

YAQUINA BAY
[Local Sponsor: Port of Newport]

Description

Sediment removed by a hopper dredge has been deposited at one of three Yaquina Bay Ocean-Dredged Material Disposal Sites (ODMDS). Between **1977** and **1985**, all material was placed in the EPA Interim ODMDS (Figure 1). Dispersion from the site was inadequate for the amount of material deposited, however, and mounding occurred.

The USACE, Portland District selected an alternate ODMDS (Section 103 Site) in **1986**, using its authority under Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972. In **1998** the Corps extended the Section 103 site selected in **1986** to include the outer 2/3 of the **1977** Interim site (figure 2).

Coordinates: Yaquina Bay Ocean Disposal Sites

Interim Site

Corner Coordinates (NAD 27):

44° 36' 31" N, 124° 06' 04" W
44° 36' 31" N, 124° 05' 16" W
44° 36' 17" N, 124° 05' 16" W
44° 36' 17" N, 124° 06' 04" W

Dimensions: 3,600' x 1,400'
Azimuth (long axis): 270° T
Average Depth: 60'

1996 Section 103 Site

Corner Coordinates (NAD 27):

44° 36' 32" N, 124° 06' 21" W
44° 36' 54" N, 124° 06' 21" W
44° 36' 54" N, 124° 05' 24" W
44° 36' 32" N, 124° 05' 24" W

Dimensions: 2,220' x 4,070'
Azimuth (long axis): 270° T
Average Depth: 70'

1998 Section 103 Site

Corner Coordinates (NAD 83):

44° 36' 53" N, 124° 06' 25" W
44° 36' 53" N, 124° 05' 28" W
44° 36' 16" N, 124° 05' 28" W
44° 36' 16" N, 124° 06' 08" W
44° 36' 31" N, 124° 06' 08" W
44° 36' 31" N, 124° 06' 25" W

Dimensions: 2,220' x 4,070' (northern rectangle) plus 2,800 x 1,400' (southern rectangle)
Azimuth (long axis): 270° T
Average Depth: 60'

In **2001** the Corps completed an ODMDS Site Evaluation Study which identified two new sites offshore from Yaquina Bay (figure 3). Selected under its Section 103 authority the Corps began utilizing the North Site in **2001** for all material dredged for the Yaquina Bay and Harbor projects.

Site coordinates (degrees, minutes, seconds; North American Datum 1983) and dimensions of North Site and the South Site are as follows:

North Site

Corner Coordinates:

44° 38' 17.98" N, 124° 07' 25.95" W
44° 38' 12.86" N, 124° 06' 31.10" W
44° 37' 14.33" N, 124° 07' 37.57" W
44° 37' 09.22" N, 124° 06' 42.73" W

Dimensions:

4,000' width by 6,500' long
597 Acres
Azimuth (long axis): 10° T
Depth: 112-152'

South Site

Corner Coordinates:

44° 36' 04.50" N, 124° 07' 52.66" W
44° 35' 59.39" N, 124° 06' 57.84" W
44° 35' 00.85" N, 124° 08' 04.27" W
44° 34' 55.75" N, 124° 07' 09.47" W

Dimensions:

4,000' wide by 6,500' long
597 Acres
Azimuth (long axis): 10° T
Depth: 112-152'

Dredged Material Description

The sediment from the Yaquina Bay and Harbor entrance to the turning basin at RM 2 is composed of medium to coarse sand having a mean grain size of 0.22 mm and low in organic content as measured by volatile solids (0.60%). Samples from within the turning basin are composed of fine sands having a mean grain size of 0.18 mm and higher volatile solids content (1.80%). Resuspended density ranged from 1518 gm/L to 1934 gm/L. Material is also occasionally dredged from the access channel of the Southbeach Marina. Material in the Southbeach Marina access channel ranges from 63.1% to 15.6% sand and 2.35% to 3.63% TOC. Depot Slough at Yaquina River mile 13 is dredge as needed on an infrequent basis. A **2003** physical analyses resulted in mean values of 0.0% gravel, 4.71% sand (2.40%-6.06% range), and 95.3% silt/clay (93.94%-97.60% range), with 10.5% volatile solids (9.43%-11.85% range). Mean grain-size for all the samples was 0.042mm; this material is classified as silt. Both physical and chemical analyses of the material from all of these projects have shown the material to be dredged to be suitable for ocean disposal without further testing. Quantities dredged are shown in Table 1.

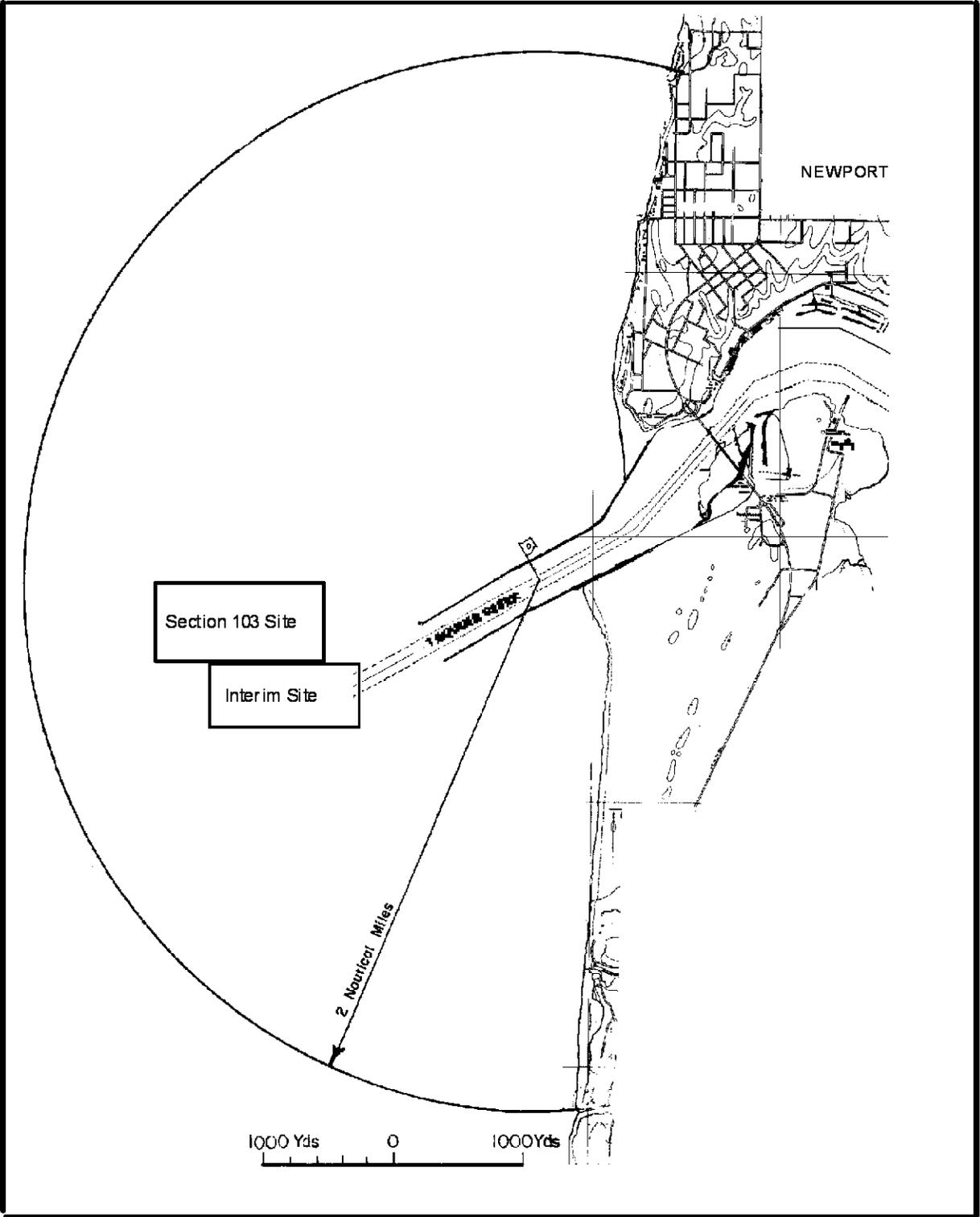


Figure 1: Yaquina ODMDS and vicinity.

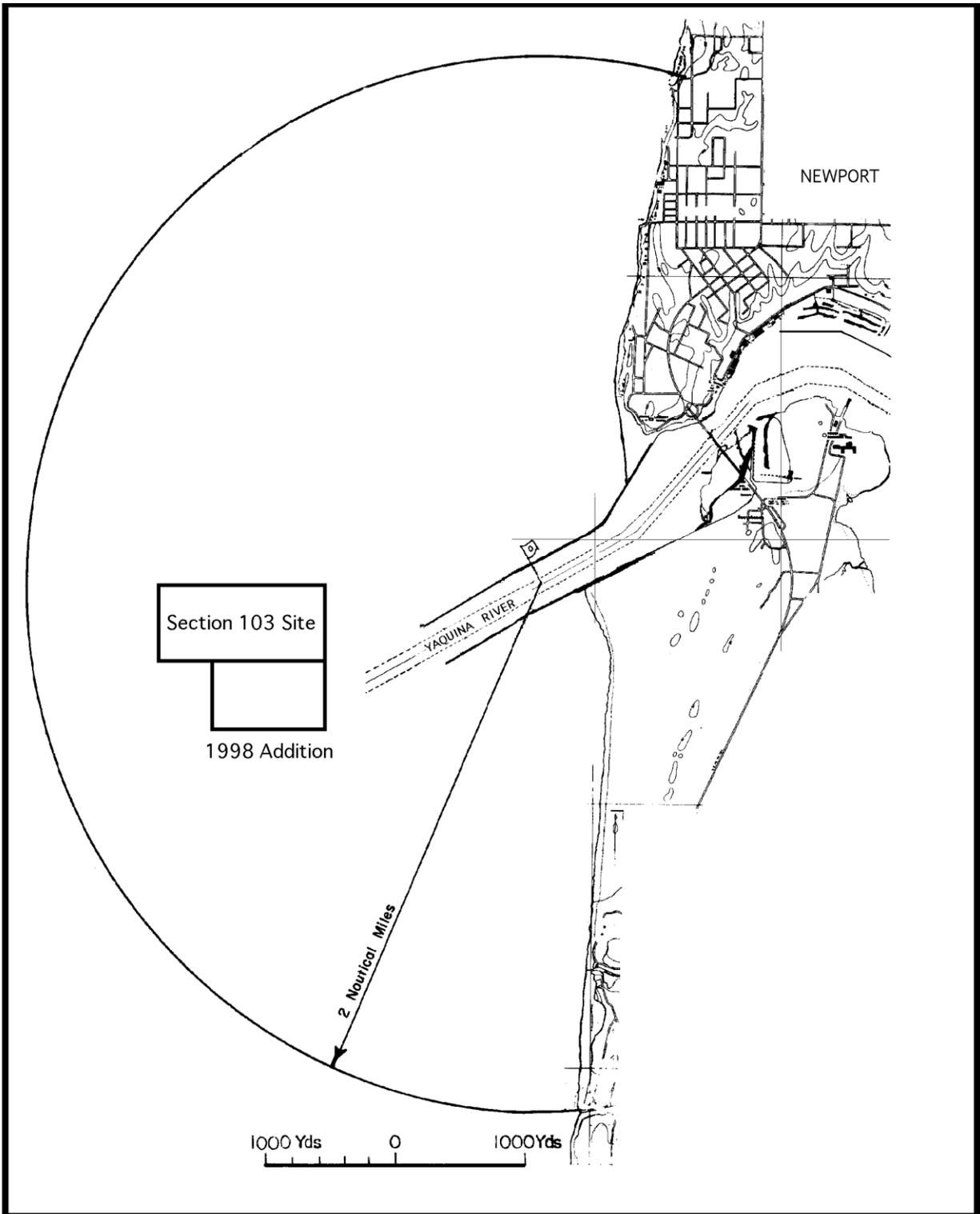


Figure 2: Yaquina Bay 1998 Section 103 ODMDS..

Sediment Evaluation

1980 June, Sediments were subjected to elutriate, benthos, and/or physical analyses from the Yaquina River and Bay navigation channel from RM 0.0 to RM 14.0. Sediments were also collected from Depot Slough. Sediments from RM 0.0 to RM 2.8 are very clean sands and could be excavated and placed without restriction. Material from Yaquina River and Depot Slough would require further evaluation including bioassays.

1981 March, Sediments from Depot Slough were subjected to "jar tests" to determine the best flocculent to use for settling sediments discharged into an upland disposal facility. Disposal facility design and flocculent application methods were presented.

In **1986 July** sediments were taken at various locations from the mouth of the Yaquina River to the turning basin at river mile 2.4. Eleven sediment samples were collected. Sample #11 was collected from the boat harbor, the rest from shoals that were to be dredged. Physical and chemical analyses were performed on all samples except #11 (no chemical analysis).

1990 April, 11 samples were collected from the federal channel between RM -0.5 to RM 2.4. All samples were subjected to physical analysis while samples YQ-BC-9 & 10 were also subjected to chemical analyses. Based upon the analyses performed all material to be dredged from the main federal channel was considered to be suitable for unconfined in-water disposal.

1990 April, 14 samples were collected outside of the federal channel at the same time as the federal channel sediment mentioned above. Funded by EPA, Region 10 the purpose for these samples was to provide basin wide sediment characterization at Yaquina Bay. Sampling stations were located in marinas, backwater areas, and up river. These sediments were finer (38.6% fines) and had higher organic content (6.5% volatile solids). Due to contamination by TBT and phenols the South Beach Marina sediments required additional testing and evaluation prior to dredging and disposal.

1991 May, 6 sediment samples were collected along the federal navigation channel in the South Beach Marina and subjected to physical, chemical, and biological analyses. The material was composed of silty sand and sandy silt. Median grain size ranged from 0.09 mm to 0.15 mm, percent fines ranged from 15.9% to 65.4% with a mean of 33.9%. Volatile solids ranged from 2.2% to 9.4% with a mean of 5.52%. All chemical analyses indicated chemical contamination was below established levels of concern. Biological testing further indicated that no unacceptable adverse environmental impacts would be expected due to dredged material disposal. The material was subsequently dredged by a small pipeline dredged and the material placed upland.

1994 February, 6 sediment samples were collected between RM 6.0 and RM 11.0 for physical analyses and to determine if the material was suitable for oyster habitat. The sediments were found to be predominantly clean sand (80.6 to 97.6%) with a small amount of silt (2.7 to 19.4%). Mean median grain size was 0.29 mm, a medium sand. Sediment samples were also collected from Depot Slough and subjected to physical as well as bulk and elutriate chemical

analyses. The Depot slough sediments were found to be acceptable for in-water or upland disposal.

1995 March, 7 sediment samples were collected from various locations in the federal channel and Southbeach Marina. Two samples from the Southbeach Marina and 1 sample from the turning basin at RM 2.5 were subjected to chemical as well as physical analysis. Material from the main federal channel was sandy with low volatile solids (0.7% to 1.2 %). Material from Southbeach Marina and the turning basin were finer (median grain size 0.03 mm, 0.07 mm & 0.15 mm) and had higher organic content (7.2%, 8.5%, & 3.6% volatile solids) than the federal channel. Chemical analyses included 8 metals, 19 pesticides, 7 PCB arochlors, 18 PAHs, 14 phenols, butyltins, AVS, and TOC. Contaminant levels were all below established levels of concern and the material determined to be suitable for unconfined in-water or upland disposal.

2000 May, Prior to potential maintenance dredging, nine sediment samples and 1 QC duplicate were collected from Yaquina Bay and South Beach Marina on May 31, 2000. All samples were submitted to Sound Analytical Services for physical analyses, with 4 samples analyzed for metals (9 inorganic), total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons (PAHs) and 3 samples submitted for organotin (TBT) analysis.

Materials represented by all samples collected during this sampling event met Tier II guidelines of the Dredge Material Evaluation Framework (DMEF) and have been determined suitable for unconfined in-water placement without further characterization.

2000 May, ODMDS Baseline sediment evaluations were conducted at the proposed new North and South ODMDSs and vicinity. Twenty stations were sampled and analyzed for physical parameters. Ten stations were combined into 5 composites for chemical analyses. Two were from both the North and South Site and one from a reference area. The material in the offshore study area is fairly uniform composed primarily of sand (96.5% to 100%) with 3.5% or less silt. All chemical analyses (metals, PAHs, pest/PCBS, Phenols, chlorinated hydrocarbons, phthalates, and misc. extractables) indicate that the material in the offshore study area is clean for chemical of concern studied.

August 2003, A total of five (5) gravity core sediment samples were collected from the Depot Slough. All samples were submitted for physical analyses including total volatile solids. All five (5) sediment samples were analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons, total and pore water organotin and dioxin/furan.

The physical analyses resulted in mean values of 0.0% gravel, 4.71% sand (2.40%-6.06% range), and 95.3% silt/clay (93.94%-97.60% range), with 10.5% volatile solids (9.43%-11.85% range). Mean grain-size for all the samples is 0.042mm; this material is classified as silt. None of the contaminants tested were found to be at or above their screening level (SL). All sediment is determined to be suitable for unconfined, in-water placement without further characterization.

2005 September, On September 12, a total of 10 samples were collected from shoaling areas at 7 stations within the federally maintained entrance channel and harbor and 3 additional stations within South Beach Marina channel. All samples were submitted for a full suite of physical and chemical parameters as outlined in the DMMF (1998) Tier II a & b. Federal Navigational Channel (FNC) samples submitted were classified as “poorly graded sand”. Mean grain-size for FNC samples is 0.18 mm, with 0.2% gravel (0.0%-1.2% range), 91.6% sand (62.3%-99.3% range) and 8.4% silt/clay (0.7%-37.6% range). Mean volatile solids were 2.7%, with a 0.4% to 13.8% range. Sample from the South Beach Marina channel had a mean grain-size of 0.09mm, with 0.6% gravel (0.0%-1.7% range), 48.2% sand (12.1%-71.7% range) and 42.8% silt/clay (28.3%-86.2% range). Mean volatile solids were 8.0%, with a 5.8% to 9.2% range.

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels well below their respective DMEF screening levels (SLs). Detection levels were sufficiently below the SL to evaluate material proposed for dredging.

Monobutyltin, which does not have an established DMEF SL, was detected in 2 samples within the South Beach Marina federally maintained channel. The levels (0.937ug/L and 0.166ug/L) are below calculated effects level concentrations*(see reference). Sediment data, from samples collected within the South Beach Marina federally maintained channel, has been submitted to the Regional Sediment Management Team for their determination as to suitability for in-water placement. The K_{ow} * is very low for monobutyltin, so it would take high environmental concentrations for any significant amounts to be bioaccumulated (ref. NOAA fisheries, J. Meador).

Sediments represented by all samples in Yaquina Bay FNC are determined to be suitable for unconfined, in-water placement without further characterization.

2010 July, Eight box core grab samples and one gravity core sample were collected from the project area on July 28, 2010. All 9 sediment samples were submitted for physical analyses, with 5 samples collected from finer-grained areas further subjected to chemical analyses.

The overall mean grain size for the project is 72% sand, with a mean grain size of 94% sand for the federal navigation channel (entrance to turning basin) and 45% sand within South Beach Marina. Chemical analyses included metals (10), pesticides/PCBs, chlorinated hydrocarbons, phenols, phthalates, miscellaneous extractables, PAHs, TPHs, TBT, and dioxin. All analyte concentrations were substantially below the SEF marine SLs. The material within the FNC study area is suitable for dredging and unconfined in-water placement without further characterization for a period for the Low and Very-Low ranked areas of 7 and 10 years respectively.

ODMDS HISTORY

Designation

1977, the Yaquina Bay ODMDS received interim designation from the EPA (Figure 1).

1985, an ODMDS evaluation report by the USACE, Portland District recommends final site designation for the interim site by EPA.

In **1986** prior to final site designation, mounding at the interim ODMDS necessitated the selection by the USACE, Portland District under its Section 103 authority of an adjusted ocean disposal site to the north of the interim site (Figure 1).

In **1998** the USACE, Portland District selected under its Section 103 authority an additional area to the south of the **1986** Section 103 area for the disposal of dredged material (Figure 2).

In **2001 July** a site evaluation study was completed.

In **2001 July** the USACE, Portland District selected under its Section 103 authority two new ODMDSs (North and South) for the disposal of dredged material (Figure 3). EPA concurred in a **July 19, 2001** letter for the first 5 year period. The North Site was first used in **2001** so expired in **2006** with an option for an additional 5 years. EPA issued a second Section 103 concurrence letter dated **April 27, 2007** for continued use of the North Site. This allows use of the North Site until the end of the dredging season of **2011**. The South Site has not been used so the Section 103 clock has not started for this site.

Evaluation Studies for Designation

1984 May, information on disposal site sediment and aquatic resources were obtained through field sampling.

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 Yaquina Bay ZSF was compiled.

1985 April, the Yaquina Bay Interim Ocean Dredged Material Disposal Site Evaluation Study, Final report was published by the Portland District. The evaluation report recommended final designation for the Yaquina Bay interim ODMDS.

In **1995** a new Yaquina Bay ODMDS evaluation study was initiated. As part of the study a side-scan sonar survey was conducted on **July 25 and 27, 1995**. Areas surveyed were the interim and Section 103 disposal sites and sandy areas further offshore. Sediment transport and modeling studies were conducted in **1996-1997** to determine site capacity and site size. Biological sampling was to commence in the fall of **1998**, after evaluation of the existing biological data for the ZSF at Yaquina Bay and finding them insufficient. Due to rough weather

and sea conditions sampling had to be postponed until **June and September 1999**.

Several meetings were held in Newport, OR to present and discuss the status of the ODMDS evaluation studies with local interest groups. As a result of these meetings and the desire to place the ocean disposal sites further to the north and south of the Yaquina Bay entrance the EPA and Corps determined that additional information was needed prior to site designation and use. The additional studies included physical and chemical baseline information, sidescan sonar, and two additional seasons of benthic sampling. The benthic sampling was conducted in **July and September 2000** and the sidescan in **July**. During the **July 2000** benthic sampling additional samples were collected for the physical and chemical baseline analyses. A site evaluation study was completed **July 2001**. Material was first placed in the north half of the North Site during the **2001** dredging season; the south half first received dredged material in **2010**.

MANAGEMENT/MONITORING

The Yaquina Bay **site management/monitoring plan** calls for conducting bathymetric surveys annually as a Tier I activity.

Bathymetric surveys of the Interim and **1986** Section 103 site were conducted in **October 1983, September 1984, August 1985, May 1986, May 1987, August 1988, August 1989, August 1990, August 1992, May/June 1993, May 1994, April 1995, June 1996, September 1996, June 1997, September 1997, May 1998, July 1998, June 1999, September 1999, May 2000, November 2000, May 2001, June 2001, May 2005 and April 2006**. Bathymetric surveys of the new North Site were conducted in **July 2001, August 2003, September 2003, May 2004, April 2006, July 2007, May 2008, April 2009, and June 2010**. Copies of bathymetry and bathymetry difference plots for the Yaquina Bay ODMDSs are attached to the end of this section.

At the interim ODMDS no prominent mound appears in the **October 1983** bathymetry. By **September 1984** a roughly conical mound with a base diameter of 600-1000 feet and a height of 16 feet in a water depth of 60 feet is evident. The **September 1984** survey was conducted immediately following the placement of 571,000 cubic yards of material between **June and September 1984**. The **August 1985** survey indicates increased mounding to 22 feet of accumulation in water depths of 64 feet at the interim ODMDS.

Due to the increased mounding at the interim ODMDS and its potential adverse effect on navigation safety, the USACE, Portland District selected an alternate ODMDS under its Section 103 authority in **1986**. Between **1985** and **1999** no dredged material was been placed at the interim ODMDS. Mounding at the interim ODMDS decreased in **1986, 1987, and 1988** such that by **August 1988** the bathymetric surveys show little or no mounding. Better than 20 feet of material present in **1985** had been removed by natural processes and depth contours had returned to their **1983** condition.

The **1986** Section 103 site is located to the north and further offshore of the interim site in

water depths ranging from 50 feet to 102 feet (Figure 1). Dredged material continued to accumulate at this site. As of **May 1998** maximum accumulation was 19 feet at an original water depth of approximately 84 feet. All contour lines continue to be shifted offshore. Between **1990** and **1997** dredged material disposal was managed by restricting placement to only deeper portions of the 103 site however management options have become limited due to continued mounding. In **1998** dredged material placement was managed by restricting the areas available for placement to the northeast and southwest corners of the site. In **1999** material placement was restricted to the new southern portion of the Section 103 site. This is the area of the **1977** interim site. The **September 1999** survey when compared to the **June 1999** survey shows accumulation of up to 3 feet of material in the NE corner of the **1977** interim site as well as in the outer 1/3. Placement was by both contract and Corps dredges with the Corps dredged restricted to the outer 1/3 of the site late in the dredging season. The **May 2000** survey shows both areas of accumulation shifted further offshore downslope into deeper water. In **2000** dredging was delayed until **October 1-9**, when ~76,800 CY was dredged. Placement was restricted to the outer deepest SW corner of the **1986** Section 103 site. This was the last year the nearshore sites were used for the placement of dredged material. Difference plots between the **May 2005** and **June 2001** survey indicates up to 6 feet of erosion in some areas after placement stopped. On average there appears to have been 3-4 feet of erosion in the **1986** Section 103 area and 1-2 feet in the area of the original **1977** Interim Site. In the deeper outer third of the site there was 10-13 feet of material when compared to the baseline **August 1985** survey.

Between **2001** and **2009** all dredged material was placed in the northern half of the Section 103 North Site. Due to a conversion error of the corner coordinates for the placement area material was accidentally placed out side of the actual disposal site between **August 8** and **August 18**. It was estimated that approximately 24,000 cubic yards of material was placed outside the northeast corner of the new North Site. Bathymetric surveys were requested but were delayed and never conducted following the event. Maximum mound height in **2007** reached 5 feet while in **2008** it had reached 6 feet and in **2009** maximum mound height reached 10 feet relative to **July 2001**. In **2009-2010** material from Depot Slough was dredged by clamshell and barged to the North Site (see Table 1). Also a portion of the material from the Yaquina Bay federal project was placed in the southern half of the North Site. Portions of the North Site have mounded 10-12 feet above the **2001** baseline bathymetry. Increased amount of material will be placed in the southern half of the North Site starting in **2011** dredging season.

Special Studies

In **1986 May** and **1989 October**, benthic and sediment characterization studies were conducted and compared to the **1984 March** study which was conducted as part of the interim site evaluation study. Variations noted between the studies appeared consistent with other areas of the Oregon Coast and did not indicate anthropogenic impacts due to dredged material disposal.

A second side-scan survey was conducted **October 13, 1995** as a result of questions raised with regard to the location and improper disposal of material dredged from Depot Slough, including debris. This dredging was under contract with the USACE, Portland District. The contractor used a clamshell with barges. The area covered in the second survey was the interim and Section 103 disposal sites and the area immediately seaward. By comparing the August and

October surveys an attempt was made to identify the location of debris. Twelve “targets” were identified as potential debris. All were located within the interim disposal site. The misplacement of material and possible inclusion of debris was coordinated with the proper state and federal agencies. Subsequent to this the ODMDS site management/monitoring plans were written to include a debris management section. All subsequent site management/monitoring plans address debris management.

In **1998** because of concerns of potential worsening of the wave environment due to mound-induced wave amplification a limited modeling effort was conducted. Using the MDFATE model simulated accumulation of “useable” disposal areas was modeled then subsequently compared to observed dredged material accumulation. A series of 5 plots were produced during the dredging season showing predicted and actual accumulation during the dredging season.

In **2001** a site evaluation study was completed as part of the site selection process for new ocean dredged material disposal site selection.

A fall **2001** benthic infaunal survey was contracted for but due to the lateness in the season was not realized prior to the onset of rough winter weather. This sampling was conducted in the spring and fall of **2002**. The resulting report compared sampling events for **1999, 2000, and 2002 (June and September)**. Conclusions were the variability noted throughout the sampling events appears to be consistent with other areas of the Oregon Coast and does not necessarily indicate a man made impact on the study area.

In **2008** the EPA’s research vessel OSV Bold visited various ODMDSs in the Pacific Northwest. At Yaquina Bay ODMDSs sidescan, benthic infauna, fish trawls, and physical/chemical studies were conducted.

Management/Monitoring Actions and Recommendations

Beginning in **1992**, CENPP-OP-NWH was formally notified of requirements for annual bathymetric surveys of all ODMDSs as a monitoring requirement. Bathymetric monitoring of the **1977** Interim and Section 103 sites was conducted through **2005** with continued attention with respect to mounding is recommended. Continued bathymetric surveys of the North Site and close management of dredged material placement is essential.

The USACE, Portland District, under its Section 103 authority, expanded the **1986** Section 103 site in **1998**. The Section 103 site at Yaquina was extended south and now includes the outer three-fourths of the area of the **1977** Interim Site. No material had been placed in this area since **1985** due to mounding of dredged material. Placement of material in **1999** was restricted to the new Section 103 area and the material evenly dispersed in the site. Material placement was managed to avoid unacceptable impacts to the wave climate (<10% increase). In **2000** the dredging volume was reduced to ~76,800 CY (average annual volume is ~313,000 CY) late in the dredging season (**October 1-9**). *Since 2001 these areas were no longer available for the disposal of dredged material.*

To avoid misplacement of material such as occurred at the new North Site in **August 2001** it is recommended that coordinated conversion calculations be double-checked in the field and back in the Portland District. Further, sufficient training of crew on both dredging shifts in conversion software is a must. Beginning and ending coordinated for all disposal activities need to be recorded in electronic form and provided to the Portland District's Waterways Maintenance Office. This information is part of the site management/monitoring effort and will be incorporated into this report and coordinated with EPA, Region 10 when requested.

Between **2001** and **2009** placement of material in the gridded northern portion of the Yaquina Bay North Section 103 disposal site was recommended. In **2010** material was first placed in the southern half as well as the northern section. As of **2011** increased use of the southern portion of the North Site is recommended. Material placement should continue in a dispersive manner as presently practiced. Possible reduction of the volume of material dredged at this project should be evaluated. Is it necessary to maintain this project to its present 40-foot authorized depth? Discussion of the need for ocean disposal was a component of the site evaluation study conducted at Yaquina Bay.

Table 1
 Volumes Dredged
 Yaquina Bay and Bar, Total Project
 [in thousands of cy]

<u>Fiscal Year</u>	<u>Hopper Dredge</u>
1986	237.3
1987	543.0
1988	324.6
1989	383.8
1990	216.7
1991	425.7
1992	213.0
1993	358.4
1994	207.0
1995	456.3
1996	286.8
1997	313.5
1998	185.4
1999	238.9
2000	104.7
2001	152.6 (N)
2002	167.6 (N)
2003	273.3 (N)
2004	271.9 (N)
2005	156.6 (N)
2006	275.8 (N)
2007	192.4 (N)
2008	171.2 (N)
2009	221.7 (N)*
2010	205.4 (N)**

*142.5 CY from Yaquina Bay and Harbor Project and 79.2 CY from Depot Slough

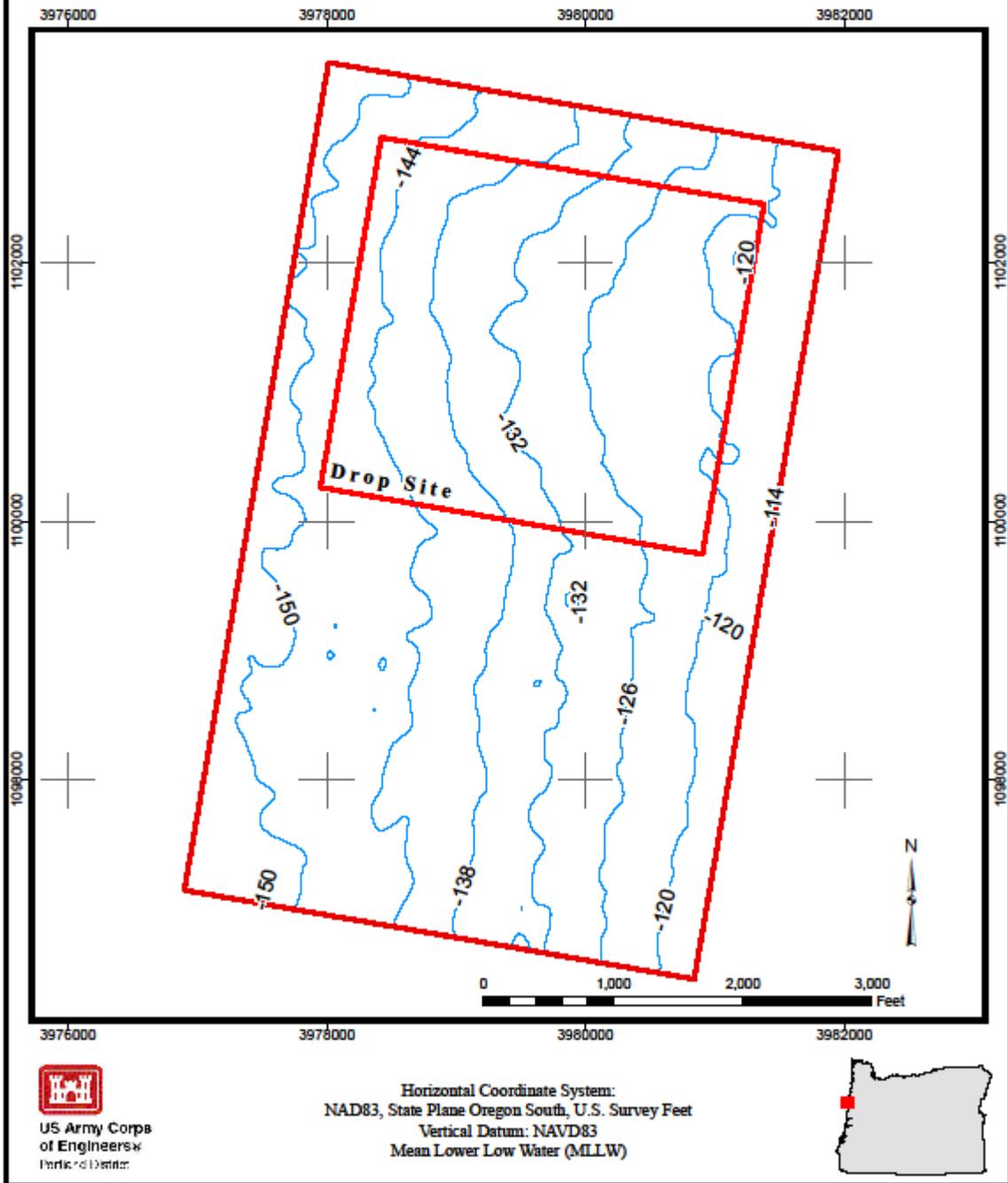
**183.4 CY from Yaquina Bay and Harbor Project and 21.9 CY from Depot Slough

OFFSHORE DREDGED MATERIAL DISPOSAL

Yaquina North Disposal Site

Survey Date: 22 June 2010

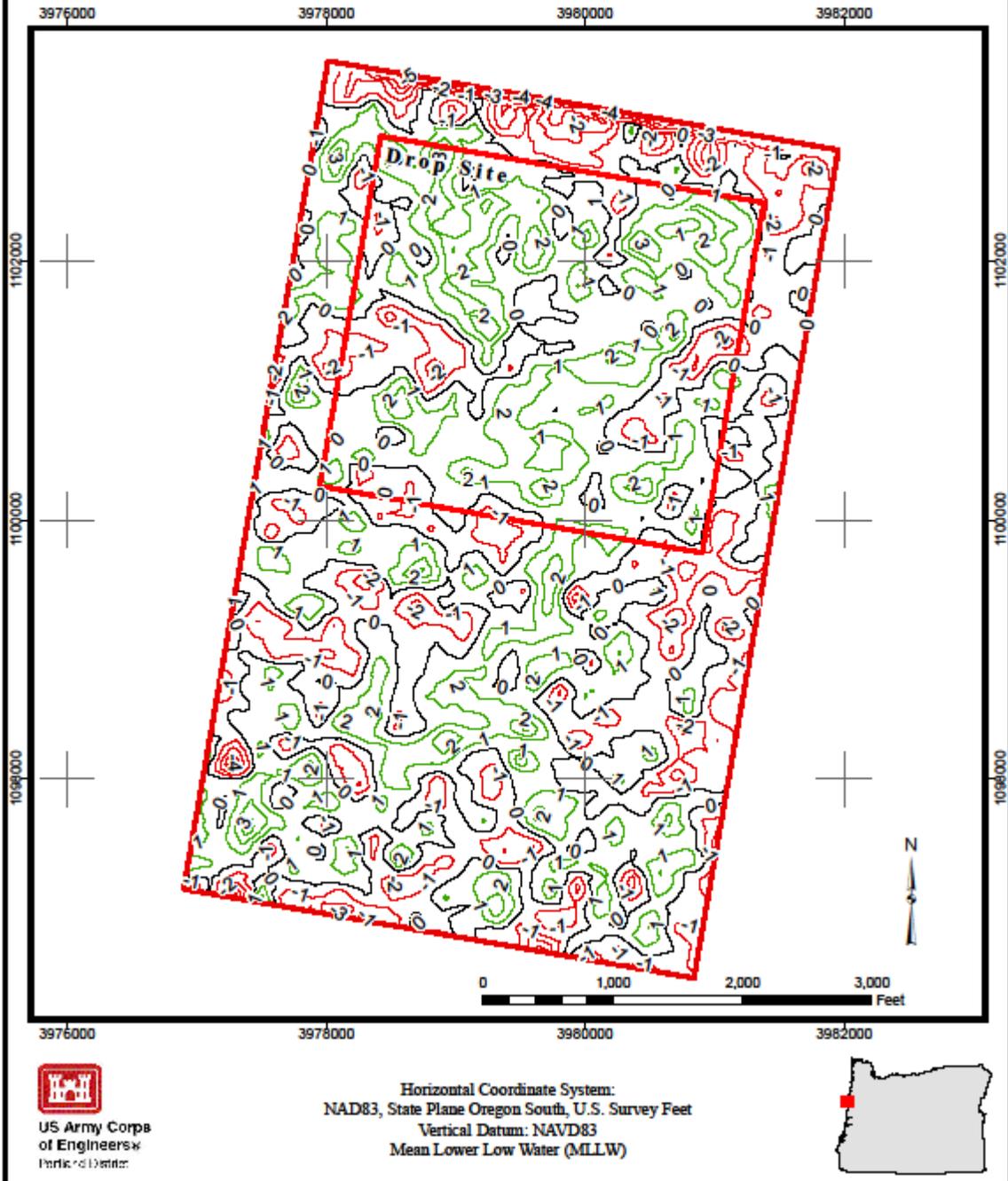
6 Foot Contours



OFFSHORE DREDGED MATERIAL DISPOSAL Yaquina North Disposal Site

Survey Date: 22 June 2010

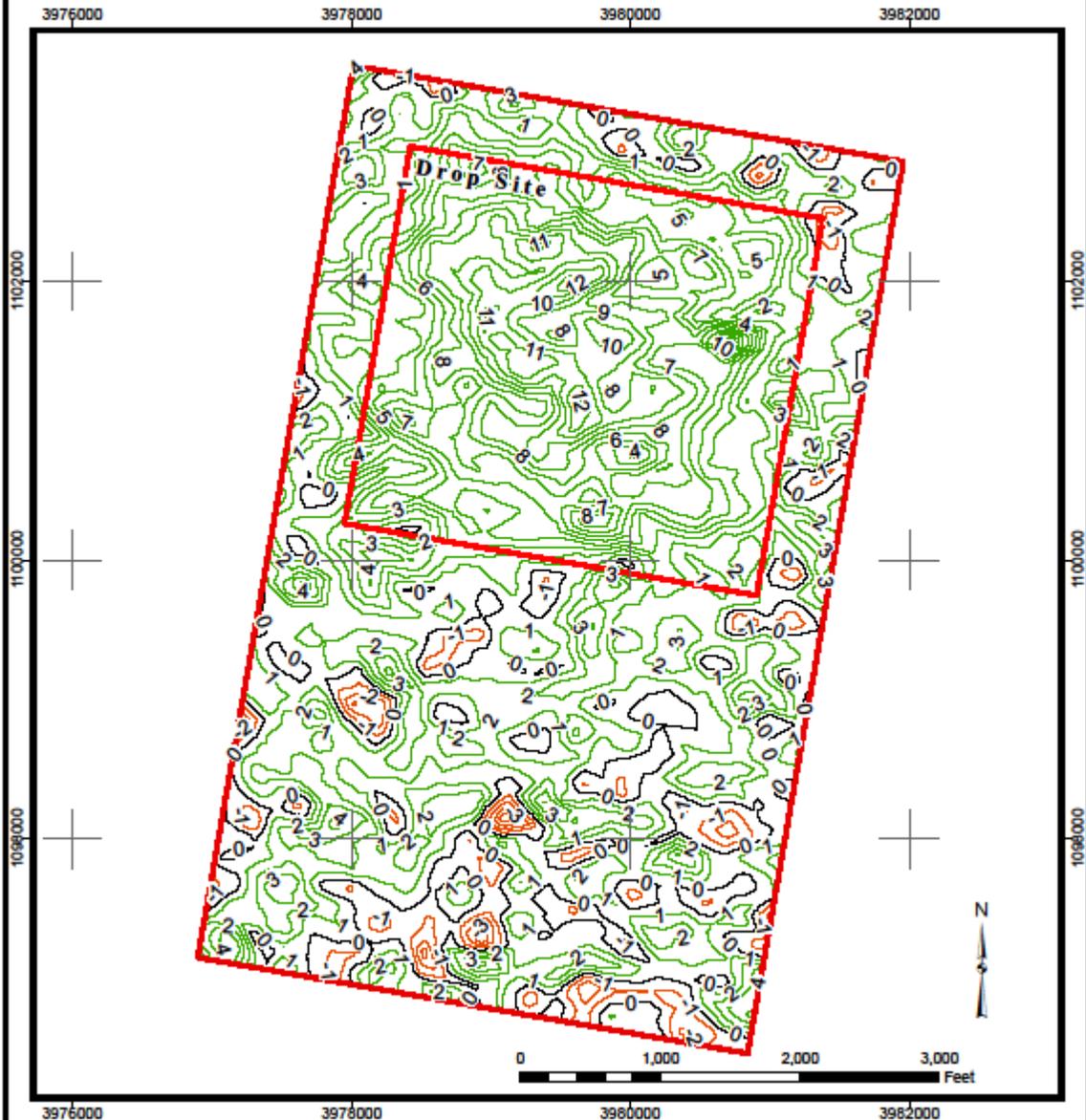
1' Contours of Change in Bathymetry from 30 April 2009



OFFSHORE DREDGED MATERIAL DISPOSAL Yaquina North Disposal Site

Survey Date: 22 June 2010

1' Contours of Change in Bathymetry from 12 February 2001



US Army Corps
of Engineers
Portland District

Horizontal Coordinate System:
NAD83, State Plane Oregon South, U.S. Survey Feet
Vertical Datum: NAVD83
Mean Lower Low Water (MLLW)

