

UMPQUA RIVER

[Local Sponsor: Port of Umpqua]

DESCRIPTION

An U.S. Environmental Protection Agency (EPA)-designated Interim ocean dredged material disposal site (ODMDS), located approximately one-half mile from the entrance to the Federal Navigation Channel (FNC), was initially used for dredged material disposal since its designation in **1977** (Figure 1). However, due to a realignment of the entrance channel in **1982**, the approaches to the Umpqua River lie over the Interim ODMDS (referred to as Site). Mounding was observed at the Interim Site in **1988**, which raised concern of potential problems for navigation. The U.S. Army Corps of Engineers – Portland District (Corps) recommended a new “Adjusted” Site in **1989**, approximately 2,800 feet north of the Interim Site, for final site designation by EPA. The Corps used the Adjusted Site under its Marine Protection, Research and Sanctuaries (MPRSA) Section 103 authority between **1991** and **2008**. Due to mounding at the Section 103 Adjusted Site, the EPA designated two new ODMDSs north and south of the entrance in **2009** under Section 102 of the MPRSA.

Coordinates: Umpqua River Interim Ocean Dredged Material Disposal Site
Corner Coordinates (NAD 27):

43° 40' 07” N, 124° 14' 18” W
43° 40' 07” N, 124° 13' 42” W
43° 39' 53” N, 124° 13' 42” W
43° 39' 53” N, 124° 14' 18” W

Dimensions: 3,600' x 1,400', Azimuth (long Axis): 270° T, Average Depth: 90'

Coordinates: Umpqua River Adjusted Section 103 Ocean Dredged Material Disposal Site
Corner Coordinates (NAD 27):

43° 40' 35” N, 124° 14' 22” W
43° 40' 35” N, 124° 13' 46” W
43° 40' 21” N, 124° 13' 46” W
43° 40' 21” N, 124° 14' 22” W

Dimensions: 1400' x 3200', Azimuth (long axis): 270° T, Average Depth: 105'

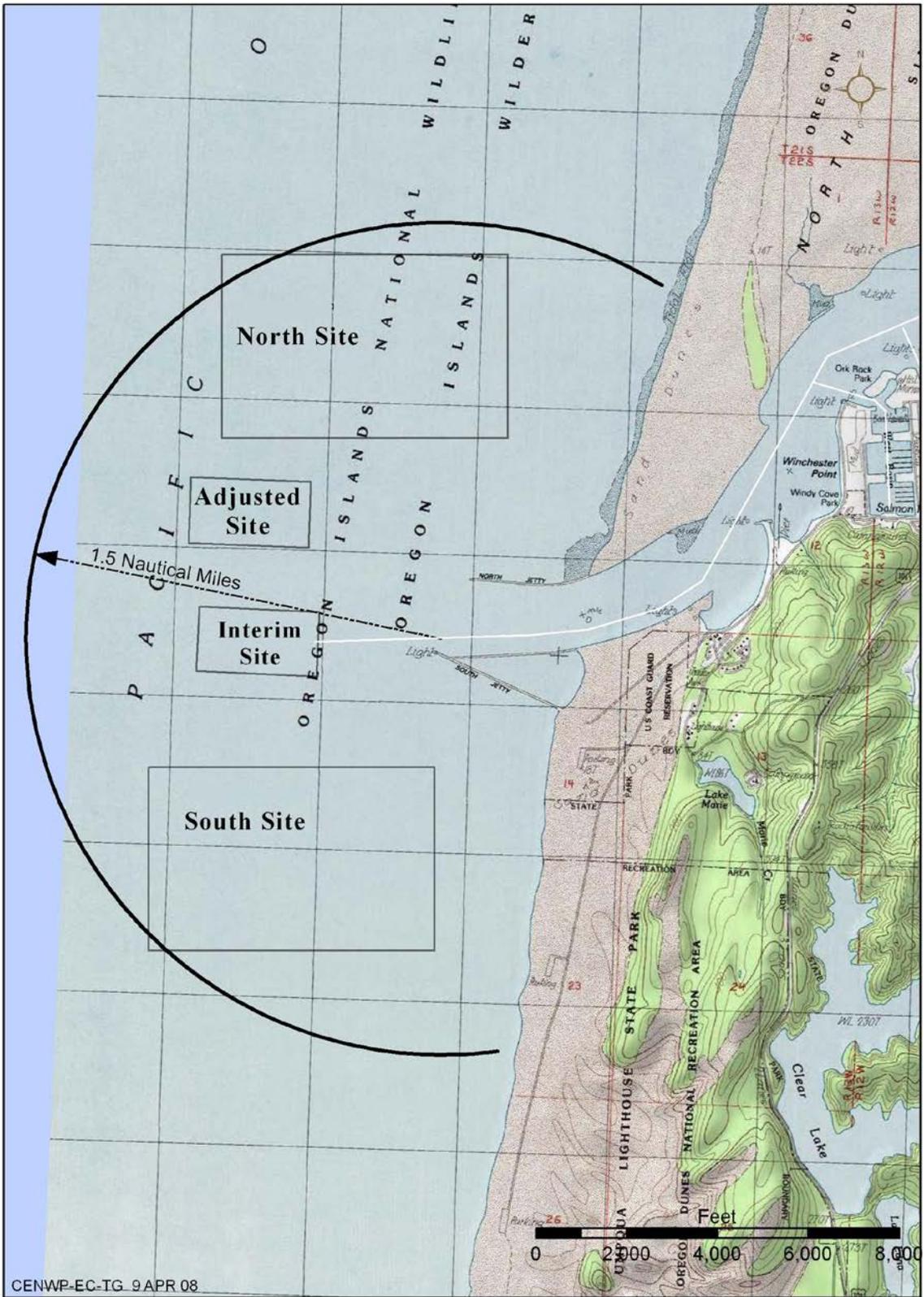


Figure 1. Umpqua ODMDS and Vicinity.

The EPA designated two new ODMDSs in **2009**. The North ODMDS is approximately 4,000 feet northwest and the South ODMDS is approximately 4,000 feet southwest from the entrance to the Umpqua River (see Figure 1). The two EPA Section 102-designated sites are used for disposal of dredged material from the Umpqua River FNC projects and other potential permitted projects. The lineal dimensions, boundary coordinates, and water depth variation for the designated North and South ODMDSs are: lineal dimension = 6,300 feet x 4,000 feet; axis azimuth = 270°; average depth = 75 feet; and 1998 elevation variation = -30 feet to -120 feet (MLLW). The corner coordinates (NAD 83) of the sites are:

North Site	South Site
43° 41' 23"N 124° 14' 20"W	43° 39' 31"N 124° 14' 35"W
43° 41' 25"N 124° 12' 54"W	43° 39' 33"N 124° 13' 09"W
43° 40' 43"N 124° 14' 17"W	43° 38' 51"N 124° 14' 33"W
43° 40' 46"N 124° 12' 52"W	43° 38' 53"N 124° 13' 07"W

Hopper dredges operate between May and September to maintain the Umpqua FNC entrance as adverse sea conditions prevent dredging at other times of year. Dredging to -28 to 30 feet (MLLW) maintains FNC project depth between dredging operations. To reduce maintenance, the entrance channel was realigned in **1982** to take advantage of the deep water off the south jetty. The entrance channel's realignment has reduced shoaling. Annual dredge quantities are presented in Table 1, at the end of the report.

Dredged Material Description

Dredged material deposited at the ODMDS comes from the FNC entrance bar, the two entrances to the Winchester boat basins, and in the main river channel up to river mile (RM) 11. The sediment at the entrance of the Umpqua River FNC is sand, with an average in-place density of 2,000 grams/liter. Sediment in the Umpqua River FNC itself is also generally sand, with an average in-place density of 1,600 to 1,900 grams/liter. The Umpqua River FNC sediments are well-sorted fine sands with median grain sizes between 0.2 mm and 0.3 mm. The North and South ODMDS sediments are also well-sorted fine sands with a median grain size of 0.3 mm. Some silt is found in the boat basin access channels into Salmon Harbor, and in the upper reaches of the Umpqua River FNC.

The Umpqua River FNC project has three in-bay disposal sites, which are used. In **1994** upland disposal as a beneficial use of dredged material for marsh and snowy plover habitat was accomplished across the river from the Winchester Bay boat basin.

Sediment Evaluation – Navigation Channel

1979 July. Winchester Bay sediments were evaluated for open water disposal.

1980 October. Sediment samples from the main channel of the FNC were collected by the Corps as part of a coastal evaluation of authorized coastal projects. The evaluation included bulk and elutriate chemical analyses as well as physical analysis. Grain size results in the FNC indicated sediments are composed of uniformly graded, fine sand with less than 8 percent silt/clay.

1986. The hopper dredge YAQUINA found pockets of a black "emulsified" sediment in Gardiner Channel (RM 8-9). Dredging was suspended. Sediment samples were collected at that time and no oil or other contaminants were detected. Sediments in Gardiner Channel were tested again in 1989 and found acceptable for unconfined in-water disposal. Maintenance of the channel by hopper dredge was resumed in 1990. In October 1991 the dredge YAQUINA again encountered oil in the vicinity of the fueling dock while dredging the Gardiner Channel reach of the FNC. Dredging was discontinued and water/oil samples collected for analysis. Analyses conducted by the NPD Materials Laboratory showed the material to be weathered Bunker Oil C (Diesel Fuel 6). The Gardiner Channel reach is currently being maintained to a depth of -18 feet MLLW (project depth is -22 feet MLLW) to avoid and remaining contaminated sediment.

1989 February. Sediment samples were collected from Gardiner Channel and its turning basin and analyzed for chemical and physical parameters. Sediments from this reach were considered suitable for unconfined, aquatic placement.

1991 September. Samples were collected from shoals in the FNC main channel and from the turning basins in Gardiner Channel and near Reedsport Docks. Physical and chemical (one sample) analyses were conducted. All material was determined to be suitable for in-water disposal. Sediment samples were also collected for various locations from the Winchester Bay access channels to evaluate the suitability of the embayment's sediment for the development of wetland habitat on the North Spit.

1992 April. Additional evaluations of the suitability of the Winchester Bay sediments for the development of wetland were conducted by Corps.

1996 July. Nine (9) samples were collected using box corer sampling gear on July 30, 1996. All samples were subjected to physical tests. Sample UQR-BC-3, from the Reedsport turning basin, and samples UQR-BC -4, -7, and -8, taken from the Gardiner channel and turning basin, and UQR-BC-9 sampled from immediately downstream of the confluence of the Gardiner and main channels were silty and were therefore also subjected to chemical analysis. The volatile solids content in the Gardiner channel sediment was the highest of all samples analyzed, ranging from 4.8 to 5.9 percent; the remaining samples had a volatile solids content ranging from 0.7 to 2.8 percent. Concentrations of all metal in the samples tested were below screening levels (SLs). Four of the five samples analyzed yielded low levels of 4,4' DDE, however, the values are estimated since each analyte was below the laboratory reporting limits of 10 ppb but above the

method detection level (MDL) of 0.3 ppb. There were no polychlorinated biphenyls (PCBs) found in any of the samples tested. All sediment samples analyzed contained polynuclear aromatic hydrocarbons (PAHs). However, total PAH in all samples were far below established concern levels. Organotins were detected in all samples in or near the Gardiner turning basin. However, each analyte is below the laboratory reporting limits of 3 ppb for the compound, but above the MDL of 0.3 ppb. All material from the FNC project was determined to be suitable for unconfined in-water disposal without further evaluations.

2001 February. Eight (8) surface grab sediment samples (UR-01 to UR-08) were collected from the Umpqua River FNC and six (6) samples from entrance channels to Winchester Bay (WB-01 to WB-06). All samples were submitted for physical analyses (mean 0.18 mm, with 77.59% sand and 22.28% fines), with 6 samples analyzed for metals, total organic carbon (TOC), pesticides/PCBs, phenols, phthalates, miscellaneous extractables, PAHs and organotin (tributyltin [TBT]) pore water analysis.

Sediment represented by samples collected during this sampling event exceeded the Tier II guidelines SL in one sample (WB-BC-03) for benzoic acid (1.2 x Dredged Material Evaluation Framework [DMEF] SL). Because benzoic acid is found in many natural forms and because neither Winchester Bay nor the sample in question have any known source of benzoic acid in the vicinity, the benzoic acid detected is thought to be an isolated, most likely a natural source, of benzoic acid. In light of this determination all sediment represented by this sampling event is considered to be suitable for unconfined, in-water placement without further characterization.

2006 August. On August 29-30, 2006 a total of eighteen (18) samples were collected from the Umpqua River FNC main channel, Winchester Bay entrance channels, and the Gardiner Channel and turning basin. All eighteen (18) samples were submitted for physical analyses including total volatile solids. Seven (7) of the eighteen (18) samples were, also, analyzed for metals (9 inorganic), TOC, pesticides and PCBs, phenols, phthalates, miscellaneous extractables, PAHs, with six (6) samples selected for both total sediment (bulk) and pore-water organotin (TBT), although only bulk analyses were conducted due to lack of pore-water volume.

The physical analyses resulted in mean values of 0.37% gravel (shell hash - 0.0%-1.2% range), 76.0% sand (15.0%-98.4% range), and 23.7% silt/clay (1.3%-84.9% range), with 6.82% volatile solids (1.67%-13.2% range) only measured on ten (10) of the eighteen (18) samples.

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels below their respective DMEF and Sediment Evaluation Framework for the Pacific Northwest (SEF) marine SLs. No PCBs or chlorinated hydrocarbons were found at the MDL in any of the samples. Several metals, organotins, pesticides, phthalates, miscellaneous extractables, phenols and low and high molecular weight PAHs were detected but at low levels. Detection levels were sufficient to evaluate material proposed for dredging. The analytical results of this characterization are consistent with historical data. Materials represented by all samples in this sampling event are determined to be suitable for unconfined, in-water placement without further characterization.

2011 August. Ten (10) sampling locations were selected in identified shoaling areas of the FNC, Winchester Bay access channels, and Gardiner Channel and turning basin. In sandy areas, a box core sampling device was used to obtain seven sediment samples for physical analysis; chemical analyses were not conducted on these samples because they were coarse-grained (97% sand on average). Four samples of the fine-grained materials in Winchester Bay were collected with a gravity core sampler: two dredge prism samples and two samples of the anticipated post-dredge surface (Z samples).

Sediment physical parameters were analyzed on all samples. Sand content in the Umpqua navigation channels averaged 95.1%; fines averaged 4.9%; average wet density was 1.84 g/cc. In the Winchester Bay, sand content in the dredge prism sediments averaged 20.7%; fines averaged 79.3%; average wet density was 1.40 g/cc.

Sediment chemical analyses were run on Sample BC-09 (RM 8+10 of the Gardiner Channel) and Winchester Bay samples (Samples GC-02A, GC-02Z, GC-03A, and GC-03Z). Metals were detected in all of the samples, but at concentrations well below the 2009 SEF marine benthic toxicity SLs. Pesticides, PCB Aroclors, chlorinated hydrocarbons, and butyltins were not detected in any of the samples. Phthalates, phenols, miscellaneous extractable compounds, PAHs, and total petroleum hydrocarbons (TPHs) were detected in some of the samples, but all detections were well below their SEF marine SLs. Under the 2009 SEF guidance, sediment sampling indicates that dredged materials in the Umpqua FNC project are suitable for unconfined, aquatic placement without additional characterization.

ODMDS HISTORY

Designation

1977 The Umpqua River ODMDS received interim designation from the EPA.

1991 August The EPA, Region 10 published the Umpqua, Oregon Dredged Material Disposal Site Designation, draft EIS for an Adjusted Site north of the **1977** interim site.

1991 October The Corps under its Section 103 authority selected the Adjusted Site north of the **1977** Interim Site for dredged material disposal.

1997 January The use of the Interim Site for the disposal of dredged material expired pursuant to WRDA 92, Section 506 (c) (4).

1997 The EPA gave verbal approval for continued use of the Section 103 Adjusted Site in response to Corps public notice on FNC Operations and Maintenance (O&M) dredging.

1998 The EPA in response to a Corps **April 8, 1998** letter reaffirmed their concurrence for continued use of the Section 103 Adjusted Site pending final site designation by EPA. The Section 103 time period was until final site designation or five years from the date of the letter which was **April 14, 1998**.

2003 The EPA in response to a Corps letter dated **April 15, 2003**, affirmed their concurrence for continued use of the Section 103 Adjusted Site pending final site designation by EPA. The Section 103 time period per EPA's **April 17, 2003** letter provided for use of the Section 103 Adjusted Site until the end of the dredging season in **2008**.

2008 The EPA, Region 10 on **November 25, 2008** issued a proposed rule for the designation of two new ODMDSs (North and South) at Umpqua River.

2009 Published on **April 24, 2009** the effective date for the EPA Site designation Final Rule was **May 26, 2009** for the North and South ODMDSs.

Evaluation Studies for Designation

During **August and September 1984**, site-specific geologic information and geophysical investigations by sidescan sonar and sub-bottom acoustic reflection profiling was performed. In addition, existing geologic and oceanographic data pertinent to the Umpqua River Zone of Siting Feasibility (ZSF) was compiled.

1984 September and 1985 January, field sampling was conducted to evaluate aquatic resources and characterize sediment of the Umpqua River ZSF.

In **1989 April**, the Umpqua Ocean Dredged Material Disposal Site Evaluation, Final Report was published by the Corps. The evaluation report recommended an adjusted ODMDS approximately 2,800 feet to the north of the Interim ODMDS in slightly deeper water.

The U.S. Coast Guard had raised concerns with the location of the Interim ODMDS with respect to the marked approach channel. The approach channel was realigned in response to changes in the entrance jetties, after the Interim ODMDS was designated. As a result, the approach channel became aligned directly over the Interim ODMDS. Potential conflicts could occur with the dredge and local ships during disposal activities and navigation problems could develop if significant mounding occurred at the disposal site.

In **2007**, sediment physical and chemical analyses, as well as site benthic infauna and trawl studies, were conducted. The biological samples were collected in **June and September 2007** with sediment samples for physical and chemical analyses also collected in **June 2007**. These studies do not indicate the proposed North or South ODMDSs contain limited or unique habitat.

MANAGEMENT/MONITORING

The original Umpqua River **site management/monitoring plan (SMMP)** was completed and coordinated for public review in **April 1997**. No comments were received. A new SMMP was prepared as part of EPA, Region 10 designation documents in **2008-2009**. This SMMP supersedes all previous SMMPs. The SMMP for these Sites calls for conducting bathymetric surveys annually as a monitoring activity. Only Sites used or planned to be used in a give year

will be surveyed.

Bathymetric surveys of the Interim or Section 103 Sites were conducted in **September 1981, August 1988, May 1991, May 1993, September 1993, April 1994, September 1994, May 1995, May 1996, September 1996, September 1997, May 1998, May 1999, June 2000, September 2000, May 2002** (interim site), **June 2002** (Section 103 site), **June 2003, June 2003, September 2004, August 2005, June 2006, May 2007, and July 2008**. With EPA Section 102 Site designation the two new ODMDSs South and North were surveyed in **May 2009** to establish contemporary baseline conditions at the sites. The North Site was subsequently surveyed in **June 2010, July 2011, June 2012, July 2013, and June 2015**. The South Site was surveyed in **June 2012**. Copies of the most recent bathymetry and bathymetry difference plots for the North Site are attached to the end of the report.

The Interim ODMDS **August 1988** bathymetric survey, when compared to the **September 1981**, survey shows the accumulation of dredged material to exceed 21 feet. Water depths decreased from -72 feet MLLW to less than -54 feet MLLW at the crest of the mound. No material has been placed in the Interim ODMDS since **1991**. By **May 1991** accumulation had decreased, through natural processes, to 15 feet of dredged material and by **April 1994** mounding has decreased to 12 feet of accumulation. The **August 1995** survey shows little change when compared to the **April 1994** survey.

In subsequent years (**May 1996-May 1999**) it appears that material eroded from the shoreward portion of the Interim Site and was transported further off shore and to the north. By **May 1999** relative to **September 1981** the contours to the north and northwest of the Interim site have prograded offshore, while the contours to the south had remained relatively unchanged. This indicates dispersion of material to the north and down slope away from the Interim Site. Comparing the **June and September 2000** to the **May 1999** bathymetric survey at the Interim Site shows a significant overall deepening of the site. The maximum mound height decreased from 13 feet to 9 feet. Compared to the **August 1988** some areas showing greater than 16 feet decrease in mound height in **September 2000**. In **August 2005**, little change is noted in the Interim Site compared to previous surveys.

The **1989** Adjusted ODMDS used under the Corps Section 103 authority is located to the north and in deeper water than the Interim ODMDS. As a result of one season's placement in **1992**, the **May 1993** survey showed that the site had accumulated up to 8 feet of dredged material. By **September 1993** accumulation was up to 10 feet. The **April 1994** survey showed the loss of 2 feet of dredged material over the winter of **1993/1994**. This indicates some movement of material at these depths, but not sufficient to remove all dredged material placed. The **August 1995** through the **September 1997** survey indicates a continued vertical growth rate of 2 feet per year on the mound. The **May 1998** bathymetric survey is in question because all contour lines show decreasing depth, when compared to the **September 1997** bathymetry. The Adjusted Site, the Interim Site and areas in-between, indicate decreases in depth. Continued mounding of dredged material appears likely at present disposal rates. The **May 1999** survey shows that the mound at the Section 103 Adjusted Site has increased to 19 feet maximum accumulation. The footprint of the mound exceeds the site boundaries in all but the southeast

corner.

The **June 2000** survey shows a maximum mound height of 18 feet (at -92 ft.[MLLW]). The **September 2000** survey as a result of dredged material disposal in **2000** had a maximum mound height increase of 2 feet to 20 feet. However, as with the Interim Site there appears to be significant erosion in the shallower nearshore area. The **June 2002** through **August 2005** Section 103 Site survey continues to show a 20-foot mound, with continued footprint accumulation outside of the site boundaries to the north and east. Note that only 9,400 cubic yards (CY) was placed at the site in **2005**. There does not appear to be any real significant change in the mound configuration and height at the site in **2008** when compared to survey in **2007, 2006, 2005, and 2004**. Mound height has varied between 18 to 20 feet in this time period.

Starting in **2009**, dredged material was placed in the new EPA-designated Section 102 designated North ODMDS. The larger site allows placement of material in shallower depths as well as allowing the spreading of the material over a larger area to avoid mounding.

Management/Monitoring Actions and Recommendations

Beginning in **1992**, the Corps was notified of requirements for annual bathymetric surveys of all ODMDSs as a Tier I monitoring requirement.

Because of the realignment of entrance channel to the FNC described above, the Corps, under its Section 103 authority, selected the recommended Adjusted Umpqua River ODMDS for dredged material disposal as of **September 1991**.

In **1998** EPA, Region 10 funded a computer modeling study to determine short-term and long-term fates of dredged material at the Umpqua ODMDSs because of the continuing mounding documented by bathymetric monitoring. Site capacity of the **1991** Section 103 Adjusted Site appears limited as documented in the bathymetric plots. The EPA modeling study further documents that the material placed at the adjusted site since **1992** has remained within the site boundaries. At the rate of placement and disposal practices at the Section 103 Site, site capacity was estimated to be exceeded in 3 years from **1998**. Site capacity is based upon a mound induced 10% increase in wave height. Existing dimensions of the Interim and Adjusted sites are 3,600 X 1,400 (feet) and 3,200 X 1,400 (feet), respectively. The modeling study calculated a site with a 20-year design life would require site dimensions of 5,800 X 4,000 feet. Two possible locations with these dimensions within the ZSF at Umpqua were identified. EPA, Region 10 used this modeling information during their **2009** final Section 102 site designation process.

The EPA draft (**1991**) Environmental Impact Statement (EIS) recommended the Adjusted Site as identified in the Corps **1989** site evaluation study. Based upon subsequent monitoring, it was determined to be too small to accommodate the volume of material dredged at Umpqua River. Because of the age of the baseline studies it was questionable if the present documentation was sufficient to designate any site at Umpqua River. Therefore new baseline studies were conducted in **2007**. These included benthic infauna surveys, trawls, and sediment physical and chemical analysis. Multi-beam bathymetry was scheduled for **2007** but was not conducted due to scheduling and poor weather. The multi-beam surveys were conducted in **2008** but the quality of

the data collected was not adequate.

The Corps Section 103 Adjusted Site expired at the end of the **2008** dredging season and was no longer available for use. EPA finalized Section 102 designation of two new Sites (South, North) prior to the **2009** dredging season. The North and South Sites were gridded and the preference is to use the shallow nearshore portions of the Sites to the maximum extent possible. The North and South Sites are surveyed annually, if used, as part of the required routine monitoring. Periodic bathymetric monitoring of the Interim Site and Section 103 Site is also recommended even though no longer used. The monitoring of the long-term fate of material placed at the Interim Site and Section 103 Site provides information which could be applied to the management of active Sites.

In **2012**, a generic dump plan (Figure 2) was developed for the Umpqua North ODMDS. Previous to the generic dump plans, directions were given to evenly distribute material evenly over the site or to restrict certain areas of the site due to mounding. Dump plans are adjusted according to annual bathymetric monitoring, and the development of a generic dump plan formalized this process.

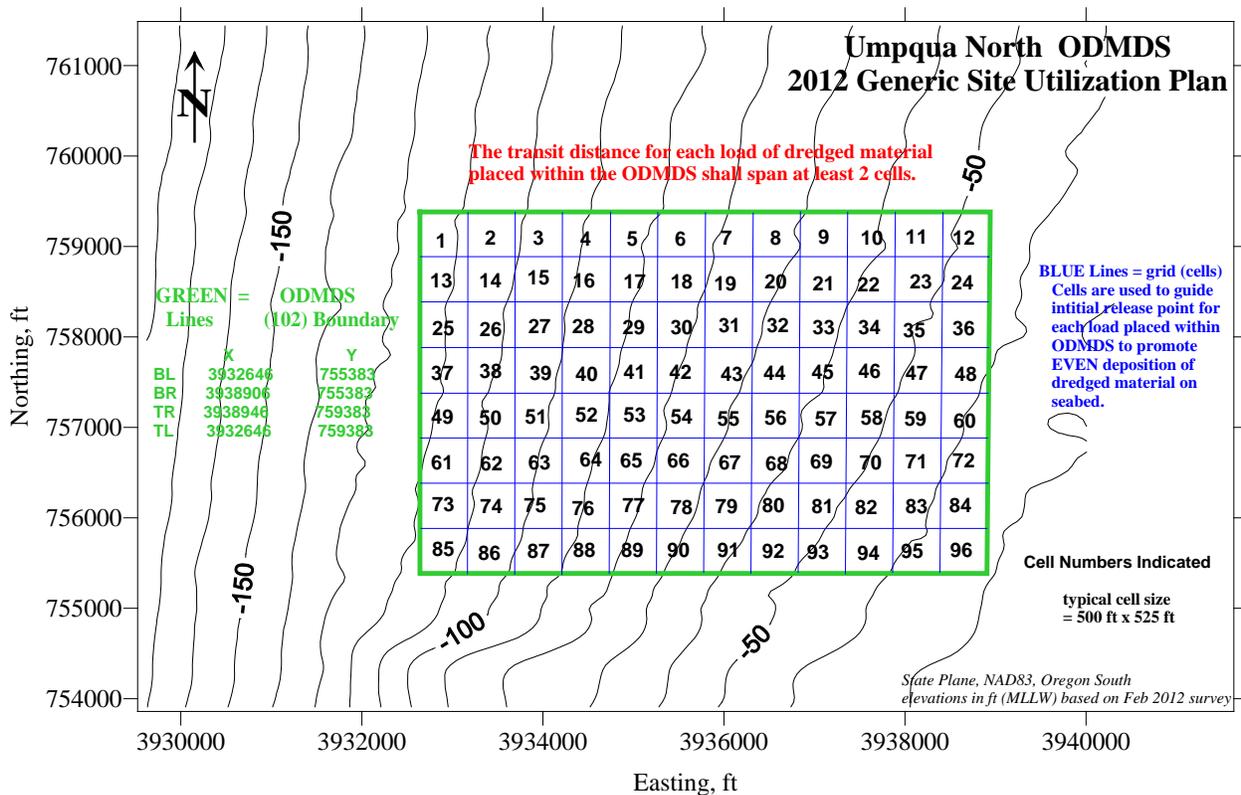


Figure 2. Umpqua North ODMDS generic dump plan (2012).

The generic dump plan was developed to direct the Dredge YAQUINA placement at the North ODMDS. All cells (1-96) are available for placement. The assigned cells are used to guide the release point for each load placed within the ODMDS to achieve even deposition of dredged material on the seabed within the ODMDS. The transit distance for each load of dredged material shall span at least two cells. Unless otherwise directed, the transit path over which dredged

material can be placed within the assigned cells is to be performed according to the vessel operator’s discretion, to promote safe and efficient operation of the equipment during the disposal operation.

Proportionally, use of the entire Umpqua North ODMDS will have more material going to the shallow water areas (less than 65 feet) than the deepwater areas. There is more area of the ODMDS located shoreward of the 65 foot shallow water contour than offshore. Allowing use of the entire ODMDS minimizes the occurrence of shallow water over-use (mounding / excessive deposition) and promotes operational flexibility for the dredges using the ODMDS. The intent of the generic dump plan is to preferentially use the shallow water area of the ODMDS, within the operational framework of dredging disposal. This use conforms to the SMMP requirement that “any sandy material going to the ocean must preferentially use the nearshore area”.

In 2014, a dump plan (Figure 3) was created for the contract dredge to place up to 45,000 CY of material at the Umpqua North ODMDS. In August 2014, the clamshell dredge Heidi Renee placed approximately 26,303 CY of material at the Umpqua North ODMDS as shown in Table 1. Dump plans were also created for the Hopper Dredge Yaquina to evenly place material across the site.

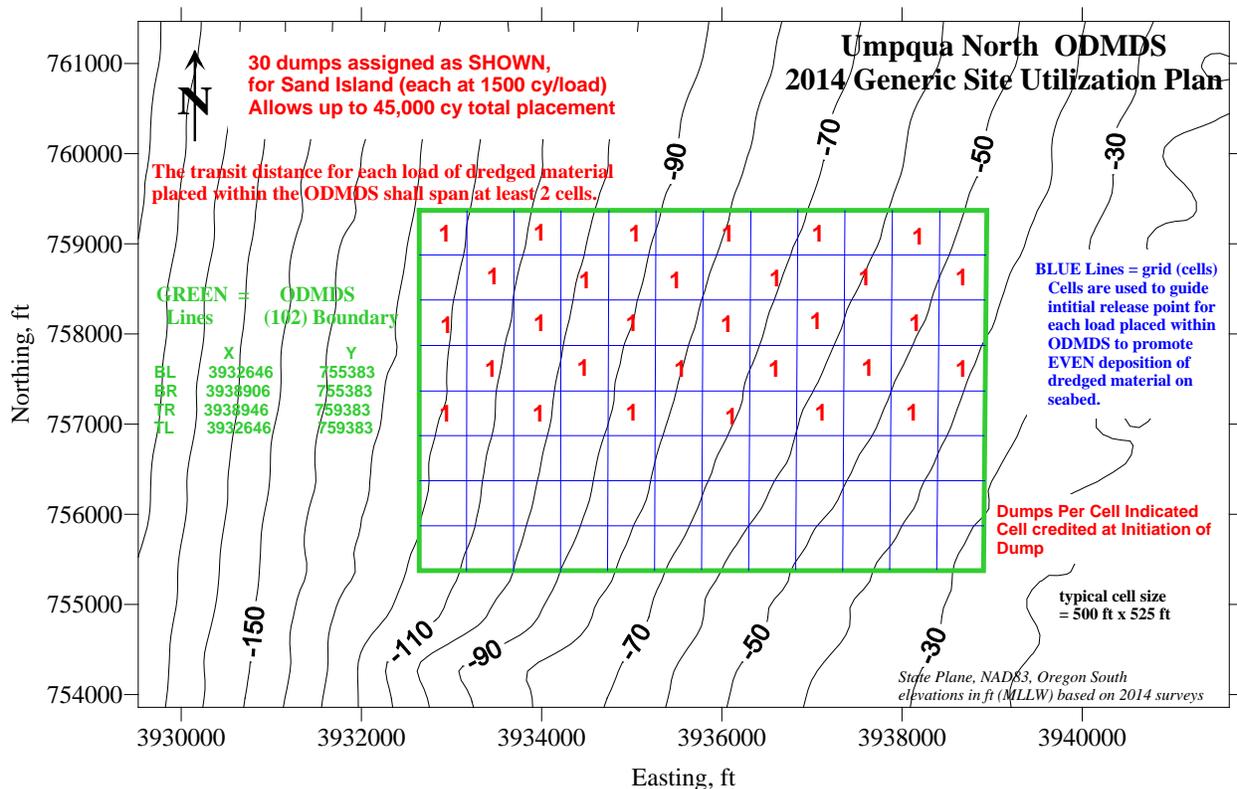


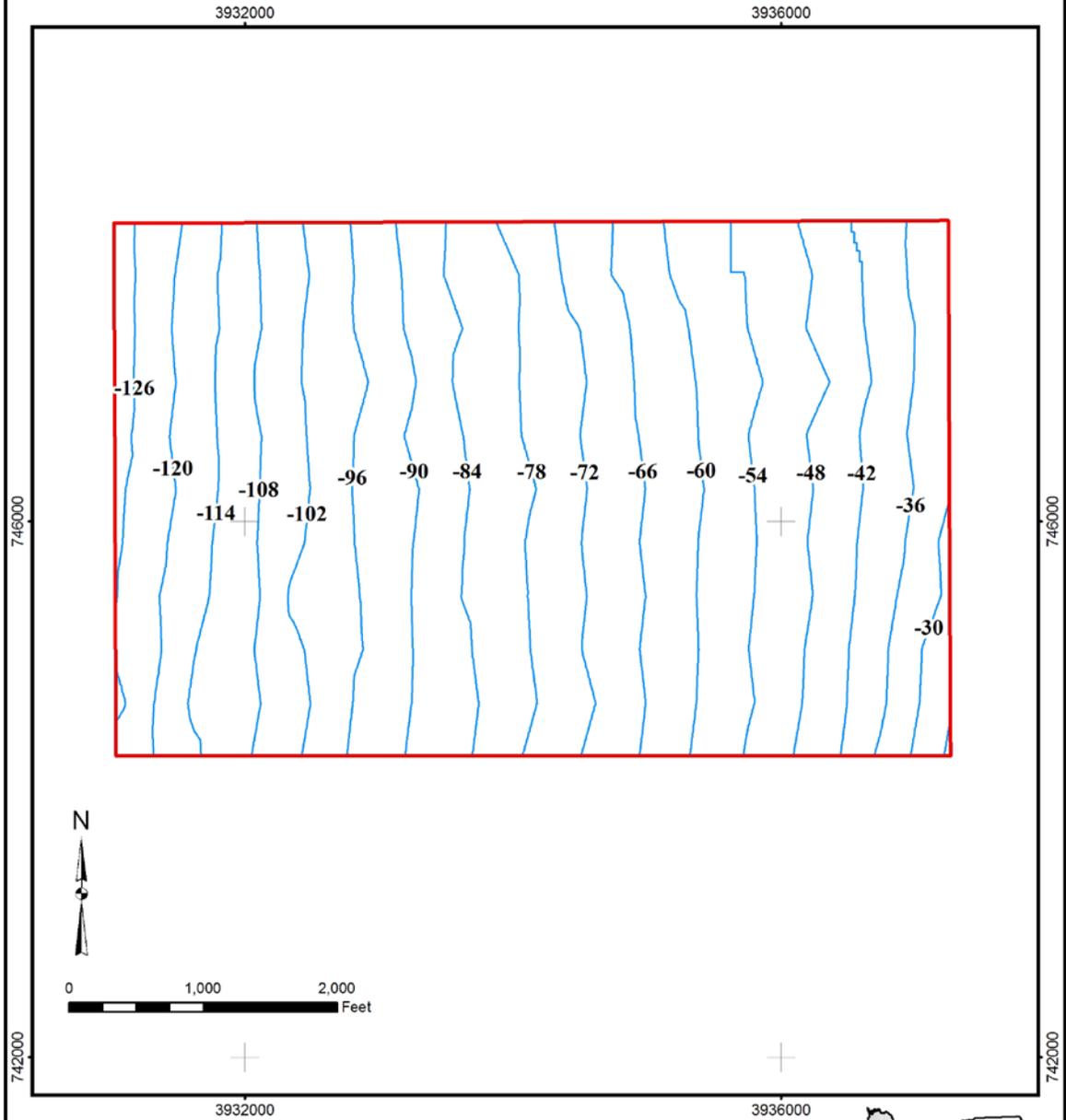
Figure 3. Umpqua North ODMDS Contract Dredge Dump Plan, 2014

Table 1

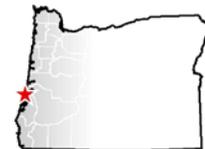
Volumes Dredged and Disposed at ODMDS
Umpqua River Federal Navigation Channel
[in thousands of cy]

<u>Fiscal Year</u>	<u>Hopper Dredge</u>
Interim Site	
1986	44.6
1987	152.4
1988	330.2
1989	158.7
1990	180.3
1991	118.4
Section 103 Adjusted Site	
1992	226.5
1993	212.8
1994	204.0
1995	93.7
1996	116.8
1997	114.5
1998	196.9
1999	168.7
2000	68.6
2001	99.4
2002	246.2
2003	113.5
2004	93.2
2005	9.4
2006	62.0
2007	106.8
2008	93.8
Section 102 North Site	
2009	60.6
2010	113.4
2011	133.2
2012	114.6
2013	23.9
2014	195.9

OFFSHORE DREDGED MATERIAL DISPOSAL
Umpqua South Disposal Site
Survey Date: 21 June 2015
6' Contours



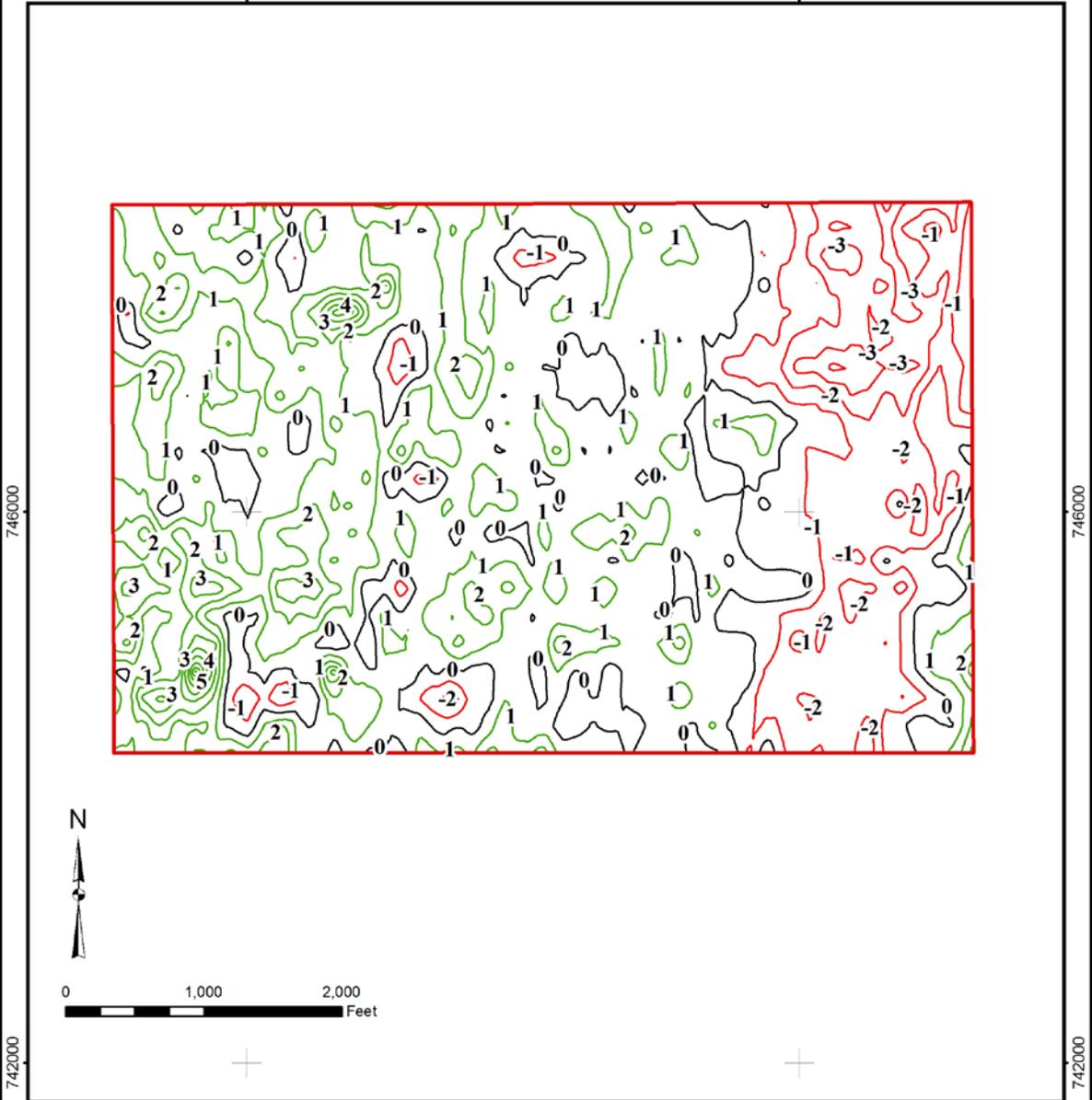
Horizontal Coordinate System:
NAD83, State Plane Oregon South, U.S. Survey Feet
Vertical Datum: NGVD 1927 (1947 Adj.)
Mean Lower Low Water (MLLW)



OFFSHORE DREDGED MATERIAL DISPOSAL
Umpqua South Disposal Site
Survey Date: 21 June 2012 & 21 June 2015
1' Contours of Change in Bathymetry from 2012 to 2015

3932000

3936000



742000

746000

3932000

3936000



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

Horizontal Coordinate System:
NAD83, State Plane Oregon South, U.S. Survey Feet
Vertical Datum: NGVD 1927 (1947 Adj.)
Mean Lower Low Water (MLLW)



OFFSHORE DREDGED MATERIAL DISPOSAL
Umpqua South Disposal Site
Survey Date: 16 September 1981 & 21 June 2015
1' Contours of Change in Bathymetry from 1981 to 2015

