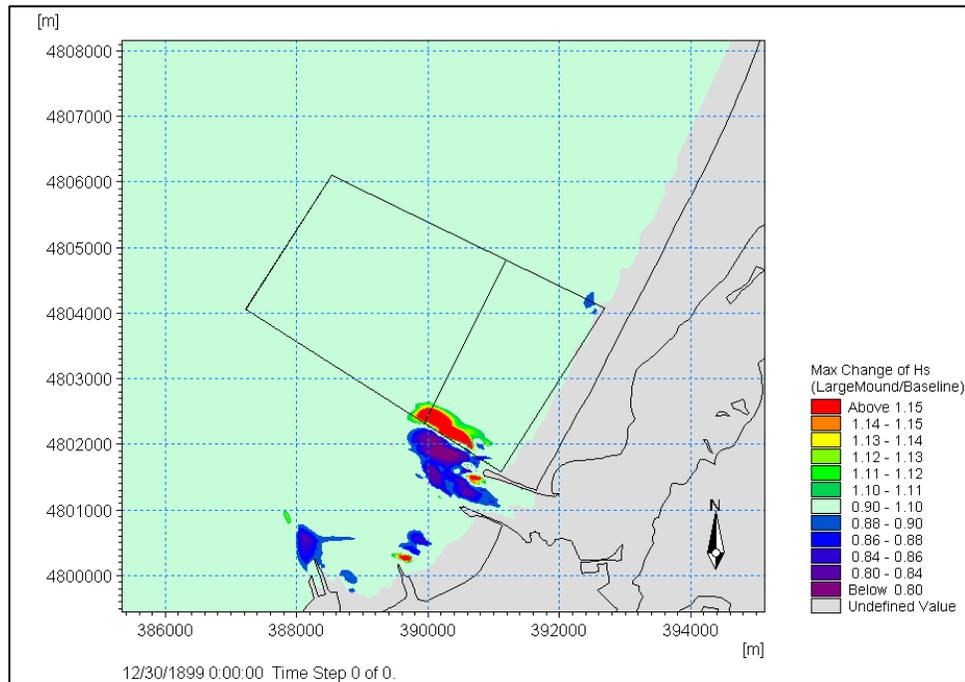
**Figure 5-17**  
**Maximum Wave Height Change Between -85 ft MLLW ODMDS F Mound and Baseline Conditions**



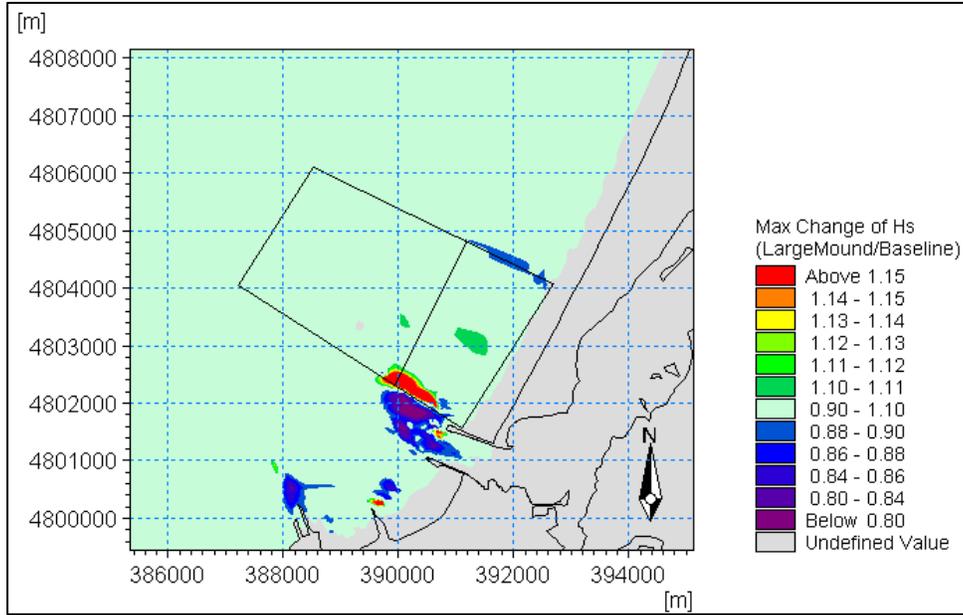
**Figure 5-18**  
**Maximum Wave Height Change Between -90 ft MLLW ODMDS F Mound and Baseline Conditions**



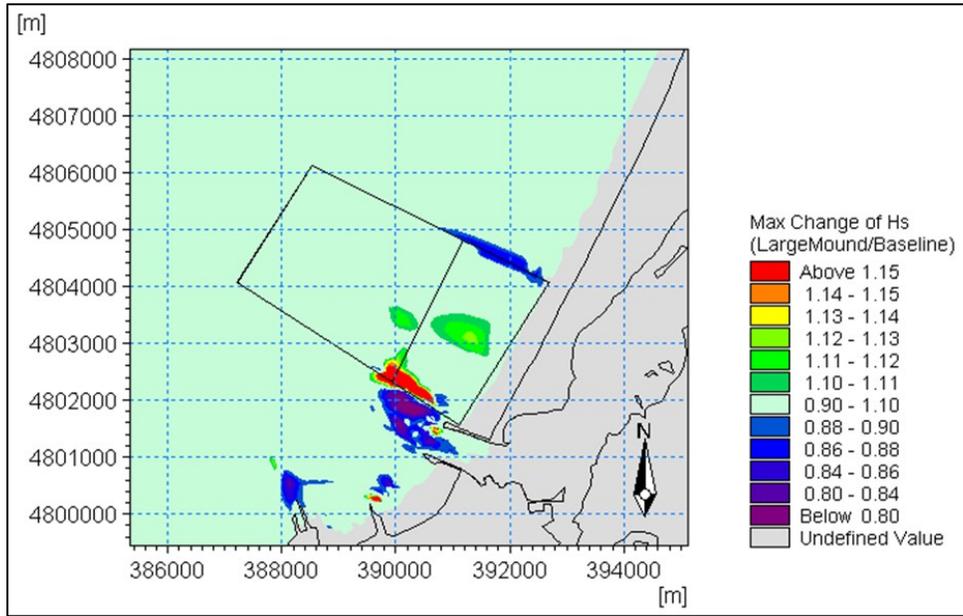
**Figure 5-19**  
**Maximum Wave Height Change Between -95 ft MLLW ODMDS F Mound and Baseline Conditions**



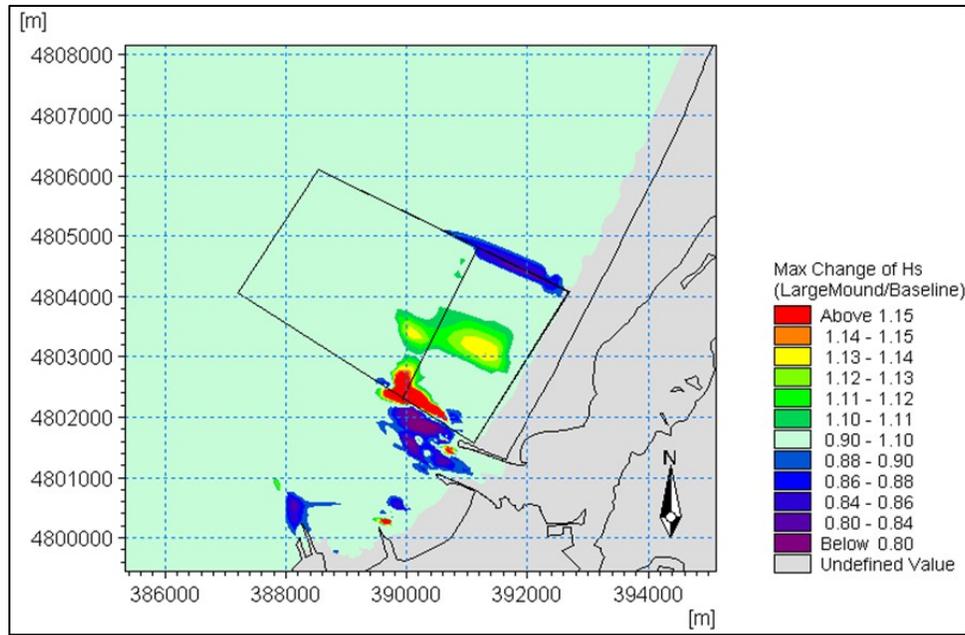
**Figure 5-20**  
**Maximum Wave Height Change Between -105 ft MLLW ODMDS F Mound and Baseline Conditions**



**Figure 5-21**  
**Maximum Wave Height Change Between 4 ft ODMS F Fill and Baseline Conditions**



**Figure 5-22**  
**Maximum Wave Height Change Between 6 ft ODMS F Fill and Baseline Conditions**



**Figure 5-23**  
**Maximum Wave Height Change Between 8 ft ODMDS F Fill and Baseline Conditions**

Table 5-1 shows the maximum increase in  $H_{m0}$  and the percentage of ODMDS F area over which the significant wave heights differ from the baseline by 10 percent or greater. It should be noted that any changes to the wave climate between the existing and baseline conditions is not included in these tables.

**Table 5-1**  
**Wave Height Increases for Mounded Conditions, ODMDS F**

Top of Mound/Mound Height	Maximum Increase in Significant Wave Height (%)	Area Over Which Wave Height Increases by More Than 10% (% of ODMDS F area)
-85 ft MLLW	13%	6%
-90 ft MLLW	12%	4%
-95 ft MLLW	11%	2%
4 ft	11%	1%
6 ft	13%	4%
8 ft	15%	9%

The analysis presented in this section evaluates the effect of incrementally filling the site and analyzes the effect of two different options for disposal of the sediment at ODMDS F, consisting of seven mound conditions in total. For the mound top option, an elevation of -95 ft MLLW exceeds the 10 percent criterion only by a slight amount and is limited spatially – it is only 2 percent of the total ODMDS F area. Similarly, the 4-ft option exceeds the 10 percent criterion only by a slight amount and is very limited spatially. Thus, it can be concluded that an elevation of -95 ft MLLW for the mound top or a mound height of 4 ft would not affect navigation.

### 5.2.3 Static Capacity of ODMDS F Offshore

The static capacity of the offshore area of ODMDS F for all the options simulated in the wave analysis ranges from 5 to 18 mcy, depending on the elevation to which sediment is dumped and the disposal plan selected (mound top elevation or mound height). Fill volumes were calculated using an AutoCAD Civil 3D model that added fill above the existing (March 25, 2015) bathymetry using the methods previously described. Table 5-2 and Table 5-3 present the static capacity for all the conditions evaluated with the wave model.

**Table 5-2**  
**ODMDS F Offshore Top of Mound Elevation to Static capacity**

Mound Top Elevation (ft MLLW)	Fill Volume (cy)
-85	10,200,000
-90	8,800,000
-95	7,400,000
-105	4,800,000

**Table 5-3**  
**ODMDS F Offshore Overall Mound Top Fill Static capacity**

Uniform Fill	Fill Volume (cy)
4-ft Fill	10,600,000
6-ft Fill	15,200,000
8-ft Fill	18,800,000

Wave results presented above indicate that it is conservative to assume that for the Mound Top Elevation filling option, an elevation of -95 ft will keep the increase in wave heights below the allowable limits. This disposal option will represent a static capacity close to 8 mcy. The uniform fill option will produce acceptable values for wave increase for a mound height of 4 ft, representing a static capacity of 10.6 mcy. Using the uniform fill option, it is assumed that ODMDS F Offshore has a static capacity of approximately 10 mcy.

#### **5.2.4 Annual Capacity of ODMDS F Nearshore**

The nearshore capacity of the ODMDS F is governed by sediment transport in the littoral zone and by ambient conditions. As previously mentioned, the nearshore area of ODMDS F is located downdrift of the inlet; the net littoral transport is northward. Because of its downdrift location, ODMDS F Nearshore is at a sediment deficit due to the jetties, and therefore, has a net erosional behavior. Sediment placed in this area makes up some of the sediment deficiency, which can then continue to be transported northwards.

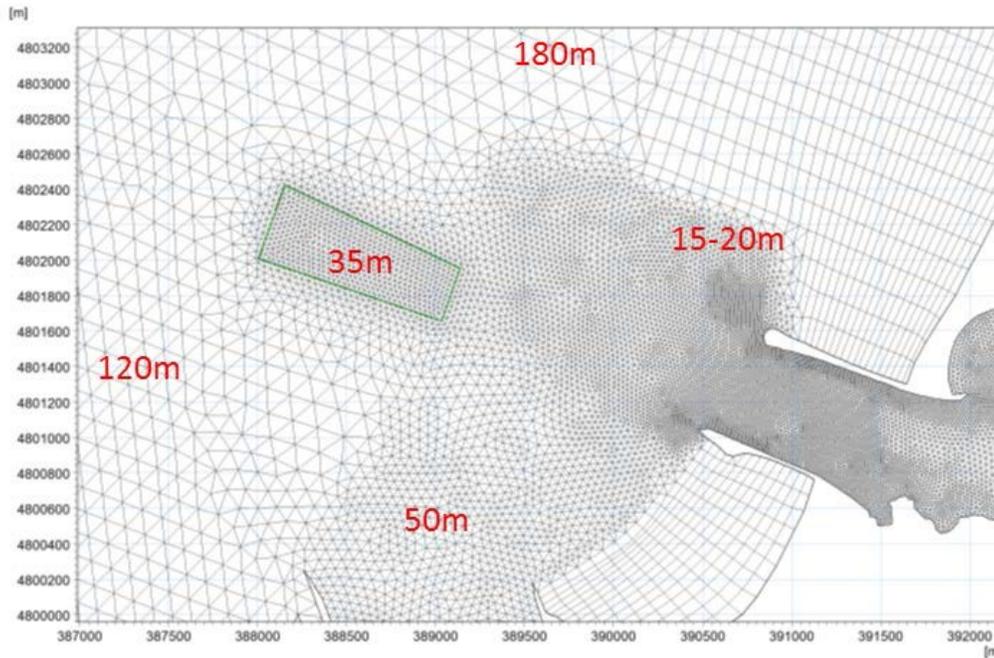
Littoral transport is a key driver on this site because it distributes the sediment—both within the site and out of the site—and thus reduces mounding, or sediment accumulation. Historical records since 2006 indicate that the nearshore site can receive to 400,000-600,000 cy of material annually, which is eventually transported out of the site, without showing any long-term accumulation. Although it is possible that the nearshore site could have a dispersion capacity larger than the maximum amount previously placed (700,000 cy/yr), this initial analysis takes the conservative approach of using the mean volume plus or minus the standard deviation as the recommendation for future placement at the nearshore site. In addition, it is important to consider that the use of this area to place material can sometimes be limited by the ability to achieve safe site access, because of waves and current conditions at ODMDS F. Under storm wave conditions, it is not possible for hopper dredges to safely enter the nearshore area and bottom dump the material. During 1 of the 9 years in the record (2009), as little as 300,000 cy of material was placed in the nearshore area. Because of the low frequency of occurrence of this low-volume placement, the assessment considers annual placements of 500,000 cy (the average annual placement, McMillan, 2018). This analysis and results corroborate the 2024 Dredged Material Management Plan (DMMP), which states that the average beneficial placement at the ODMDS F Nearshore from 2006 – 2015 was 495,000 cy/yr (USACE 2024).

Overall, it can be concluded that ODMDS F (Offshore plus Nearshore) has a static capacity of 10 mcy, plus an annual dispersal of approximately 900,000 cy/yr. The USEPA SMMP states that for the existing placement rate, Site F has “virtually unlimited capacity,” however, an increased annual placement rate may exceed the annual dispersal rate of the site and reduce its lifespan. The 2024 DMMP suggests that the USACE pursue the option of using the Proposed North Spit Nearshore Littoral Placement Site post-construction as a supplemental placement site for future maintenance material.

### **5.3 ODMDS E Capacity Evaluation**

#### **5.3.1 Mesh and Bathymetric Conditions Investigated in MIKE-21 SW**

The grid used for ODMDS E uses 35-meter spacing and is sufficiently resolved to represent mounded conditions. It can be seen in Figure 5-24.

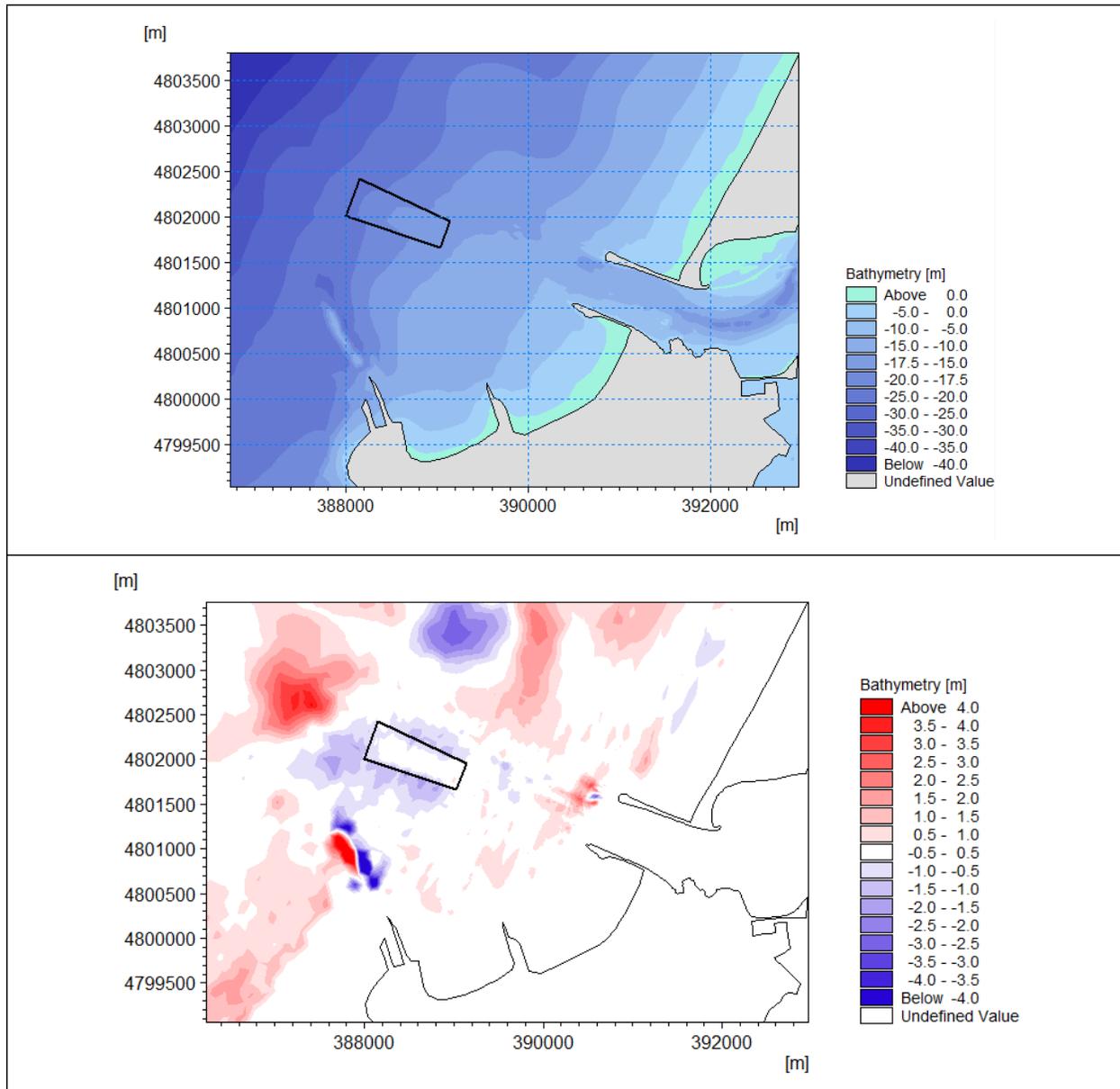


**Figure 5-24**  
**X-Y Grid Used for Wave Simulations for ODMDS E**

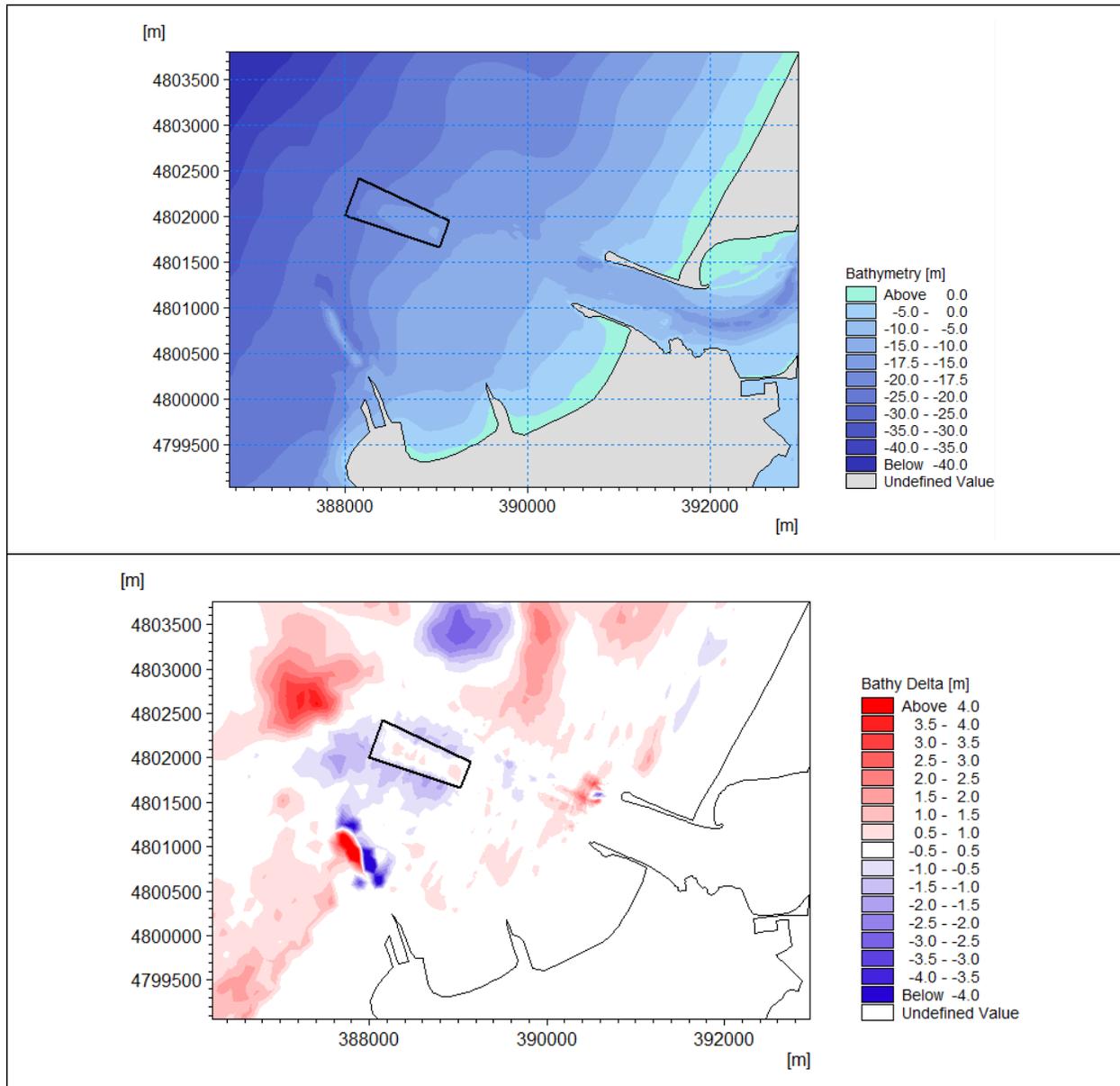
At ODMDS E, the same baseline condition is used as for ODMDS F. Since 1994 (the baseline bathymetry), dispersal of the mound at ODMDS E has occurred, and the bathymetry under the existing condition is about 6 ft deeper (Figure 5-6). Because the bathymetry has changed significantly between these dates, the baseline condition may not represent the best comparison for the future effect of placement at the site, relative to present conditions.

Two mound heights were investigated: 4 ft and 6 ft. In both cases, the mound was placed on the existing bathymetry. These bathymetries (in meters), as well as the change from the baseline condition, can be seen in Figure 5-25 and Figure 5-26.

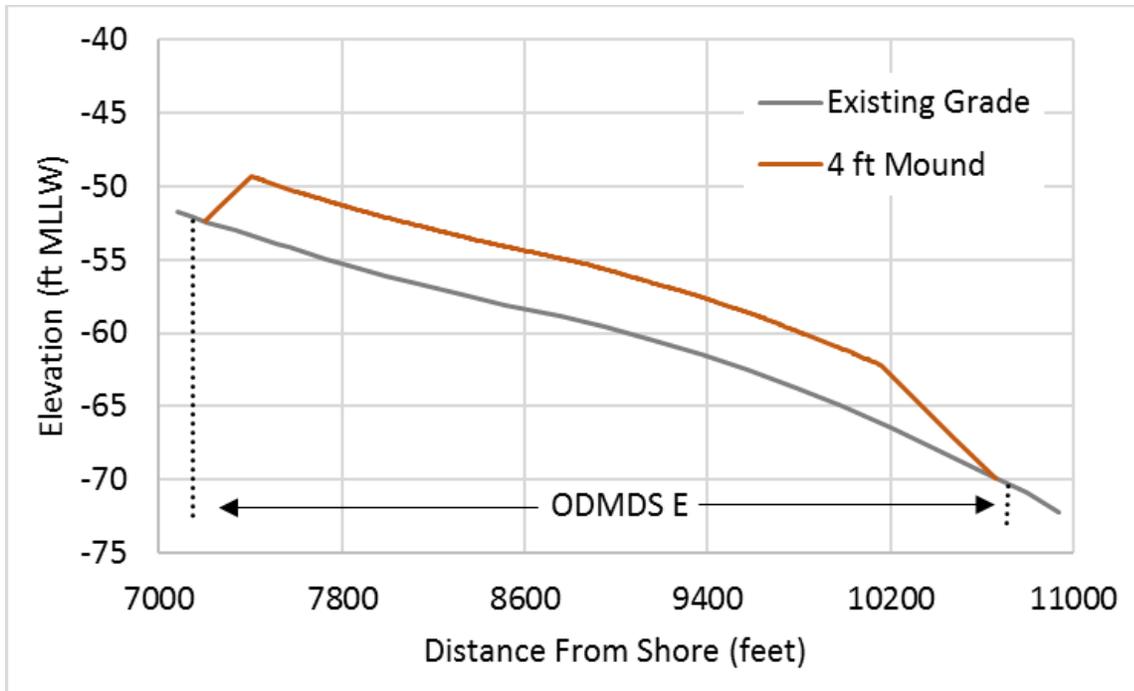
A sample cross section of a 4 ft mound, facing south, can be seen in Figure 5-27.



**Figure 5-25**  
**Top Panel: 4 ft Mound Condition Bathymetry; Bottom Panel: Difference in Elevation Between 4 ft Mound and Baseline Conditions**



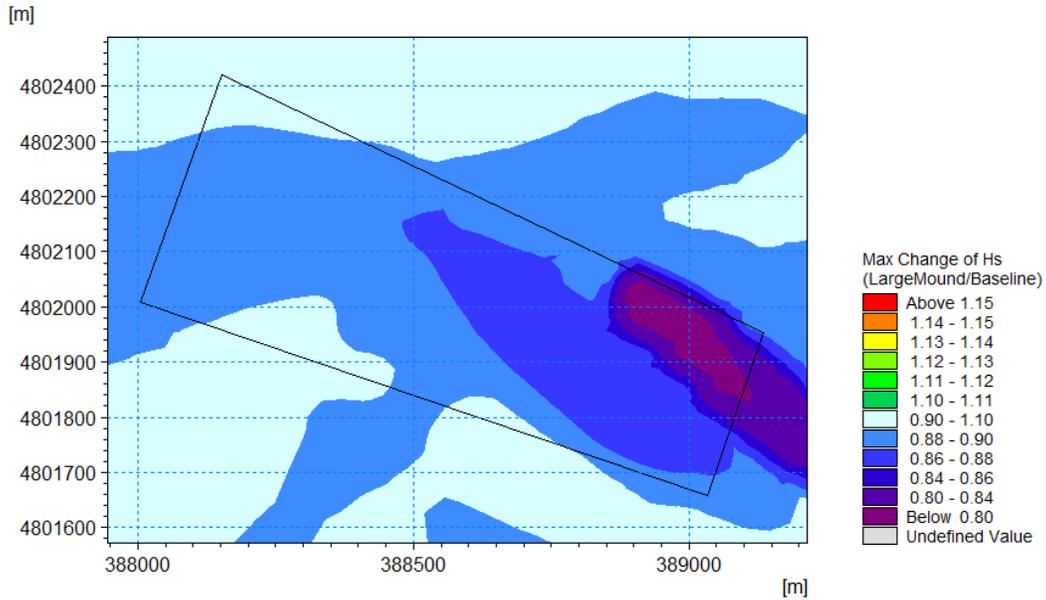
**Figure 5-26**  
**Top Panel: 6 ft Mound Condition Bathymetry; Bottom Panel: Difference in Elevation Between 6 ft Mound and Baseline Conditions**



**Figure 5-27**  
**Sample Mound Cross Section, Facing South**

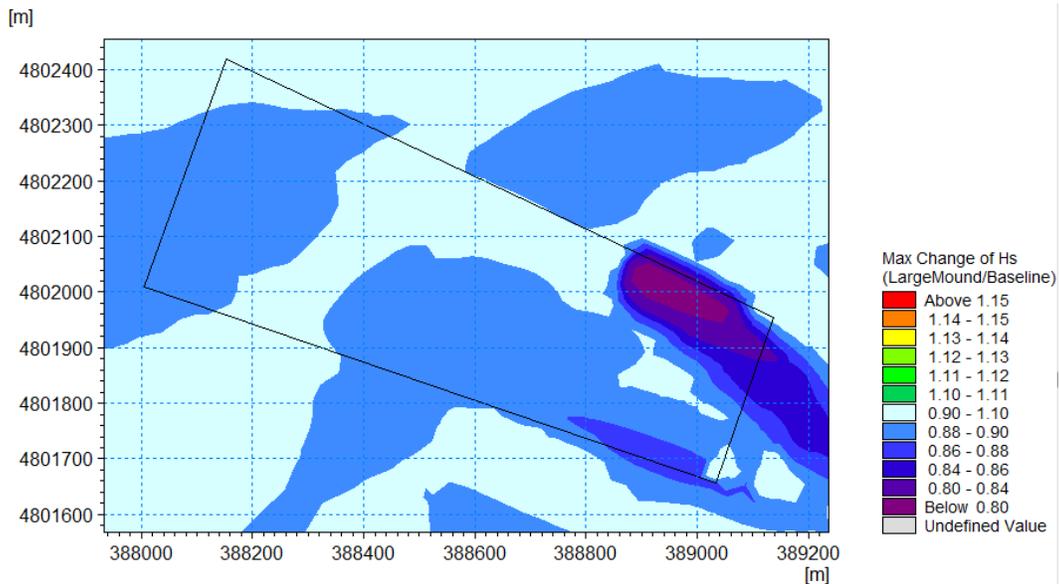
### 5.3.2 Wave Modeling Results

As noted above, wave heights at ODMDS E decrease under the existing condition relative to the baseline condition (Figure 5-28). The increases and decreases in significant wave heights are related to existing bathymetry in the area, and it is expected that these changes will be present in the mound conditions as well when compared to the same baseline condition.

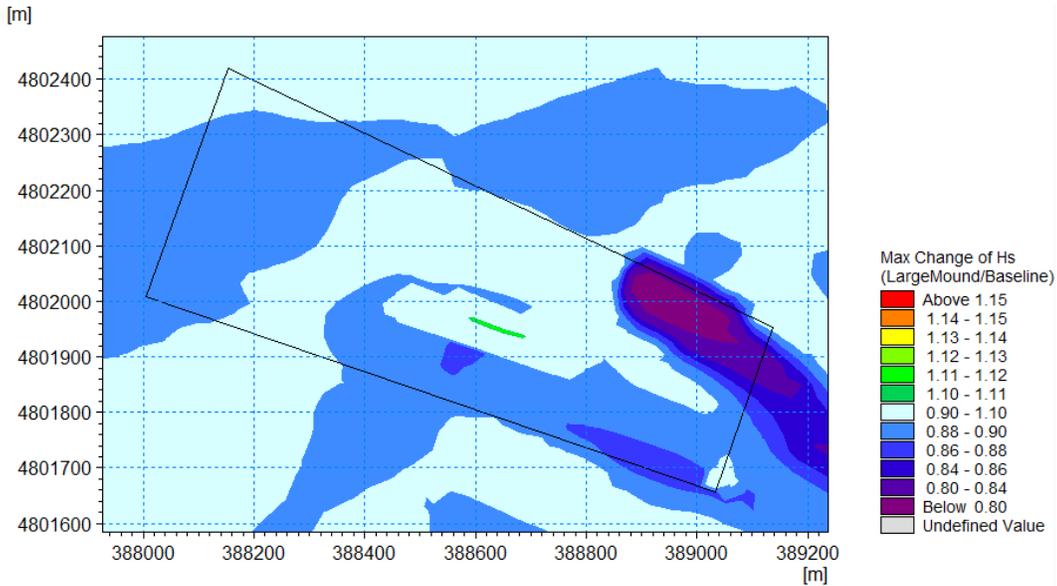


**Figure 5-28**  
**Maximum Significant Wave Height Change Between Existing and Baseline Conditions, ODMDS E**

The maximum changes in wave height ratios for the various mounded conditions at ODMDS E can be seen in Figure 5-29 and Figure 5-30. For both mounded conditions, the area that experiences a 10 percent change in the wave height ratio decreases relative to the comparison in Figure 5-28. For the 6-ft mound, the increase in the wave height ratio by more than 10 percent is very localized in the middle of the ODMDS.



**Figure 5-29**  
**Maximum Wave Height Change Between 4 ft ODMDS E Fill and Baseline Conditions**



**Figure 5-30**  
**Maximum Wave Height Change Between 6 ft ODMDS E Fill and Baseline Conditions**

Table 5-4 show the maximum increase in  $H_{m0}$  and the percentage of ODMDS E area over which the significant wave heights differ from the baseline by 10 percent or greater. It should be noted that any changes to the wave climate between the existing and baseline conditions is not included in these tables.

**Table 5-4**  
**Wave Height Increases for Mounded Conditions, ODMDS E**

Top of Mound/Mound Height	Maximum Increase in Significant Wave Height (%)	Area Over Which Wave Height Increases by More Than 10% (% of ODMDS F area)
4 ft	>10%	0%
6 ft	11%	2%

At ODMDS E, a 4-ft mound does not increase the waves by more than 10 percent relative to both the baseline condition. Therefore, it is not expected to cause adverse impacts to navigation.

### 5.3.3 Static Capacity of ODMDS E

Based on the wave modeling results presented above, a 4-ft mounded condition does not adversely affect navigation relative to the baseline or existing conditions. The volume of this mound corresponds to a static capacity of 457,000 cy. Placing a 4-ft high mound over the reduced ODMDS E (Figure 3-2 and Figure 3-3) corresponds to a static capacity of 322,000 cy for the 2023 PA Plan. These static capacities are presented in Table 5-5.

**Table 5-5  
Capacity of ODMDS E**

<b>Condition</b>	<b>Static capacity (cy)</b>	<b>Annual Capacity (cy/yr – assumes 50-year life)</b>
Existing Condition	457,000	72,000
2023 PA	322,000	51,000

It should be noted that allowing a 4-ft mound entails less volume than the USACE rule of thumb that the mound height can be ~10 percent of the depth. At the midpoint of the ODMDS E, the depth is 60 ft MLLW; according to this rule, a 6-ft mound height would be acceptable. For the present analysis, however, the 4-ft mound shall be considered.

The static capacity calculated based on effects to the wave climate is much less than the maximum volume measured at the site. In 1985, the measured mound volume was over 2.3 mcy (Figure 4-8), relative to 2013 bathymetry. Based on the exponential decay model, the mound volume in 1982 (when material placement in ODMDS E declined) may have been as high as 3 mcy (Figure 4-10). However, wave modeling indicates that such large mound volumes threaten safe navigation.

**5.3.4 Annual Capacity of ODMDS E**

As shown in Section 4.4, material dispersal from the site can be modeled by an exponential decay relationship, with a decay constant of 0.00041/days. The purpose of this section is to determine the amount of volume that can be placed annually for 50 years such that the static capacity of the site is never exceeded under the existing and reduced site. The decay relationship was simulated such that material would be added each year while the site underwent dispersal.

Based on this relationship and the static capacity calculated in Section 5.3.4, an annual volume of 72,000 cy can be placed annually at the existing ODMDS E. Implementation of the 2023 PA Plan would reduce the annual volume to 51,000 cy/yr or 56,000 cy/yr, respectively. These annual capacities are presented in Table 5-5.

Since the most recent ODMDS F designation in 2006 (which established the Nearshore and Offshore zones favoring placement in ODMDS F Nearshore to retain sediment in the littoral cell) the placement of material into ODMDS E has been less than 10,000 cy/yr on average. Assuming these operations are maintained in the future, the reduction in the annual volume may be acceptable. Therefore, implementation of the project is not likely to deter USACE from using the site as it is presently used.

## 6. CONCLUSIONS AND RECOMMENDATIONS

This study investigates the capacity of ODMDS F to accommodate dredged material for future maintenance dredging and for capital dredging. In addition, portions of the Entrance Channel under the 2023 PA Plan will overlap with ODMDS E; this report assesses how this overlap may affect the potential placement capacity of ODMDS E. The other three existing sites – ODMDS H, Site G, and Site 8.4 – are not expected to be affected by the proposed channel modifications.

### 6.1 ODMDS F

Wave modeling and analysis of previous dispersal at ODMDS F indicates that the site has a static capacity of 10 mcy. In addition, up to 900,000 cy of material can disperse from the site annually, 500,000 cy from the nearshore and 400,000 from the offshore.

ODMDS F does not have the capacity to handle material from the capital dredging; therefore, another disposal option must be investigated. The 2024 Dredged Material Management Plan (DMMP) evaluated and proposed the establishment of additional sites to handle construction material. The plan selected includes a new MPSRA Section 103 One-time Use ODMDS (Proposed site L) for disposal and the Proposed North Spit Nearshore Littoral Placement Site for the beneficial use of clean sand from the construction of the channel deepening (USACE, 2024).

For future placement of material dredged during O&M, the potential future use and capacity of ODMDS can be assessed based on the projected volume requirements for disposal of O&M material, shown in Table 6-1. Under the Existing Condition, the total placement volume is expected to be less than the annual dispersal volume. Therefore, sediment accumulation is not expected to be significant, and ODMDS F may be used indefinitely for the Existing Condition. The additional O&M material anticipated for the 2023 PA Plan may potentially exceed the dispersive rate of the site on an annual basis. Under the 2023 PA Plan, 266,000 cy/yr of accumulation is expected in ODMDS F offshore, indicating a service life of roughly 38 years. The DMMP allows for the USACE to pursue the option of using the Proposed North Spit Nearshore Littoral Placement Site post-construction as a placement site for future maintenance material.

**Table 6-1**  
**ODMDS F Service Life Under Various Project Conditions**

Description	Existing Condition	2023 PA
Placement (cy/yr)	832,000	1,166,000
Accumulation (cy/yr)	-	266,000
Lifespan (yr)	Indefinite	~38

## 6.2 ODMDS E

The static capacity of the existing ODMDS E is approximately 457,000 cy; upon construction of the 2023 PA Plan, this capacity would be 322,000 cy. Analysis of historic bathymetry changes shows the site to be dispersive; historically, ODMDS E has exhibited exponential decay (i.e., dispersal is proportional to the volume of material at the site). Applying this observed site behavior to a potential future mound, USACE may be able to place up to 72,000 cy under the Existing Conditions and up to 51,000 cy under the 2023 PA Plan over the next 50 years. Assuming that use of the site will be consistent with the use since the designation of ODMDS F Offshore and Nearshore (i.e., less than 10,000 cy/yr into ODMDS E on average), the reduction in site capacity will be acceptable.

Dredging records and ODMDS E placement history suggest that 60 percent of the material placed in ODMDS E is recycled into the channel. Therefore, ODMDS E may not represent an ideal disposal location, hence its infrequent use. Under the 2023 PA Plan, the Entrance Channel extends further offshore and is therefore closer to ODMDS E; as a result, the percentage of sediment placed in ODMDS E that migrates into the channel would likely increase. In addition to the stated concern with mounding (USACE 2012b, 2015b), increased dredging is also an effect of using ODMDS E.

## 6.3 Site G

Implementation of the 2023 PA Plan is not anticipated to impact USACE's existing or future use of Site G or threaten the reliability of the existing/future FNC. This assessment investigates the physical effects of the project during capital dredging, during the equilibration period, and over the long-term. It is expected that sediment placed in Site G will continue to disperse as it does today (as explained in Section 4.5). Consistent with the analyses of Figure 4-12 and Figure 4-13, material placed in Site G will not accumulate along the cross section (which includes Site G, the dredged 2023 PA Plan, or in the bottom of the riverbed). Material will continue to be flushed offshore by ebb currents or in-bay by flood currents, as shown in Figure 4-14. Implementation of the 2023 PA Plan will not change the physical forces at Site G, which have made it a dispersive site for the historically placed volumes.

The following sub-sections provide an analysis of the physical effects of the project at Site G during capital dredging, during the equilibration period, and over the long-term.

### 6.3.1.1 Capital Dredging

The present Site G is deeper than the existing FNC. Moreover, all dredging associated with the 2023 PA Plan will occur at depths deeper than the existing FNC. Any maintenance material placed by the Corps of Engineers in Site G during construction of the 2023 PA would be placed below the existing FNC. Therefore, any material placed at site G during capital dredging would not affect existing navigation within the FNC. Material placed in Site G would continue to disperse as it presently does. Finally, OIPCB's contractors will be present to remove any material that sloughs into the 2023 PA channel during construction, including all equilibration material and any material placed in Site G that might disperse into the 2023 PA design prism.

### 6.3.1.2 Equilibration

Side slope equilibration at Site G will continue until 6 years after capital dredging is complete. Material volumes associated with side slope equilibration at site G are presented in Table 6-2. Side

slope equilibration volumes are estimated using the evaluated channel condition (See Sub-appendix 9, *Channel Side Slope Analysis*). For the purpose of definitively accounting for all equilibrated material, it is conservatively assumed that 100% of all side slope equilibration material will remain in the channel reach adjacent to Site G and must be removed during maintenance dredging, even though the historical evidence shows that this area is dispersive (Section 4.5) and much of the material will be flushed with the tide.

**Table 6-2  
Side Slope Equilibration Volume by Year**

Construction Phase/ Year	Side Slope Equilibration Volume (cy)
2	17,800
3	14,600
4	10,800
5	7,200
6	4,400
7	2,400
8	1,200
9	500

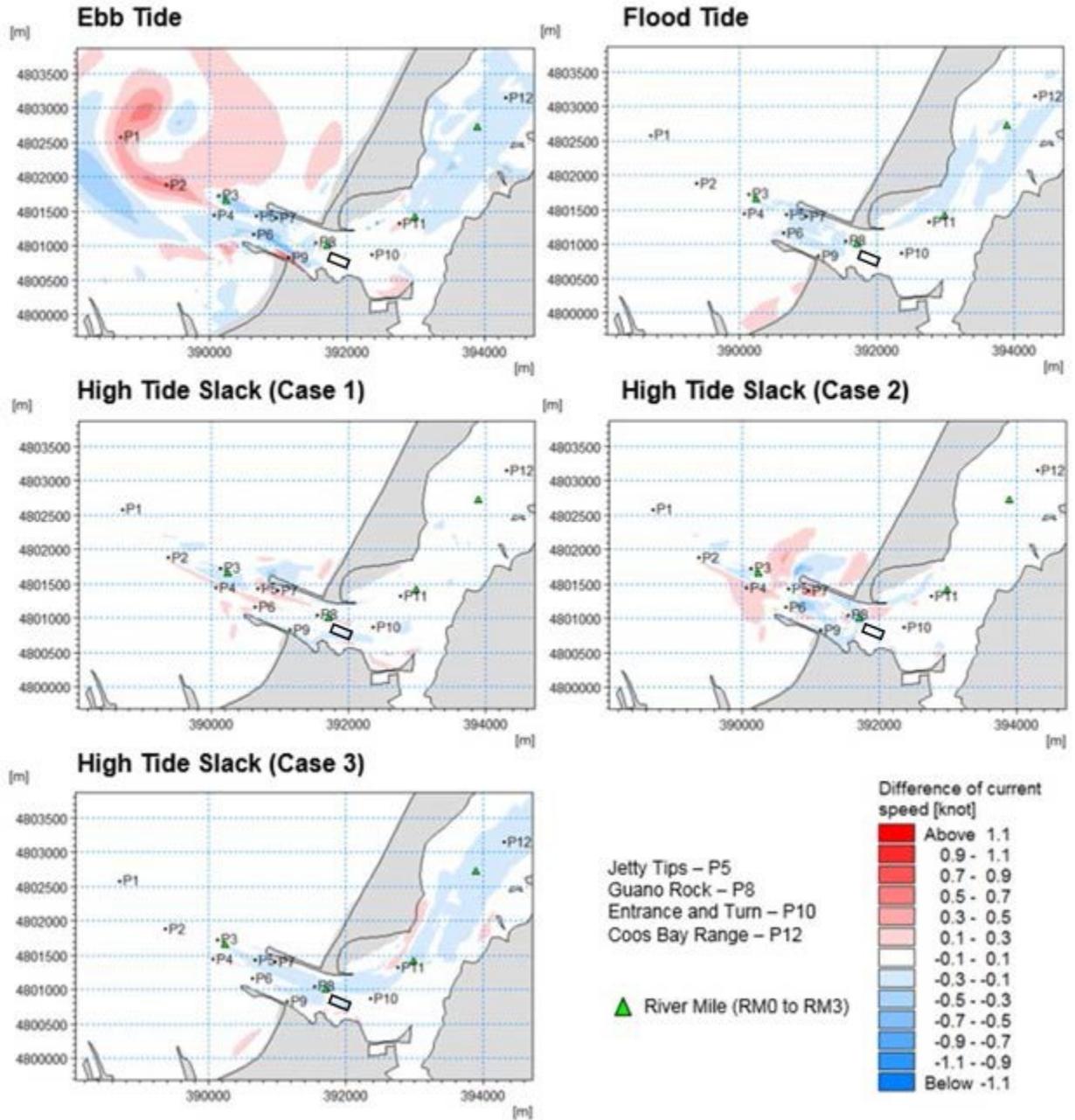
Side slope equilibration will deepen the riverbed at Site G by up to 8 feet. Material placed by USACE into Site G during the equilibration period will continue to disperse as it does presently (i.e., sediment will not accumulate at Site G nor does it slough to the bottom of the channel) because the physical forces, which cause Site G to be dispersive are not affected by the 2023 PA. As a result, the Corps can continue to use Site G as it does now, with no impact on Site G or the deepened and widened Federal Navigation Channel.

**6.3.1.3 Long-Term**

After side slope equilibration is complete, it is expected that Site G will continue to behave consistent with the historical and present conditions because nothing will have been changed by the 2023 PA Plan to affect the dispersive nature of the site. Figure 3-8 of Sub-appendix 4 shows velocity vectors under the 2023 PA. Figure 6-1 shows difference plots of current velocities, comparing without-project conditions with the 2023 PA, for the five conditions investigated. Under each condition, current velocities are not projected to change at Site G. Therefore, USACE will be able to place material at Site G consistent with the existing practices, and the material will disperse consistent with existing dispersal.

While it is unclear without a detailed tracer study where the material that disperses out of Site G eventually settles (i.e., in or out of the estuary or the FNC), this dispersal process will not be changed by the 2023 PA Plan. So, to the extent that some of the material may settle in some portion of the FNC, it is already included in existing shoaling rates and projected dredge volumes. And for that portion of material dispersing from Site G that settles outside of the FNC, it does not affect dredging quantities, or the availability of Site G. Analysis of the 2023 PA Plan already accounts for the volume and eventual location of material dispersing from Site G.

Analysis of existing and with-project bathymetry, including side slope equilibration (Figure 3-4), and without- and with-project current velocities (Figure 6-1) supports the conclusion that Site G will continue to be dispersive under with-project conditions for the volumes of material historically placed at the site.



**Figure 6-1**  
**Difference Plots of Entrance Currents through the Tidal Cycle (2023 PA minus WOP) (Site G outlined in black)**

**6.4 ODMDS H**

No changes to the site nor the quantity of material disposed of are expected to change.

**6.5 Site 8.4**

No changes to the site nor the quantity of material placed are expected to change.

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