Monitoring Survey at the Portland Disposal Site
August 2001

Disposal Area Monitoring System DAMOS

D A M O S

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13. ABSTRACT

The Portland Disposal Site (PDS) was monitored in August 2001 as part of the Disposal Area Monitoring System (DAMOS). Field operations consisting of Remote Ecological Monitoring of the Seafloor (REMOTS®) surveys were concentrated over three dredged material disposal mounds within PDS and three nearby reference areas. The three disposal mounds were comprehensively sampled to evaluate benthic recolonization of the individual dredged material deposits relative to conditions on the ambient seafloor at the reference areas.

The PDA 98 Mound was formed in the fall of 1998 and winter of 1999 by the placement of 315,600 m³ of sediment dredged from the interior reaches of the federally maintained channel within Portland Harbor and the Fore River. The August 2001 survey confirmed the continued benthic recolonization of the PDA 98 Mound at 2.5 years post disposal. An advanced Stage I on III population was present at each station that displayed soft sediment in the REMOTS® images. Based on the findings of the 2001 survey, the PDA 98 Mound is expected to fully recover as the foraging activity associated with Stage III deposit feeders continues to consume the organic matter entrained within the deposited sediments and increases the level of oxidation below the sediment-water interface.

The DG Mound is located approximately 500 m to the northeast of the PDA 98 Mound and corresponds to the location of the US Coast Guard Class A special purposes buoy "DG" within the confines of PDS. Depth difference comparisons between the September 1998 and July 2000 multibeam bathymetric surveys detected a sizable accumulation of material at the DG Buoy location resulting from disposal activity. Disposal logs indicate that a total estimated barge volume of 186,450 m³ of sediment dredged from the Fore River and Portland Harbor has been deposited in close proximity to the DG buoy between 1999 and 2001. A 25-station REMOTS® survey performed over the DG Mound in August 2001 detected benthic conditions analogous to those of the PDA 98 Mound.

The Royal River Mound was formed in the southeast corner of PDS between 1995 and 1997 as part of a capping demonstration project at this relatively deep water disposal site. Sediments were sequentially dredged from the Royal River in Yarmouth, Maine and deposited at the PDA 95 buoy to successfully form a capped mound on the PDS seafloor. The August 2001 survey was performed to evaluate benthic habitat conditions over the Royal River Mound four years after the completion of the demonstration project. The surface sediments were characteristic of historic dredged material with a generally gray color relative to 1997 sediment profile images, suggesting a reduced organic load. The benthic habitat conditions detected over the Royal River Mound were found to be comparable to that of the ambient, Gulf of Maine sediments at the reference areas.

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EXECUTIVE SUMMARY

The Portland Disposal Site (PDS) was monitored in August 2001 as part of the Disposal Area Monitoring System (DAMOS). Field operations consisting of Remote Ecological Monitoring of the Seafloor (REMOTS®) surveys were concentrated over three dredged material disposal mounds within PDS and three nearby reference areas. The three disposal mounds were comprehensively sampled to evaluate benthic recolonization of the individual dredged material deposits relative to conditions on the ambient seafloor at the reference areas.

The PDA 98 Mound was formed in the fall of 1998 and winter of 1999 by the placement of 315,600 m^3 of sediment dredged from the interior reaches of the federally maintained channel within Portland Harbor and the Fore River. Dredged material disposal operations during the first and second phases of the project targeted a natural containment cell located near the center of the disposal site. Monitoring surveys performed during the summer of 2000 indicated the majority of the dredged material deposit was retained within the natural containment cell, with some accumulation of sediment over a prominent bedrock ridge to the south of the disposal location. The initial benthic recolonization surveys indicated the sediment deposit was recovering as anticipated, with a well-developed Stage I benthic infaunal population over the entire mound, and progression to Stage III at greater than 50% of the stations sampled.

The August 2001 survey confirmed the continued benthic recolonization of the PDA 98 Mound, as an advanced Stage I on III population was present at each station displaying soft sediment in the REMOTS® images. The bioturbational activity of this advanced benthic infaunal community was responsible for the formation of mean redox potential discontinuity (RPD) depths ranging from 1.1 to 2.8 cm below the sediment-water interface. The moderate RPD depths and presence of an advanced benthic infaunal community resulted in Organism Sediment Index (OSI) values ranging from +3 to +9, with the overall average for the mound exceeding the composite value calculated for the reference areas. Based on the findings of the 2001 survey, the PDA 98 Mound is expected to fully recover as the foraging activity associated with Stage III deposit feeders continues to consume the organic matter entrained within the deposited sediments and increases the level of oxidation below the sediment-water interface.

The DG Mound is located approximately 500 m to the northeast of the PDA 98 Mound and corresponds to the location of the US Coast Guard Class A special purposes buoy "DG" within the confines of PDS. The DG Mound is composed of many layers of sediment placed at PDS in recent years from dredging operations in the Casco Bay region. Since the winter of 1999, a total estimated barge volume of 186,450 m^3 of sediment dredged from Portland Harbor and the Fore River has been deposited in close proximity to the DG buoy. Disposal logs indicate that approximately 155,800 m^3 of silt,

clay, and sand removed from the outer reaches of Portland Harbor was deposited at the DG buoy as part of the third phase of dredging performed in winter 1999. This volume of material was followed by smaller quantities in 2000 (18,300 m^3) and 2001 (12,350 m^3) produced by small dredging projects at multiple marine terminals in the Fore River.

Depth difference comparisons between the September 1998 and July 2000 multibeam bathymetric surveys detected a sizable accumulation of material at the DG buoy location resulting from the 1999 and 2000 disposal. However, no sediment-profile images were collected in the summer of 2000 to confirm the findings of the bathymetry or evaluate benthic recolonization over the DG Mound. A 25-station REMOTS® survey performed over the DG Mound in August 2001 detected benthic conditions analogous to those of the PDA 98 Mound. Although there was minimal impact related to the recent 2001 disposal detected, the majority of the replicate images displayed biologically reworked dredged material supporting a stable benthic infaunal population. Stage I tube-dwelling polychaetes were observed in relative abundance at the sediment-water interface over Stage III deposit feeding invertebrates at depth. In conjunction with the presence of an advanced benthic community, RPD depths were moderate to deep, yielding an overall average OSI value of +7 for the DG Mound. This value is indicative of an undisturbed or non-degraded benthic environment and exceeded the composite OSI value calculated for the reference areas.

The Royal River Mound was formed in the southeast corner of PDS between 1995 and 1997 as part of a capping demonstration project at this relatively deep water disposal site. Sediments were sequentially dredged from the Royal River in Yarmouth, Maine and deposited at the PDA 95 buoy to successfully form a capped mound on the PDS seafloor. The mound was extensively surveyed during the demonstration project, but had not been evaluated for benthic recolonization since the January 1997 postcap survey.

In August 2001, benthic habitat conditions over the Royal River Mound were found to be comparable to that of the ambient, Gulf of Maine sediments at the reference areas. The sediment detected in the replicate images was characteristic of historic dredged material with a generally gray color indicating a reduction in organic load relative to January 1997 as a result of biological reworking. An advanced successional stage assemblage was present at the majority of the stations sampled, and RPD depths ranged from 1.7 to 3.7 cm. The average OSI value over the Royal River Mound (+6.3) was slightly higher than the composite value for the PDS reference areas, reflecting undisturbed benthic conditions.

Similar to the findings of previous survey efforts, the data obtained from the PDS reference areas were representative of the ambient conditions surrounding the disposal site. However, the composition of the seafloor at the reference areas may not be directly comparable to the thick layers of soft sediment composing the disposal mounds. Despite the presence of deep RPDs ranging from 1.4 to 4.7 cm, a low abundance of Stage III activity at the reference areas in August 2001 resulted in diminished OSI values. Stage III activity over reference areas SREF and EREF appeared to be limited by the presence of rocky substrate and small patches of soft sediment existing as thin layers over bedrock. In addition, the limited quality of the data obtained from SEREF prevented the analysis of key parameters. As a result, the dataset compiled for the PDS reference areas was relatively limited and may have produced a skewed composite OSI value of +5.7.

1.0 INTRODUCTION

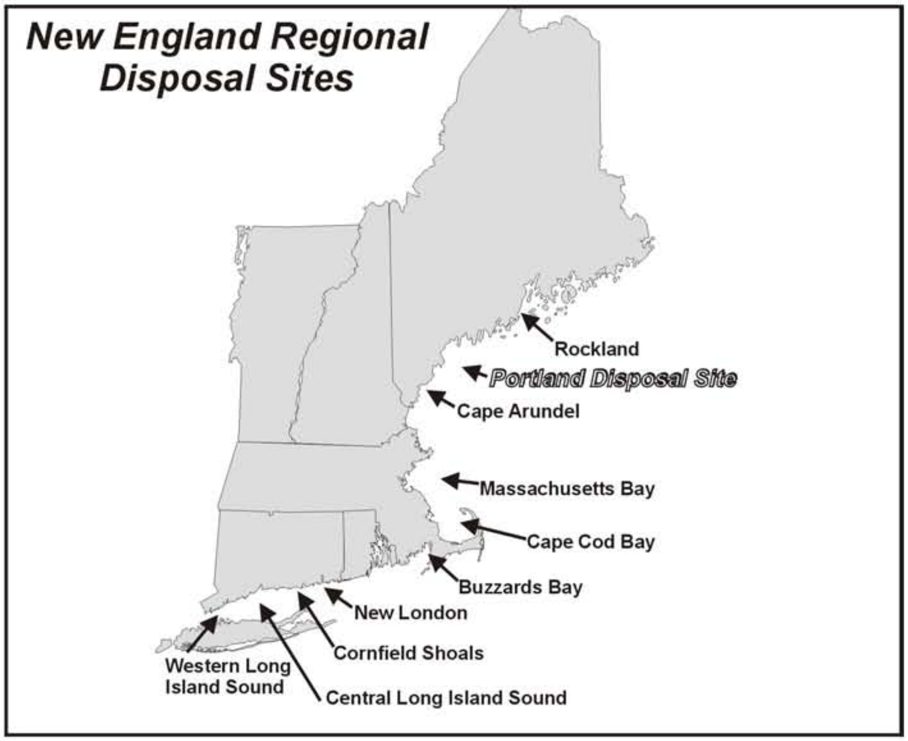
1.1 Background

In 1977, the New England District (NAE) of the U.S. Army Corps of Engineers established the Disposal Area Monitoring System (DAMOS) to monitor the environmental impacts associated with the subaqueous disposal of sediments dredged from harbors, inlets, and bays in the New England region. The DAMOS Program conducts detailed monitoring studies to detect and minimize any physical, chemical, and biological impacts of dredging and dredged material disposal activities. DAMOS monitoring helps to ensure that any effects of sediment deposition on the marine environment are confined to designated seafloor areas and are of limited duration. A flexible, tiered monitoring protocol (Germano et al. 1994) is applied in the long-term management of sediment disposal at ten regional open-water dredged material disposal sites along the coast of New England (Figure 1-1).

The Portland Disposal Site (PDS) is one of three regional dredged material disposal sites located in the waters of Maine. It covers a 3.42 km^2 (1 nmi^2) area of seafloor centered at latitude 43°34.105' N and longitude 70°01.969' W (NAD 83), approximately 13.2 km (7.1 nmi) east of Dyer Point, Cape Elizabeth, Maine (Figure 1-2). PDS is characterized by a rough, irregular bottom topography, with areas of soft sediment accumulation in the basins among bedrock outcrops. Sediments deposited at PDS have originated from dredging projects in Portland Harbor, Fore River, and many of the smaller rivers and harbors within the Casco Bay region. In recent years, there has been significant DAMOS monitoring activity at this site, as part of a comprehensive subaqueous capping feasibility study.

The depositional environment of PDS, especially within the deeper fine-grained basins, indicates that volumes of dredged material can be placed without significant subsequent movement beyond the disposal site boundaries. Dredged material disposal operations specifically target these natural basins to form mounds of sediment on the seafloor. The various bedrock ridges surrounding the depositional areas provide a measure of protection from wave energy and thus act to contain the deposited dredged material. The steep sides of the depressions or hollows disrupt any near bottom orbital currents generated by passing storm waves, minimizing resuspension over the surface of the sediment deposit. In addition, the rock walls of the natural seafloor features prevent the lateral spread of non-cohesive sediment on the seafloor as a dredged material mound is developed over time.

A



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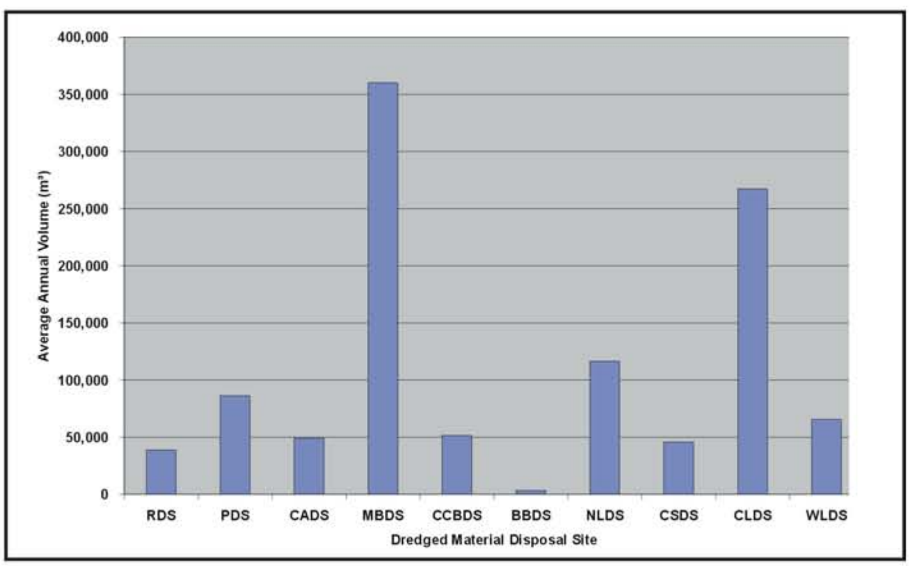


Figure 1-1. Location of the ten dredged material disposal sites along coastal New England (A) and average annual dredged material disposal volume at each site based on the period 1982 to 2001 (B)

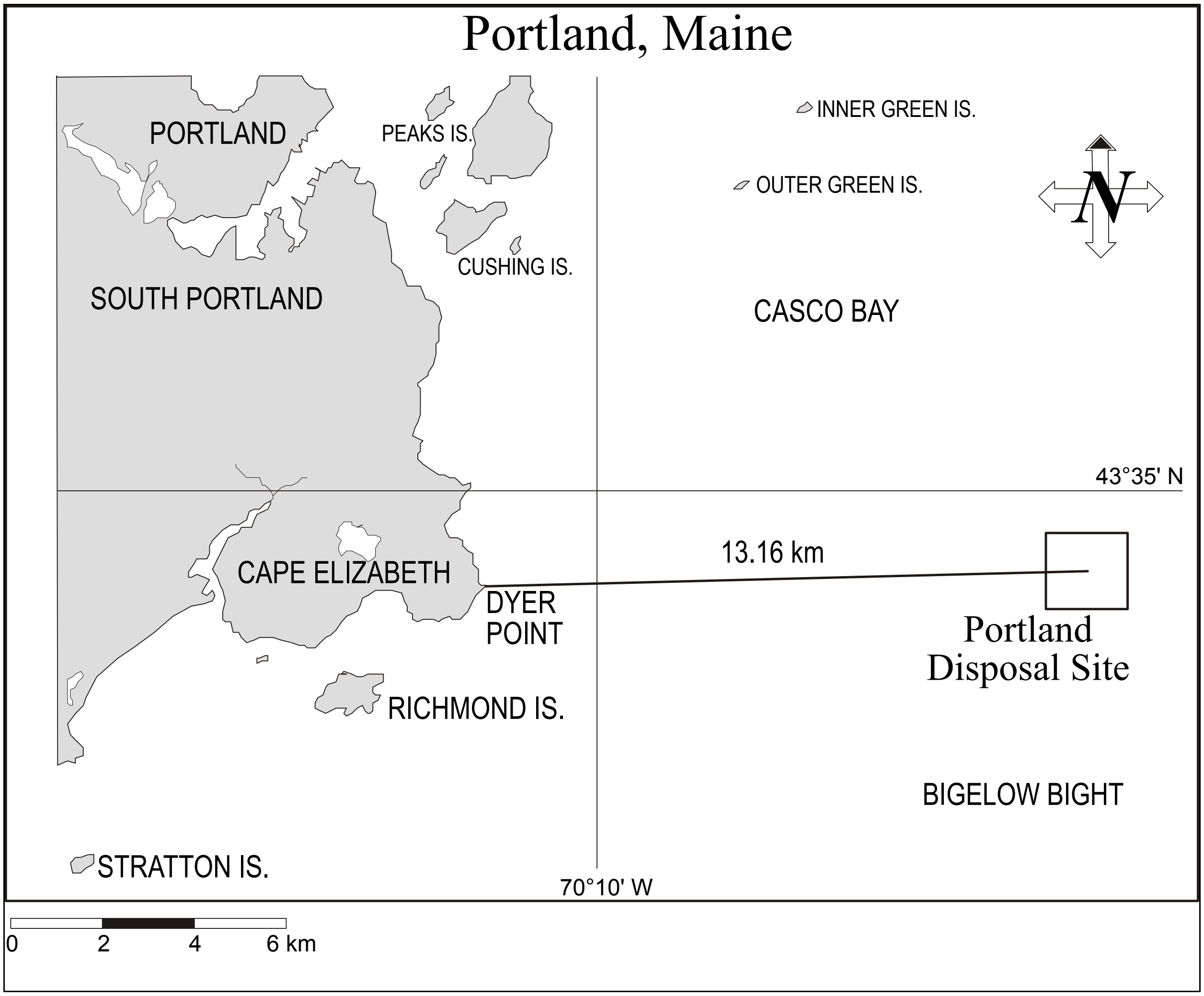


Figure 1-2. Location of the Portland Disposal Site, relative to the Maine shoreline and Casco Bay

The regulated and monitored placement of dredged material has been occurring at PDS since 1977, with an average annual disposal volume of approximately 99,000 m^3 of sediment deposited at the U.S. Coast Guard, Class-A; Special Purposes buoy (DG), located in the northern region of the site (Figure 1-3; Morris 1996). The dredged material released from barges in close proximity to the DG buoy coalesces into a single large seafloor deposit, composed of multiple layers of material originating from many different projects. However, dredged material emanating from exceptionally large projects often requires long-term monitoring and is usually directed to other locations within the disposal site that are marked with a secondary buoy. The practice of creating discrete mounds within the boundaries of PDS facilitates long-term monitoring of material from specific dredging projects.

1.2 PDA 98 Mound

The PDA 98 Mound was developed on the PDS seafloor in the fall of 1998 and winter of 1999 by the placement of sediment dredged from the federal channel and various marine terminals in the Fore River and Portland Harbor. In November 1998, the DAMOS disposal buoy "PDA 98" was placed at coordinates 43°34.147´ N, 70°02.209´ W within a natural seafloor containment basin having an estimated capacity of over 1 million cubic meters (Figure 1-3). Due to various project logistics, the dredging of the harbor was divided into three phases (Figure 1-4). The first phase of dredging consisted of the removal of 291,500 m^3 of sediment from the upper reaches of the Fore River. This material was transported to PDS and placed at the PDA 98 buoy position, followed by an additional 5,700 m^3 of sediment dredged from individual berthing areas and marinas in the harbor as part of the second phase.

The third phase of the dredging project occurred in the spring of 1999. Approximately 18,500 m^3 of material dredged from marine terminals in the Fore River were transported to PDS and placed at the PDA 98 buoy. An additional estimated barge volume of 155,800 m^3 was removed from the outer reaches of the federal channel in Portland Harbor. However, this material was placed at the DG buoy located 500 m to the northeast of PDA 98 (Figures 1-3 and 1-4).

In July 2000, a postdisposal precision multibeam bathymetric survey was performed over a 4.41 km^2 area encompassing PDS to document changes in bottom topography resulting from dredged material deposition. The survey results confirmed the formation of two detectable sediment deposits on the PDS seafloor (SAIC 2002). The larger of the two deposits was detected in close proximity to the PDA 98 buoy location and consisted of approximately 315,700 m^3 of dredged material from Portland Harbor. A significant

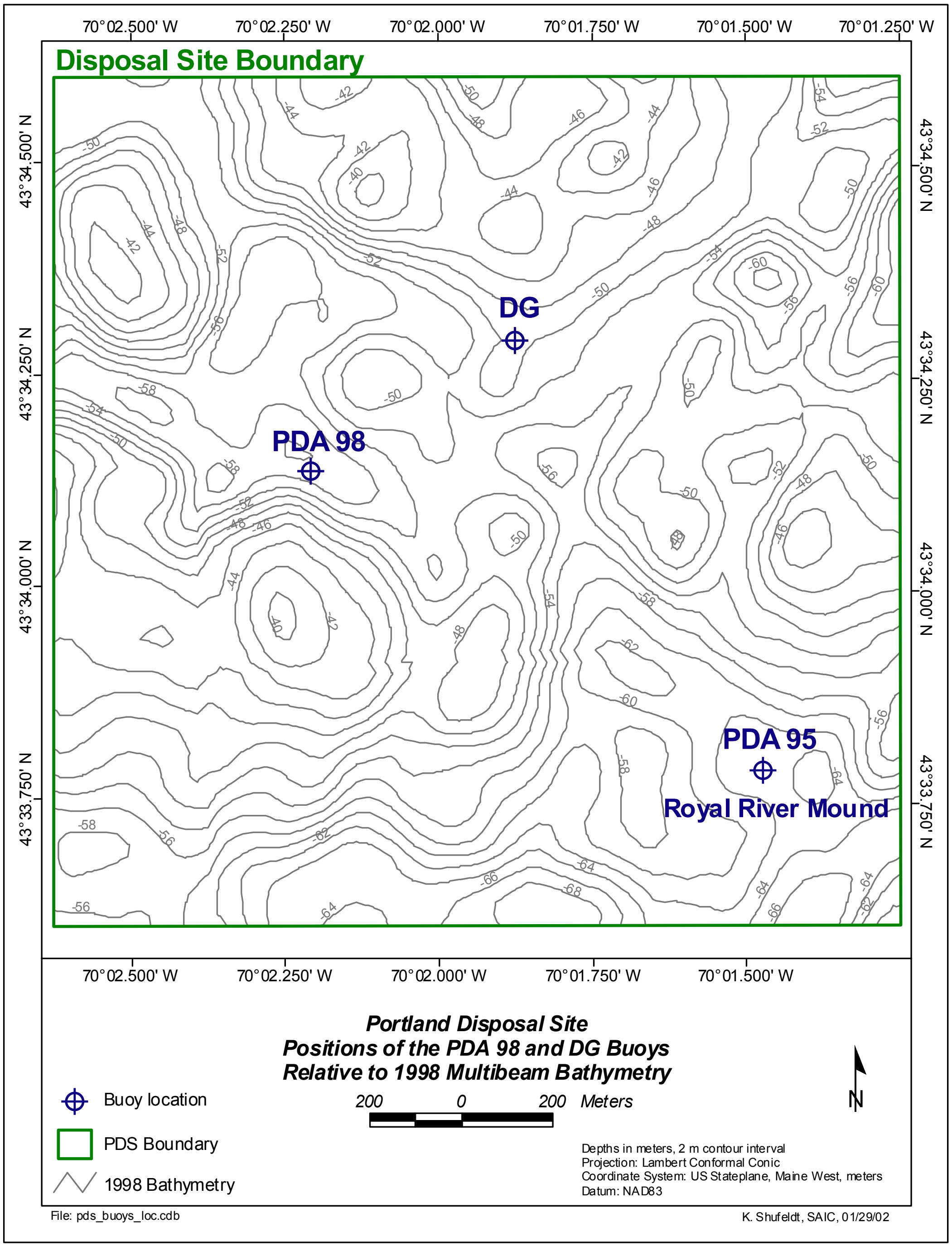


Figure 1-3. Locations of the PDA 95 (Royal River Mound), PDA 98, and DG buoys relative to the PDS boundary

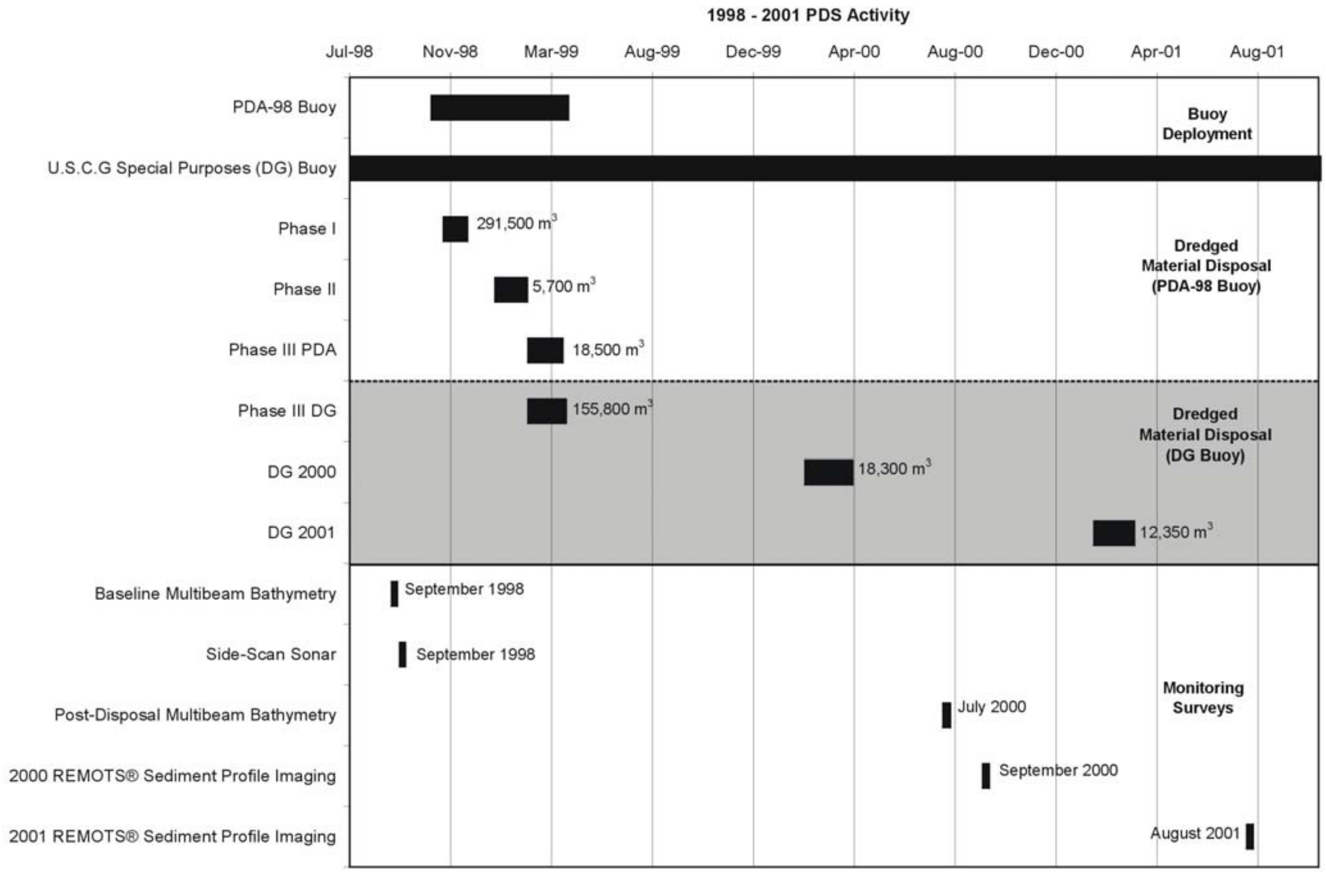


Figure 1-4. Timeline of dredged material disposal and environmental monitoring efforts at the Portland Disposal Site from July 1998 through August 2001

portion of the dredged material was confined within a natural containment basin formed by the northwest/southeast trending trough originally detected in November 1998.

A REMOTS® sediment-profile imaging survey was conducted over the PDA 98 Mound in September 2000 to verify the stability of the sediment deposit and evaluate benthic recolonization. The sediment-profile images collected over this mound confirmed the bathymetric survey results, showing a fairly wide distribution of dredged material within the active area of PDS. In addition, the REMOTS® results indicated that the benthic habitat over the PDA 98 Mound was recovering as anticipated at 18 months post disposal, with continued recovery expected over the next several years.

1.3 DG Mound

The second of the two dredged material deposits detected in the July 2000 multibeam was located adjacent to the DG buoy. During the fall of 1998 and winter of 1999, a total estimated volume of 155,800 m^3 of material was removed from the outer reaches of the federal navigational channel of Portland Harbor as part of the third phase of maintenance dredging operations. This material was transported to PDS and placed at the DG buoy position, forming a new layer of sediment over the surface of the DG Mound. In addition, material generated by two small maintenance projects (18,300 m^3) was deposited at the DG buoy in the winter of 2000, for a total sediment placement volume of 174,000 m^3 at the DG buoy between the September 1998 and July 2000 monitoring surveys (Figure 1-4). Disposal activity at the DG buoy continued during 2001 with an estimated 12,350 m^3 of sediment dredged from the Fore River (Figure 1-4; Appendix A). Although the DG buoy area has received multiple dredged material deposits over many years, the surface of the DG Mound had not been examined since July 1992.

1.4 Royal River Mound

The Royal River Mound, located in the southeast corner of PDS, is a moderate-sized disposal mound formed between 1995 and 1997 as part of a capping demonstration project at PDS (Figure 1-3; Morris et al. 1998). This mound was developed by the disposal of 61,700 m^3 of material sequentially dredged from the Royal River in Yarmouth, ME during 1995 and 1996 then placed at the PDA 95 buoy. Comprehensive monitoring surveys were performed over the Royal River Mound throughout the course of the project to document the successful development of a capped mound at the relatively deep-water (65 m) PDS. The mound was last surveyed in 1997 as part of the postcap survey to evaluate the effectiveness of capping operations and assess benthic conditions. Results of the monitoring surveys conducted in January 1997 showed that a discrete, capped, dredged material disposal mound had been created on the seafloor within the Royal River Project Area. The objectives of the January 1997 postcap survey did not include the assessment of benthic recolonization over the newly capped Royal River Mound. However, the 1997 sediment-profile images were re-evaluated as part of the current study with the data serving as a basis of comparison for the August 2001 results.

1.5 Objectives and Predictions

The objective of the August 2001 sediment-profile imaging survey over PDS was to evaluate the benthic recolonization status and habitat conditions within the surface sediments over the PDA 98, DG, and Royal River disposal mounds, relative to conditions at the three surrounding reference areas.

The August 2001 field effort tested the following predictions:

- The sediments of the PDA 98 Mound were expected to be supporting an advanced benthic infaunal population, with Stage II or Stage III communities existing at most stations, as predicted by the DAMOS tiered monitoring protocols.

- Due to the limited amount of time between the most recent sediment placement event and monitoring operations (six months) over the DG Mound, the surface deposit was expected to display a moderate amount of benthic disturbance, and a stable population of Stage I organisms.

- Four years after the completion of the capping demonstration project at the Royal River Mound, the surface of the mound was expected to be supporting a stable and advanced benthic community, with habitat conditions similar to those displayed in the ambient sediment at the reference areas.

2.0 METHODS

The August 2001 monitoring survey at PDS consisted of a comprehensive REMOTS® sediment-profile imaging survey conducted aboard the M/V *Beavertail* from 10 to 13 August 2001. As previously indicated, three separate dredged material mounds were sampled to examine sediment composition and benthic recolonization relative to three surrounding reference areas (Figure 2-1).

2.1 Navigation

Differentially-corrected Global Positioning System (DGPS) data in conjunction with Coastal Oceanographic's HYPACK® navigation and survey software were used to provide real-time navigation to an accuracy of ±3 m. A DSMPro GPS receiver was used to obtain raw satellite data and provide vessel position information in the horizontal control of North American Datum of 1983 (NAD 83). The GPS receiver is integrated with a differential beacon receiver to improve overall accuracy of the satellite data to the necessary tolerances. The U.S. Coast Guard differential beacon broadcasting from Brunswick, Maine (316 kHz) was utilized for real-time satellite corrections due to its geographic position relative to PDS.

The DGPS data were ported to HYPACK® data acquisition software for position logging and helm display. The REMOTS® target stations were determined prior to the start of survey operations and stored in a project database. Throughout the survey, individual stations were selected and displayed in sequence to position the survey vessel at the correct geographic location for sampling. The position of each replicate sample was logged with a time stamp in Universal Time Coordinate (UTC) and a text identifier to facilitate Quality Control (QC) and subsequent input into a Geographic Information System (GIS) database.

2.2 Sediment-Profile Imaging

REMOTS® (Remote Ecological Monitoring of the Seafloor) sediment-profile imaging is a benthic sampling technique used to detect and map the distribution of thin (<20 cm) dredged material layers, delineate benthic disturbance gradients, and monitor the process of benthic recolonization at dredged material disposal mounds. This is a reconnaissance survey technique used for rapid collection, interpretation and mapping of data on physical and biological seafloor characteristics. The DAMOS Program has used this technique for routine disposal site monitoring for over 20 years.

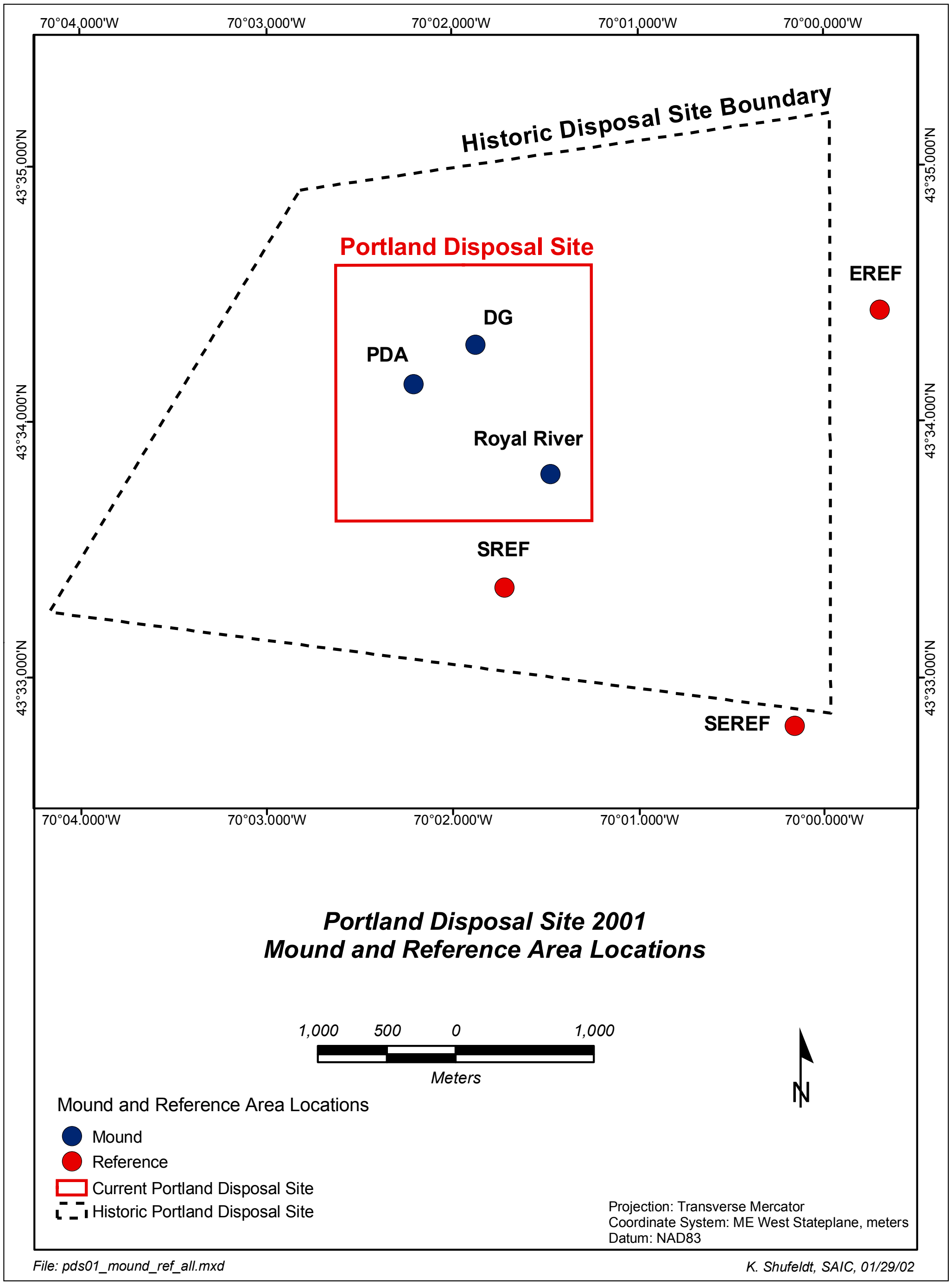


Figure 2-1. Map showing the current Portland Disposal Site and historic disposal site boundaries, as well as the disposal mounds and reference areas sampled during the August 2001 REMOTS® survey.

The REMOTS® hardware consists of a Benthos Model 3731 sediment-profile camera designed to obtain undisturbed, vertical cross-section photographs (*in situ* profiles) of the upper 15 to 20 cm of the seafloor (Figure 2-2). Computer-aided analysis of each REMOTS® image yields a suite of standard measured parameters, including sediment grain size major mode, camera prism penetration depth (an indirect measure of sediment bearing capacity/density), small-scale surface boundary roughness, depth of the apparent redox potential discontinuity (RPD, a measure of sediment aeration), infaunal successional stage, and Organism-Sediment Index (OSI, a summary parameter reflecting overall benthic habitat quality).

OSI values may range from –10 (azoic with low sediment dissolved oxygen and/or presence of methane gas in the sediment) to +11 (healthy, aerobic environment with deep RPD depths and advanced successional stages). The OSI values are calculated using values assigned for the apparent RPD depth, successional status, and indicators of methane gas or low oxygen. Standard REMOTS® image acquisition and analysis methods are described fully in Rhoads and Germano (1982; 1986) and in the recent DAMOS Contribution No. 128 (SAIC 2001a).

2.3 PDS Survey Areas

A 28-station REMOTS® sampling grid, centered at the PDA 98 buoy position and originally sampled in the September 2000 monitoring survey, was re-occupied in the August 2001 survey (Figure 2-3; Table 2-1). Based on the irregular bottom topography within the disposal site, the eight arms of the radial station grid were oriented to collect images in areas likely to have dredged material accumulations. Best effort was made to obtain at least three replicate images at each station analysis of benthic conditions and infaunal successional status.

A 25-station, modified-radial REMOTS® survey grid was established around the DG buoy (Figure 2-4; Table 2-2). Centered at coordinates 43°34.291´ N, 70°01.895´ W, the REMOTS® survey grid consisted of eight radial arms. Due to the surrounding bottom topography and likely areas of dredged material accumulation, sampling stations extended out 200 m from center along the northern, northeastern, southern, southwestern, western, and northwestern arms, while stations extended 300 m along the eastern and southeastern arms. Furthermore, this sampling pattern minimized overlap between the DG and PDA 98 survey grids (Figures 2-3 and 2-4).

The REMOTS® survey performed over the Royal River capped mound consisted of a 13-station, cross-shaped grid centered at coordinates 43°33.795´N, 70°01.483´W (Figure 2-5; Table 2-3). The 2001 survey grid consisted of a subset of the stations sampled

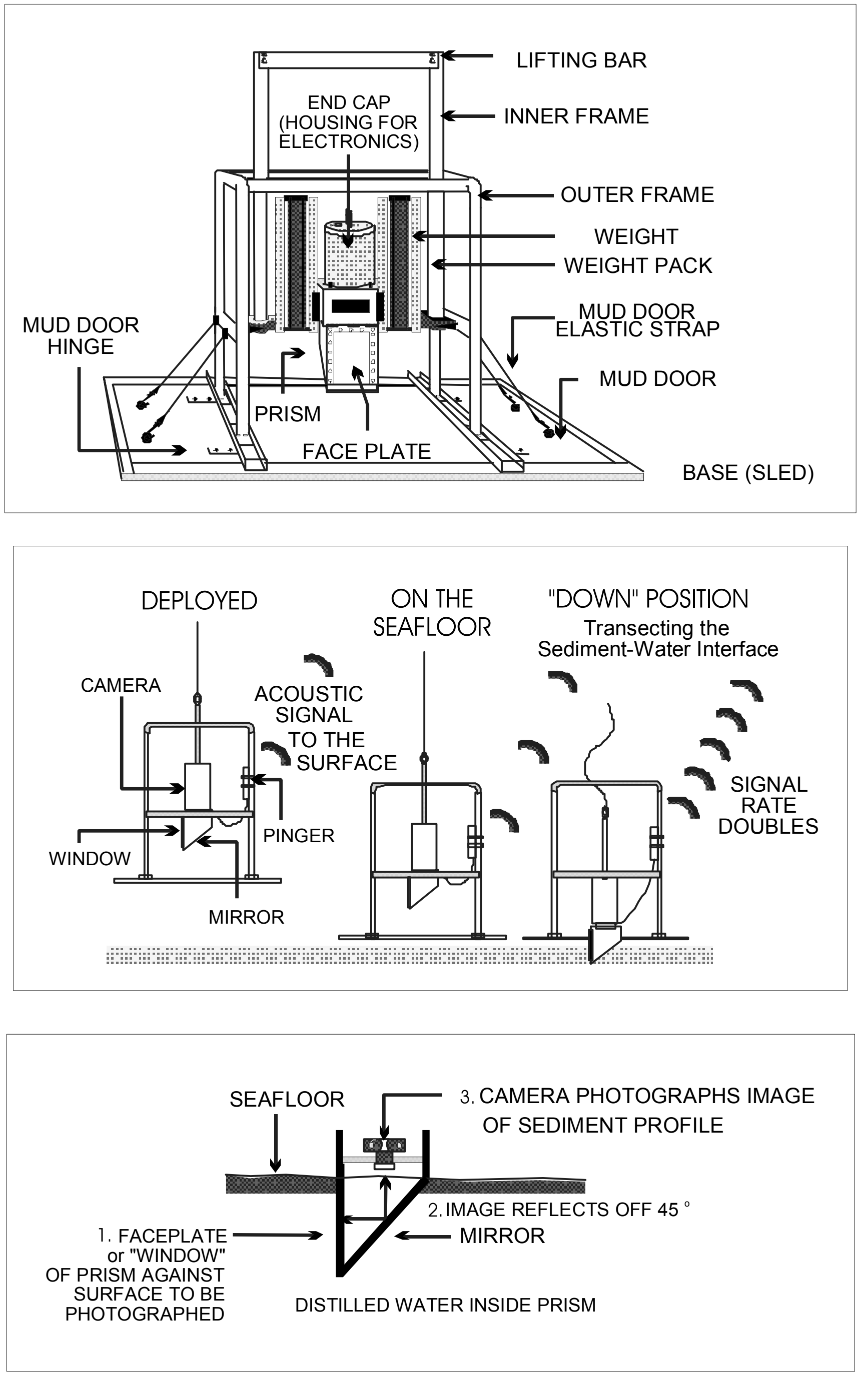


Figure 2-2. Schematic diagram of the Benthos Inc. Model 3731 REMOTS® sediment-profile camera and sequence of operation on deployment

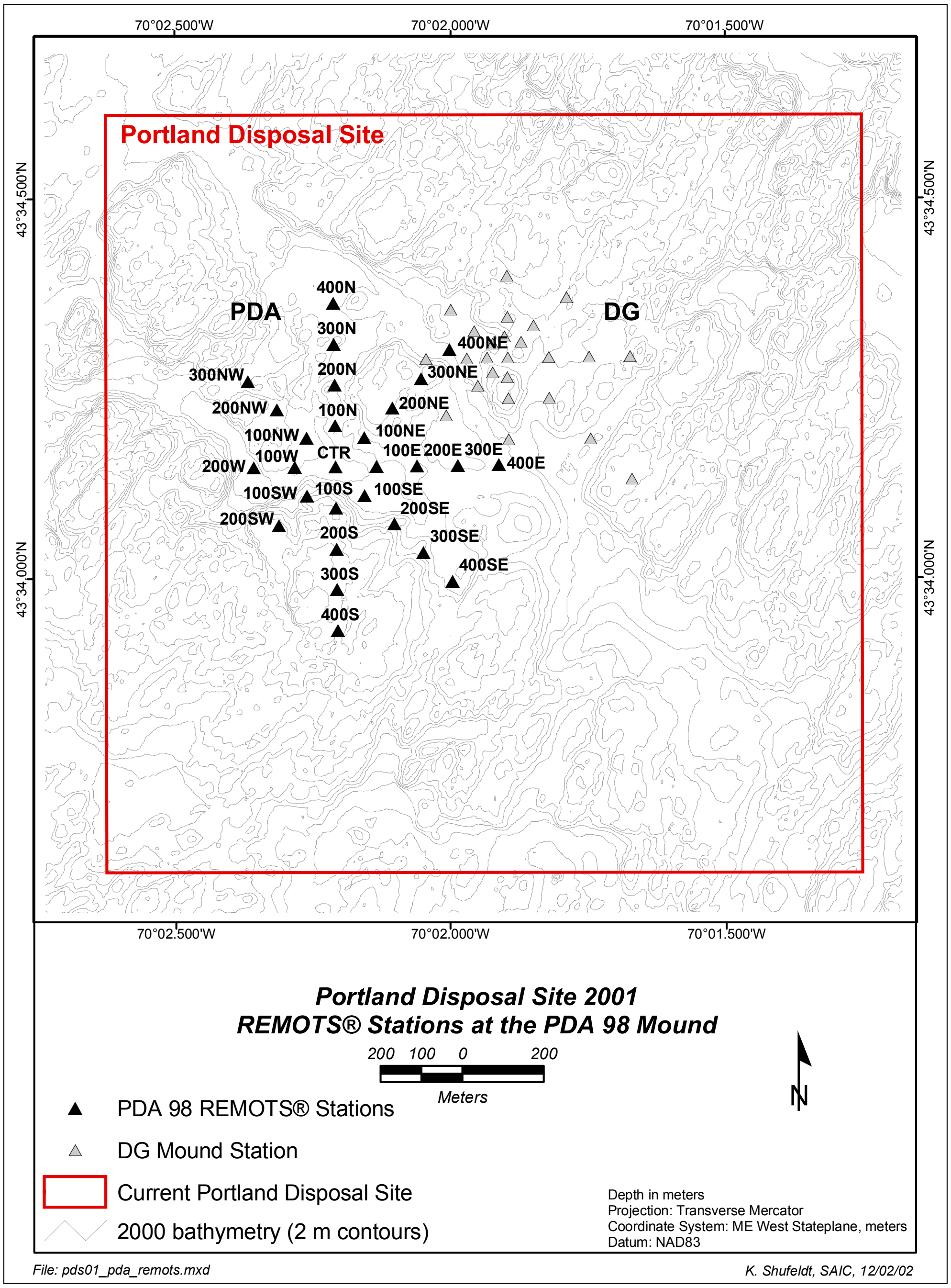


Figure 2-3. Map showing the locations of the August 2001 REMOTS® sediment-profile imaging stations over the PDA 98 Mound, overlaid on the depth contours from the July 2000 bathymetric survey.

Table 2-1.

PDS August 2001 REMOTS® Station Locations over the PDA 98 Mound

Area	Station	Latitude	Longitude
PDA 98 CENTER 43° 34.147´ N 70° 02.209´ W NAD 83	CTR	43° 34.147´ N	70° 02.209´ W
	100N	43° 34.201´ N	70° 02.210´ W
	200N	43° 34.255´ N	70° 02.211´ W
	300N	43° 34.309´ N	70° 02.212´ W
	400N	43° 34.363´ N	70° 02.213´ W
	100NE	43° 34.186´ N	70° 02.157´ W
	200NE	43° 34.224´ N	70° 02.105´ W
	300NE	43° 34.263´ N	70° 02.053´ W
	400NE	43° 34.302´ N	70° 02.001´ W
	100E	43° 34.148´ N	70° 02.135´ W
	200E	43° 34.148´ N	70° 02.060´ W
	300E	43° 34.149´ N	70° 01.986´ W
	400E	43° 34.150´ N	70° 01.912´ W
	100SE	43° 34.109´ N	70° 02.156´ W
	200SE	43° 34.072´ N	70° 02.103´ W
	300SE	43° 34.034´ N	70° 02.049´ W
	400SE	43° 33.996´ N	70° 01.996´ W
	100S	43° 34.093´ N	70° 02.208´ W
	200S	43° 34.039´ N	70° 02.207´ W
	300S	43° 33.985´ N	70° 02.206´ W
	400S	43° 33.931´ N	70° 02.205´ W
	100SW	43° 34.108´ N	70° 02.261´ W
	200SW	43° 34.070´ N	70° 02.313´ W
	100W	43° 34.146´ N	70° 02.283´ W
	200W	43° 34.146´ N	70° 02.358´ W
	100NW	43° 34.185´ N	70° 02.262´ W
	200NW	43° 34.222´ N	70° 02.315´ W
	300NW	43° 34.260´ N	70° 02.369´ W

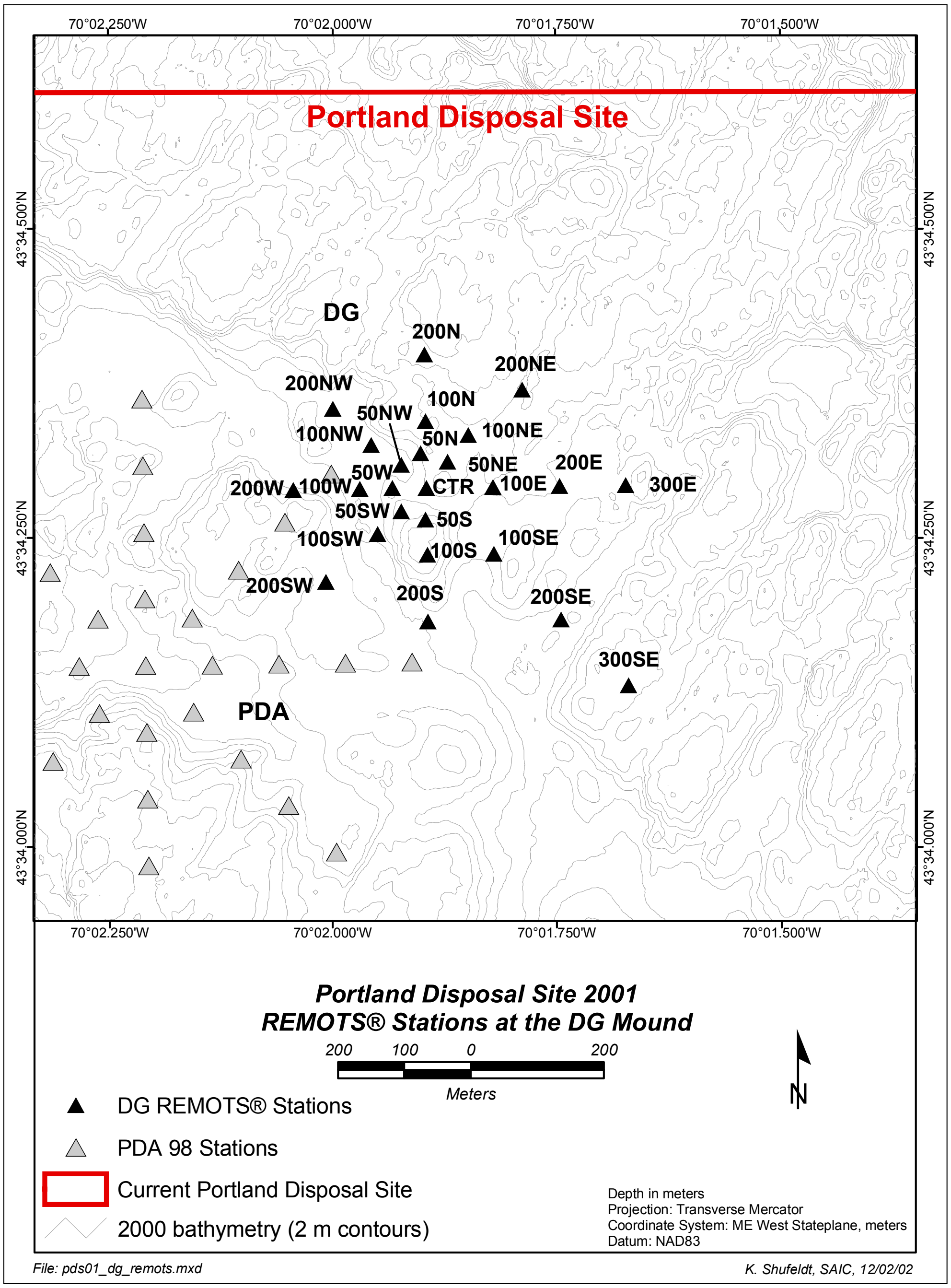


Figure 2-4. Map showing the locations of the August 2001 REMOTS® sediment-profile imaging stations over the DG Mound, overlaid on the depth contours from the July 2000 bathymetric survey.

Table 2-2.

PDS August 2001 REMOTS® Station Locations over the DG Mound

Area	Station	Latitude	Longitude
DG Buoy CENTER 43° 34.291´ N 70° 01.895´ W NAD 83	CTR	43° 34.291´ N	70° 01.895´ W
	100N	43° 34.345´ N	70° 01.896´ W
	200N	43° 34.399´ N	70° 01.897´ W
	300N	43° 34.318´ N	70° 01.902´ W
	50NE	43° 34.312´ N	70° 01.871´ W
	100NE	43° 34.333´ N	70° 01.848´ W
	200NE	43° 34.370´ N	70° 01.788´ W
	100E	43° 34.291´ N	70° 01.821´ W
	200E	43° 34.292´ N	70° 01.747´ W
	300E	43° 34.293´ N	70° 01.673´ W
	100SE	43° 34.237´ N	70° 01.820´ W
	200SE	43° 34.184´ N	70° 01.745´ W
	300SE	43° 34.131´ N	70° 01.670´ W
	50S	43° 34.265´ N	70° 01.896´ W
	100S	43° 34.237´ N	70° 01.895´ W
	200S	43° 34.183´ N	70° 01.894´ W
	50SW	43° 34.272´ N	70° 01.924´ W
	100SW	43° 34.254´ N	70° 01.950´ W
	200SW	43° 34.215´ N	70° 02.008´ W
	50W	43° 34.291´ N	70° 01.933´ W
	100W	43° 34.290´ N	70° 01.970´ W
	200W	43° 34.289´ N	70° 02.044´ W
	50NW	43° 34.309´ N	70° 01.923´ W
	100NW	43° 34.326´ N	70° 01.957´ W
	200NW	43° 34.355´ N	70° 01.999´ W

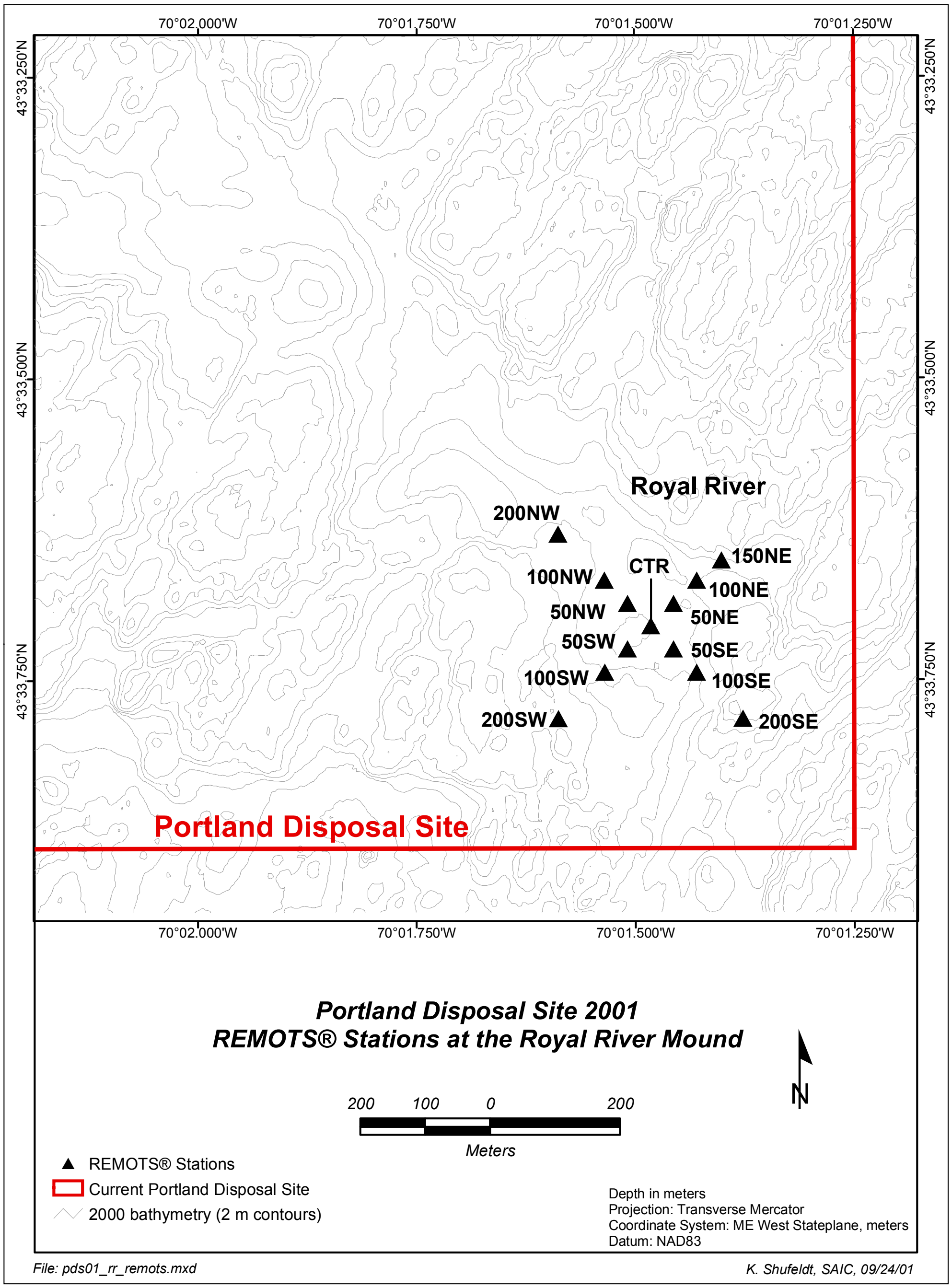


Figure 2-5. Map showing the locations of the August 2001 REMOTS® sediment-profile imaging stations over the Royal River Mound, overlaid on the depth contours from the July 2000 bathymetric survey.

Table 2-3.

PDS August 2001 REMOTS® Station Locations over the Royal River Mound

Area	Station	Latitude	Longitude
Royal River CENTER 43° 33.795´ N 70° 01.483´ W NAD 83	RR_CTR	43° 33.795´ N	70° 01.483´ W
	50NE	43° 33.814´ N	70° 01.457´ W
	100NE	43° 33.833´ N	70° 01.431´ W
	150NE	43° 33.850´ N	70° 01.403´ W
	50SE	43° 33.776´ N	70° 01.457´ W
	100SE	43° 33.757´ N	70° 01.431´ W
	200SE	43° 33.719´ N	70° 01.378´ W
	50SW	43° 33.776´ N	70° 01.510´ W
	100SW	43° 33.757´ N	70° 01.536´ W
	200SW	43° 33.719´ N	70° 01.589´ W
	50NW	43° 33.814´ N	70° 01.510´ W
	100NW	43° 33.833´ N	70° 01.536´ W
	200NW	43° 33.872´ N	70° 01.589´ W

as part of the 1995–97 capping demonstration project. The sampling design included a southeastern, southwestern, and northwestern arm extending 200 m from the center station, and a northeastern arm extending 150 m to evaluate the benthic environment in areas likely to display soft sediment accumulation.

A total of 13 stations were selected from the three reference areas on the ambient seafloor surrounding PDS to provide a basis of comparison with conditions over the disposal mounds. Individual stations were randomly distributed within a 300 m radius of each reference area center. Five stations were selected within SOUTH REF (SREF; 43°33.351´ N, 70°01.722´ W), while four stations were randomly distributed around the centers of both reference areas EAST REF (EREF; 43°34.434´ N, 69°59.701´ W) and SOUTHEAST REF (SEREF; 43°32.807´ N, 70°00.162´ W; Figure 2-1; Table 2-4). Best effort was made to obtain at least three replicate photographs at each station.

Table 2-4.

REMOTS® Station Locations over the PDS Reference Areas

Area	Station	Latitude	Longitude
EAST REF CENTER 43°34.434´ N 69°59.701´ W	EREF1	43° 34.422´ N	69° 59.839´ W
	EREF2	43° 34.381´ N	69° 59.631´ W
	EREF3	43° 34.427´ N	69° 59.709´ W
	EREF5	43° 34.517´ N	69° 59.772´ W
SOUTH REF CENTER 43°33.351´ N 70°01.722´ W	SREF2	43° 33.353´ N	70° 01.734´ W
	SREF5	43° 33.442´ N	70° 01.716´ W
	SREF6	43° 33.439´ N	70° 01.600´ W
	SREF7	43° 33.440´ N	70° 01.825´ W
	SREF8	43° 33.382´ N	70° 01.828´ W
SE REF CENTER 43°32.807´ N 70°00.162´ W	SEREF1	43° 32.784´ N	70° 00.203´ W
	SEREF2	43° 32.851´ N	70° 00.099´ W
	SEREF3	43° 32.672´ N	70° 00.182´ W
	SEREF4	43° 32.814´ N	70° 00.164´ W

3.0 RESULTS

The REMOTS® results compiled for the PDA 98 and DG Mounds were primarily used to assess the distribution of dredged material and monitor the subsequent recovery of the benthic infaunal community. A complete set of August 2001 REMOTS® image analysis results is provided in Appendix B; these results are summarized in tables below.

3.1 PDA 98 Mound

3.1.1 Dredged Material Distribution and Physical Sediment Characteristics

The sediment observed in the REMOTS® images at most of the PDA 98 Mound stations was considered to be dredged material, which generally extended from the sediment surface to below the imaging depth of the REMOTS® camera at each station (i.e., dredged material greater than penetration; Figure 3-1). The surface sediments over the PDA 98 Mound were composed primarily of fine-grained, gray and black silt often mottled with white clay or displaying white clay chips (Figure 3-2). The silt and cohesive clay noted in the 2001 images were similar in appearance to the dredged material observed in the September 2000 survey. Historic dredged material in the form of gray, biologically reworked silt was detected in numerous replicate images at Stations 200W, 300N, 400N, 400S, and 400SE. A major modal grain size of >4 phi was calculated for 26 of the 28 stations over the PDA 98 Mound (Figure 3-2; Table 3-1).

Hard bottom was detected at two stations (200SW and 300S), with no detectable deposits of ambient fine-grained sediment or historic dredged material. The hard bottom prevented sufficient camera penetration, precluding measurement of several key REMOTS® parameters (e.g., RPD, successional status, OSI, and boundary roughness). Major modal grain size classifications at these stations were –1 to 0 phi, as rock and cobble was observed in the far field of the sediment-profile image (Table 3-1). Although soft sediments were not observed at either station as part of the August 2001 survey, dredged material had been previously noted at Station 300S and Station 200SW during the 2000 survey. Results from the 2000 survey at both stations consisted of dredged material thicknesses greater than camera penetration depths, which ranged between 7.8 and 21.1 cm for three replicate images from both stations. The difference between surveys could be a reflection of spatial variability in the substrate in this portion of the site, or an indication of erosion of material due to hydrodynamic conditions. An evaluation of the likelihood that material was eroded from these locations is presented in the discussion section below.

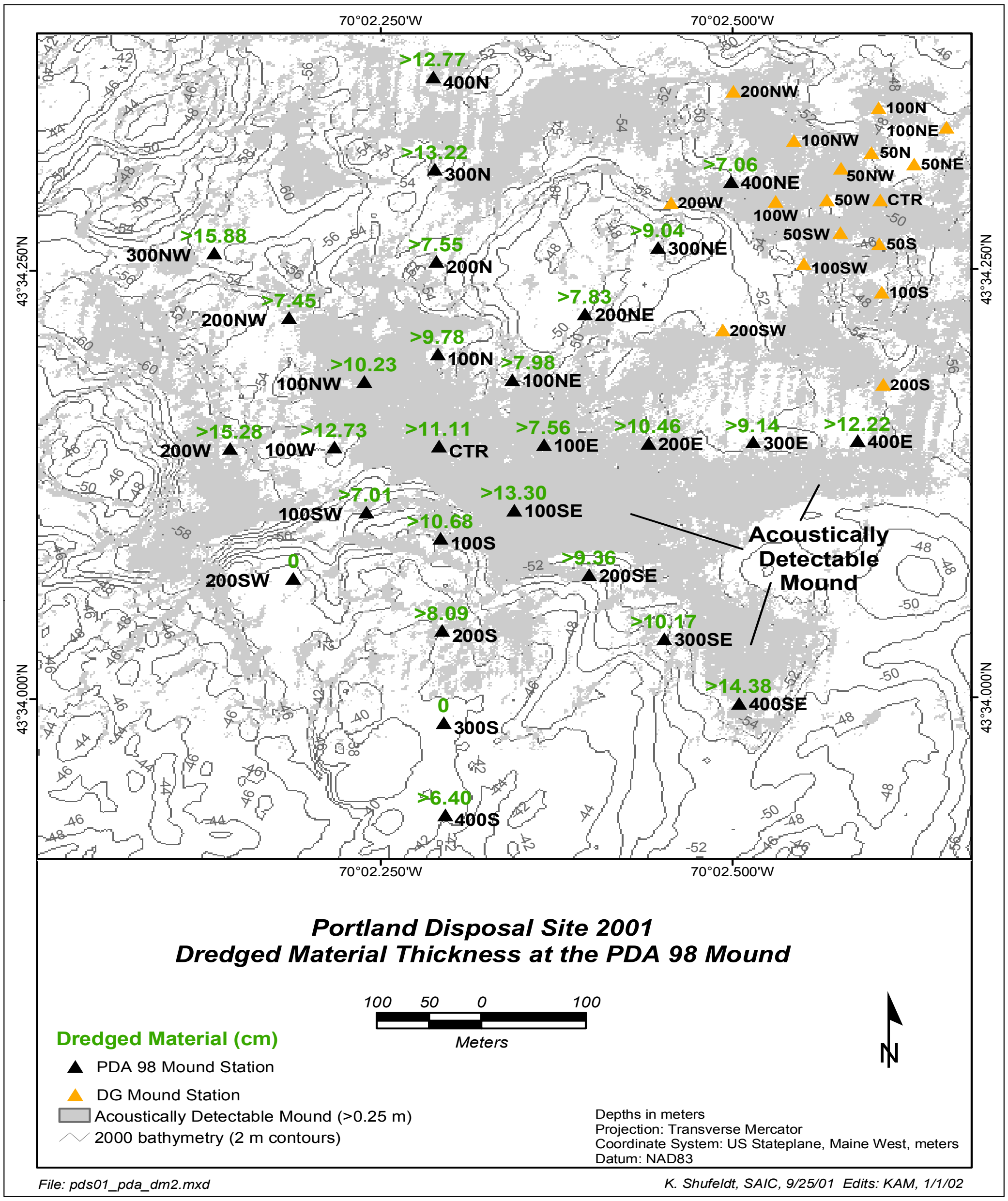


Figure 3-1. Map of replicate-averaged dredged material thickness over the PDA 98 Mound relative to the distribution of dredged material as detected by the depth difference between the 2000 and the 1998 bathymetric surveys. A greater than sign (>) indicates that the measured dredged material thickness was greater than the penetration (i.e., imaging) depth of the sediment-profile camera.

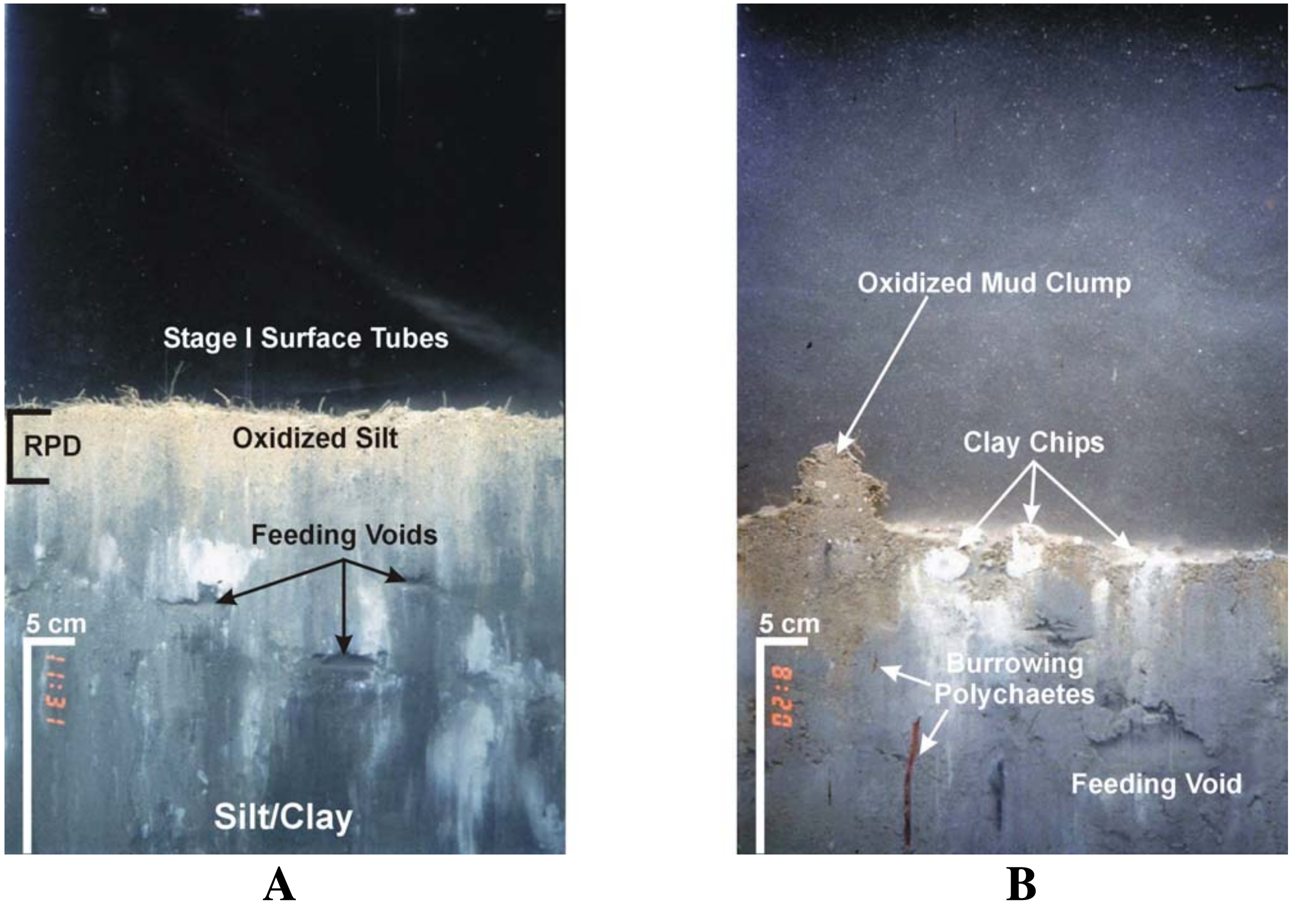


Figure 3-2. REMOTS® images collected from Station 200NE (A) and Station 200S (B) showing the characteristics of dredged material (silt over mottled white and gray cohesive clay) observed throughout the PDA 98 Mound images, as well as illustrating reworked dredged material on the surface of the PDA 98 Mound.

Table 3-1.

Summary of REMOTS® Results for Stations at the PDA 98 Mound

Station	Camera Penetration Mean (cm)	Dredged Material Thickness Mean (cm)	Number of Reps w/ Dredged Material	RPD Mean (cm)	Successional Stages Present	Highest Stage Present	Grain Size Major Mode (phi)	Methane Present	OSI Mean	OSI Median	Boundary Roughness Mean (cm)
CTR	11.11	>11.11	3	2.00	I,III	ST_I_ON_III	>4	NO	8.33	9	0.79
100N	9.78	>9.78	3	1.42	I,III	ST_I_ON_III	>4	NO	7.67	7	0.90
100NE	7.98	>7.98	3	1.65	I,III	ST_I_ON_III	>4	NO	6.33	7	1.40
100E	7.56	>7.56	3	1.62	I,III	ST_I_ON_III	>4	NO	6.33	7	0.88
100SE	13.30	>13.30	3	1.91	I,III	ST_I_ON_III	>4	NO	7.00	8	0.68
100S	10.68	>10.68	3	1.40	I,III	ST_I_ON_III	>4	NO	7.00	7	0.74
100SW	7.01	>7.01	3	1.56	I,III	ST_I_ON_III	>4	NO	6.00	7	1.80
100W	12.73	>12.73	3	2.08	I,III	ST_I_ON_III	>4	NO	8.33	9	0.52
100NW	10.23	>10.23	3	1.73	I,III	ST_I_ON_III	>4	NO	7.67	8	0.96
200N	7.55	>7.55	3	1.89	I,III	ST_I_ON_III	>4	NO	6.67	8	1.11
200NE	7.83	>7.83	3	1.33	I,III	ST_I_ON_III	>4	NO	7.33	7	0.77
200E	10.46	>10.46	3	1.23	I,III	ST_I_ON_III	>4	NO	6.00	7	2.15
200SE	9.36	>9.36	3	1.59	I,III	ST_I_ON_III	>4	NO	7.67	8	1.11
200S	8.09	>8.09	3	1.51	I,III	ST_I_ON_III	>4	NO	7.33	7	1.40
200SW	0.00	0.00	0	INDET	INDET	INDET	-1 to 0	NO	INDET	INDET	INDET
200W	15.28	>15.28	3	2.02	I,III	ST_I_ON_III	>4	NO	6.67	8	1.12
200NW	7.45	>7.45	3	1.38	I,III	ST_I_ON_III	>4	NO	7.33	7	1.53
300N	13.22	>13.22	3	1.76	I,III	ST_I_ON_III	>4	NO	6.67	8	1.25
300NE	9.04	>9.04	3	1.82	I,III	ST_I_ON_III	>4	NO	6.67	7	0.85
300E	9.14	>9.14	3	1.40	I,III	ST_I_ON_III	>4	NO	4.67	3	1.61
300SE	10.17	>10.17	3	1.53	I,III	ST_I_ON_III	>4	NO	6.33	7	1.02
300S	0.00	0.00	0	INDET	INDET	INDET	-1 to 0	NO	INDET	INDET	INDET
300NW	15.88	>15.88	3	1.78	I,III	ST_I_ON_III	>4	NO	5.33	4	0.81
400N	12.77	>12.77	3	2.79	I,III	ST_I_ON_III	>4	NO	9.00	9	0.96
400NE	7.06	>7.06	3	1.07	I,III	ST_I_ON_III	>4	NO	5.67	7	1.73
400E	12.22	>12.22	3	2.07	I,III	ST_I_ON_III	>4	NO	6.00	6	0.99
400SE	14.38	>14.38	3	1.58	I,III	ST_I_ON_III	>4	NO	5.00	4	1.01
400S	6.40	>6.40	3	2.51	I,III	ST_III	>4	NO	4.50	4.5	2.16
AVG	9.52	>9.52	3	1.72					6.67	6.94	1.16
MAX	15.88	>15.88	3	2.79					9.00	9	2.16
MIN	0.00	0.00	0	1.07					4.50	3	0.52

Similar to the seafloor conditions within the disposal site, soft sediments are found within relatively small basins and crevices between exposed bedrock outcrops at the reference areas. The soft sediments detected at the reference areas were characterized as predominately fine-grained silt and clay with a major modal grain size of >4 phi (Table 3-2). Station SREF2 and two replicate images from Station EREF5 were the exceptions to this finding, as hard bottom conditions were detected (Table 3-2).

The penetration depth of the camera prism typically serves as a measure of sediment density or compaction, by indicating the relative bearing strength of the sediment. Replicate-averaged prism penetration depths over the PDA 98 mound ranged from 15.9 cm at Station 300NW to 0.00 cm at Stations 300S and 200SW, with an overall average of 9.5 cm (Table 3-1). These relatively low overall mean prism penetration depths suggest relatively high bearing strength sediment is present at the surface of the dredged material deposit. Similarly, the overall mean camera penetration depths at the reference areas were fairly low, averaging 10.2 cm (Table 3-2).

Replicate-averaged boundary roughness values over the PDA 98 Mound ranged from 0.5 cm to 2.2 cm (average of 1.2 cm), which was comparable to the reference area overall average of 0.95 cm (Tables 3-1 and 3-2). There was no obvious spatial pattern associated with these relatively low boundary roughness values. Surface roughness was primarily attributed to physical disturbance at the disposal site, as large mud clumps, smaller oxidized and reduced mud clasts, and white clay chips were scattered at the sediment-water interface in numerous replicates (Figure 3-2B). A number of stations also exhibited biogenic surface roughness due to the presence of dense tubicolous, opportunistic polychaetes and surface reworking by burrowing infauna.

3.1.2 Biological Conditions and Benthic Recolonization

Three parameters were used to assess the benthic recolonization status and overall benthic habitat quality of the disposal site relative to the reference areas: apparent Redox Potential Discontinuity (RPD) depth, Organism-Sediment Index (OSI), and infaunal successional status. These three parameters were mapped on station location plots to outline the biological conditions at each station established over the project mounds.

The redox potential discontinuity (RPD) is measured on each image to determine the apparent depth of oxygen penetration into the surface sediment. The replicate-averaged apparent RPD measurements for the PDA 98 Mound stations ranged from 1.1 cm at Station 400NE to 2.8 cm at Station 400N (Figure 3-3; Table 3-1). The overall RPD average of 1.7 cm suggests shallow to moderate aeration of the surface sediments.

Table 3-2.

Summary of REMOTS® Results for Stations Occupied over the PDS Reference Areas

Station	Camera Penetration Mean (cm)	RPD Mean (cm)	Successional Stages Present	Highest Stage Present	Grain Size Major Mode (phi)	Methane Present	OSI Mean	OSI Median	Boundary Roughness Mean (cm)
EAST									
EREF1	13.33	1.39	I,III	ST_I_ON_III	>4	NO	5.00	5	1.14
EREF2	9.57	2.56	I,III	ST_I_ON_III	>4	NO	7.00	10	1.17
EREF3	9.93	3.63	I	ST_I	>4	NO	6.33	6	1.07
EREF5	8.58	INDET	I	ST_I	>4	NO	INDET	INDET	1.59
SOUTH									
SREF2	2.59	2.58	I	ST_I	>4	NO	5.00	5	0.48
SREF5	14.13	2.74	I	ST_I	>4	NO	5.00	5	0.69
SREF6	9.07	3.00	I	ST_I	>4	NO	5.00	5	1.07
SREF7	9.96	2.18	I,III	ST_I_ON_III	>4	NO	8.00	8	1.10
SREF8	10.53	2.44	I	ST_I	>4	NO	5.00	5	0.62
SE									
SEREF1	11.83	2.44	INDET	INDET	>4	NO	INDET	INDET	0.91
SEREF2	12.44	2.25	I	ST_I	>4	NO	4.00	4	0.93
SEREF3	9.78	INDET	I,III	ST_I_ON_III	>4	NO	INDET	INDET	0.81
SEREF4	11.06	2.47	I	ST_I	>4	NO	4.67	4	0.77
AVG	10.22	2.52					5.43	5.7	0.95
MAX	14.13	3.63					8.00	10	1.59
MIN	2.59	1.39					4.00	4	0.48

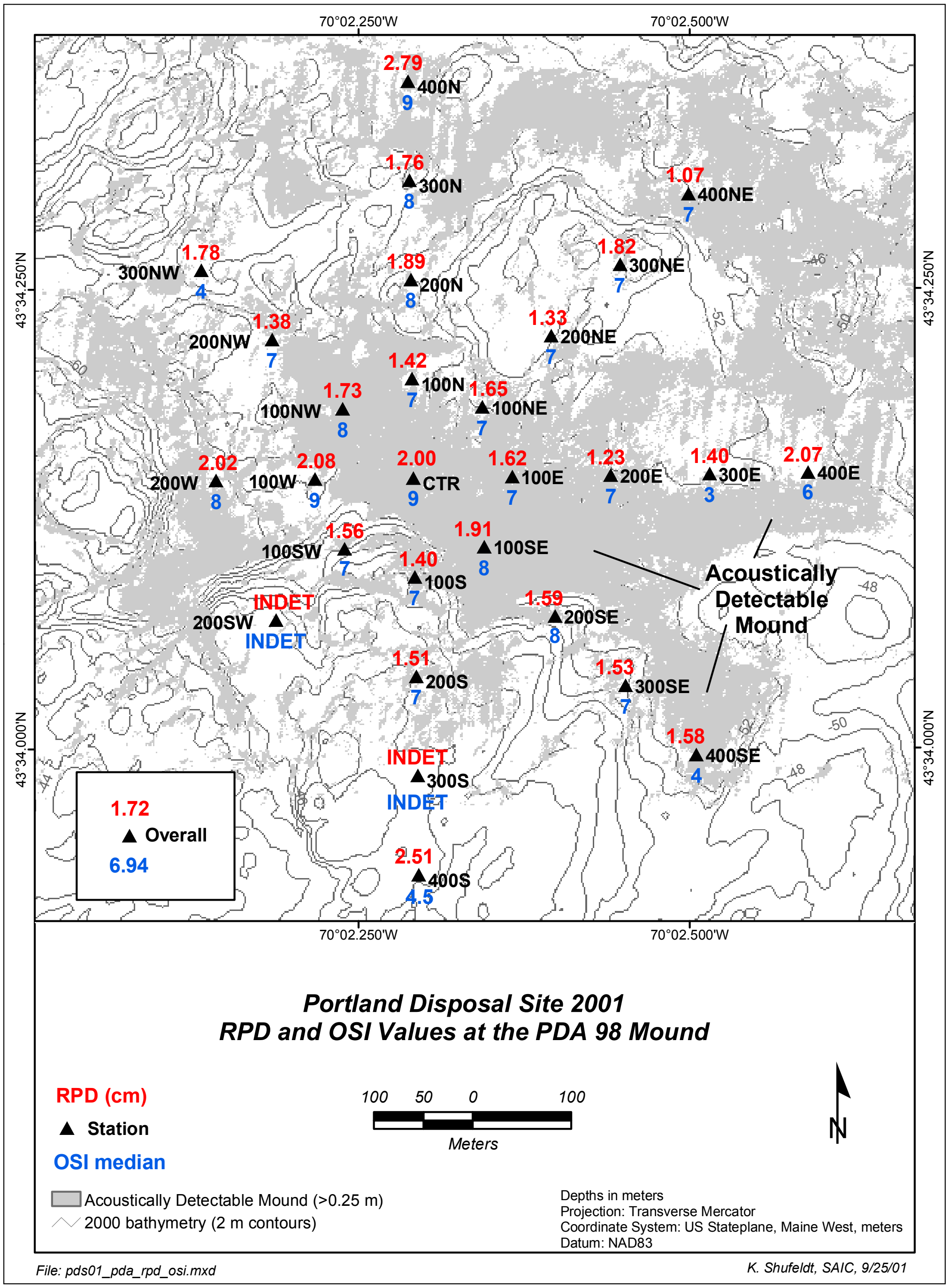


Figure 3-3. Map of replicate-averaged RPD depths (red) and median OSI values (blue) detected over the PDA 98 Mound relative to the distribution of dredged material as detected by the depth difference between the 2000 and 1998 bathymetric surveys.

These values were lower than the mean RPD depth values observed at the reference areas, which ranged from 1.4 cm to 3.6 cm, with an overall average of 2.5 cm indicative of moderate to well oxygenated surface sediment (Table 3-2). Numerous stations at the disposal mound had reduced sediment present at the sediment-water interface; reduced mud adhering to the camera resulted in a smearing artifact that obscured the RPD in some images. However, none of the stations occupied within the disposal site and surrounding reference areas showed any evidence of low sediment dissolved oxygen conditions, visible redox rebounds, or traces of methane gas entrained within the sediment.

The successional stage recolonization status was relatively advanced, with both Stage I and Stage III communities inhabiting the sediments of the PDA 98 Mound (Figure 3-4; Table 3-1). Stage I pioneering polychaetes occurred together with Stage III head-down, deposit-feeding infauna. Stage I organisms included small, surface dwelling polychaetes, whose tubes were clearly visible at the sediment surface (Figure 3-5). Stage III activity was marked by active feeding voids in the subsurface sediments at the disposal site stations (Figures 3-2 and 3-5). The combination of both Stage I and Stage III taxa at all the stations within the disposal site and a higher occurrence of Stage III activity during the 2001 survey, suggests that the benthic recolonization status of the disposal site area has proceeded as anticipated since the 2000 survey efforts. In comparison to the PDA 98 Mound, the reference areas displayed more stations with only Stage I taxa and fewer occurrences of Stage III activity (Table 3-2).

The range of OSI values within the disposal site suggests somewhat variable benthic conditions, ranging from moderately disturbed (+3) at Station 300E to undisturbed (+9) at Stations 100W, 400N, and CTR (overall average of +6.9; Figures 3-3 and 3-5; Table 3-1). The benthic conditions at the majority of the stations were considered non-degraded or undisturbed, as OSI values were above +6. The low values calculated at various PDA 98 stations reflect relatively shallow RPD depths and a lower abundance of Stage III infauna in the replicate images acquired at these stations. Slightly shallower RPD depths at the PDA 98 Mound stations were probably the result of a higher inventory of organic matter contained within the dredged material and resulting increased sediment oxygen demand. OSI values for two stations (200SW and 300S) were considered indeterminate, as under penetration of the camera prism on the hard bottom prevented measurement of several key parameters. While the range of median OSI values over the PDA 98 survey area (+3 to +9, n=26) was lower than the range for the reference area (+4 to +10, n=10), the overall average of +6.9 at the PDA 98 Stations was higher than the overall average for the reference area, +5.7 (Table 3-2).

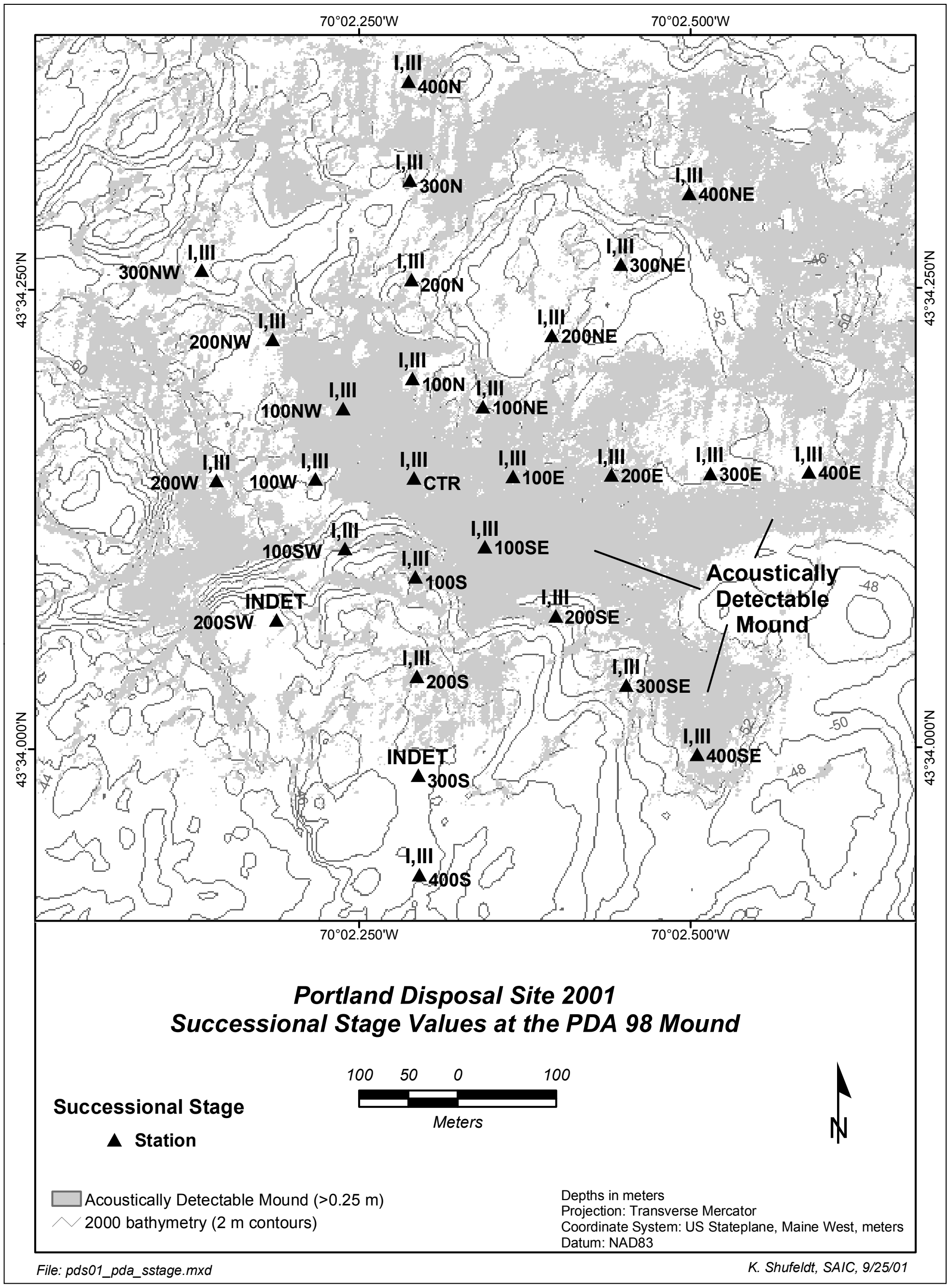


Figure 3-4. Map of successional stage status for the REMOTS® stations established over the PDA 98 Mound, relative to the distribution of dredged material as detected by the depth difference between the 2000 and 1998 bathymetric surveys.

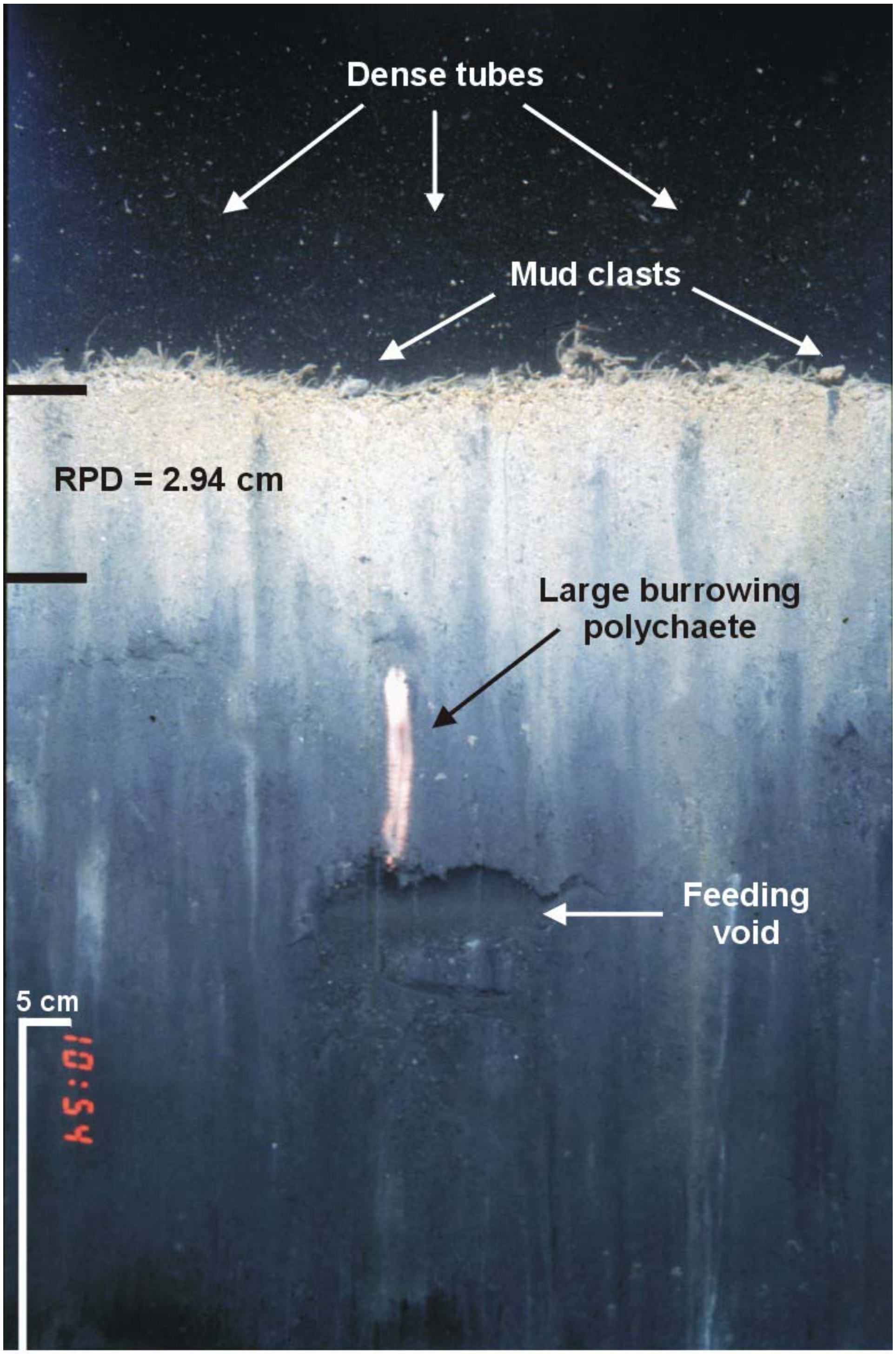


Figure 3-5. REMOTS® image collected from Station 100W within the PDA 98 Mound illustrating healthy or undisturbed benthic habitat conditions

Overall, the August 2001 REMOTS® results indicated that the surface sediments comprising the PDA 98 Mound had been extensively recolonized by an advanced successional stage community consisting of both surface-dwelling and deeper-dwelling infauna. It is expected that the RPD depths will gradually deepen over time as the organic matter is consumed by the deposit feeding infauna and the dredged material continues to experience extensive bioturbation by the recolonizing benthic organisms.

3.2 DG Mound

3.2.1 Dredged Material Distribution and Physical Sediment Characteristics

Dredged material was detected in layers exceeding the penetration (i.e., imaging) depth of the sediment-profile camera at all of the DG Mound stations (Figure 3-6; Table 3-3). The majority of the sediments observed in the surface and near surface layers of this disposal mound were primarily composed of fine-grained, gray to black silt and clay. A major modal grain size of >4 phi was calculated for 21 of the 25 stations (Table 3-3). Similar to the PDA 98 Mound, white cohesive clay chips were detected in the subsurface sediments at many stations (Figure 3-7A).

A minor sand fraction was observed at several stations, while higher amounts of sand and gravel were detected at Stations DG100S, DG100SW, DG200N, and DG300SE, where the major modal grain size was classified as 4 to 3 phi (Table 3-3). Historic, biologically reworked dredged material was noted at Stations DG200SE and DG300SE, as the sediment displayed physical characteristics similar to the material observed at the PDA 98 Mound (Figure 3-7B). In addition, indications of dredged material layering (relic RPDs) were evident in several replicate images collected from stations within a 50 m radius of the disposal buoy.

Mean camera penetration depths for the DG Mound ranged from 2.5 cm at Station DG300SE to 16.2 cm at Station DG300E (overall average of 8.1 cm; Table 3-3). Several of these shallow camera penetration measurements may be indicative of hard bottom underlying a thin veneer of deposited sediment. Under-penetration of the REMOTS® camera on the hard seafloor at Station DG300SE and in replicate images from Stations DG100S, DG200N, DG200NE, and DG50S prevented the analysis of key parameters (e.g., RPD, successional status, surface roughness, and OSI).

The average boundary roughness values for the DG Mound stations ranged from 0.6 cm at Station DG200NW to 4 cm at Station DG100SE, with an overall average

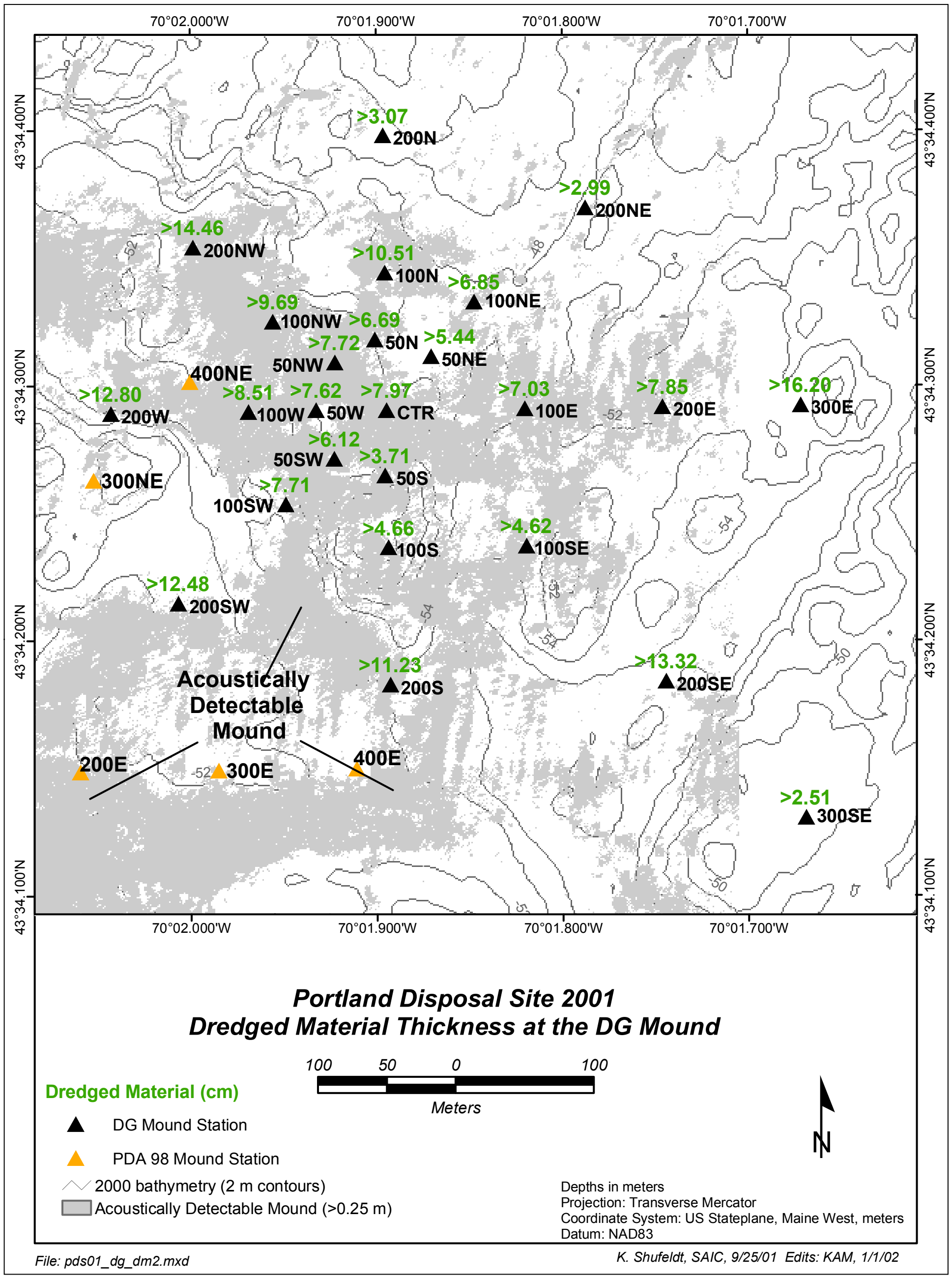


Figure 3-6. Map of replicate-averaged dredged material thickness over the DG Mound relative to the distribution of dredged material as detected by the depth difference between the 2000 and 1998 bathymetric surveys. A greater than sign (>) indicates that the measured dredged material thickness was greater than the penetration (i.e., imaging) depth of the sediment-profile camera.

Table 3-3.

Summary of REMOTS® Results for Stations at the DG Mound

Station	Camera Penetration Mean (cm)	Dredged Material Thickness Mean (cm)	Number of Reps w/ Dredged Material	RPD Mean (cm)	Successional Stages Present	Highest Stage Present	Grain Size Major Mode (phi)	Methane Present	OSI Mean	OSI Median	Boundary Roughness Mean (cm)
DGCTR	7.97	>7.97	3	1.25	I,III	ST_I_ON_III	>4	NO	7.33	7	1.07
DG50N	6.69	>6.69	3	2.17	I,III	ST_I_ON_III	>4	NO	7.00	9	1.02
DG50NE	5.44	>5.44	3	1.17	I,III	ST_I_ON_III	>4	NO	5.67	7	1.63
DG50S	3.71	>3.71	3	0.96	I,III	ST_I_ON_III	>4	NO	7.00	7	1.11
DG50W	7.62	>7.62	3	1.47	I	ST_I	>4	NO	3.33	3	1.40
DG50SW	6.12	>6.12	3	0.78	I,III	ST_I_ON_III	>4	NO	6.67	7	1.70
DG50NW	7.72	>7.72	3	1.50	I,III	ST_I_ON_III	>4	NO	6.00	7	0.79
DG100N	10.51	>10.51	3	1.72	I,III	ST_I_ON_III	>4	NO	8.00	8	1.23
DG100NE	6.85	>6.85	3	2.00	I,III	ST_I_ON_III	>4	NO	8.33	8	1.19
DG100E	7.03	>7.03	3	1.69	I,III	ST_I_ON_III	>4	NO	7.67	8	1.05
DG100SE	4.62	>4.62	3	0.93	I,III	ST_I_ON_III	>4	NO	5.67	7	4.02
DG100S	4.66	>4.66	3	1.02	I,III	ST_I_ON_III	4 to 3	NO	5.00	5	1.15
DG100SW	7.71	>7.71	3	1.33	I,III	ST_I_ON_III	4 to 3	NO	6.00	6	1.33
DG100W	8.51	>8.51	3	0.85	I,III	ST_I_ON_III	>4	NO	5.67	7	1.18
DG100NW	9.69	>9.69	2	1.29	I,III	ST_I_ON_III	>4	NO	7.50	8	1.00
DG200N	3.07	>3.07	3	1.76	I,III	ST_I_ON_III	4 to 3	NO	6.00	6	0.95
DG200NE	2.99	>2.99	2	2.47	I,III	ST_I_ON_III	>4	NO	9.00	9	0.89
DG200E	7.85	>7.85	3	1.86	I,III	ST_I_ON_III	>4	NO	8.00	8	0.92
DG200SE	13.32	>13.32	3	1.99	I,III	ST_I_ON_III	>4	NO	5.33	4	1.12
DG200S	11.23	>11.23	3	1.83	I,III	ST_I_ON_III	>4	NO	6.33	7	1.71
DG200SW	12.48	>12.48	3	2.47	I,III	ST_I_ON_III	>4	NO	8.67	9	0.99
DG200W	12.80	>12.80	3	2.08	I,III	ST_I_ON_III	>4	NO	7.00	8	1.06
DG200NW	14.46	>14.46	3	2.03	I,III	ST_I_ON_III	>4	NO	6.67	7	0.63
DG300E	16.20	>16.20	3	2.16	I,III	ST_I_ON_III	>4	NO	7.00	7	1.04
DG300SE	2.51	>2.51	3	INDET	I	ST_I	4 to 3	NO	INDET	INDET	1.42
AVG	8.07	>8.07	3	1.62					6.70	7.04	1.26
MAX	16.20	>16.20	3	2.47					9.00	9	4.02
MIN	2.51	2.51	2	0.78					3.33	3	0.63

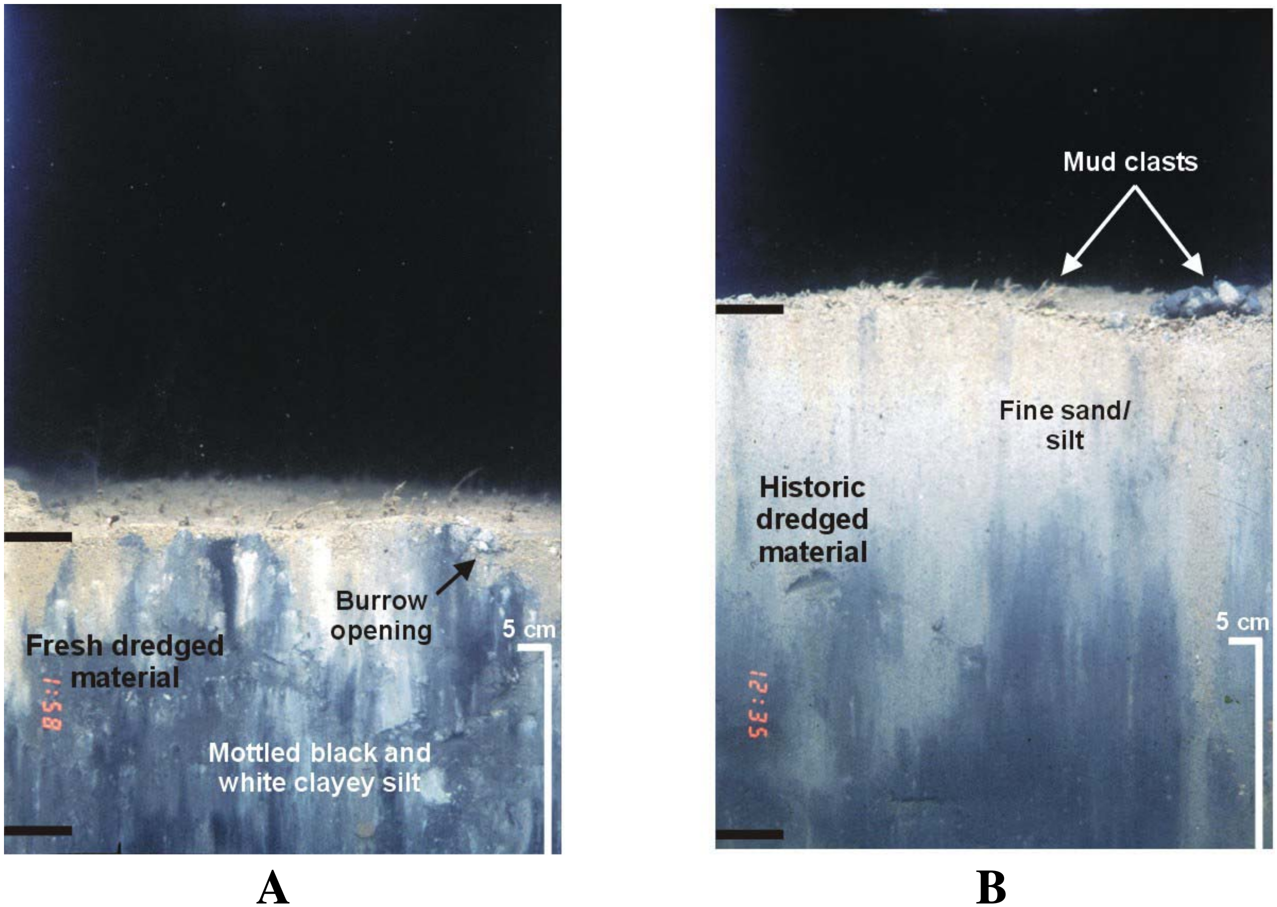


Figure 3-7. REMOTS® images collected from DG Mound Stations DG100SE (A) and DG200SE (B) comparing the fresh dredged material comprised of gray and black silt-clay detected at Station DG100SE and the historic dredged material (biologically reworked) at Station DG 200SE.

of 1.3 cm (Table 3-3). These measurements were slightly higher than the boundary roughness values observed at the reference areas (overall average of 1.0 cm; Table 3-2).

The elevated value at Station DG100SE was due to a highly irregular and sloping topography, along with the presence of large mud clumps and mud clasts (Figure 3-8). There was no obvious spatial pattern to the boundary roughness values across the surveyed area. The surface roughness was deemed to be physical in nature in the majority of replicate images due to the continuing disposal of dredged material at this location. However, biogenic surface roughness was present at several stations, due to the presence of dense tubicolous polychaetes and surface reworking by burrowing infauna. Small shells and shell fragments were observed at the sediment surface at several stations.

3.2.2 Biological Conditions and Benthic Recolonization

The replicate-averaged RPD values for the REMOTS® stations occupied over the DG Mound ranged from a shallow 0.8 cm at Station DG50SW to a well-developed 2.5 cm at Stations DG200NE and DG200SW (Figure 3-9; Table 3-3). The overall average RPD of 1.6 cm was lower than the composite value calculated for the reference areas (2.5 cm) and is indicative of a shallow to moderately oxygenated surface sediment layer (Tables 3-2 and 3-3). None of the replicate images obtained over the DG Mound showed any evidence of low sediment dissolved oxygen conditions, visible redox rebounds, or traces of methane gas.

The surface of the DG Mound was composed of a thin layer of recently deposited dredged material (winter 2001), as well as an historic sediment deposit (1998–99) from Portland Harbor. The benthic recolonization status over the DG Mound included both Stage I pioneering polychaetes present at the sediment surface along with Stage III activity at many stations (Figure 3-10; Table 3-3). Stage I taxa were coupled with Stage III taxa at all stations, with the exception of Stations DG50W and DG300SE where only Stage I taxa were observed. There was a higher frequency of Stage III taxa together with Stage I organisms in the replicate images collected over the DG Mound than observed at the reference areas. Spiral polychaete tubes were observed at the sediment-water interface at Station 100SW (Figure 3-11). The presence of a diverse mixture of Stages I and III organisms indicates that benthic recolonization of this mound has met or exceeded expectations within six months of the last dredged material placement event.

Replicate-averaged median OSI values over the DG Mound ranged from +3 at Station DG50W to +9 at Stations DG200NE, DG200SW, and DG50N (Figure 3-9; Table 3-3). The overall mound average of +7, indicative of a non-degraded or undisturbed

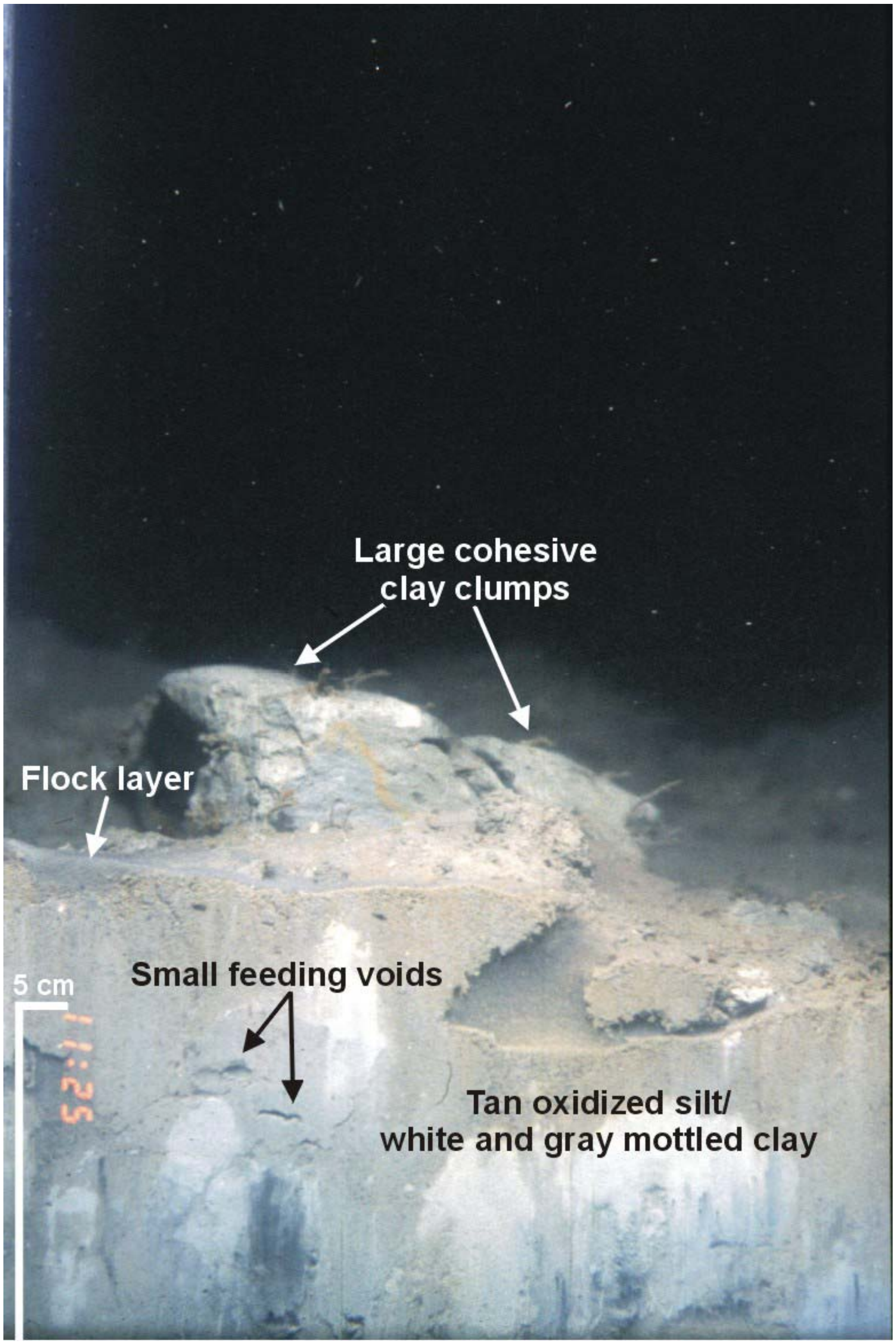


Figure 3-8. REMOTS® image obtained from Station DG100SE within the dredged material of the DG Mound illustrating an irregular topography with large cohesive clay clumps along with a fluidized flock layer suggesting a recent physical disturbance from dredged material deposition.

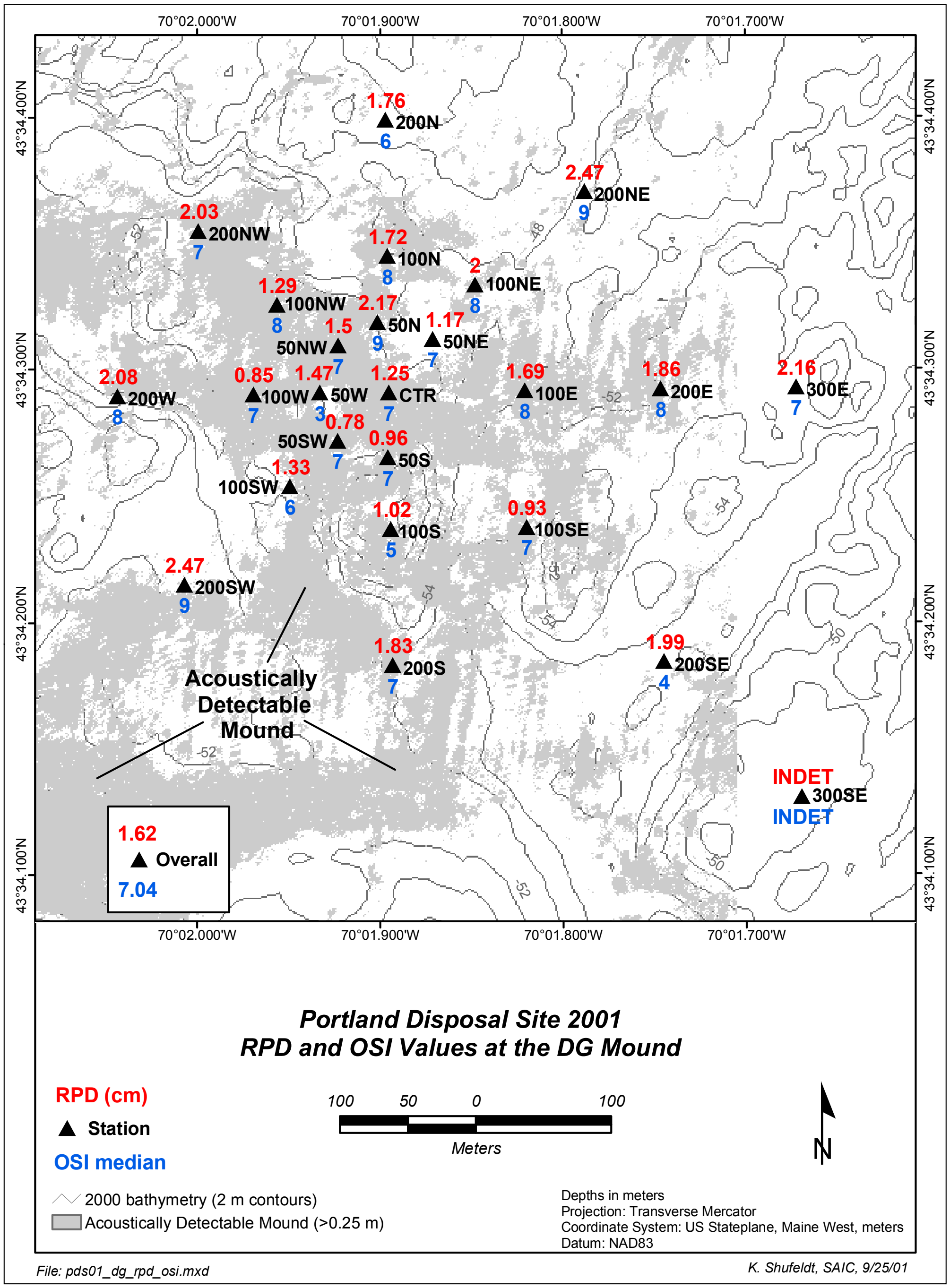


Figure 3-9. Map of replicate-averaged RPD depths (red) and median OSI values (blue) detected over the DG Mound relative to the distribution of dredged material as detected by the depth difference between the 2000 and 1998 bathymetric surveys.

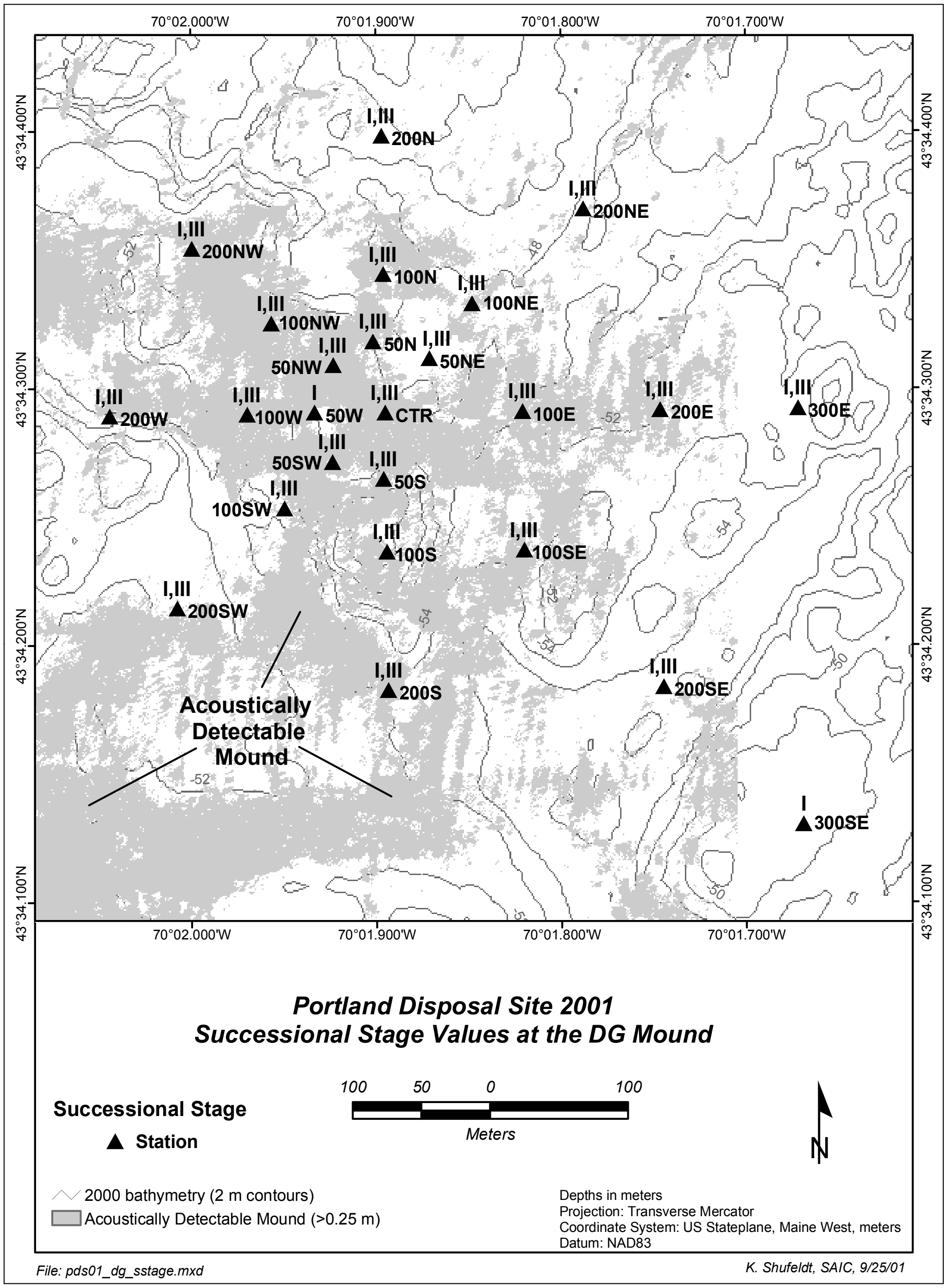


Figure 3-10. Map of successional stage status for the REMOTS® stations established over the DG Mound relative to the distribution of dredged material as detected by the depth difference between the 2000 and 1998 bathymetric surveys.

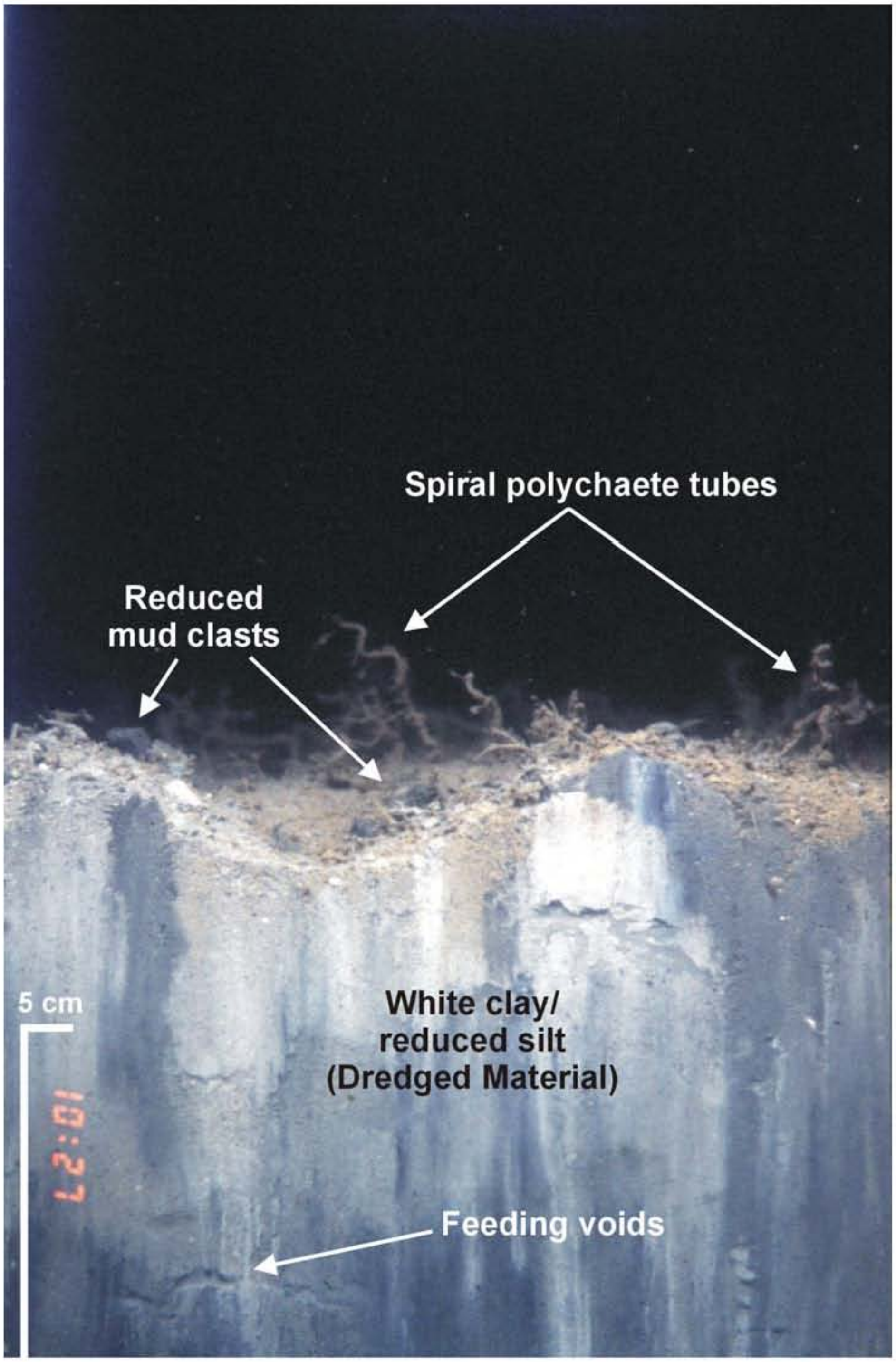


Figure 3-11. REMOTS® image collected from DG Mound Station DG100SW showing spiral polychaete tubes at the sediment-water interface over feeding voids at depth (Stage I on III)

benthic environment, was greater than the reference area average of +5.7 (Table 3-2). A shallow mean RPD depth together with a Stage I community at Station DG50W yielded a median OSI value representative of a moderately disturbed benthic environment (+3). Conversely, values at the higher end of the scale (+9) reflected substantially deeper RPD depths and Stage III activity noted in the subsurface sediments. OSI values for Station DG300SE were indeterminate because of under-penetration of the camera prism on a hard bottom.

3.3 Royal River Mound

3.3.1 Dredged Material Distribution and Physical Sediment Characteristics

With the exception of Station RR200SE, the sediment observed in the REMOTS® images was determined to be historic dredged material that exceeded the camera prism penetration depth at 12 of the 13 stations occupied over the Royal River Mound (Figure 3-12). Composed primarily of brown, oxidized sandy silt over gray and black sandy silt, the surface sediments were similar in appearance to the sandy capping dredged material (CDM) placed at the PDA 96 buoy as part of the final phase of the Portland Disposal Site Capping Demonstration Project (Figure 3-13; Morris et al. 1998). The major modal grain size was classified as >4 phi at 10 of the 13 stations despite the presence of a significant fine sand component throughout the images (Table 3-4). A major modal grain size of 4 to 3 phi was identified at Stations RR100NW and RR200SW where a higher sand component was observed (Figure 3-13).

Hard bottom conditions were found at Station RR200SE, as no soft sediment was detected in two replicate images and multiple sampling attempts during the August 2001 survey. This station is positioned over an area of seafloor displaying high relief, likely a rocky area subject to advection of the fine-grained sediment over time. The February 1996 baseline survey, completed as part of the capping demonstration project, also indicated hard bottom conditions at this station. The January 1997 postcap survey, however, had detected an average soft sediment thickness of nearly 9 cm at Station RR200SE after the placement of 22,200 m^3 of CDM at the PDA 95 buoy position (Morris et al. 1998).

Mean camera penetration depths for stations over the Royal River Mound were shallow, ranging from 0 cm at Station RR200SE to 9 cm at Station RR50NE, with an overall average of 6.8 cm (Table 3-4). These shallow depths are due to the presence of sand in the dredged material at most stations, which is generally more resistant to penetration of the camera prism. Under-penetration of the REMOTS® camera and camera lens condensation prevented the analysis of key parameters (e.g., RPD, successional status,

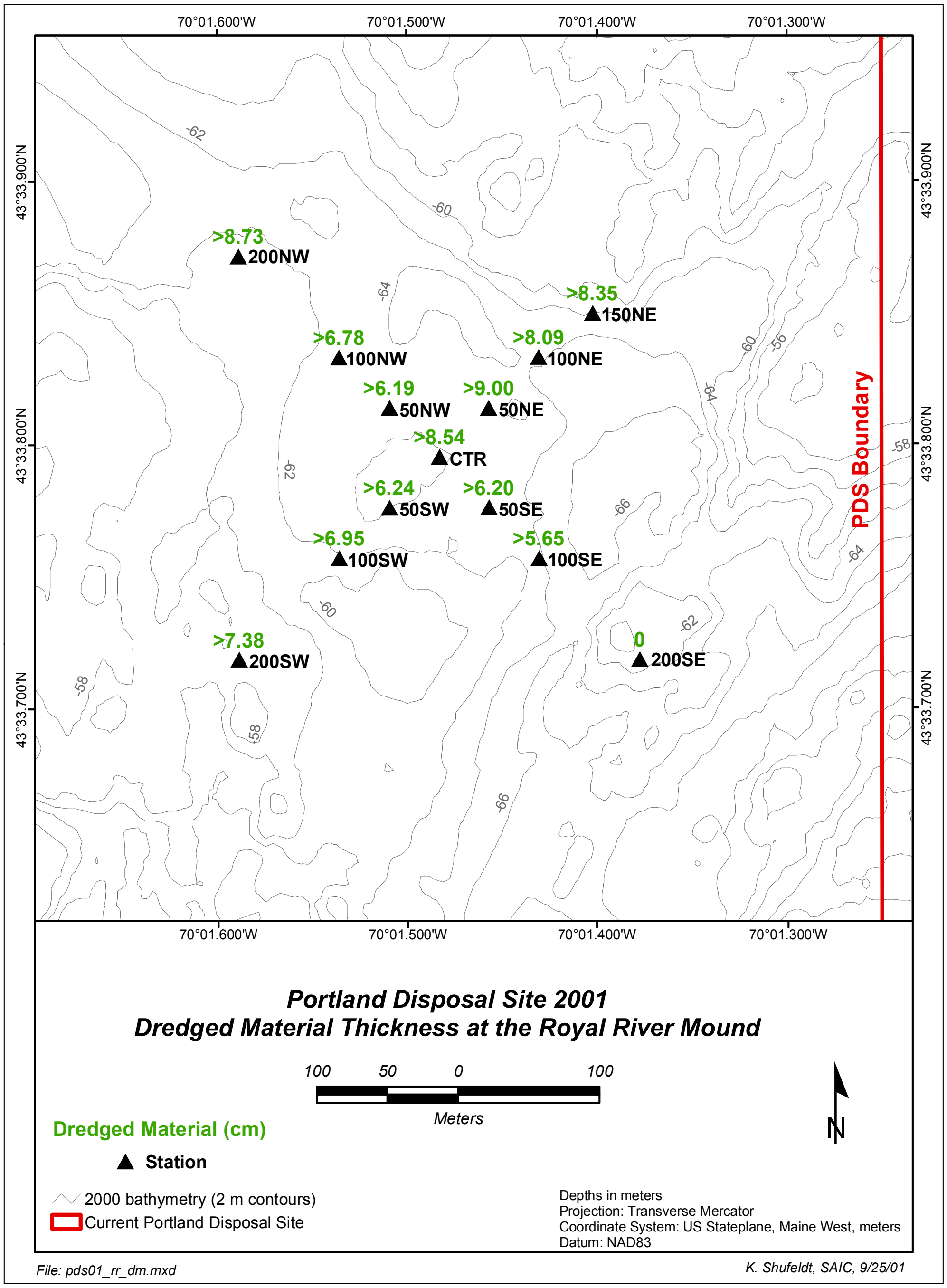


Figure 3-12. Map of replicate-averaged dredged material thickness over the Royal River Mound, overlaid on July 2000 bathymetry. A greater than sign (>) indicates that the measured dredged material thickness was greater than the penetration (i.e., imaging) depth of the sediment-profile camera.

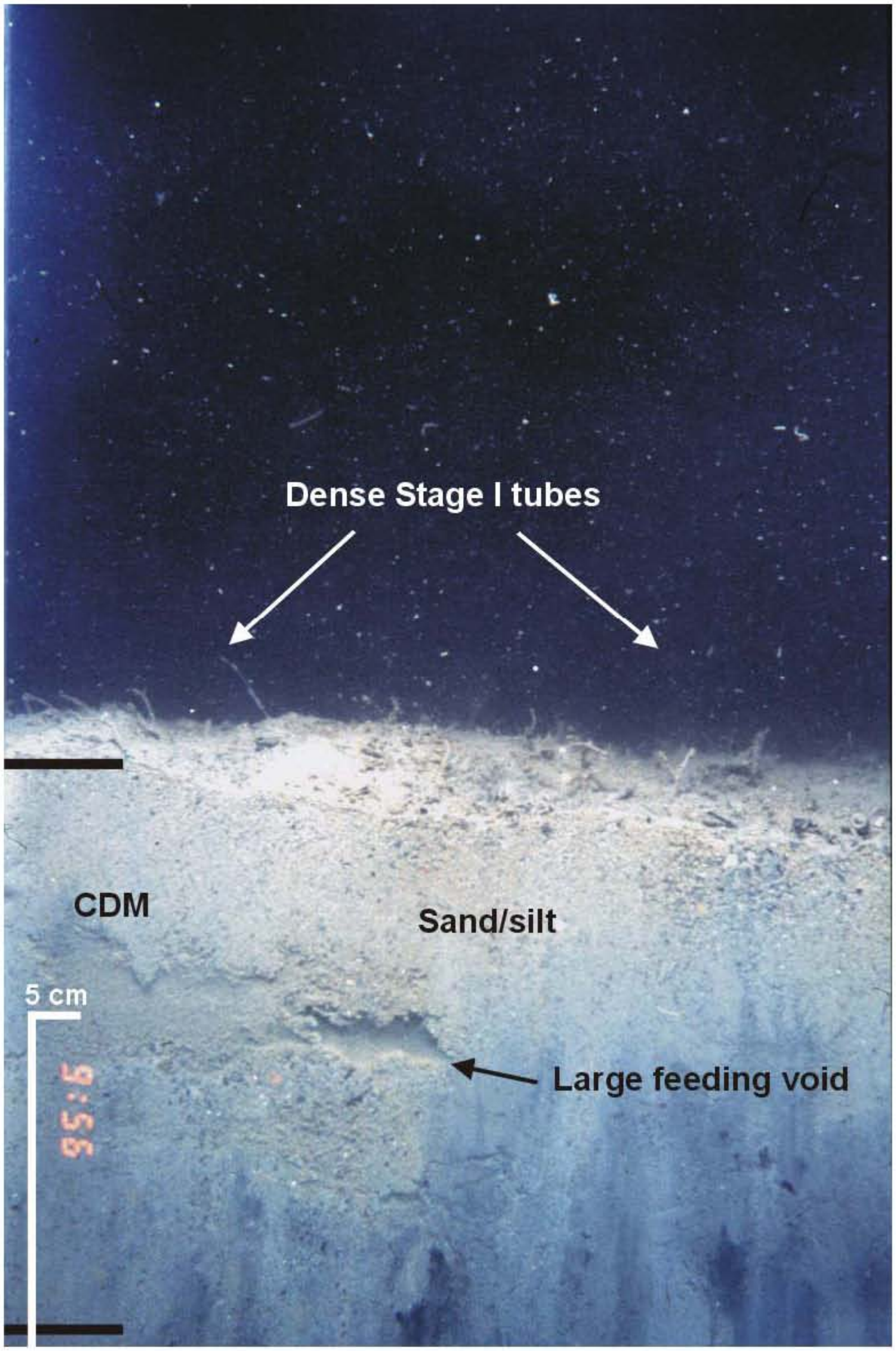


Figure 3-13. REMOTS® image obtained from Station RR200SW over the Royal River Mound illustrating the high sand content of the CDM. This is also an example of a Stage I on III successional stage.

Table 3-4.

Summary of REMOTS® Results for Stations at the Royal River Mound

Station	Camera Penetration Mean (cm)	Dredged Material Thickness Mean (cm)	Number of Reps w/ Dredged Material	RPD Mean (cm)	Successional Stages Present	Highest Stage Present	Grain Size Major Mode (phi)	Methane Present	OSI Mean	OSI Median	Boundary Roughness Mean (cm)
RRCTR	8.54	>8.54	3	2.26	I,III	ST_I_ON_III	>4	NO	7.00	8	0.56
RR50NE	9.00	>9.00	3	2.56	I,III	ST_I_ON_III	>4	NO	7.33	8	0.85
RR50SE	6.20	>6.20	3	2.07	I	ST_I	>4	NO	4.00	4	1.03
RR50SW	6.24	>6.24	3	1.69	I,III	ST_I_ON_III	>4	NO	7.50	7.5	1.11
RR50NW	6.19	>6.19	3	2.60	I,II	ST_I_TO_II	>4	NO	5.67	5	1.21
RR100NE	8.09	>8.09	3	2.63	I	ST_I	>4	NO	5.00	5	0.96
RR100SE	5.65	>5.65	3	1.76	I,III	ST_I_ON_III	>4	NO	5.33	5	0.84
RR100SW	6.95	>6.95	3	1.78	I,III	ST_I_ON_III	>4	NO	5.33	4	1.27
RR100NW	6.78	>6.78	3	2.37	I,III	ST_I_ON_III	4 to 3	NO	6.00	5	1.22
RR150NE	8.35	>8.35	3	3.71	I,III	ST_I_ON_III	>4	NO	10.00	10	2.57
RR200SE	0.00	0.00	0	INDET	INDET	INDET	0 TO -1	INDET	INDET	INDET	INDET
RR200SW	7.38	>7.38	3	2.07	I,III	ST_I_ON_III	4 to 3	NO	8.33	8	1.05
RR200NW	8.73	>8.73	3	2.48	I,III	ST_I_ON_III	>4	NO	6.00	6	1.02
AVG	6.78	>6.78	2.77	2.33					6.46	6.29	1.14
MAX	9.00	>9.00	3	3.71					10.00	10	2.57
MIN	0.00	0.00	0	1.69					4.00	4	0.56

surface roughness, and OSI) in 7 of the 38 (18%) replicate images collected over the Royal River Mound in August 2001.

Replicate-averaged boundary roughness values for the Royal River Mound stations ranged from 0.6 cm at Station RRCTR to 2.6 cm at Station RR150NE (average of 1.1 cm), which was comparable to the reference area average of nearly 1 cm (Tables 3-2 and 3-4). Surface roughness was predominately due to the presence of reduced mud clasts and a sloping topography observed in many images. There also were scattered occurrences of biogenic surface roughness due to dense, tubicolous polychaetes and surface reworking by burrowing infauna. Small shells and shell fragments were observed at the sediment-water interface in a number of images.

3.3.2 Biological Conditions and Benthic Recolonization

The replicate-averaged RPD measurements for the Royal River Mound were relatively deep, ranging from 1.7 cm at Station RR50SW to 3.7 cm at Station RR150NE (overall average of 2.3 cm; Figure 3-14; Table 3-4). These values were comparable to the overall value observed at the reference areas (2.5 cm) and are indicative of moderate to well aerated surface sediments on the mound. There was no evidence of low sediment dissolved oxygen, visible redox rebounds, or traces of methane gas in any of the replicate images.

The successional stage status at the Royal River Mound included both surface tube-dwelling Stage I polychaetes together with Stage III head-down, deposit-feeding infauna (Figures 3-13 and 3-15; Table 3-4). The well-developed Stage I community observed in two replicate images from Station RR50NW appeared to be showing some advancement to a Stage II status due to the presence of some apparent amphipod tubes. Stage III organisms were not observed in the images from Stations RR100NE, RR50NW, and RR50SE; only Stage I taxa were found in the sediment at these stations. The presence of a diverse mixture of Stages I, II, and III over the Royal River Mound, with a predominance of Stage I on III, indicated an advanced benthic recolonization status consistent with expectations.

Replicate-averaged median OSI values for the Royal River Mound ranged from +4 at Stations RR100SW and RR50SE to +10 at Station RR150NE, with an overall average of +6.3 (Figure 3-14; Table 3-4). Again, this overall average indicated non-degraded or undisturbed benthic habitat conditions (OSI values > +6), and was slightly higher than the composite OSI value for the reference areas (+5.7). Stations RR100SW and RR50SE revealed moderately degraded benthic habitat conditions (+4), as a function of variable RPD depths and a higher occurrence of Stage I taxa in replicate images. Alternatively, the

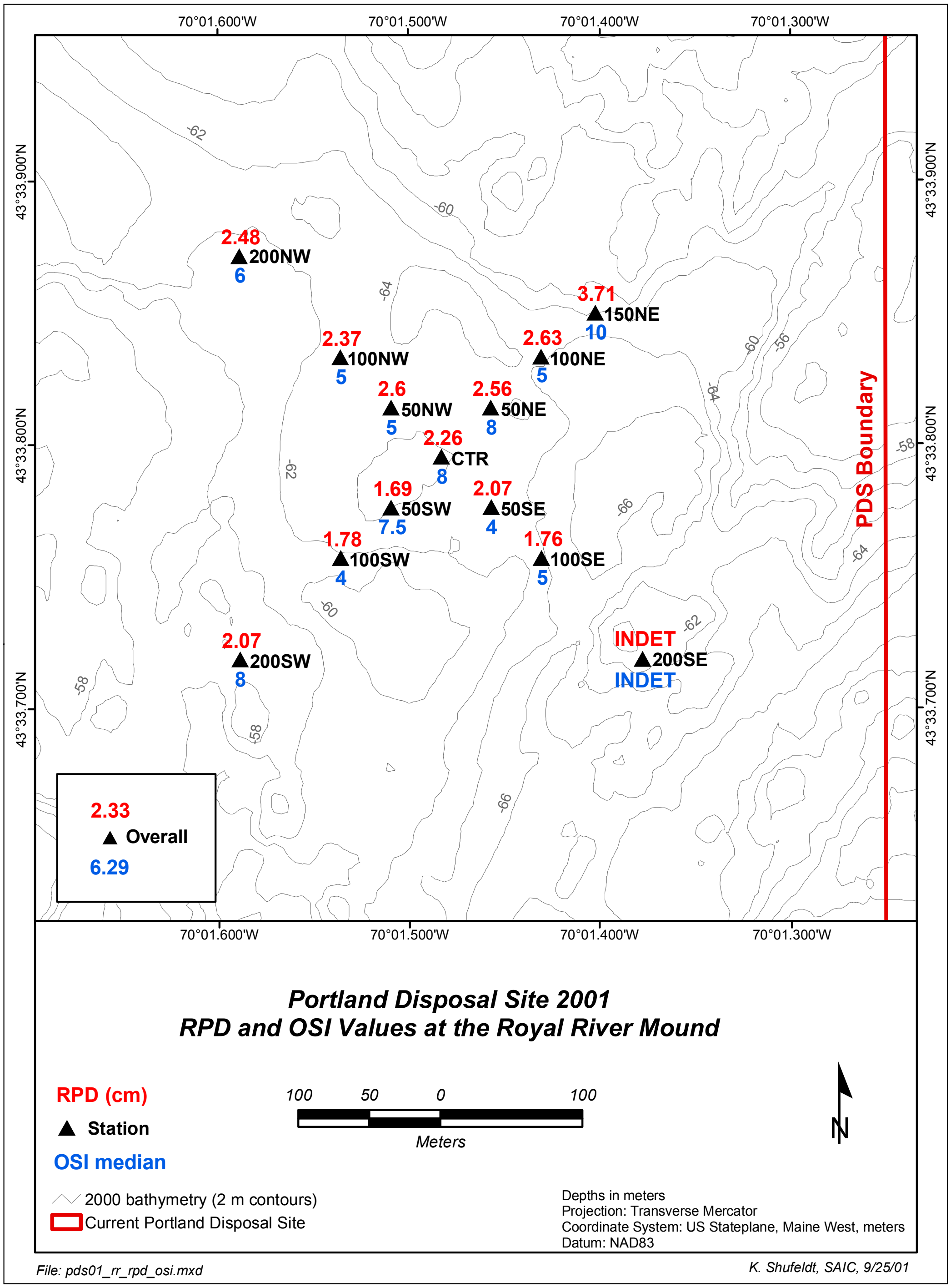


Figure 3-14. Map of replicate-averaged RPD depths (red) and median OSI values (blue) detected over the Royal River Mound, overlaid on July 2000 bathymetry

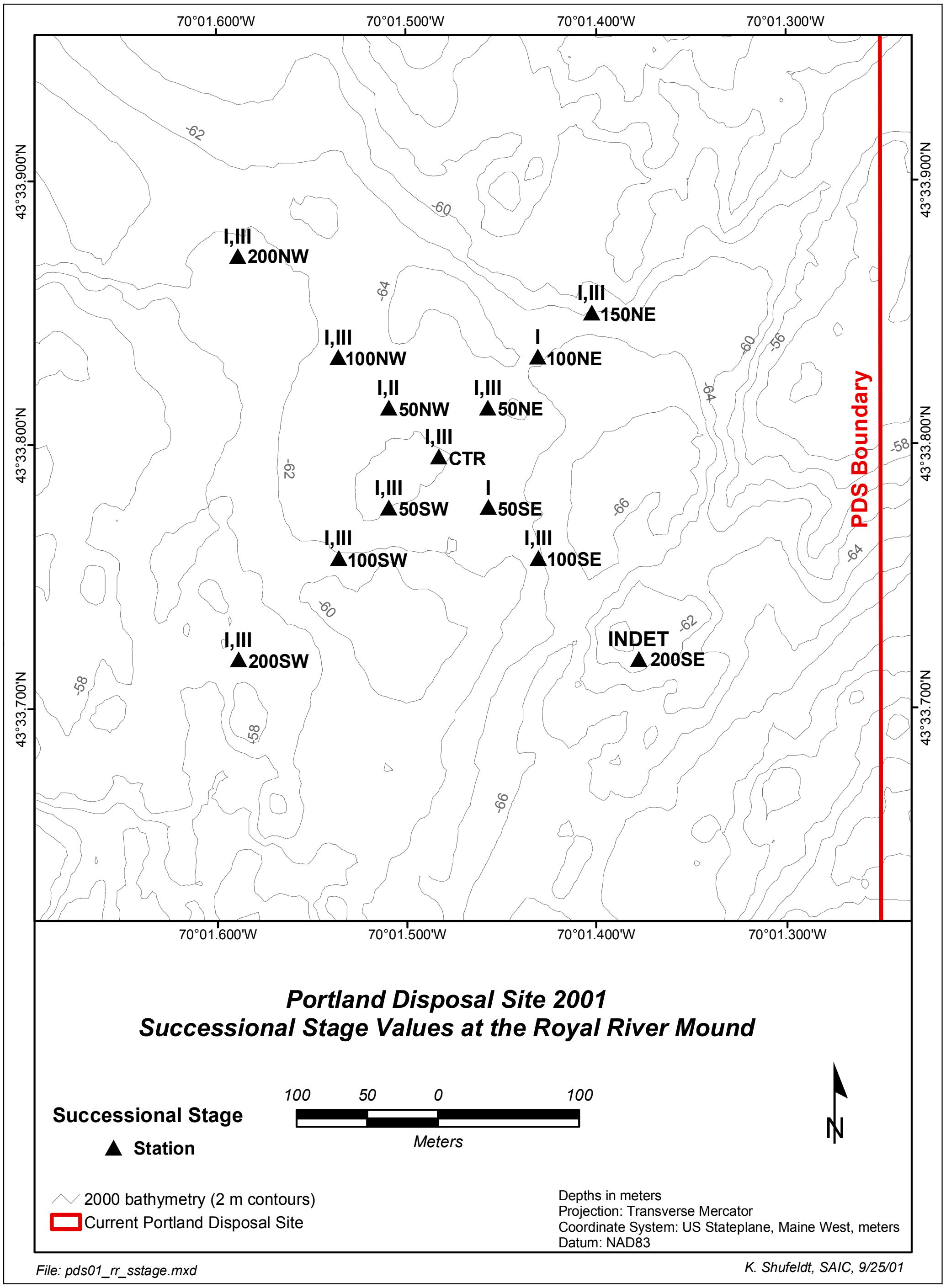


Figure 3-15. Map of successional stage status at the REMOTS® stations over the Royal River Mound, overlaid on July 2000 bathymetry

single analyzable replicate image at station RR150NE exhibited non-degraded benthic habitat conditions, with an OSI of +10 derived from an extremely well-developed RPD of 3.7 cm and Stage I and Stage III activity. The 2001 REMOTS® results indicated that the surface sediments comprising the Royal River Mound have been recolonized extensively by a benthic community consisting of both surface-dwelling and deeper-dwelling infauna. The RPD depths may further deepen over time as the CDM continues to experience extensive bioturbation by the recolonizing benthic organisms.

3.4 PDS Reference Areas

3.4.1 Physical Sediment Characteristics

Ambient surface sediments at the three reference areas consisted of a tan, oxidized layer of silt over gray silt and fine sand. A major modal grain size of >4 phi was calculated for the reference area stations, indicating soft sediment accumulation (Table 3-2). Dredged material was not detected in any of the analyzable images. A hard bottom caused camera under-penetration at Station SREF2 and in two replicate images at Station EREF5. In addition, camera lens condensation resulted in several obscured images, limiting the measurement of certain key parameters (e.g., RPD, successional status, and OSI). Mean camera penetration measurements were slightly higher at the reference areas compared to the PDA 98, DG, and Royal River Mounds, with a range of 2.6 cm at Station SREF2 to 14.1 cm at Station SREF5 (overall average of 10.2 cm; Tables 3-1 through 3-4).

Replicate-averaged boundary roughness values for the reference areas ranged from 0.5 cm at Station SREF2 to 1.6 cm at Station EREF5 (Table 3-2). The relatively low overall average of nearly 1 cm suggests only a slight amount of small-scale surface relief. Both oxidized and reduced mud clasts, indicative of recent physical disturbance, were detected in numerous stations.

3.4.2 Biological Conditions

The RPD depths at the reference area stations ranged from a moderate value of 1.4 cm at Station EREF1 to a well-developed 3.6 cm at Station EREF3 (Table 3-2). The overall average of 2.5 cm was higher than the average values for the disposal mounds and suggests moderate to deep oxygen penetration into the sediment. There was no evidence of low sediment dissolved oxygen conditions, visible redox rebounds, or traces of methane gas in the images obtained from the PDS reference areas.

Successional stage status at the reference areas appeared to be less advanced than the disposal mound stations, with a lower frequency of Stage III taxa and prevalence of Stage I taxa at most stations (Table 3-2). Evidence of Stage III head-down deposit-feeders (i.e., feeding voids) was found at only four of the thirteen stations. When present, Stage III taxa occurred together with surface dwelling Stage I polychaetes.

As previously described, the reference area average median OSI value of +5.7 was lower than those observed in the dredged material at the disposal mound stations (Tables 3-1 through 3-4). Despite the lower average median value, the range of median OSI values for all stations at the reference area (+4 to +10) was generally comparable to the range of values at the disposal mounds (+2 to +9 at the PDA 98 Mound; +4 to +10 at the DG Mound; and +4 to +10 at the Royal River Mound). Given the deep RPD values at the reference area, comparability of the range of median OSI values for each site, and relatively minor differences in the average median OSI value compared to the disposal mounds, these results may simply reflect natural sampling variability rather than evidence of more degraded conditions at the reference area. The EREF reference area stations appeared to be supporting a more advanced benthic community relative to SREF and SEREF, with well-developed RPD depths and a higher occurrence of Stage III taxa resulting in elevated OSI values. The average reference area OSI value for the August 2001 survey (+5.7) was lower than the average value for the previous September 2000 survey (+6.8). Continued monitoring at the disposal site and reference areas will help to further define the natural variability and implications of differences in median OSI values between disposal mounds and the reference areas.

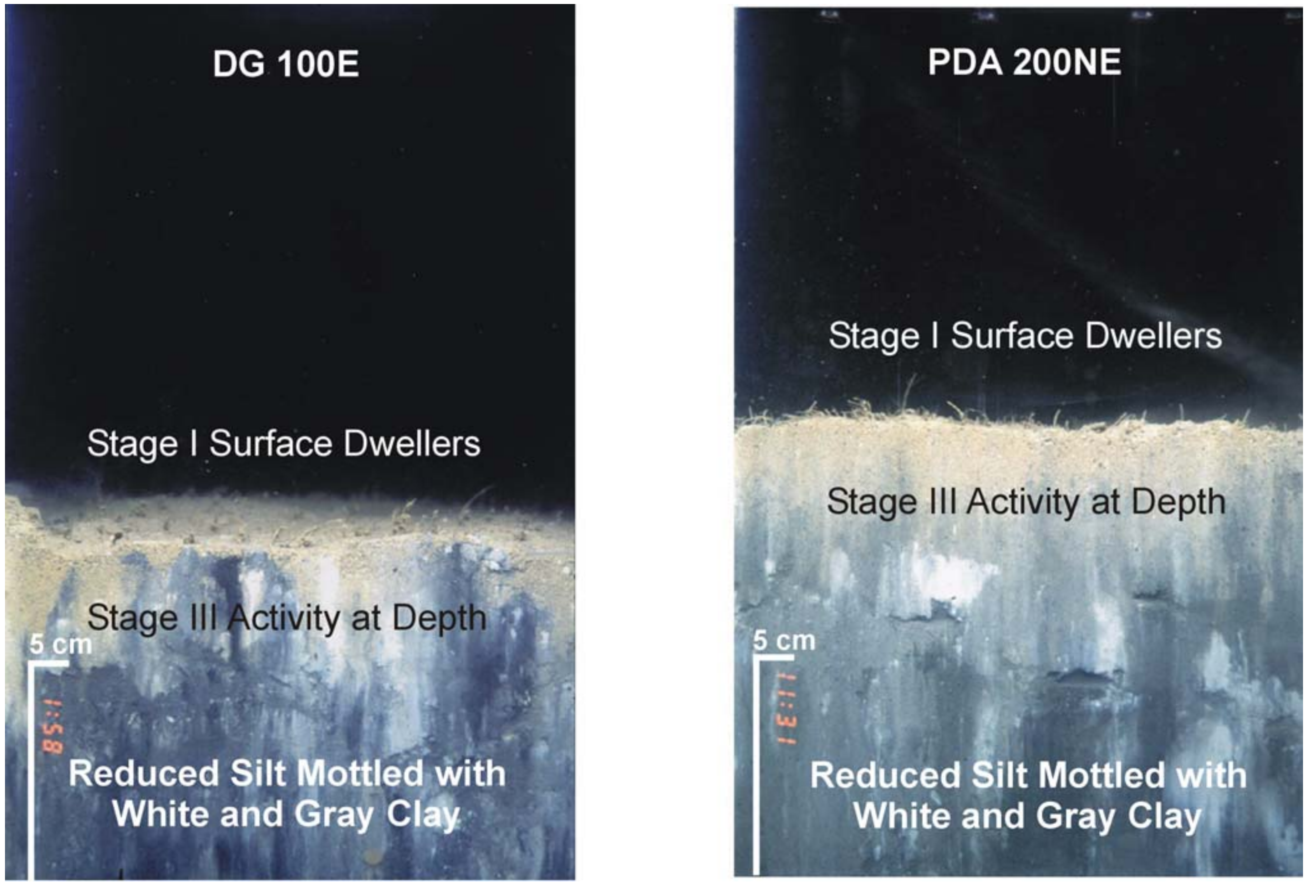
4.0 DISCUSSION

4.1 Dredged Material Distribution

Comparisons between the September 1998 and July 2000 bathymetric surveys indicated a significant accumulation of Portland Harbor sediment at the DG buoy position, as well as at the PDA 98 buoy (SAIC 2002). Sediment-profile images were not collected over the DG Mound in the September 2000 environmental monitoring survey. However, the REMOTS® images collected over the DG Mound in August 2001 displayed recently placed dredged material throughout the survey grid at thicknesses exceeding the camera prism penetration depth, supporting the findings of the July 2000 depth difference calculations. The 12,350 m^3 of sediment placed at the DG buoy since the 2000 survey apparently formed a thin (<5 cm) layer of fresh dredged material over the central portion of the now historic deposit. However, the limited volume and similar composition of the new material was insufficient to change the overall characteristics of the sediment comprising the surface of the DG Mound.

The majority of the material identified over the DG Mound was composed of gray silt and white cohesive clay chips, similar to the sediment observed at many PDA 98 Mound stations (Figure 4-1). The presence of this type of material within the DG Mound survey grid suggests the majority of the deposit originated from the 155,800 m^3 of dredged material placed at the DG buoy during the third phase of dredging in Portland Harbor (outer channel) in the spring of 1999 (Figure 1-4). The 18,300 m^3 removed from the Fore River in the winter of 2000 was also present in the surficial sediment layers. However, due to the age and volume of the sediment deposit, as well as the origin of the material, differentiation between the 1999 (155,800 m^3), 2000 (18,300 m^3), and 2001 (12,350 m^3) deposits was not possible.

The August 2001 REMOTS® survey also indicated the continued presence of dredged material at the PDA 98 buoy position, as well as within the remainder of the natural containment cell. Historic dredged material was detected at all but two stations (200SW and 300S) established over the PDA 98 Mound. This material was a product of the first and second phases of maintenance dredging operations in Portland Harbor during the fall of 1998 and winter of 1999 (Figure 1-4). In general, the nature of the dredged material (cohesive silt-clay) in August 2001 was similar to the sediment observed in the September 2000 survey. It is hypothesized that biological reworking of the surface sediments acted to dissipate some of the organic load within the dredged material deposit, yielding a higher-reflectance, gray silt in August 2001 compared to the darker material observed in the September 2000 survey.



A **B**

Figure 4-1. REMOTS® images collected from Station 100E over the DG Mound (A) and Station 200NE over the PDA 98 Mound (B) displaying strong similarities in sediment appearance, composition, and benthic recolonization

The sediment-profile imaging data suggests the aprons of the PDA 98 and DG Mounds have essentially coalesced on the PDS seafloor. Based on the August 2001 REMOTS® results for both mounds in conjunction with the July 2000 acoustically detectable dredged material deposit, the aerial distribution of recently deposited dredged material, or footprint, was determined to be nearly 0.72 km^2 (Figure 4-2). The majority of the 502,000 m^3 of sediment deposited at PDS over the past three years resides within the confines of the northwest-southeast trending trough feature in the northern portion of the disposal site. The remainder of the sediment has formed an apron of fine-grained material that has settled over the bedrock substrate surrounding the trough, or has accumulated within the multitude of smaller faults and fissures (depositional areas) in the bedrock seafloor. The movement of soft, non-cohesive sediments from the higher ridges to the smaller depositional areas present in PDS is expected over periods of time due to the physical conditions that exist at this disposal site.

Detailed oceanographic and modeling studies performed at PDS indicate that the near-bottom current regime alone does not provide sufficient energy to resuspend and transport sediments. However, sediment resuspension can periodically occur in areas of exposed seafloor when surface waves reach heights of 3 m or more as part of large-scale storm events (WES 1998; McDowell and Pace 1998). The elevated orbital velocity associated with the passage of these larger, storm-generated waves increases shear stress at the sediment-water interface and causes the incorporation of non-cohesive sediment into the water column. The weak near-bottom currents then transport the suspended sediment grains a short distance before the particles settle to the seafloor once again. As this process is repeated throughout a given period of time (months/years), soft sediments that accumulate on bedrock outcrops through dredged material placement or natural processes will tend to be focused towards small depositional areas (e.g., crevices and troughs among the rock outcrops) that are protected from any further transport by storm-generated waves.

The REMOTS® images obtained from Stations 200SW and 300S indicate the process of advection may be influencing the dredged material apron surrounding the PDA 98 Mound somewhat. Sediment-profile images from Stations 200SW and 300S on the PDA 98 survey grid displayed minimal REMOTS® camera penetration and exposed bedrock in the far field, indicative of hard bottom conditions. Images collected previously at these stations as part of the September 2000 survey showed the presence of soft sediments. Both the multibeam bathymetry and side-scan sonar data collected over PDS in 1998 showed that Stations 200SW and 300S are located over a large bedrock ridge south of the PDA 98 buoy position at a water depth of approximately 40 m (SAIC 2001b). Although the top of this bedrock ridge was covered with an accumulation of soft sediment one year ago, the material has likely been transported to adjacent deeper areas over the

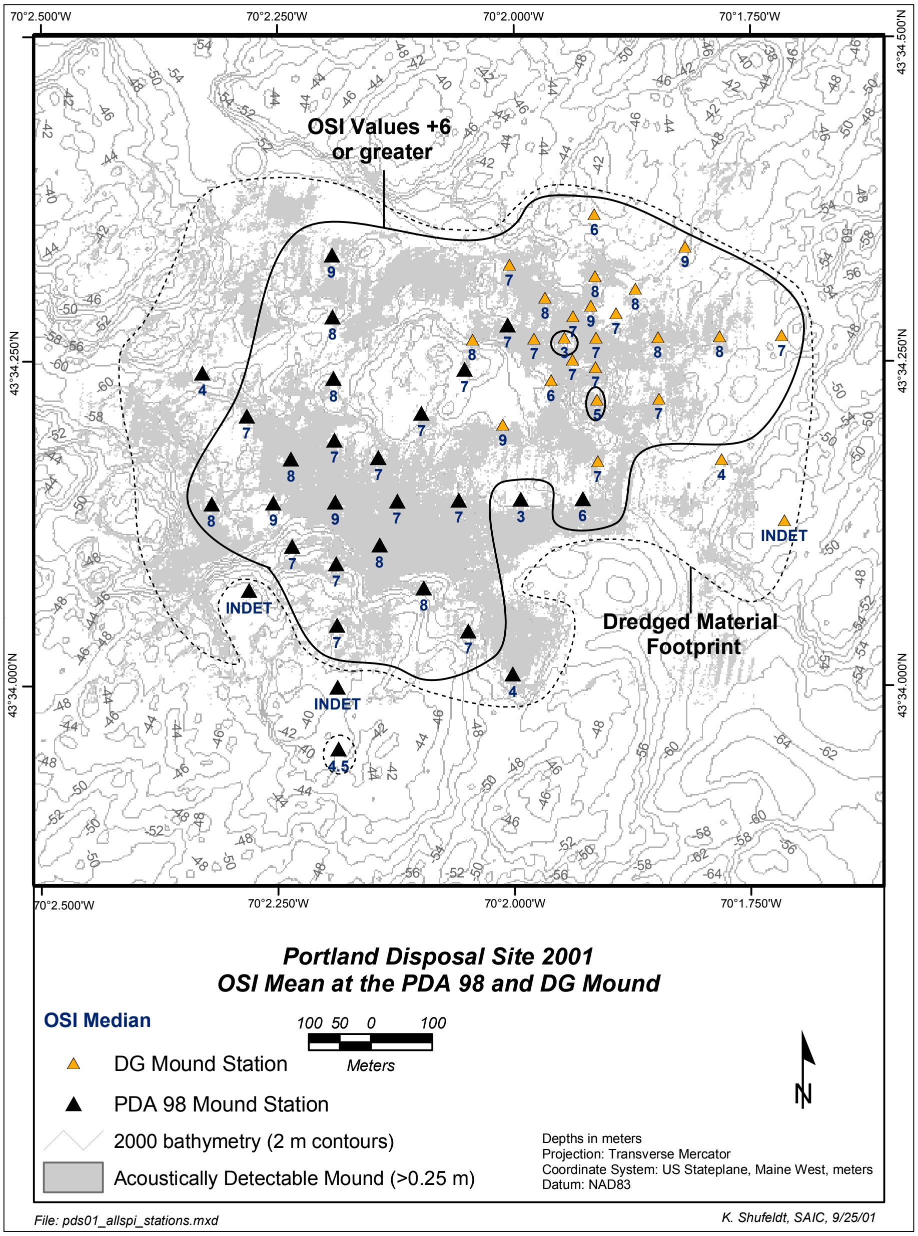


Figure 4-2. Map showing the combined results from the PDA 98 and DG Mounds REMOTS® survey grids to determine the footprint of recently deposited dredged material (dashed line) and the area of seafloor displaying undisturbed benthic habitat conditions (solid line). The gray shading represents the acoustically detectable dredged material deposit resulting from the depth difference comparison of the September 1998 and July 2000 multibeam bathymetric surveys.

winter months by periodic high waves and bottom currents. Further evidence of such advection was detected at Station 400S during the 2001 survey, as replicate images revealed an accumulation (>6.4 cm) of soft sediment in an area that was characterized as hard bottom in the 2000 monitoring survey (Figures 3-1 and 4-2).

Meteorological and oceanographic data compiled by NOAA's National Data Buoy Center, Buoy 44007 located south-southwest of PDS, indicated that eight weather events producing significant wave heights in excess of 3 m occurred between the September 2000 and August 2001 REMOTS® surveys (Figure 4-3). These events occurred between the months of November through April, were generally short lived (15 to 20 hours in duration), and were primarily the product of storm winds emanating from directions of unlimited fetch (easterly and southerly; Figure 4-3). As evidenced by the REMOTS® data, these wave events may have been of sufficient magnitude to relocate a >11 cm thick layer of deposited sediment from the surface of exposed bedrock outcrops in some locations. Net transport of suspended material by near bottom currents over PDS is generally to the southwest, in response to the counter-clockwise circulation patterns in the Gulf of Maine (SAIC 2001b). As a result, the sediment that existed on the surface of the bedrock ridge was likely moved to depositional areas to the south and west, and may constitute a portion of the apparent accumulation of soft sediment at Station 400S.

Limited advection was also identified over the Royal River Mound in the southeast corner of PDS. The 2001 REMOTS® data from the Royal River Mound indicated the presence of sandy capping dredged material (CDM) at 12 of the 13 stations within the survey grid. This CDM, composed of gray and black sandy silt, was originally placed at the PDA 96 buoy position in fall 1996 as part of the final phase of the Portland Disposal Site Capping Demonstration Project (Morris et al. 1998). The 2001 images displayed sediment with physical characteristics similar to the CDM identified in the January 1997 postcap survey (Figure 4-4). However, differences in sediment color were noted due to a presumed biologically mediated reduction in the concentration of organic matter within the sediment over the four-year period.

In the August 2001 survey, all but Station RR200SE displayed dredged material thickness values that exceeded the camera imaging depth. Minimal REMOTS® camera prism penetration and exposed bedrock in the farfield of the replicate images collected at Station RR200SE in August 2001 indicated the presence of a rocky substrate (Figure 4-5). Comparisons with REMOTS® data collected in various phases of the capping demonstration project indicate Station RR200SE was devoid of soft sediment until approximately 9 to 12 cm of CDM was placed on the seafloor in December 1996 (Morris et al. 1998).

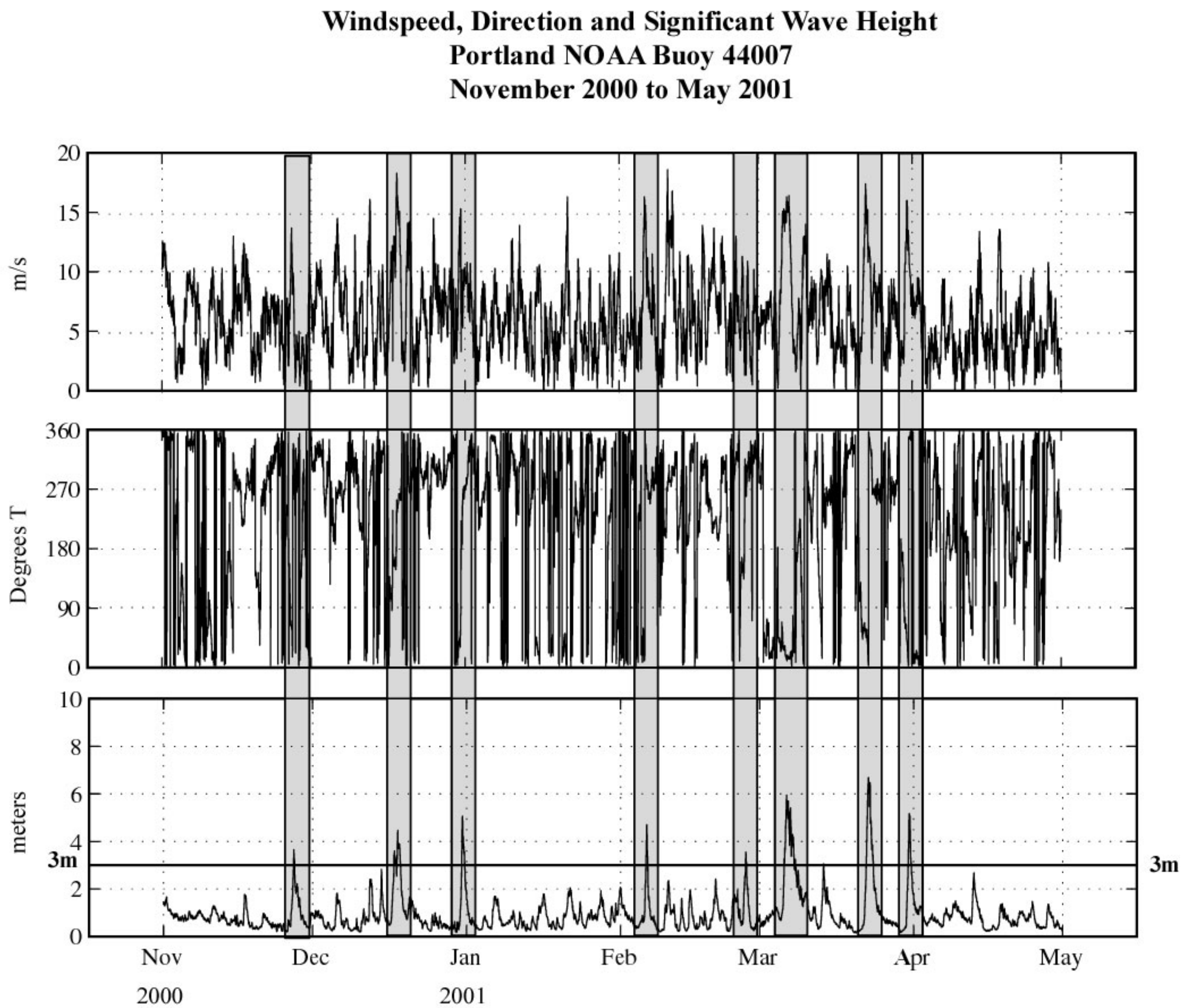
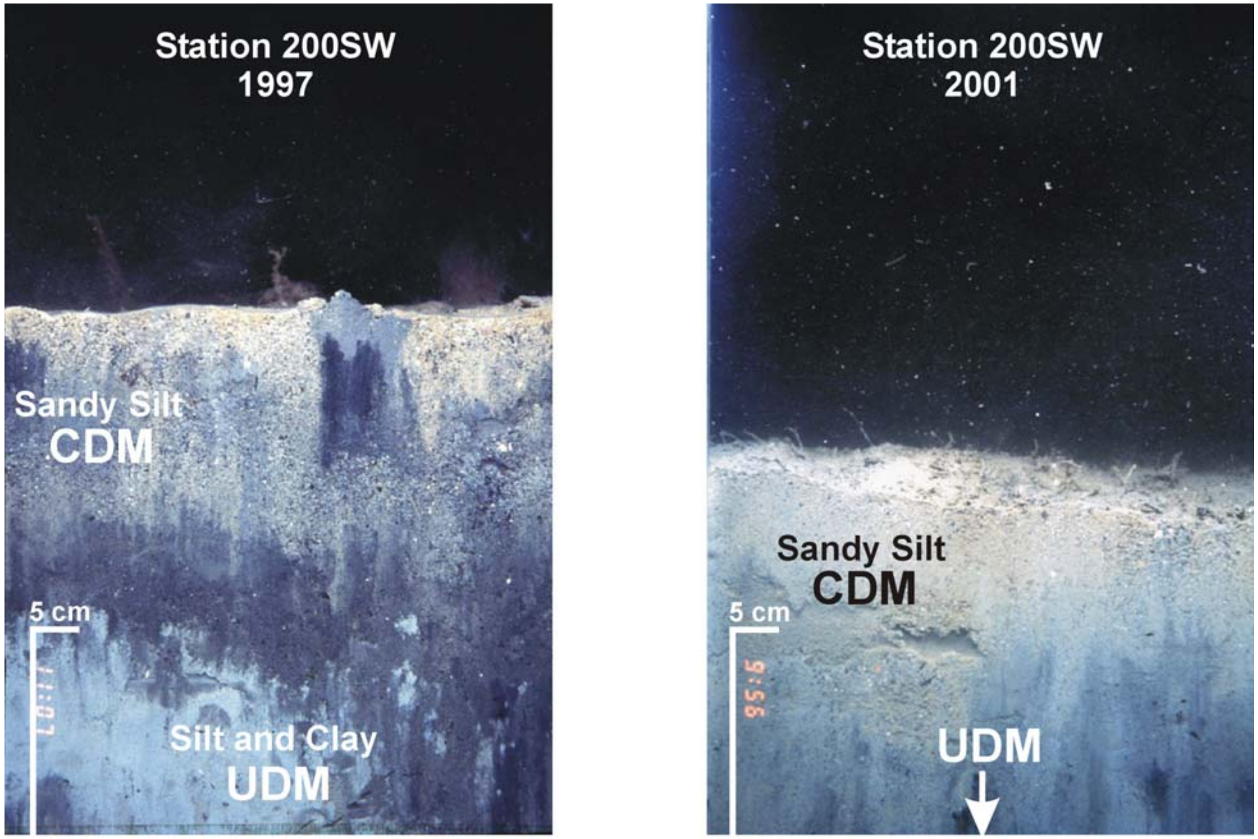
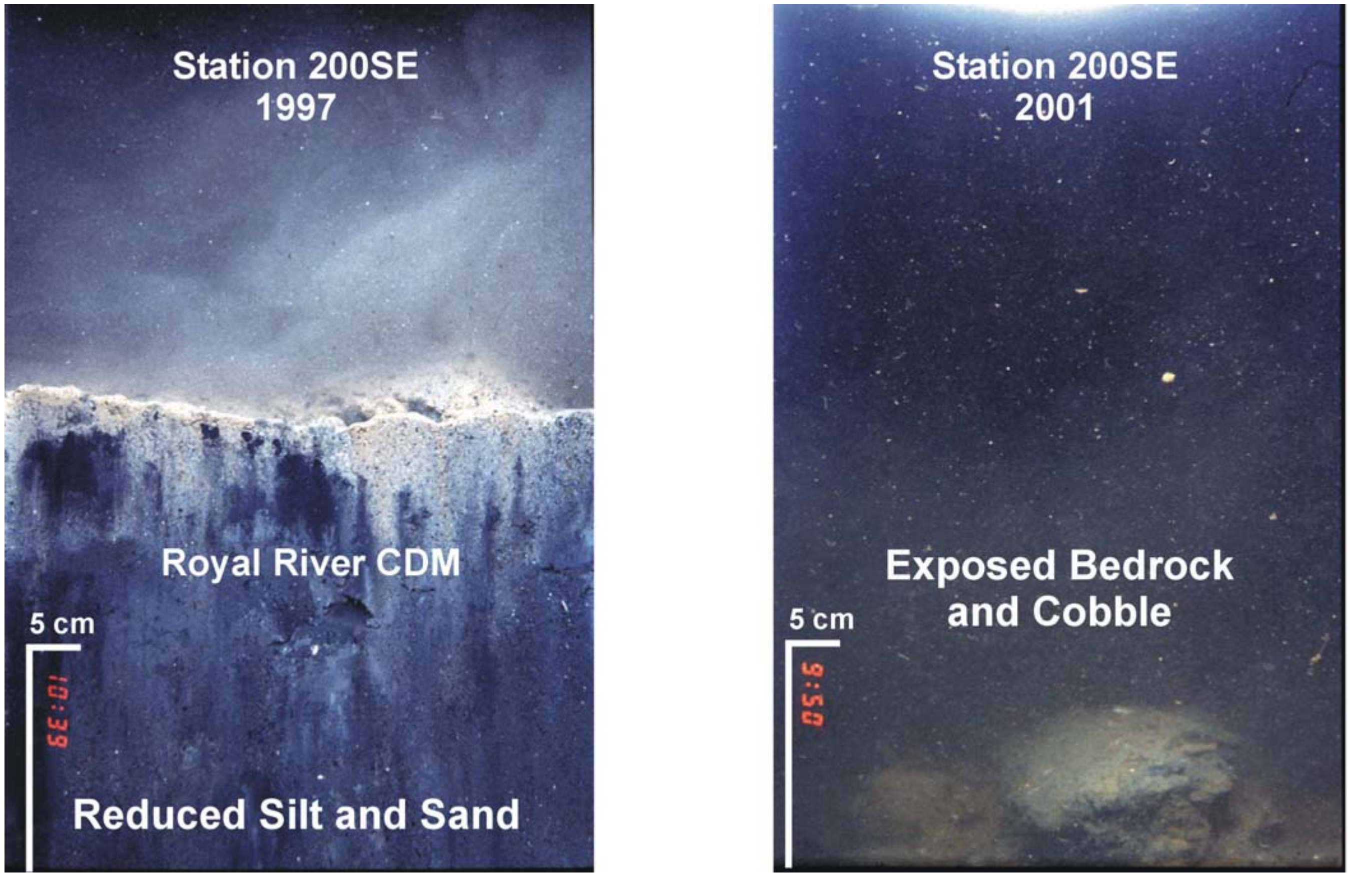


Figure 4-3. Time series of wind speed, direction, and significant wave height measured between the occurrence of the September 2000 and August 2001 monitoring surveys over PDS. The record was abbreviated to the period between November 2000 and May 2001 to focus on weather events that generated surface waves of 3 m or greater (shaded rectangles).



A B

Figure 4-4. REMOTS® images collected from Station 200SW over the Royal River Mound in the January 1997 postcap survey (A) and the August 2001 monitoring survey (B) displaying similarities in surface sediment composition. The slight differences in color are due to the reduction of organic matter within the dredged material via bioturbation over a four year period.



A B

Figure 4-5. REMOTS® images collected from Station 200SE over the Royal River Mound as part of the January 1997 postcap survey (A) and the August 2001 monitoring survey (B) displaying differences in soft sediment accumulation and the apparent reduction in cap material thickness over a four year period.

Bathymetric and side-scan sonar data indicates Station RR200SE was established over an area of seafloor displaying a depth of 64 m, with strong vertical profiles and composed of bedrock. The detection of CDM at Station RR200SE during the January 1997 postcap survey and the subsequent absence of CDM observed during the recent 2001 monitoring survey suggest that the sediment was advected from the top of this bedrock outcrop into a nearby depositional area between the two surveys.

4.2 Biological Conditions and Benthic Recolonization

When evaluated as a single, recently placed sediment deposit, the PDA 98 and DG Mounds displayed undisturbed benthic habitat conditions over the majority of the dredged material footprint. Median OSI values in excess of +6 were common over the interior portion of the sediment deposit, while lower OSI values (+4) were primarily detected on the fringes (Figure 4-2). In addition, several isolated stations located on the eastern lobe of the sediment deposit displayed conditions indicative of a disturbed benthic habitat. Most of these disturbances were attributed to the recent placement of dredged material in close proximity to the DG buoy.

With the exception of these isolated areas of disturbance, benthic habitat conditions appeared quite similar over two survey grids. Benthic community, mean RPD depth, and OSI information displayed strong agreement in areas where the sediment-profile imaging stations composing the two grids overlapped or were closely aligned (i.e., PDA 98 Stations 300NE and 400NE versus DG Mound Stations 100W and 200W). The results from these stations suggest that benthic habitat is recovering as anticipated and conditions are stable within the area recently impacted by dredged material.

4.2.1 PDA 98 Mound

The August 2001 REMOTS® results for the PDA 98 Mound indicate that benthic habitat quality over this sediment deposit has continued to recover as anticipated. OSI values ranged from +3 to +9 over the surface of the disposal mound, with the majority of the stations (85%) displaying values of +6 or greater. This indicates the presence of non-degraded benthic habitat quality over most of the PDA 98 Mound. Despite some variability among stations, the overall OSI value calculated for the PDA 98 Mound (+6.9) was higher than that of the PDS reference areas (+5.7) and generally reflected improving benthic habitat conditions relative to the September 2000 survey (+5.6).

At approximately 2.5 years post disposal, the surface sediments comprising the PDA 98 Mound appear to be supporting a relatively active infaunal population consisting of both surface tube-dwelling and subsurface deposit-feeding organisms. In general, the successional stage status of the PDA 98 Mound showed significant advancement relative to September 2000, as Stage III activity was detected at all stations displaying soft sediment accumulation (SAIC 2002). The frequency of Stage III organisms in the replicate images over the disposal mound exceeded the frequency at the PDS reference areas, and was the primary factor in the calculation of high OSI values. The Stage III individuals inhabiting the sediment at depth were consistently accompanied by suspension-feeding Stage I organisms observed in relative abundance at the sediment-water interface (e.g., Figures 3-2A and 3-5). These findings indicate that the sediment over the PDA 98 Mound had become extensively colonized and was supporting a stable Stage III population at the time of the August 2001 survey.

Despite the higher abundance of Stage III infaunal deposit feeders within the dredged material mound and resulting increase in bioturbation, the apparent depth of oxygen penetration into the PDA 98 Mound sediments (1.7 cm) was somewhat shallower than that measured over the mound in September 2000. However, a corresponding minor decrease in RPD depths was also noted in the comparison of reference area datasets for 2000 and 2001, suggesting differences in the incorporation of oxygen into the surficial sediments is occurring on a regional scale. The most likely explanation for the shallower RPD depths at both PDA 98 and the reference areas relative to the September 2000 survey is related to minor differences in bottom-water dissolved oxygen concentrations or bottom-water temperatures within the Casco Bay region.

The only significant decline in habitat conditions relative to September 2000 was at Station 300E, as the median OSI value fell 4 points due to both shallower RPD and lower abundance of Stage III organisms. Station 300E is located roughly in the center of the northwest-southeast trending trough feature, an area of substantial soft sediment accumulation approximately 250 m south-southwest of the DG buoy position (Figure 4-2). It is possible that recent disposal activity at the DG buoy resulted in the placement of additional sediment at Station 300E, which would cause an apparent decline in habitat conditions. Future monitoring surveys performed over PDA 98 Mound should increase the focus on conditions at 300E to verify that the surficial sediments recover and habitat conditions re-align with those detected over the remainder of the mound to rule out regression in benthic habitat due to sediment composition, organic load, or contaminant concentrations.

4.2.2 DG Mound

The August 2001 field operations over the active DG Mound represented the first environmental monitoring activity at this location since July 1992. Given the composition of the sediment, the disposal history of the DG Mound, and the timing of survey operations, benthic conditions were expected to be similar to those at the PDA 98 Mound. However, limited benthic disturbance associated with the recent placement of dredged material also was anticipated at some of the sampling stations located near the center of the survey grid. In general, the DG Mound displayed undisturbed benthic habitat conditions, with an overall OSI value of +7.0. This relatively high OSI value indicates that recovery from the benthic disturbance associated with the 1998–99 disposal activity had met or exceeded expectations at the majority of stations over the DG Mound. One station (50W) located in close proximity to the DG buoy had an OSI value of +3 (Figure 4-2). The benthic conditions at this station were likely due to the recent (2000–01) deposition of dredged material and the resulting physical seafloor disturbance. Conditions at Station 50W are expected to improve, as Stage III organisms become established and begin to rework the newly deposited material.

Similar to the PDA 98 Mound, the overall average RPD at the DG Mound (1.6 cm) was lower than the overall value noted at the reference areas (2.5 cm), indicating moderately oxygenated surface sediments. These relatively shallow RPD values may be attributed to an elevated inventory of organic matter within the deposited dredged material and associated increased sediment oxygen demand.

As anticipated after a recent benthic disturbance, opportunistic Stage I polychaetes were detected in abundance at the sediment-water interface at all of the August 2001 stations over the DG Mound. Stage III activity was also noted in the subsurface sediments at 23 of the 25 stations (92%). The widespread presence of Stage III organisms served as the basis of the elevated OSI values over the disposal mound. The presence of an abundant Stage I community at all the stations, with considerable advancement into a Stage III assemblage over the majority of the DG Mound, suggests benthic recolonization had met and exceeded expectations over this mound. Periodic monitoring of the DG Mound is recommended in the future to document changes in benthic habitat conditions as new layers of dredged material are added.

4.2.3 Royal River Mound

Four years after the completion of the 1997 capping demonstration project, benthic habitat conditions over the Royal River Mound were comparable to those of ambient Gulf of Maine sediments. Specifically, the overall OSI value calculated for the Royal River Mound (+6.3) was indicative of an undisturbed environment and slightly higher than the composite OSI value calculated for the three PDS reference areas (+5.7). There has been a notable increase in OSI values between the January 1997 and August 2001 datasets (+5.0 in 1997 to +6.3 in 2001; Appendix C). This increase in average OSI values is a function of both deeper RPDs and a higher abundance of Stage III organisms in the subsurface sediments.

The average apparent depth of oxygen penetration in surface sediments over the Royal River Mound was comparable to the RPD measurements for the reference areas. The overall average RPD depth of 2.3 cm represented moderately aerated surface sediments over the DG Mound, consistent with expectations. However, the trend of shallower RPD depths detected over the PDA 98 Mound and reference areas relative to the 2000 dataset suggests the Royal River Mound may also have been mildly affected by a regional reduction in bottom water dissolved oxygen concentrations.

The 2001 REMOTS® results indicated that the surface sediments comprising the Royal River Mound had been recolonized extensively by a benthic community consisting of both surface tube-dwelling and deeper deposit-feeding infauna. Most of the Royal River Mound stations had a Stage I on III successional status. The Stage III organisms, present at all but two stations, consume organic matter entrained within the deposited material and tend to aerate the sediment column through bioturbation, resulting in deeper RPD depths. The presence of a mixture of successional stages at the Royal River Mound (with emphasis on Stage I on III) indicates that advanced benthic recolonization of this four-year-old sediment deposit has occurred as expected.

The REMOTS® surveys performed in support of various phases of the 1995–97 capping demonstration project focused on tracking the formation of distinct sediment layers (Ambient/UDM/CDM) on the PDS seafloor over time. Therefore, it is difficult to make valid comparisons with past benthic recolonization data. To compare current benthic habitat conditions with those of the January 1997 postcap survey, data from a portion of the sampling stations (13 of the original 33 stations) were re-analyzed. These data indicated the presence of shallow to moderately oxygenated surface sediments within the sandy silt CDM, with an overall mean RPD depth of 1.4 cm (Appendix C1). Feeding voids, evidence of the presence of infaunal deposit feeders, were observed in the sediment-profile images at several stations one month following the placement of CDM, indicating rapid recolonization of the dredged material deposit. With Stage I tube-dwelling polychaetes present at the sediment-water interface and a number of Stage III organisms at depth within the sediment, the benthic community was classified as Stage I on III. The resulting OSI values over the newly capped mound ranged from +3 to +8, with an overall average OSI value of +5 (Appendix C1).

As expected, RPD depths have deepened over the past four years to reflect the increased levels of bioturbation and consumption of organic matter within the surface sediments of the Royal River Mound (overall mean RPD of 2.3 cm). Although the benthic community has remained relatively constant since the 1997 postcap survey, with a classification of Stage I on III, evidence of Stage III activity occurred with higher frequency in the replicate images collected in August 2001. The net increase in OSI values (+6.3 in 2001 versus +5 in 1997) demonstrates the general improvement in benthic habitat quality over the mound. Although the conditions over the Royal River disposal mound were analogous to that on the ambient seafloor in August 2001, periodic monitoring efforts may be beneficial in the future to verify the stability of the benthic community.

4.2.4 PDS Reference Areas

The PDS reference areas have been monitored periodically over the past 12 years to provide insight into the habitat conditions within ambient sediments of the Casco Bay and Bigelow Bight region and serve as a basis of comparison with the data obtained at the disposal site. The three reference areas (EREF, SEREF, and SREF) have continued to show undisturbed benthic habitat conditions, with OSI values ≥+6, until the recent 2001 survey. The composite OSI values generated from the August 2001 survey data (+5.7) are lower than the values observed during the September 2000 survey (+6.8), which could be reflecting a slight increase in the level of biological stress within the benthos and a corresponding decrease in benthic habitat conditions. Comparisons between the August 2001 and the September 2000 datasets show a 0.7 cm reduction in average RPD depth and a lower abundance of Stage III organisms as factors contributing to the 1.1-point decline in OSI values.

The multibeam bathymetric data collected as part of the September 1998 survey indicated the seafloor at reference areas EREF and SREF is quite similar to that of the disposal site (SAIC 2001b). As described in Section 4.1, physical oceanographic processes in the region promote the accumulation of soft sediment within pockets that exist between outcrops of exposed bedrock. In an attempt to examine benthic habitat conditions within these soft sediment deposits at the reference areas, sediment-profiling imaging surveys often encounter stations displaying hard bottom and shallow camera penetration depths. The data obtained from such stations are limited in quality and prevent the analysis of key ecological parameters. Furthermore, the hard substrate tends to serve as a barrier, restricting the lateral and downward movement of adult Stage III individuals. As a result, low numbers of Stage III organisms are expected in these areas of rocky substrate due to the limitations on burrowing and reduced organic matter content within the ambient sediments, yielding skewed datasets.

The data collected from EREF and SREF show little difference in benthic habitat conditions between the 2000 and 2001 surveys. EREF appeared to be supporting a relatively stable benthic community in comparison to the other reference area stations, with well-developed RPD depths and a slightly higher occurrence of Stage III taxa, resulting in elevated OSI values (+7). SREF continued to display a predominance of Stage I organisms with a limited presence of Stage III at one station occupied within the 300 m sampling radius. Despite the low abundance of Stage III infauna, median OSI values remained relatively high (+5) as RPD depths ranged between 2.2 and 3 cm.

In general, the seafloor conditions at SEREF are significantly different than those at EREF and SREF. Seafloor conditions at SEREF include a thick ambient sediment layer and little rocky substrate. These characteristics typically promote better benthic habitat conditions, including a dominance of Stage III taxa, deeper RPD depths, and subsequent higher OSI values, relative to EREF and SREF. However, the 2001 survey results suggest that conditions were not superior at SEREF. Most notably, the SEREF REMOTS® results indicated a sharp decline in OSI values between the August 2001 and September 2000 surveys (+8.1 to +4). This decline in OSI values, however, may not signify a degradation of benthic conditions since 2000. The OSI value of +4 calculated for SEREF is based on significantly fewer analyzable replicate images for each station than in previous surveys. Condensation in the sediment-profile camera reduced clarity within many of the replicate images, which caused difficulties in identifying small-scale features (i.e., feeding voids and tubes) essential to determine successional status and resulted in many indeterminate classifications (Table 3-2; Appendix B4). As a result, the dataset compiled for SEREF is not as robust as those of previous monitoring efforts and cannot be used with confidence to describe temporal trends.

5.0 CONCLUSIONS

The August 2001 survey showed that benthic habitat conditions over the PDA 98 Mound continued to recover as anticipated, with the average OSI value increasing 1.3 points relative to the September 2000 survey (+5.6 to +6.9). At nearly two years post disposal, the sediment was supporting a stable infaunal population. An abundance of Stage III organisms and moderate RPD depths over the surface of the mound resulted in an average OSI value that was slightly higher than the composite value for the surrounding reference areas. The recovery process is expected to continue over the PDA 98 Mound for the next several years as the foraging activity of the Stage III infaunal deposit feeders cause RPD depths to deepen due to increased bioturbation and consumption of the organic matter entrained within the sediment deposit.

The DG Mound is composed of many layers of sediment removed from various dredging projects along the southern coast of Maine. However, based on the timing of disposal operations and volume of material placed at the DG buoy over the past three years, all the surficial sediments identified in the August 2001 REMOTS® images likely originated from the Fore River and Portland Harbor. Similar to the PDA 98 Mound, benthic habitat conditions over the DG Mound in August 2001 met or exceeded expectations following the placement of 30,350 m^3 of dredged material over the past two years. The majority of the surficial sediment appeared to have been readily recolonized, displaying a relatively advanced Stage III benthic infaunal population within six months of the most recent sediment placement event. Periodic monitoring of this disposal mound is recommended to document changes in benthic habitat quality as additional layers of dredged material are added in the future.

Benthic habitat conditions over the Royal River Mound were classified as undisturbed four years after the completion of the capping demonstration project. An advanced benthic community comprised of both surface-dwelling and infaunal deposit-feeding organisms was observed over the disposal mound in conjunction with relatively deep RPDs. As anticipated, comparisons between the August 2001 and January 1997 postcap results indicated a general improvement in benthic habitat conditions, with OSI values increasing 1.3 points (+5 to +6.3). However, periodic monitoring of the Royal River Mound is recommended over the next several years to verify continued benthic community development.

The benthic conditions present at all three disposal mounds monitored as part of the August 2001 survey effort exceeded those detected at the PDS reference areas. The OSI values calculated for the reference areas had decreased slightly in comparison to the

September 2000 survey effort. Although a trend of slightly shallower RPD depths was noted, the primary reason for the lower OSI values was related to an apparent reduction in the amount of Stage III activity detected within the ambient sediments. As in previous monitoring surveys, this appears to be a product of a skewed dataset collected over areas with an abundance of hard seafloor (EREF and SREF), which limits camera penetration and the numbers of Stage III organisms inhabiting a relatively thin layer of soft sediment. Furthermore, a substantial number of OSI values could not be determined for replicate images collected in the soft sediment of SEREF. As a result, the dataset compiled for the PDS reference areas was not as robust as those of previous monitoring efforts, which may be a contributing factor to the apparent decline in benthic habitat conditions.

6.0 REFERENCES

Germano, J.D., Rhoads, D.C., Lunz, J.D. 1994. An integrated, tiered approach to monitoring and management of dredged material disposal sites in the New England region. DAMOS Contribution No. 87 (SAIC Report No. 7575&234). U.S. Army Corps of Engineers, New England Division, Waltham, MA.

McDowell, S.C., Pace, S.D. 1998. Oceanographic measurements at the Portland Disposal Site during the spring of 1996. DAMOS Contribution No. 121. US Army Corps of Engineers, New England District, Concord, MA.

Morris, J.T. 1996. DAMOS site management plans. SAIC Report No. 365. Final report submitted to the U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Morris, J.T., Saffert, H.S., Murray P.M. 1998. The Portland Disposal Site capping demonstration project 1995–1997. DAMOS Contribution No. 123. U.S. Army Corps of Engineers, New England District, Concord, MA.

Rhoads, D.C., Germano, J.D. 1982. Characterization of organism-sediment relations using sediment-profile imaging: An efficient method of Remote Ecological Monitoring of the Seafloor (REMOTS® System). Mar. Ecol. Prog. Ser. 8:115–128.

Rhoads, D.C., Germano, J.D. 1986. Interpreting long-term changes in benthic community structure: a new protocol. Hydrobiologia 142:291–308

SAIC. 2001a. Monitoring cruise at the New London Disposal Site, 1992–1998, Vol. I. DAMOS Contribution No. 128. U.S. Army Corps of Engineers, New England District, Concord, MA.

SAIC. 2001b. Dredged material fate study at the Portland Disposal Site, 1998–2000. SAIC Report No. 552. Draft report submitted to the US Army Corps of Engineers, New England District, Concord, MA.

SAIC. 2002. Monitoring survey at the Portland Disposal Site, Summer 2000. DAMOS Contribution No. 136. (SAIC Report No. 544). US Army Corps of Engineers, New England District, Concord, MA.

Waterways Experiment Station (WES). 1998. A predictive model for sediment transport at the Portland Disposal Site, Maine. DAMOS Contribution No. 122. US Army Corps of Engineers, New England District, Concord, MA.

Appendix A
Disposal Logs

Appendix A, Disposal Logs

1999 ▬ 2000 **PDS**

Project: Casco Bay - Portland, ME

Permit Number: 198902221 **Permittee:** YACHT HAVEN INC.

Buoy	Departure	Disposal	Return	Latitude	Longitude	Buoy's Vector	Volume (CY)
DG	2/8/2000	2/8/2000	2/8/2000	43.57126667	-70.0300333	90' SW	750
DG	2/10/2000	2/10/2000	2/10/2000	43.57116667	-70.0316667	80' W	750
DG	2/11/2000	2/11/2000	2/11/2000	43.57266667	-70.031	100' E	750
DG	2/15/2000	2/15/2000	2/15/2000	43.571	-70.0316667	90' W	750
DG	2/17/2000	2/17/2000	2/17/2000	43.57133333	-70.0313333	80' WS	750
DG	2/17/2000	2/17/2000	2/18/2000	43.57083333	-70.0316667	90' E	750
DG	2/22/2000	2/22/2000	2/22/2000	43.572	-70.0315	100' E	630
DG	2/23/2000	2/23/2000	2/23/2000	43.5725	-70.0301667	80' E	750
DG	2/24/2000	2/24/2000	2/24/2000	43.57283333	-70.0311667	80' E	750
DG	2/25/2000	2/25/2000	2/25/2000	43.571	-70.0318333	90' E	750
DG	2/28/2000	2/28/2000	2/28/2000	43.57266667	-70.0318333	100' E	750
DG	3/1/2000	3/1/2000	3/1/2000	43.573	-70.0315	100' E	750
DG	3/2/2000	3/2/2000	3/2/2000	43.571	-70.0321667	100' W	750
DG	3/3/2000	3/3/2000	3/3/2000	43.57083333	-70.0316667	100' W	750
DG	3/6/2000	3/6/2000	3/6/2000	43.57033333	-70.032	100' W	750
DG	3/8/2000	3/8/2000	3/8/2000	43.57183333	-70.0315	100' W	700
DG	3/8/2000	3/8/2000	3/8/2000	43.57216667	-70.0305	100' E	700
DG	3/9/2000	3/9/2000	3/9/2000	43.57183333	-70.0315	90' E	800
DG	3/13/2000	3/13/2000	3/13/2000	43.57133333	-70.0321667	90' W	750
DG	3/16/2000	3/16/2000	3/16/2000	43.57267	-70.03117	80 ft E	750
DG	3/20/2000	3/20/2000	3/21/2000	43.57123	-70.0315	80 ft E	750
DG	3/21/2000	3/21/2000	3/21/2000	43.5715	-70.03233	60 ft E	750
DG	3/22/2000	3/22/2000	3/22/2000	43.57183	-70.03033	60 ft E	750
DG	3/23/2000	3/23/2000	3/23/2000	43.572	-70.03167	80 ft E	750
DG	3/24/2000	3/24/2000	3/24/2000	43.5722333	-70.0315	80 ft E	750
DG	3/27/2000	3/27/2000	3/27/2000	43.57233	-70.03133	80 ft E	750
DG	3/29/2000	3/29/2000	3/29/2000	43.57283	-70.03183	80 ft E	750
DG	3/30/2000	3/30/2000	3/30/2000	43.5705	-70.03117	100 ft E	750
DG	3/31/2000	3/31/2000	3/31/2000	43.572	-70.03133	80 E	500
DG	4/5/2000	4/5/2000	4/6/2000	43.57217	-70.0315	80 ft E	750
DG	4/6/2000	4/6/2000	4/6/2000	43.57307	-70.03	80 ft E	700

Project Total Volume: **17,418 CM** **22,780 CY**

Project: FORE RIVER

Permit Number: 199803142 **Permittee:** MOBIL OIL COMPANY

Buoy	Departure	Disposal	Return	Latitude	Longitude	Buoy's Vector	Volume (CY)
DG	3/1/2000	3/1/2000	3/1/2000	43.56923333	-70.0373167		379
DG	3/8/2000	3/8/2000	3/8/2000	43.5715	-70.031	50' S	376
DG	3/19/2000	3/19/2000	3/19/2000	43.573	-70.03133	100 N	376

Project Total Volume: **865 CM** **1,131 CY**

Buoy Total Volume: **18,282 CM** **23,911 CY**

2000 — 2001 **PDS**

Project: FORE RIVER AT PORTLAND ME

Permit Number: 199902455 **Permittee:** MERRILL INDUSTRIES

Buoy	Departure	Disposal	Return	Latitude	Longitude	Buoy's Vector	Volume (CY)
DG	1/31/2001	1/31/2001	1/31/2001	43.571666	-70.0315	100ft SW	1200
DG	2/7/2001	2/7/2001	2/7/2001	43.57233	-70.03117	90ft SW	1550
DG	2/12/2001	2/12/2001	2/12/2001	43.57183	-70.031	80ft ENE	1500
DG	2/18/2001	2/18/2001	2/18/2001	43.571	-70.03117	100ft SW	1500
DG	2/22/2001	2/22/2001	2/22/2001	43.571	-70.03117	100ft SW	1500
DG	2/27/2001	2/27/2001	2/27/2001	43.5715	-70.03067	80ft SW	1550
DG	3/1/2001	3/1/2001	3/1/2001	43.571	-70.03117	100ft SW	1500
DG	3/3/2001	3/3/2001	3/3/2001	43.57372	-70.031	100ft SW	1300
DG	3/8/2001	3/8/2001	3/8/2001	43.571	-70.03117	80ft SW	1550
DG	3/12/2001	3/12/2001	3/12/2001	43.57084	-70.031	100ft SW	1500
DG	3/21/2001	3/21/2001	3/21/2001	43.57267	-70.03117	100ft SW	1500

Project Total Volume:	**12,348 CM**	**16,150 CY**
Buoy Total Volume:	**12,348 CM**	**16,150 CY**
Report Total Volume:	**30,631 CM**	**40,061 CY**

Appendix B
August 2001 REMOTS® Data

Appendix B1
PDA 98 Mound REMOTS® Sediment-Profile Imaging Data from the August 2001 Survey

Station	Replicate	Date	Time	Successional Stage	Grain Size (phi)			Mud Clasts		Camera Penetration (cm)				Dredged Material Thickness (cm)			Redox Rebound Thickness (cm)			Apparent RPD Thickness(cm)		
					Min	Max	Maj Mode	Count	Avg. Diam	Min	Max	Range	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
PDA																						
100E	A	8/11/2001	9:38	ST_I_ON_III	>4	2	>4	0	0	8.43	8.97	0.54	8.7	8.43	8.97	>8.7	0	0	0	0.43	3.89	2.79
100E	B	8/11/2001	9:38	ST_I_ON_III	>4	2	>4	0	0	5.57	6.43	0.86	6	5.57	6.43	>6	0	0	0	0.11	2.7	0.92
100E	C	8/11/2001	9:39	ST_I	>4	2	>4	0	0	7.35	8.59	1.24	7.97	7.35	8.59	>7.97	0	0	0	0.05	2.97	1.16
100N	D	8/11/2001	9:26	ST_I_ON_III	>4	3	>4	4	0.21	8.71	9.57	0.86	9.14	8.71	9.57	>9.14	0	0	0	1.02	3.76	2.42
100N	E	8/11/2001	9:27	ST_I_ON_III	>4	3	>4	5	0.42	9.09	9.62	0.54	9.35	9.09	9.62	>9.35	0	0	0	0.54	1.34	1.02
100N	F	8/11/2001	9:27	ST_I_ON_III	>4	2	>4	2	0.38	10.22	11.51	1.29	10.86	10.22	11.51	>10.86	0	0	0	0.38	1.24	0.83
100NE	A	8/11/2001	11:47	ST_I_ON_III	>4	3	>4	0	0	5.14	7.68	2.54	6.41	5.14	7.68	>6.41	0	0	0	0.76	3.84	2.26
100NE	B	8/11/2001	11:48	ST_I_ON_III	>4	2	>4	12	0.27	9.24	9.95	0.7	9.59	9.24	9.95	>9.59	0	0	0	0.43	2.16	1.34
100NE	C	8/11/2001	11:49	ST_I	>4	2	>4	0	0	7.46	8.43	0.97	7.95	7.46	8.43	>7.95	0	0	0	0.05	2.86	1.36
100NW	A	8/11/2001	10:58	ST_I_ON_III	>4	3	>4	0	0	11.08	11.89	0.81	11.49	11.08	11.89	>11.49	0	0	0	0.7	2.38	1.49
100NW	B	8/11/2001	11:00	ST_I_ON_III	>4	3	>4	0	0	9.89	10.27	0.38	10.08	9.89	10.27	>10.08	0	0	0	0.27	2.49	1.68
100NW	C	8/11/2001	11:00	ST_I_ON_III	>4	3	>4	2	0.47	8.27	9.95	1.68	9.11	8.27	9.95	>9.11	0	0	0	0.05	3.24	2.01
100S	D	8/11/2001	10:26	ST_I_ON_III	>4	2	>4	0	0	11.35	12.05	0.7	11.7	11.35	12.05	>11.7	0	0	0	0.27	3.14	1.5
100S	E	8/11/2001	10:27	ST_I_ON_III	>4	3	>4	0	0	10.97	11.78	0.81	11.38	10.97	11.78	>11.38	0	0	0	0.22	2.27	1.41
100S	F	8/11/2001	10:28	ST_I_ON_III	>4	3	>4	0	0	8.59	9.3	0.7	8.95	8.59	9.3	>8.95	0	0	0	0.11	3.24	1.28
100SE	A	8/11/2001	11:54	ST_I	>4	2	>4	0	0	11.98	12.62	0.64	12.3	11.98	12.62	>12.3	0	0	0	0.8	2.78	1.8
100SE	B	8/11/2001	11:55	ST_I_ON_III	>4	3	>4	9	0.21	13.8	14.49	0.7	14.14	13.8	14.49	>14.14	0	0	0	0.53	2.35	1.56
100SE	C	8/11/2001	11:55	ST_I_ON_III	>4	2	>4	0	0	13.1	13.8	0.7	13.45	13.1	13.8	>13.45	0	0	0	0.05	3.64	2.37
100SW	E	8/11/2001	10:32	ST_I	>4	2	>4	0	0	5.08	7.46	2.38	6.27	5.08	7.46	>6.27	0	0	0	0.05	3.24	1.4
100SW	G	8/12/2001	8:59	ST_I_ON_III	>4	3	>4	2	0.46	8.22	10.16	1.95	9.19	8.22	10.16	>9.19	0	0	0	0.27	2.49	1.77
100SW	H	8/12/2001	8:59	ST_I_ON_III	>4	3	>4	0	0	5.03	6.11	1.08	5.57	5.03	6.11	>5.57	0	0	0	0.05	3.03	1.5
100W	A	8/11/2001	10:54	ST_I_ON_III	>4	2	>4	3	0.21	14.65	15.41	0.76	15.03	14.65	15.41	>15.03	0	0	0	1.03	4.11	2.94
100W	B	8/11/2001	10:54	ST_I_ON_III	>4	2	>4	0	0	12	12.16	0.16	12.08	12	12.16	>12.08	0	0	0	0.22	3	2.5
100W	C	8/11/2001	10:55	ST_I_ON_III	>4	3	>4	7	0.13	10.76	11.41	0.65	11.08	10.76	11.41	>11.08	0	0	0	0.22	1.51	0.81
200E	A	8/11/2001	9:43	ST_I	>4	2	>4	0	0	7.78	11.89	4.11	9.84	7.78	11.89	>9.84	0	0	0	0.05	1.73	0.81
200E	B	8/11/2001	9:43	ST_I_ON_III	>4	2	>4	12	0.25	10.65	12.05	1.41	11.35	10.65	12.05	>11.35	0	0	0	0.32	3.35	2.05
200E	C	8/11/2001	9:44	ST_I_ON_III	>4	2	>4	8	0.21	9.73	10.65	0.92	10.19	9.73	10.65	>10.19	0	0	0	0.05	3.03	0.82
200N	A	8/10/2001	10:51	ST_I_ON_III	>4	3	>4	0	0	5.65	6.88	1.24	6.26	5.65	6.88	>6.26	0	0	0	0.22	2.63	1.82
200N	B	8/10/2001	10:54	ST_I	>4	3	>4	0	0	10.86	12.53	1.67	11.69	10.86	12.53	>11.69	0	0	0	0.05	2.96	2.07
200N	C	8/10/2001	10:55	ST_I_ON_III	>4	3	>4	2	0.51	4.49	4.92	0.43	4.7	4.49	4.92	>4.7	0	0	0	0.54	2.49	1.77
200NE	A	8/11/2001	11:30	ST_I_ON_III	>4	3	>4	7	0.21	4.97	6	1.03	5.49	4.97	6	>5.49	0	0	0	0.22	2.22	1.33
200NE	B	8/11/2001	11:31	ST_I_ON_III	>4	3	>4	0	0	10.65	11.08	0.43	10.86	10.65	11.08	>10.86	0	0	0	0.11	3.14	1.83
200NE	C	8/11/2001	11:31	ST_I_ON_III	>4	2	>4	0	0	6.7	7.57	0.86	7.14	6.7	7.57	>7.14	0	0	0	0.38	1.46	0.84
200NW	A	8/11/2001	11:03	ST_I_ON_III	>4	3	>4	0	0	10.16	11.3	1.14	10.73	10.16	11.3	>10.73	0	0	0	0.11	3.62	1.8
200NW	B	8/11/2001	11:04	ST_I_ON_III	>4	2	>4	3	0.25	2	4.81	2.81	3.41	2	4.81	>3.41	0	0	0	0.27	2.16	1.14
200NW	C	8/11/2001	11:05	ST_I_ON_III	>4	3	>4	2	1.36	7.89	8.54	0.65	8.22	7.89	8.54	>8.22	0	0	0	0.43	2	1.2
200S	C	8/10/2001	10:21	ST_I_ON_III	>4	2	>4	0	0	10.54	10.97	0.43	10.76	10.54	10.97	>10.76	0	0	0	0.05	3.08	1.8
200S	G	8/11/2001	10:13	ST_I_ON_III	>4	3	>4	0	0	4.38	5.3	0.92	4.84	4.38	5.3	>4.84	0	0	0	0.38	1.78	1.22
200S	L	8/12/2001	8:20	ST_I_ON_III	>4	2	>4	0	0	7.24	10.11	2.86	8.68	7.24	10.11	>8.68	0	0	0	0.3	2	1.5
200SE	C	8/11/2001	12:01	ST_I_ON_III	>4	2	>4	5	0.62	5.67	7.22	1.55	6.44	5.67	7.22	>6.44	0	0	0	0.64	2.41	1.74
200SE	D	8/12/2001	8:24	ST_I_ON_III	>4	2	>4	0	0	9.2	10.37	1.18	9.79	9.2	10.37	>9.79	0	0	0	1.18	2.67	1.78
200SE	E	8/12/2001	8:25	ST_I_ON_III	>4	2	>4	2	0.37	11.55	12.14	0.59	11.84	11.55	12.14	>11.84	0	0	0	0.8	1.71	1.25
200SW	B	8/10/2001	11:34	INDET	0	-1	-1 to 0	0	0	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
200SW	H	8/11/2001	10:40	INDET	0	-1	-1 to 0	0	0	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
200SW	K	8/12/2001	8:55	INDET	1	0	1 to 0	0	0	0.43	1.08	0.65	0.76	0	0	0	0	0	0	NA	NA	NA
200W	B	8/11/2001	10:49	ST_I_ON_III	>4	2	>4	15	0.18	14.7	15.19	0.49	14.95	14.7	15.19	>14.95	0	0	0	0.65	3.57	1.84
200W	C	8/11/2001	10:50	ST_I_ON_III	>4	3	>4	15	0.21	15.57	17.03	1.46	16.3	15.57	17.03	>16.3	0	0	0	0.54	3.3	2
200W	F	8/12/2001	9:09	ST_I	>4	3	>4	12	0.86	13.89	15.3	1.41	14.59	13.89	15.3	>14.59	0	0	0	0.97	3.68	2.23
300E	A	8/11/2001	9:47	ST_I_ON_III	>4	3	>4	0	0	7.84	9.24	1.41	8.54	7.84	9.24	>8.54	0	0	0	0.05	2.65	1.62
300E	C	8/11/2001	9:49	ST_I	>4	2	>4	0	0	8	9.14	1.14	8.57	8	9.14	>8.57	0	0	0	0.05	2.32	1.29
300E	F	8/12/2001	8:16	ST_I	>4	3	>4	5	0.27	9.19	11.46	2.27	10.32	9.19	11.46	>10.32	0	0	0	0.32	2.32	1.28
300N	A	8/10/2001	10:59	ST_I_ON_III	>4	2	>4	0	0	10.92	12.22	1.3	11.57	10.92	12.22	>11.57	0	0	0	0.22	2.76	1.58
300N	D	8/11/2001	9:19	ST_I	>4	3	>4	0	0	15.14	16.81	1.68	15.97	15.14	16.81	>15.97	0	0	0	0.76	2	1.25
300N	E	8/11/2001	9:19	ST_I_ON_III	>4	3	>4	7	0.42	11.73	12.49	0.76	12.11	11.73	12.49	>12.11	0	0	0	1.03	3.84	2.44
300NE	D	8/12/2001	8:09	ST_I	>4	2	>4	0	0	4.16	4.86	0.7	4.51	4.16	4.86	>4.51	0	0	0	0.05	3.08	2.37
300NE	E	8/12/2001	8:10	ST_I_ON_III	>4	3	>4	0	0	8.97	9.78	0.81	9.38	8.97	9.78	>9.38	0	0	0	0.65	2.5	1.75
300NE	F	8/12/2001	8:10	ST_I_ON_III	>4	3	>4	4	0.3	12.7	13.73	1.03	13.22	12.7	13.73	>13.22	0	0	0	0.22	2.05	1.35
300NW	A	8/11/2001	11:08	ST_I	>4	3	>4	6	0.21	17.24	18	0.76	17.62	17.24	18	>17.62	0	0	0	0.11	4.27	1.94
300NW	B	8/11/2001	11:09	ST_I_ON_III	>4	3	>4	0	0	14.54	15.35	0.81	14.95	14.54	15.35	>14.95	0	0	0	0.22	1.95	1.6
300NW	C	8/11/2001	11:10	ST_I	>4	3	>4	0	0	14.65	15.51	0.86	15.08	14.65	15.51	>15.08	0	0	0	0.54	2.76	1.79
300SE	A	8/11/2001	12:05	ST_I_ON_III	>4	2	>4	1	0.29	4.44	6.15	1.71	5.29	4.44	6.15	>5.29	0	0	0	0.27	3.58	2.46
300SE	B	8/11/2001	12:06	ST_I	>4	2	>4	8	0.28	10.75	11.44	0.7	11.1	10.75	11.44	>11.1	0	0	0	0.21	1.71	0.77
300SE	C	8/11/2001	12:07	ST_I_ON_III	>4	2	>4	7	0.38	13.8	14.44	0.64	14.12	13.8	14.44	>14.12	0	0	0	0.21	2.09	1.35
300S	J	8/12/2001	8:46	INDET	0	-1	-1 to 0	0	0	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
300S	K	8/13/2001	8:25	INDET	0	-1	-1 to 0	8	0.25	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
300S	N	8/13/2001	8:27	INDET	0	-1	-1 to 0	0	0	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
400E	A	8/11/2001	9:52	ST_I_ON_III	>4	2	>4	20	0.42	14.27	14.81	0.54	14.54	14.27	14.81	>14.54	0	0	0	0.49	4.49	2.81
400E	B	8/11/2001	9:53	ST_I	>4	3	>4	12	0.18	14.49	15.68	1.19	15.08	14.49	15.68	>15.08	0	0	0	0.92	1.68	1.33
400E	C	8/11/2001	9:54	ST_I_ON_III	>4	3	>4	0	0	6.43	7.68	1.24	7.05	6.43	7.68	>7.05	0	0	0	NA	NA	NA
400N	C	8/10/2001	11:19	ST_I_ON_III	>4	3	>4	0	0	11.41	12.27	0.87	11.84	11.41	12.27	>11.84	0	0	0	0.86	4.11	2.8
400N	F	8/11/2001	9:13	ST_I_ON_III	>4	3	>4	0	0	11.62	12.81	1.19	12.22	11.62	12.81	>12.22	0	0	0	1.35	3.51	2.63
400N	G	8/11/2001	9:14	ST_I_ON_III	>4	3	>4	3	0.21	13.84	14.65	0.81	14.24	13.84	14.65	>14.24	0	0	0	0.59	4.11	2.94
400NE	A	8/11/2001	11:18	ST_I_ON_III	>4	2	>4	0	0	4.05	6.43	2.38	5.24	4.05	6.43	>5.24	0	0	0	0.32	2.54	1.7
400NE	B	8/11/2001	11:19	ST_I_ON_III	>4	3	>4	0	0	5.46	7.57	2.11	6.51	5.46	7.57	>6.51	0	0	0	0.2	1.25	1
400NE	C	8/11/2001	11:19	ST_I	>4	2	>4	1	0.42	9.08	9.78	0.7	9.43	9.08	9.78	>9.43	0	0	0	0.27	1	0.5
400S	C	8/10/2001	9:57	ST_I	>4	3	>4	7	1.18	11.19	12.32	1.14	11.76	11.19	12.32	>11.76	0	0	0	1.08	4.86	3.62
400S	G	8/12/2001	8:39	ST_I	>4	3	>4	2	2.29	3.3	4.22	0.92	3.76	3.3	4.22	>3.76	0	0	0	0.49	2.32	1.4
400S	K	8/13/2001	8:31	ST_III	>4	3	>4	4	0.25	1.46	5.89	4.43	3.68	1.46	5.89	>3.68	0	0	0	NA	NA	NA
400SE	A	8/11/2001	12:11	ST_I	>4	3	>4	8	0.22	13.69	15.13	1.44	14.41	13.69	15.13	>14.41	0	0	0	0.37	2.03	1.38
400SE	B	8/11/2001	12:12	ST_I	>4	3	>4	1	0.37	15.03	16.15	1.12	15.59	15.03	16.15	>15.59	0	0	0	0.96	2.51	1.6
400SE	C	8/11/2001	12:13	ST_I_ON_III	>4	3	>4	2	1.05	12.89	13.37	0.48	13.13	12.89	13.37	>13.13	0	0	0	0.53	2.41	1.76
CTR	A	8/10/2001	10:31	ST_I_ON_III	>4	3	>4	0	0	10.43	10.86	0.43	10.65	10.43	10.86	>10.65	0	0	0	0.16	3.95	2.47
CTR	C	8/10/2001	10:34	ST_I_ON_III	>4	2	>4	0	0	10	11.29	1.29	10.65	10	11.29	>10.65	0	0	0	0.05	2.1	1.14
CTR	E	8/11/2001	9:31	ST_I_ON_III	>4	3	>4	1	0.51	11.72	12.37	0.65	12.04	11.72	12.37	>12.04	0	0	0	0.05	3.6	2.39

Appendix B1 (continued)

Station	Replicate	Date	Time	Methane Min	Methane Max	Methane Mean	OSI	Surface Roughness	Low DO	Comments
PDA										
100E	A	8/11/2001	9:38	0	0	0	9	BIOGENIC	NO	DM>P, TAN/MOTTLED BLK M; WHITE CLAY@Z, DENSE TUBES, VOIDS
100E	B	8/11/2001	9:38	0	0	0	7	PHYSICAL	NO	DM>P, TAN/MOTTLED BLK M, COH CLAY, TUBES, VOIDS, PATCHY RPD, RED SED@SURF
100E	C	8/11/2001	9:39	0	0	0	3	PHYSICAL	NO	DM>P, TAM/BLK M, V.RED SED@SURF, PATCHY RPD, TUBES, CLAY, WORMS@Z
100N	D	8/11/2001	9:26	0	0	0	9	PHYSICAL	NO	DM>P, TAN/BLK M, TUBES, VOIDS, OX&RED CLASTS
100N	E	8/11/2001	9:27	0	0	0	7	PHYSICAL	NO	DM>P,TAN/BLK M,TUBES,VOIDS,PATCHY RPD,RED SED@SURF,WHT CLAY CHIPS@Z,R CLASTS
100N	F	8/11/2001	9:27	0	0	0	7	PHYSICAL	NO	DM>P,TAN/BLK M,TUBES,VOIDS,BURROW,RED CLSTS,RED SED@SURF,PATCHY RPD,WOOD?,CLAY
100NE	A	8/11/2001	11:47	0	0	0	9	PHYSICAL	NO	DM>P,TAN/MOTTLED BLK M, WHITE CLAY,IRREG TOPO,TUBES,VOIDS,SHELLS&M CLUMPS-FAR
100NE	B	8/11/2001	11:48	0	0	0	7	PHYSICAL	NO	DM>P, TAN/BLK M, CLAY CHIPS, TUBES, VOIDS, OX&RED CLASTS, RED SED, PATCHY RPD
100NE	C	8/11/2001	11:49	0	0	0	3	PHYSICAL	NO	DM>P, TAN/BLK M, RED SED@SURF, PATCHY RPD, TUBES
100NW	A	8/11/2001	10:58	0	0	0	7	PHYSICAL	NO	DM>P, TAN/BLK M, TUBES, VOIDS, SM WORM@Z, SM CLAY CHIPS
100NW	B	8/11/2001	11:00	0	0	0	8	BIOGENIC	NO	DM>P, TAN/BLK M, DENSE TUBES, HYROID, VOIDS, FLOCK LYR, CLAY CHIPS@Z
100NW	C	8/11/2001	11:00	0	0	0	8	PHYSICAL	NO	DM>P, TAN/BLK M, TUBES, VOIDS, RED CLASTS, CLAY @Z
100S	D	8/11/2001	10:26	0	0	0	7	BIOGENIC	NO	DM>P, TAN/SULFIDIC BLK M, WHITE CLAY@Z, DENSE TUBES, VOIDS,BURROW, HYDROID?
100S	E	8/11/2001	10:27	0	0	0	7	BIOGENIC	NO	DM>P, TAN/BLK MOTTLED M, COH WHT CLAY, DENSE TUBES, VOIDS, HYROIDS, RED SED
100S	F	8/11/2001	10:28	0	0	0	7	BIOGENIC	NO	DM>P, TAN/GRY M, WHT CLAY, TUBES,VOIDS, SURF REWORK?,RED SED@SURF,PATHCY RPD
100SE	A	8/11/2001	11:54	0	0	0	4	BIOGENIC	NO	DM>P, TAN/GRY&BLK M, DENSE TUBES
100SE	B	8/11/2001	11:55	0	0	0	8	BIOGENIC	NO	DM>P, TAN/BLK M, DENSE TUBES, VOID, OX&RED CLASTS, RED SED@SURF
100SE	C	8/11/2001	11:55	0	0	0	9	BIOGENIC	NO	DM>P, TAN/GRY&BLK M, DENSE TUBES, VOID, RED SED@SURF
100SW	E	8/11/2001	10:32	0	0	0	3	PHYSICAL	NO	DM>P, TAN/GRY M, RED SED @SURF, TUBES, BURROW
100SW	G	8/12/2001	8:59	0	0	0	8	BIOGENIC	NO	DM>P, TAN/GRY M, DENSE TUBES, BURROW-OPENING, VOIDS?, RED CLASTS
100SW	H	8/12/2001	8:59	0	0	0	7	PHYSICAL	NO	DM>P, TAN/GRY M, RED SED @SURF, DENSE TUBES, VOIDS, STICK?
100W	A	8/11/2001	10:54	0	0	0	9	BIOGENIC	NO	DM>P, TAN/BLK M, DENSE TUBES, VOIDS, LG BURROWING WORM@Z, OX&RED CLSTS,HYDROID?
100W	B	8/11/2001	10:54	0	0	0	9	PHYSICAL	NO	DM>P,TAN/BLK M, WIPER SMEARS, TUBES, VOIDS,WIP CLST,WORM@Z,HYROID?
100W	C	8/11/2001	10:55	0	0	0	7	PHYSICAL	NO	DM>P,TAN/BLK M,RED SED@SURF-PATCHY RPD,TUBES,OX&RED CLSTS,VOID,CLAY CHIP,WIP SMEARS
200E	A	8/11/2001	9:43	0	0	0	3	PHYSICAL	NO	DM>P, TAM/MOTTLED BLK M, WHT CLAY@Z, SLOPING TOPO, TUBES, THIN RPD
200E	B	8/11/2001	9:43	0	0	0	8	PHYSICAL	NO	DM>P, TAN/MOTTLED BLK M, CLAY, TUBES, VOIDS, OX&RED CLSTS,BURROW OPNING,WORM@Z
200E	C	8/11/2001	9:44	0	0	0	7	PHYSICAL	NO	DM>P, TAN/MOTLD BLK M,CLAY@Z, TUBES, VOIDS,FLOCK LYR,RED SED@SURF,WORM@Z,CLASTS
200N	A	8/10/2001	10:51	0	0	0	8	PHYSICAL	NO	DM>P, TAN/GRY M, DENSE TUBES, VOIDS, WORM @Z
200N	B	8/10/2001	10:54	0	0	0	4	PHYSICAL	NO	DM>P, TAN/GRY M, SM WHT CLAY CHIPS, TUBES, SM VOID?
200N	C	8/10/2001	10:55	0	0	0	8	PHYSICAL	NO	DM>P, TAN/GRY M, DENSE TUBES, SM VOIDS, RED CLASTS,SM WHITE CLAY CHIPS
200NE	A	8/11/2001	11:30	0	0	0	7	PHYSICAL	NO	DM>P, TAN/MOTTLED BLK M, WHITE CLAY CHIPS, TUBES, VOIDS, RED CLASTS
200NE	B	8/11/2001	11:31	0	0	0	8	BIOGENIC	NO	DM>P, TAN/MOTTLED BLK M,WHITE CLAY, DENSE TUBES,VOIDS,SM WORM@Z,CAM CABLE-VIEW
200NE	C	8/11/2001	11:31	0	0	0	7	PHYSICAL	NO	DM>P,TAN/BLK&GRY M,CLAY STREAKS,WIPER CLST,TUBES,VOIDS,RED SED@SURF,WORM@Z
200NW	A	8/11/2001	11:03	0	0	0	8	BIOGENIC	NO	DM>P, TAN/BLK M, DENSE TUBES, LG VOID, WORMS @Z, SM CLAY CHIPS
200NW	B	8/11/2001	11:04	0	0	0	7	PHYSICAL	NO	DM>P, MOTTLED TAN&BLK M, UNDERPEN, TUBES, RED CLASTS, VOID?,THIN RPD,RED SED
200NW	C	8/11/2001	11:05	0	0	0	7	PHYSICAL	NO	DM>P, TAN/GRY&BLK M, RED SED, WIPER CLAST, VOIDS, WORM@Z, SHELL FRAGS
200S	C	8/10/2001	10:21	0	0	0	8	BIOGENIC	NO	DM>P, TAN/MOTTLED GRY M, WHITE CLAY CHIPS, DENSE TUBES, VOIDS, BURROW
200S	G	8/11/2001	10:13	0	0	0	7	PHYSICAL	NO	DM>P, BRN/GRY&BLK M,COH CLAY CHIPS, TUBES,VOIDS,LG M CLUMPS-CLAY- FAR,WORM@Z
200S	L	8/12/2001	8:20	0	0	0	7	PHYSICAL	NO	DM>P,TAN&GRY M,CLAY CHIPS,TUBES,VOIDS,BURROW OPNING, WORMS@Z,PATCHY RPD,M CLUMP
200SE	C	8/11/2001	12:01	0	0	0	8	PHYSICAL	NO	DM>P, TAN/MOTTLED GRY M, WHITE COH CLAY, TUBES, VOIDS, OX&RED CLASTS, BURROW
200SE	D	8/12/2001	8:24	0	0	0	8	PHYSICAL	NO	DM>P, TAM/BLK M, WHITE CLAY CHIPS, TUBES, VOIDS, SURF REWORKING, WORM@Z
200SE	E	8/12/2001	8:25	0	0	0	7	PHYSICAL	NO	DM>P, TAN/BLK M, TUBES, VOIDS, WHITE CLAY CHIP, OX CLASTS, RED SED
200SW	B	8/10/2001	11:34	0	0	0	99	INDETERMINATE	NO	DM?, HARD BOTTOM - UNDERPENETRATION
200SW	H	8/11/2001	10:40	0	0	0	99	INDETERMINATE	NO	DM?, HARD BOTTOM - UNDERPENETRATION
200SW	K	8/12/2001	8:55	0	0	0	99	PHYSICAL	NO	DM?, HARD BOTTOM - UNDERPENETRATION, TUBES
200W	B	8/11/2001	10:49	0	0	0	8	PHYSICAL	NO	HISTORIC DM>P, TAN/GRY M, DENSE TUBES, VOIDS, OX&RED CLSTS,WORM@Z, MULINIA?
200W	C	8/11/2001	10:50	0	0	0	8	PHYSICAL	NO	HISTORIC DM>P,TAN/GRY M,RED SED@SURF-PATCHY RPD,TUBES,VOIDS,CLSTS, BURROW.WORM@Z
200W	F	8/12/2001	9:09	0	0	0	4	PHYSICAL	NO	HISTORIC DM>P, TAN/BLK M, TUBES, OX&RED CLASTS, RED SED @SURF
300E	A	8/11/2001	9:47	0	0	0	8	PHYSICAL	NO	DM>P, TAN/GRY MOTTLED M, COH CLAY @Z, TUBES, VOIDS
300E	C	8/11/2001	9:49	0	0	0	3	BIOGENIC	NO	DM>P, TAN/MOTLD GRY&TAN M, TUBES,LG BURROW-OPENING, CLAY@SURF,RED SED@Z
300E	F	8/12/2001	8:16	0	0	0	3	PHYSICAL	NO	DM>P, TAN/GRY M, TUBES, OX&RED CLASTS, RED SED@SURF, PATCHY RPD
300N	A	8/10/2001	10:59	0	0	0	8	BIOGENIC	NO	DM>P, TAN/GRY M, DENSE TUBES, VOID?, MULINIA?, RELIC RPD, SM WORM@Z
300N	D	8/11/2001	9:19	0	0	0	3	PHYSICAL	NO	HISTORIC DM>P, TAN/GRY M, TUBES, BURROW
300N	E	8/11/2001	9:19	0	0	0	9	PHYSICAL	NO	HISTORIC DM>P, TAN/GRY M, DENSE TUBES, VOID, OX&RED CLASTS, RED SED@SURF
300NE	D	8/12/2001	8:09	0	0	0	5	PHYSICAL	NO	DM>P, BRN/BLK SANDY M, UNDERPEN, TUBES
300NE	E	8/12/2001	8:10	0	0	0	8	PHYSICAL	NO	DM>P, TAN/BLK M, RED SED@SURF=WIPER CLST, TUBES, VOIDS, SM CLAY CHIPS
300NE	F	8/12/2001	8:10	0	0	0	7	PHYSICAL	NO	DM>P, TAN/GRY M, RED SED@SURF, TUBES, VOIDS, WHITE CLAY CHIPS
300NW	A	8/11/2001	11:08	0	0	0	4	BIOGENIC	NO	DM>P, TAN/GRY M, WHITE CLAY STREAKS, DENSE TUBES, OX&RED CLASTS
300NW	B	8/11/2001	11:09	0	0	0	8	BIOGENIC	NO	DM>P, TAN/BLK M, DENSE TUBES, VOID, GRAY CLAY@SURF, WIPER SMEAR
300NW	C	8/11/2001	11:10	0	0	0	4	PHYSICAL	NO	DM>P, TAN/BLK M, TUBES, RED SED@SURF, WIPER CLAST
300SE	A	8/11/2001	12:05	0	0	0	9	BIOGENIC	NO	DM>P, TAN/BLK M, DENSE TUBES, VOIDS, RED CLAST
300SE	B	8/11/2001	12:06	0	0	0	3	BIOGENIC	NO	DM>P,TAN/BLK M,CLAY CHIPS,TUBES,HYDROIDS,OX&RED CLSTS,RED SED@SURF,SURF REWORK?
300SE	C	8/11/2001	12:07	0	0	0	7	PHYSICAL	NO	DM>P, TAN/BLK M, RED SED @SURF, PATCHY RPD,TUBES,SM VOIDS, OX&RED CLSTS,BURROW
300S	J	8/12/2001	8:46	0	0	0	99	INDETERMINATE	NO	HISTORIC DM?, HARD BOTTOM-UNDERPEN
300S	K	8/13/2001	8:25	0	0	0	99	INDETERMINATE	NO	HISTORIC DM?, HARD BOTTOM-UNDERPEN, SM RED CLASTS, TUBES
300S	N	8/13/2001	8:27	0	0	0	99	INDETERMINATE	NO	HISTORIC DM?, HARD BOTTOM-OVERPENETRATION
400E	A	8/11/2001	9:52	0	0	0	9	PHYSICAL	NO	DM>P, TAN/GRY M, SM CLAY CHIPS, LG VOIDS,DENSE TUBES, OX&RED CLSTS, WORMS @Z
400E	B	8/11/2001	9:53	0	0	0	3	PHYSICAL	NO	DM>P, TAN/GRY M, TUBES, OX&RED CLASTS, BURROW OPENING
400E	C	8/11/2001	9:54	0	0	0	99	PHYSICAL	NO	DM>P, BLACK&TAN M, TUBES,VOIDS, RED SED,WIPER CLAST=IND RPD
400N	C	8/10/2001	11:19	0	0	0	9	PHYSICAL	NO	HISTORIC DM>P, TAN/GRY&BLK M, TUBES, VOIDS, WORMS @Z
400N	F	8/11/2001	9:13	0	0	0	9	BIOGENIC	NO	HISTORIC DM>P, TAN/GRY&BLK M, DENSE TUBES, VOIDS, WHITE CLAY @Z
400N	G	8/11/2001	9:14	0	0	0	9	BIOGENIC	NO	HISTORIC DM>P, TAN/GRY&BLK M, DENSE TUBES, VOIDS, RED CLASTS
400NE	A	8/11/2001	11:18	0	0	0	8	BIOGENIC	NO	DM>P, BRN/GREYISH BROWN M, TUBES, VOIDS, HYROIDS
400NE	B	8/11/2001	11:19	0	0	0	7	PHYSICAL	NO	DM>P, BRNISH GREY CLAY, RED SED, TUBES, VOIDS, LG M CLUMP-FAR,SM WORMS@Z
400NE	C	8/11/2001	11:19	0	0	0	2	BIOGENIC	NO	DM>P,TAN/GRY M, TUBES,HYDROIDS,LG COLLAPSED BURROW-OPENING,OX CLAST
400S	C	8/10/2001	9:57	0	0	0	6	PHYSICAL	NO	HISTORIC DM>P, TAN/GRY M, TUBES, V SM VOID?, LG RED CLASTS,WORM @ TOP RIGHT
400S	G	8/12/2001	8:39	0	0	0	3	PHYSICAL	NO	HISTORIC DM>P, BRN/GRY M,LG MUD CLUMPS, HYRDROIDS, UPEN, TUBES, FLOCK LYR?
400S	K	8/13/2001	8:31	0	0	0	99	PHYSICAL	NO	HISTORIC DM>P, GRY M>P, RPD?, VOIDS, SLOPING TOPO, OX&RED CLASTS
400SE	A	8/11/2001	12:11	0	0	0	3	PHYSICAL	NO	HISTORIC DM>P, TAN/GRY M, TUBES, OX&RED CLASTS, WORM @Z, BURROW OPENING
400SE	B	8/11/2001	12:12	0	0	0	4	PHYSICAL	NO	HISTORIC DM>P, TAN/GRY&BLK M, TUBES, OX CLASTS, RED SED@SURF, WORM@Z
400SE	C	8/11/2001	12:13	0	0	0	8	PHYSICAL	NO	DM>P, TAN/GRY&BLK M, RED SED@SURF, WIP CLST, RED CLSTS, TUBES, SM VOID
CTR	A	8/10/2001	10:31	0	0	0	9	BIOGENIC	NO	DM>P, TAN/DK GREY M, DENSE TUBES, VOIDS
CTR	C	8/10/2001	10:34	0	0	0	7	PHYSICAL	NO	DM>P, TAN/GRY M, DENSE TUBES, VOIDS, BURROW, SM WORMS@Z, SANDY
CTR	E	8/11/2001	9:31	0	0	0	9	PHYSICAL	NO	DM>P, TAN/BLK M, TUBES, VOIDS, RED CLAST, MULINIA?

Appendix B2

DG Mound REMOTS® Sediment-Profile Imaging Data from the August 2001 Survey

Station	Replicate	Date	Time	Successional Stage	Grain Size (phi)			Mud Clasts		Camera Penetration (cm)				Dredged Material Thickness (cm)			Redox Rebound Thickness (cm)			Apparent RPD Thickness(cm)		
					Min	Max	Maj Mode	Count	Avg. Diam	Min	Max	Range	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
DG																						
DG100E	A	8/11/2001	13:57	ST_I_ON_III	>4	2	>4	0	0	3.78	5.19	1.41	4.49	3.78	5.19	>4.49	0	0	0	1.68	2.76	2.11
DG100E	B	8/11/2001	13:57	ST_I_ON_III	>4	2	>4	0	0	8.22	8.86	0.65	8.54	8.22	8.86	>8.54	0	0	0	1.03	2.27	1.65
DG100E	C	8/11/2001	13:58	ST_I_ON_III	>4	2	>4	0	0	7.51	8.59	1.08	8.05	7.51	8.59	>8.05	0	0	0	0.32	4.81	1.31
DG100N	D	8/12/2001	11:52	ST_I_ON_III	>4	2	>4	1	0.94	8.49	9.57	1.08	9.03	8.49	9.57	>9.03	0	0	0	0.81	3.03	2.29
DG100N	G	8/13/2001	8:57	ST_I_ON_III	>4	2	>4	0	0	13.3	14.22	0.92	13.76	13.3	14.22	>13.76	0	0	0	0.86	2.16	1.57
DG100N	H	8/13/2001	8:58	ST_I_ON_III	>4	2	>4	0	0	7.89	9.57	1.68	8.73	7.89	9.57	>8.73	0	0	0	0.22	2.22	1.31
DG100NE	B	8/11/2001	14:07	ST_I_ON_III	>4	2	>4	0	0	6.32	7.3	0.97	6.81	6.32	7.3	>6.81	0	0	0	1.14	2.05	1.6
DG100NE	D	8/12/2001	11:58	ST_I_ON_III	>4	2	>4	0	0	7.14	8.38	1.24	7.76	7.14	8.38	>7.76	0	0	0	0.76	1.95	1.31
DG100NE	F	8/12/2001	11:59	ST_I_ON_III	>4	2	>4	0	0	5.3	6.65	1.35	5.97	5.3	6.65	>5.97	0	0	0	1.73	4.16	3.1
DG100NW	E	8/12/2001	11:42	ST_I_ON_III	>4	2	>4	0	0	8.86	9.73	0.86	9.3	8.86	9.73	>9.3	0	0	0	0.27	1.35	0.86
DG100NW	F	8/12/2001	11:43	ST_I_ON_III	>4	2	>4	0	0	9.51	10.65	1.14	10.08	9.51	10.65	>10.08	0	0	0	1.08	2.59	1.72
DG100S	D	8/12/2001	10:32	INDET	>4	-1	4 to 3	0	0	1.29	2.42	1.13	1.85	1.29	2.42	>1.85	0	0	0	0.7	1.72	1.07
DG100S	E	8/12/2001	10:32	ST_I_ON_III	4	2	4 to 3	5	0.74	3.98	5.11	1.13	4.54	3.98	5.11	>4.54	0	0	0	0.27	1.24	0.76
DG100S	F	8/12/2001	10:33	ST_I	>4	2	>4	2	1.3	6.99	8.17	1.18	7.58	6.99	8.17	>7.58	0	0	0	0.27	1.83	1.24
DG100SE	C	8/11/2001	12:41	ST_I	>4	2	>4	2	1.23	1.41	4.43	3.03	2.92	1.41	4.43	>2.92	0	0	0	0.16	1.51	1.08
DG100SE	F	8/12/2001	11:25	ST_I_ON_III	>4	2	>4	0	0	4.38	7.14	2.76	5.76	4.38	7.14	>5.76	0	0	0	0.27	1.3	0.91
DG100SE	H	8/13/2001	8:50	ST_I_ON_III	>4	2	>4	1	3.88	2.05	8.32	6.27	5.19	2.05	8.32	>5.19	0	0	0	0.38	1.57	0.79
DG100SW	D	8/12/2001	10:25	ST_I	4	2	4 to 3	10	0.55	7.37	8.17	0.81	7.77	7.37	8.17	>7.77	0	0	0	0.11	3.01	1.79
DG100SW	E	8/12/2001	10:26	ST_I_ON_III	4	2	4 to 3	6	1.18	6.02	7.37	1.34	6.69	6.02	7.37	>6.69	0	0	0	0.22	2.53	1.71
DG100SW	F	8/12/2001	10:27	ST_I_ON_III	>4	2	>4	6	0.7	7.74	9.57	1.83	8.66	7.74	9.57	>8.66	0	0	0	0.22	0.75	0.5
DG100W	F	8/12/2001	10:07	ST_I_ON_III	>4	2	>4	10	0.55	10.22	11.51	1.29	10.86	10.22	11.51	>10.86	0	0	0	0.48	1.51	0.88
DG100W	G	8/12/2001	10:08	ST_I_ON_III	>4	2	>4	4	0.27	6.51	8.06	1.56	7.28	6.51	8.06	>7.28	0	0	0	0.32	1.88	0.86
DG100W	H	8/12/2001	10:08	ST_I	>4	2	4 to 3	1	0.67	7.04	7.74	0.7	7.39	7.04	7.74	>7.39	0	0	0	0.27	1.56	0.8
DG200E	A	8/11/2001	13:51	ST_I_ON_III	>4	2	>4	0	0	7.08	7.84	0.76	7.46	7.08	7.84	>7.46	0	0	0	0.92	2.54	1.96
DG200E	B	8/11/2001	13:51	ST_I_ON_III	>4	2	>4	0	0	6.32	6.81	0.49	6.57	6.32	6.81	>6.57	0	0	0	0.22	2.54	1.86
DG200E	C	8/11/2001	13:52	ST_I_ON_III	>4	2	>4	2	0.25	8.76	10.27	1.51	9.51	8.76	10.27	>9.51	0	0	0	0.43	2	1.75
DG200N	A	8/11/2001	13:32	ST_I_ON_III	>4	2	>4	0	0	3.95	4.27	0.32	4.11	3.95	4.27	>4.11	0	0	0	1.35	2.27	1.93
DG200N	C	8/11/2001	13:34	ST_I	4	2	4 to 3	0	0	3.41	3.73	0.32	3.57	3.41	3.73	>3.57	0	0	0	0.7	1.89	1.58
DG200N	E	8/12/2001	12:04	ST_I	>4	1	4 to 3	0	0	0.43	2.65	2.22	1.54	0.43	2.65	>1.54	0	0	0	NA	NA	NA
DG200NE	A	8/11/2001	13:38	INDET	>4	3	>4	0	0	0.05	0.92	0.86	0.49	0.05	0.92	>0.49	0	0	0	NA	NA	NA
DG200NE	C	8/11/2001	13:39	ST_I_ON_III	>4	2	>4	0	0	5.03	5.95	0.92	5.49	5.03	5.95	>5.49	0	0	0	0.86	3.57	2.47
DG200NW	A	8/11/2001	13:04	ST_I	>4	3	>4	1	0.13	14.49	14.86	0.38	14.68	14.49	14.86	>14.68	0	0	0	1.46	2.59	2
DG200NW	C	8/11/2001	13:06	ST_I_ON_III	>4	2	>4	5	0.3	12.32	13.24	0.92	12.78	12.32	13.24	>12.78	0	0	0	0.05	4.05	2.81
DG200NW	D	8/11/2001	13:07	ST_I_ON_III	>4	3	>4	1	0.52	15.62	16.22	0.59	15.92	15.62	16.22	>15.92	0	0	0	0.49	2.22	1.29
DG200S	A	8/11/2001	12:48	ST_I_ON_III	>4	2	>4	3	0.2	7.46	9.14	1.68	8.3	7.46	9.14	>8.3	0	0	0	1.19	2.11	1.5
DG200S	B	8/11/2001	12:49	ST_I_ON_III	>4	2	>4	8	0.21	11.73	12.76	1.03	12.24	11.73	12.76	>12.24	0	0	0	0.22	2.5	1.75
DG200S	C	8/11/2001	12:50	ST_I	>4	2	>4	5	0.2	11.95	14.38	2.43	13.16	11.95	14.38	>13.16	0	0	0	0.05	2.5	2.25
DG200SE	A	8/11/2001	12:30	ST_I	>4	2	>4	1	0.46	12.38	13.51	1.14	12.95	12.38	13.51	>12.95	0	0	0	0.59	3.08	2.04
DG200SE	B	8/11/2001	12:31	ST_I	>4	2	>4	0	0	12.81	14	1.19	13.41	12.81	14	>13.41	0	0	0	0.22	1.78	1.13
DG200SE	C	8/11/2001	12:35	ST_I_ON_III	>4	2	>4	5	0.75	13.08	14.11	1.03	13.59	13.08	14.11	>13.59	0	0	0	0.05	3.89	2.8
DG200SW	A	8/11/2001	12:54	ST_I_ON_III	>4	2	>4	0	0	10.97	12.16	1.19	11.57	10.97	12.16	>11.57	0	0	0	1.3	3.84	2.81
DG200SW	B	8/11/2001	12:55	ST_I_ON_III	>4	2	>4	0	0	12.86	13.08	0.22	12.97	12.86	13.08	>12.97	0	0	0	0.43	2.5	2.35
DG200SW	C	8/11/2001	12:55	ST_I_ON_III	>4	2	>4	4	0.3	12.11	13.68	1.57	12.89	12.11	13.68	>12.89	0	0	0	0.16	3	2.25
DG200W	A	8/11/2001	12:59	ST_I_ON_III	>4	2	>4	0	0	9.35	10.43	1.08	9.89	9.35	10.43	>9.89	0	0	0	0.49	2.86	1.92
DG200W	D	8/12/2001	10:01	ST_I_ON_III	>4	2	>4	0	0	12.32	13.19	0.86	12.76	12.32	13.19	>12.76	0	0	0	0.59	2.97	1.83
DG200W	F	8/12/2001	10:03	ST_I	>4	1	>4	7	1.24	15.14	16.38	1.24	15.76	15.14	16.38	>15.76	0	0	0	0.5	2.75	2.5
DG300E	C	8/11/2001	13:46	ST_I_ON_III	>4	2	>4	1	0.3	14.38	15.62	1.24	15	14.38	15.62	>15	0	0	0	0.97	1.89	1.43
DG300E	D	8/12/2001	10:49	ST_I_ON_III	>4	2	>4	0	0	15.08	15.62	0.54	15.35	15.08	15.62	>15.35	0	0	0	0.43	2.6	2.3
DG300E	E	8/12/2001	10:50	ST_I	>4	2	>4	6	0.2	17.57	18.92	1.35	18.24	17.57	18.92	>18.24	0	0	0	1.41	4	2.75
DG300SE	A	8/11/2001	12:25	ST_I	>4	2	>4	0	0	2.38	4.43	2.05	3.41	2.38	4.43	>3.41	0	0	0	NA	NA	NA
DG300SE	D	8/12/2001	10:41	INDET	>4	1	4 to 3	0	0	1.41	3.08	1.68	2.24	1.41	3.08	>2.24	0	0	0	NA	NA	NA
DG300SE	E	8/12/2001	10:42	INDET	>4	1	4 to 3	0	0	1.62	2.16	0.54	1.89	1.62	2.16	>1.89	0	0	0	NA	NA	NA
DG50N	A	8/11/2001	14:24	ST_I	>4	3	>4	0	0	3.98	5.11	1.13	4.54	3.98	5.11	>4.54	0	0	0	0.48	1.72	1.31
DG50N	D	8/12/2001	11:35	ST_I_ON_III	>4	2	>4	0	0	6.18	7.2	1.02	6.69	6.18	7.2	>6.69	0	0	0	0.65	3.92	2.87
DG50N	F	8/12/2001	11:36	ST_I_ON_III	>4	2	>4	0	0	8.39	9.3	0.91	8.84	8.39	9.3	>8.84	0	0	0	0.65	3.92	2.34
DG50NE	C	8/11/2001	14:32	ST_I_ON_III	>4	3	>4	5	0.21	3.98	4.78	0.81	4.38	3.98	4.78	>4.38	0	0	0	0.7	1.67	1.24
DG50NE	E	8/12/2001	11:30	ST_I_ON_III	>4	2	>4	12	0.27	4.79	6.51	1.72	5.65	4.79	6.51	>5.65	0	0	0	0.16	3.28	1.77
DG50NE	G	8/13/2001	8:54	ST_I	>4	2	>4	10	0.63	5.11	7.47	2.37	6.29	5.11	7.47	>6.29	0	0	0	0.2	0.6	0.5
DG50NW	D	8/12/2001	11:47	ST_I	>4	2	>4	8	0.21	5.62	6.59	0.97	6.11	5.62	6.59	>6.11	0	0	0	0.49	2.49	1.57
DG50NW	E	8/12/2001	11:48	ST_I_ON_III	>4	2	>4	0	0	10.65	11.24	0.59	10.95	10.65	11.24	>10.95	0	0	0	0.05	2.16	1.42
DG50NW	F	8/12/2001	11:49	ST_I_ON_III	>4	2	>4	2	0.7	5.7	6.51	0.81	6.1	5.7	6.51	>6.1	0	0	0	0.86	1.88	1.5
DG50S	E	8/12/2001	10:22	ST_I_ON_III	>4	3	>4	4	0.34	5.27	8.06	2.8	6.67	5.27	8.06	>6.67	0	0	0	0.16	2.8	1.57
DG50S	F	8/12/2001	10:22	ST_I_ON_III	>4	2	>4	20	1.26	4.14	4.68	0.54	4.41	4.14	4.68	>4.41	0	0	0	0.1	0.6	0.35
DG50S	G	8/13/2001	9:12	INDET	1	-1	1 to 0	0	0	0.05	0.05	0	0.05	0.05	0.05	>0.05	0	0	0	NA	NA	NA
DG50SW	D	8/12/2001	10:17	ST_I_ON_III	>4	2	>4	0	0	6.67	9.25	2.58	7.96	6.67	9.25	>7.96	0	0	0	0.4	1.5	1
DG50SW	E	8/12/2001	10:17	ST_I_ON_III	>4	2	>4	6	0.56	4.78	6.4	1.61	5.59	4.78	6.4	>5.59	0	0	0	0.27	2.15	1.13
DG50SW	F	8/12/2001	10:18	ST_I_ON_III	>4	3	>4	0	0	4.35	5.27	0.91	4.81	4.35	5.27	>4.81	0	0	0	0.1	0.3	0.2
DG50W	A	8/11/2001	14:40	ST_I	>4	3	>4	0	0	5.48	6.94	1.45	6.21	5.48	6.94	>6.21	0	0	0	0.16	2.47	1.25
DG50W	D	8/12/2001	10:12	ST_I	4	2	4 to 3	0	0	7.85	8.44	0.59	8.15	7.85	8.44	>8.15	0	0	0	0.11	4.3	2.21
DG50W	E	8/12/2001	10:12	ST_I	>4	2	>4	12	0.29	7.42	9.57	2.15	8.49	7.42	9.57	>8.49	0	0	0	0.16	1.99	0.95
DGCTR	A	8/13/2001	9:06	ST_I_ON_III	>4	3	>4	0	0	6.88	8.76	1.88	7.82	6.88	8.76	>7.82	0	0	0	0.32	1.18	0.77
DGCTR	B	8/13/2001	9:07	ST_I_ON_III	>4	2	>4	0	0	7.15	8.01	0.86	7.58	7.15	8.01	>7.58	0	0	0	0.38	2.9	1.77
DGCTR	C	8/13/2001	9:08	ST_I_ON_III	>4	2	>4	2	0.29	8.28	8.76	0.48	8.52	8.28	8.76	>8.52	0	0	0	0.54	1.77	1.2

Appendix B2 (continued)

Station	Replicate	Date	Time	Methane			OSI	Surface Roughness	Low DO	Comments
				Min	Max	Mean				
DG										
DG100E	A	8/11/2001	13:57	0	0	0	8	PHYSICAL	NO	DM>P, BRN/GRY SANDY M, TUBES, VOID, BUUROW OPENING?
DG100E	B	8/11/2001	13:57	0	0	0	8	PHYSICAL	NO	DM>P, BRN/MOTTLED BLK M, COH CLAY, TUBES, VOIDS, RED SED, SHELL FRAG
DG100E	C	8/11/2001	13:58	0	0	0	7	BIOGENIC	NO	DM>P, BRN SAND/MOTTLED BLK M, WHT COH CLAY,TUBES,VOIDS,BURROWS-OPNING,RED SED
DG100N	D	8/12/2001	11:52	0	0	0	9	BIOGENIC	NO	DM>P, BRN/GRY&BLK SANDY M, DENSE TUBES, VOID?, BURROW,RED CLST,LG M CLUMP-FAR
DG100N	G	8/13/2001	8:57	0	0	0	8	BIOGENIC	NO	DM>P,BRN/GRY&BLK SANDY M,TUBES,VOIDS, OX VERT BURROW-OPNING,RED SED,SHELL BITS
DG100N	H	8/13/2001	8:58	0	0	0	7	PHYSICAL	NO	DM>P, BRN/BLK SANDY M, COH CLAY, WIPER SMEAR,TUBES, VOIDS-W/WORM, BURROW
DG100NE	B	8/11/2001	14:07	0	0	0	8	PHYSICAL	NO	DM>P, BRN/MOTTLED BLK SANDY M, WHT&GRY CLAY @Z, TUBES, VOIDS, RED SED
DG100NE	D	8/12/2001	11:58	0	0	0	7	BIOGENIC	NO	DM>P, BRN/GRY SANDY M, DENSE TUBES, VOIDS, RED SED, SHELL FRAGS, HYDROID?
DG100NE	F	8/12/2001	11:59	0	0	0	10	BIOGENIC	NO	DM>P,BRN/GRY&BLK SANDY M,COH CLAY@Z,DENSE TUBES,VOID,SHELLS,FLOCK LYR?-OPNING?
DG100NW	E	8/12/2001	11:42	0	0	0	7	PHYSICAL	NO	DM>P, BRN/GRY SANDY M, PATCHY RPD, TUBES, VOIDS, WORM @Z
DG100NW	F	8/12/2001	11:43	0	0	0	8	PHYSICAL	NO	DM>P, BRN/GRY SANDY M, CLAY @Z, TUBES, VOIDS, BURROW
DG100S	D	8/12/2001	10:32	0	0	0	99	PHYSICAL	NO	DM>P, BRNISH GRY SANDY M>P,UPEN-HARD BOTTOM,V.LG M CLUMP/ROCK?,CLAY CHIPS,TUBES
DG100S	E	8/12/2001	10:32	0	0	0	7	PHYSICAL	NO	DM>P, BRN/BLK&GRY SANDY M, SM TUBES, VOID, PATCHY RPD, RED CLSTS, RED SED
DG100S	F	8/12/2001	10:33	0	0	0	3	PHYSICAL	NO	DM>P, BRN S/GRY&WHT CLAYEY SILT, TUBES, LG RED CLSTS, PATCHY RPD,SHELL BITS
DG100SE	C	8/11/2001	12:41	0	0	0	3	PHYSICAL	NO	DM>P, TAN/GRY SANDY M, WHITE COH CLAY, UNDERPEN,CLAY CLASTS, TUBES
DG100SE	F	8/12/2001	11:25	0	0	0	7	PHYSICAL	NO	DM>P, TAN SANDY M/WHITE COH CLAY, TUBES, VOIDS, LG M CLUMP-FAR, FLOCK LYR
DG100SE	H	8/13/2001	8:50	0	0	0	7	PHYSICAL	NO	DM>P,BRNISH GRY M>P,GRY CLAY,TUBES,VOIDS,IRREG TOPO-SLOPING,LG M CLUMP,RED SED
DG100SW	D	8/12/2001	10:25	0	0	0	4	BIOGENIC	NO	DM>P, BRN/GRY SANDY M, TUBES, BURROW OPENING, RED CLASTS, HYDROIDS, SHELL BIT
DG100SW	E	8/12/2001	10:26	0	0	0	8	PHYSICAL	NO	DM>P, BRN/BLK SANDY M, RED SED@SURF, TUBES, VOID, RED CLASTS, WORMS @Z
DG100SW	F	8/12/2001	10:27	0	0	0	6	BIOGENIC	NO	DM>P,TAN&BLK CLAYEY M,IRREG TOPO,VOIDS,DENSE TUBES,RED SED,THIN RPD
DG100W	F	8/12/2001	10:07	0	0	0	7	PHYSICAL	NO	DM>P,BRN S/BLK CLAYEY M,RED SED,THIN RPD,TUBES,VOIDS,RED CLSTS,WORMS@Z,HYDROID
DG100W	G	8/12/2001	10:08	0	0	0	7	BIOGENIC	NO	DM>P,BRN/BLK SANDY M,RED SED,PATCH RPD,TUBES,RED CLSTS,BURROW WORMS@Z,BURROW
DG100W	H	8/12/2001	10:08	0	0	0	3	PHYSICAL	NO	DM>P, BRN/BLK SANDY M, WIPER SMEAR, TUBES, SHELL BITS
DG200E	A	8/11/2001	13:51	0	0	0	8	PHYSICAL	NO	DM>P, BRNISH GRY SANDY M>P, TUBES, VOIDS, WHITE CLAY CHIPS, RED SED
DG200E	B	8/11/2001	13:51	0	0	0	8	PHYSICAL	NO	DM>P, BRN/GRY SANDY M, TUBES, VOID
DG200E	C	8/11/2001	13:52	0	0	0	8	PHYSICAL	NO	DM>P, TAN/GRY SANDY M, WIPER SMEAR,TUBES,VOIDS,SM CLAY CHIPS,WORM
DG200N	A	8/11/2001	13:32	0	0	0	8	BIOGENIC	NO	DM>P, BRN/GRY SANDY M, UNDERPEN, DENSE TUBES, VOIDS, BURROW OPENING
DG200N	C	8/11/2001	13:34	0	0	0	4	PHYSICAL	NO	DM>P,BRNISH GRY SANDY M>P,UNDERPEN,TUBES,RED SED@SURF,HYDROID,CLAY CHIPS
DG200N	E	8/12/2001	12:04	0	0	0	99	PHYSICAL	NO	DM>P, BRNISH GRY SANDY M>P, UPEN, HARD BOTTOM, TUBES, LG MUD CLUMPS-FARFIELD
DG200NE	A	8/11/2001	13:38	0	0	0	99	PHYSICAL	NO	DM>P, BRN M>P, UNDERPEN, HARD BOTTOM, DENSE TUBES, SHELL FRAGS
DG200NE	C	8/11/2001	13:39	0	0	0	9	PHYSICAL	NO	DM>P, BRN/GRY SANDY M, DENSE TUBES, VOIDS, CLAY CHIP@Z, SM BURROW OPNING
DG200NW	A	8/11/2001	13:04	0	0	0	4	PHYSICAL	NO	DM>P, TAN/BLK M, SM DENSE TUBES, RED CLAST, WORM @Z
DG200NW	C	8/11/2001	13:06	0	0	0	9	PHYSICAL	NO	DM>P, BRN SAND/GRY M,COH CLAY@Z,TUBES,VOIDS,M CLASTS, OBJ/ORG @SURF?,SHELL FRAG
DG200NW	D	8/11/2001	13:07	0	0	0	7	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, RED SED@SURF,PATCHY RPD,TUBES,VOIDS,WORMS@Z,WIP CLST
DG200S	A	8/11/2001	12:48	0	0	0	7	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, DENSE TUBES, VOIDS, RED CLASTS, CLAY CHIPS
DG200S	B	8/11/2001	12:49	0	0	0	8	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, WIPER SMEARS,TUBES,VOIDS,CLAY CHIPS, OX&RED CLSTS
DG200S	C	8/11/2001	12:50	0	0	0	4	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, WIPER SMEARS, TUBES, WHT CLAY CHIPS,WIP CLST
DG200SE	A	8/11/2001	12:30	0	0	0	4	PHYSICAL	NO	HISTORIC DM>P, TAN/BLK SANDY M, TUBES, OX CLAST, SM WORM@Z
DG200SE	B	8/11/2001	12:31	0	0	0	3	PHYSICAL	NO	HISTORIC DM>P, TAN/BLK SANDY M, RED SED@SURF,PATCHY RPD,TUBES, IRON OXIDE@Z,WIP CLST
DG200SE	C	8/11/2001	12:35	0	0	0	9	PHYSICAL	NO	HISTORIC DM>P, TAN/BLK SANDY M, DENSE TUBES, VOIDS, OX&RED CLASTS, IRON OXIDE@Z
DG200SW	A	8/11/2001	12:54	0	0	0	9	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, SM DENSE TUBES, VOIDS, WHITE CLAY @Z
DG200SW	B	8/11/2001	12:55	0	0	0	9	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, TUBES, WIPER SMEAR, VOIDS
DG200SW	C	8/11/2001	12:55	0	0	0	8	PHYSICAL	NO	DM>P,TAN/BLK SANDY M,WIP SMEAR,PATCHY RPD,VOIDS,LG TUBE?-HYDROID?,RED CLST
DG200W	A	8/11/2001	12:59	0	0	0	8	BIOGENIC	NO	DM>P, TAN/BLK SANDY M, DENSE TUBES, SM VOIDS, LG VOID
DG200W	D	8/12/2001	10:01	0	0	0	8	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, RED SED @Z, TUBES, VOIDS, SHELL FRAG
DG200W	F	8/12/2001	10:03	0	0	0	5	PHYSICAL	NO	DM>P,TAN S/BLK M, DENSE TUBES, HYDROID, RED CLSTS, SURF REWORK
DG300E	C	8/11/2001	13:46	0	0	0	7	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, TUBES, VOID, HYDROID?, IRON OXIDE @SURF
DG300E	D	8/12/2001	10:49	0	0	0	9	BIOGENIC	NO	DM>P, TAN/BLK SANDY M, DENSE TUBES, VOIDS, HYDROID?
DG300E	E	8/12/2001	10:50	0	0	0	5	PHYSICAL	NO	DM>P, TAN/BLK SANDY M, RED SED @SURF, TUBES, CLAY CHIPS, OX&RED CLASTS
DG300SE	A	8/11/2001	12:25	0	0	0	99	BIOGENIC	NO	HISTORIC DM>P, BRN SANDY M>P,UPEN,DENSE TUBES,BURROW OPNING,SHELL FRAGS,WORM@Z
DG300SE	D	8/12/2001	10:41	0	0	0	99	PHYSICAL	NO	HISTORIC DM>P, BRN&GRY SANDY M>P, UNDERPEN, HARD BOTTOM, LG MUD CLUMP, TUBES?
DG300SE	E	8/12/2001	10:42	0	0	0	99	BIOGENIC	NO	HISTORIC DM>P,BRN SANDY M>P,UPEN-HARD BOTTOM,TUBES,LG WORM@SURF,SHELLS, ROCKS-FAR
DG50N	A	8/11/2001	14:24	0	0	0	3	PHYSICAL	NO	DM>P, TAN/MOTTLED CLAYEY SILT, RED SED, TUBES, M CLUMPS-FAR, PATCHY RPD
DG50N	D	8/12/2001	11:35	0	0	0	9	PHYSICAL	NO	DM>P, BRN SANDY M/GRY CLAYEY SILT, TUBES, VOID, BURROW, WORM@Z, RED SED
DG50N	F	8/12/2001	11:36	0	0	0	9	BIOGENIC	NO	DM>P, BRN/GRY SANDY M, WHT CLAY CHIPS, TUBES, VOIDS, WORM @Z
DG50NE	C	8/11/2001	14:32	0	0	0	7	PHYSICAL	NO	DM>P, TAN SANDY M, CLAY@Z, TUBES, LG VOIDS, RED CLSTS, RED SED
DG50NE	E	8/12/2001	11:30	0	0	0	8	BIOGENIC	NO	DM>P, BRN/GRY&BLK SANDY M, LG BURROW OPENING, RED CLASTS,VOIDS,SM TUBES,WORM@Z
DG50NE	G	8/13/2001	8:54	0	0	0	2	PHYSICAL	NO	DM>P, GRYISH TAN CLAYEY SILT, IRREG TOPO-M CLUMPS,RED CLSTS,TUBES,RED SED
DG50NW	D	8/12/2001	11:47	0	0	0	4	PHYSICAL	NO	DM>P, BRN/GRY SANDY M,WHT CLAY CHIPS, OX&RED CLASTS, TUBES,VOID LOWER RT?
DG50NW	E	8/12/2001	11:48	0	0	0	7	PHYSICAL	NO	DM>P, BRN/MOTTLED BLK M, WHT CLAY, TUBES, VOIDS, RED SED, WORM @Z?, RELIC RPD?
DG50NW	F	8/12/2001	11:49	0	0	0	7	PHYSICAL	NO	DM>P, BRN/GRY&BLK SANDY M, CLAY, RED SED@SURF, RED CLSTS, TUBES, VOIDS, WORM@Z
DG50S	E	8/12/2001	10:22	0	0	0	8	PHYSICAL	NO	DM>P,BRN S/MOTLD BLK&GYR CLAY,BURROW OPNING,TUBES,VOIDS,CLSTS,LG M CLUMPS-FAR
DG50S	F	8/12/2001	10:22	0	0	0	6	PHYSICAL	NO	DM>P, TAN&BLK MOTTLED CLAY,V.RED SED, TUBES,VOIDS,RED CLSTS,LG M CLUMP-FAR,UPEN
DG50S	G	8/13/2001	9:12	0	0	0	99	INDETERMINATE	NO	DM>P, UNDERPEN-HARD BOTTOM, LG MUD CLUMPS-FARIELD
DG50SW	D	8/12/2001	10:17	0	0	0	7	PHYSICAL	NO	DM>P, GRYISH BRN SILT>P, BURROWS-OPENINGS, TUBES,VOIDS,SHELL BITS,RED SED@Z
DG50SW	E	8/12/2001	10:17	0	0	0	7	PHYSICAL	NO	DM>P, BRN S/GRY M, PATCHY RPD, TUBES, VOIDS, RED CLASTS, SHELL BITS
DG50SW	F	8/12/2001	10:18	0	0	0	6	PHYSICAL	NO	DM>P, GREYISH BRN SILTY CLAY>P, RED SED @SURF, RPD?, TUBES, VOIDS
DG50W	A	8/11/2001	14:40	0	0	0	3	BIOGENIC	NO	DM>P, TAN/MOTTLED CLAYEY SILT, RED SED, DENSE TUBES, SM VOID?
DG50W	D	8/12/2001	10:12	0	0	0	4	PHYSICAL	NO	DM>P, BRN/BLK SANDY M, DENSE TUBES, SM VOID?, LG M CLUMP-FAR, RED SED
DG50W	E	8/12/2001	10:12	0	0	0	3	PHYSICAL	NO	DM>P, BRNISH GRY SANDY M>P, RED SED, PATCHY RPD, TUBES,MULINIA?,CLAY CHIPS,WORM
DGCTR	A	8/13/2001	9:06	0	0	0	7	PHYSICAL	NO	DM>P, BRN/GRYISH BRN CLAYEY SILT, VOIDS, THIN RPD, DENSE TUBES, BURROW
DGCTR	B	8/13/2001	9:07	0	0	0	8	PHYSICAL	NO	DM>P, BRN S/GRY&BLK CLAY, TUBES, RED SED@SURF, VOIDS,ROCKS-FAR?,SHELL BITS
DGCTR	C	8/13/2001	9:08	0	0	0	7	PHYSICAL	NO	DM>P, BRN S/GRY&BLK CLAYEY SILT, RED SED@Z, VOIDS, BURROW, WORM@Z, RED CLSTS

Appendix B3
Royal River Mound REMOTS® Sediment-Profile Imaging Data from the August 2001 Survey

Station	Replicate	Date	Time	Successional Stage	Grain Size (phi)			Mud Clasts		Camera Penetration (cm)				Dredged Material Thickness (cm)			Redox Rebound Thickness (cm)			Apparent RPD Thickness(cm)		
					Min	Max	Maj Mode	Count	Avg. Diam	Min	Max	Range	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Royal River																						
RR100NW	D	8/12/2001	12:33	ST_I_ON_III	>4	2	>4	3	0.28	5.76	6.85	1.09	6.3	5.76	6.85	>6.3	0	0	0	1.25	2.66	2.33
RR100NW	E	8/12/2001	12:34	ST_I	4	2	4 to 3	6	0.13	7.61	8.21	0.6	7.91	7.61	8.21	>7.91	0	0	0	0.65	3.7	2.68
RR100NW	F	8/12/2001	12:35	ST_I	>4	2	4 to 3	0	0	5.16	7.12	1.96	6.14	5.16	7.12	>6.14	0	0	0	1.47	2.99	2.09
RR100NE	A	8/11/2001	16:54	ST_I	>4	2	>4	0	0	6.52	7.66	1.14	7.09	6.52	7.66	>7.09	0	0	0	NA	NA	NA
RR100NE	E	8/12/2001	14:25	ST_I	>4	2	>4	0	0	7.93	8.97	1.03	8.45	7.93	8.97	>8.45	0	0	0	0.76	2.5	2.02
RR100NE	G	8/12/2001	14:27	ST_I	>4	2	>4	0	0	8.37	9.08	0.71	8.72	8.37	9.08	>8.72	0	0	0	2.17	4.46	3.23
RR100SE	A	8/11/2001	16:41	ST_I_ON_III	>4	3	>4	0	0	5.71	6.79	1.09	6.25	5.71	6.79	>6.25	0	0	0	1.52	2.61	2.26
RR100SE	B	8/11/2001	16:42	ST_I	>4	3	>4	0	0	3.48	4.18	0.71	3.83	3.48	4.18	>3.83	0	0	0	0.11	1.74	0.74
RR100SE	D	8/12/2001	14:09	ST_I	>4	2	>4	0	0	6.52	7.23	0.71	6.88	6.52	7.23	>6.88	0	0	0	0.6	3.04	2.27
RR100SW	B	8/11/2001	16:07	ST_I	>4	2	>4	5	0.21	2.83	4.02	1.2	3.42	2.83	4.02	>3.42	0	0	0	1.03	2.34	1.62
RR100SW	D	8/12/2001	13:46	ST_I_ON_III	>4	2	>4	3	0.86	8.75	10.27	1.52	9.51	8.75	10.27	>9.51	0	0	0	0.87	3.48	2.28
RR100SW	E	8/12/2001	13:47	ST_I	>4	2	>4	15	0.18	7.39	8.48	1.09	7.93	7.39	8.48	>7.93	0	0	0	0.54	2.28	1.43
RR150NE	A	8/11/2001	16:59	ST_I_ON_III	>4	2	>4	0	0	7.5	9.35	1.85	8.42	7.5	9.35	>8.42	0	0	0	1.58	4.35	3.71
RR150NE	C	8/11/2001	17:00	ST_I_ON_III	>4	2	>4	0	0	9.4	12.12	2.72	10.76	9.4	12.12	>10.76	0	0	0	NA	NA	NA
RR150NE	D	8/11/2001	17:01	ST_I_ON_III	>4	2	>4	1	0.93	4.29	7.45	3.15	5.87	4.29	7.45	>5.87	0	0	0	NA	NA	NA
RR200NW	E	8/12/2001	12:25	ST_I	>4	2	>4	0	0	8.26	8.97	0.71	8.61	8.26	8.97	>8.61	0	0	0	1.74	3.86	3.19
RR200NW	F	8/12/2001	12:26	ST_I	>4	2	>4	0	0	8.26	9.13	0.87	8.7	8.26	9.13	>8.7	0	0	0	0.11	4.46	2.74
RR200NW	H	8/13/2001	9:23	ST_I_ON_III	>4	2	>4	0	0	8.15	9.62	1.47	8.89	8.15	9.62	>8.89	0	0	0	0.71	2.01	1.5
RR200SE	I	8/13/2001	9:49	INDET	1	-1	0 TO -1	0	0	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
RR200SE	J	8/13/2001	9:50	INDET	1	-1	NA	2	5.67	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
RR200SW	H	8/13/2001	9:56	ST_I_ON_III	4	2	4 to 3	0	0	7.53	8.87	1.34	8.2	7.53	8.87	>8.2	0	0	0	0.05	3.44	1.98
RR200SW	J	8/13/2001	9:57	ST_I_ON_III	4	2	4 to 3	0	0	5.82	6.9	1.09	6.36	5.82	6.9	>6.36	0	0	0	0.33	3.7	1.82
RR200SW	K	8/13/2001	9:58	ST_I_ON_III	>4	2	>4	4	0.23	7.23	7.93	0.71	7.58	7.23	7.93	>7.58	0	0	0	0.43	3.91	2.41
RR50NE	D	8/12/2001	14:21	ST_I_ON_III	>4	2	>4	5	0.5	8.15	9.51	1.36	8.83	8.15	9.51	>8.83	0	0	0	0.76	3.42	2.79
RR50NE	E	8/12/2001	14:22	ST_I	>4	2	>4	7	0.21	9.29	9.62	0.33	9.46	9.29	9.62	>9.46	0	0	0	0.11	3.8	2.98
RR50NE	F	8/12/2001	14:23	ST_I_ON_III	>4	2	>4	10	0.11	8.26	9.13	0.87	8.7	8.26	9.13	>8.7	0	0	0	0.43	3.1	1.92
RR50NW	D	8/12/2001	12:39	ST_I_TO_II	>4	2	>4	0	0	6.52	8.15	1.63	7.34	6.52	8.15	>7.34	0	0	0	1.47	5	3.43
RR50NW	E	8/12/2001	12:40	ST_I_TO_II	4	2	4 to 3	3	0.41	4.73	5.98	1.25	5.35	4.73	5.98	>5.35	0	0	0	0.54	2.66	1.92
RR50NW	F	8/12/2001	12:41	ST_I	>4	2	>4	5	0.29	5.49	6.25	0.76	5.87	5.49	6.25	>5.87	0	0	0	0.49	3.37	2.46
RR50SE	D	8/12/2001	14:13	ST_I	>4	2	>4	0	0	4.73	5.82	1.09	5.27	4.73	5.82	>5.27	0	0	0	0.6	2.5	1.91
RR50SE	E	8/12/2001	14:14	ST_I	>4	2	>4	5	0.6	7.88	8.26	0.38	8.07	7.88	8.26	>8.07	0	0	0	0.6	2.55	2.22
RR50SE	F	8/12/2001	14:15	ST_I	>4	2	>4	0	0	4.46	6.09	1.63	5.27	4.46	6.09	>5.27	0	0	0	NA	NA	NA
RR50SW	B	8/11/2001	16:02	INDET	>4	0	>4	4	0.29	0.6	1.58	0.98	1.09	0.6	1.58	>1.09	0	0	0	NA	NA	NA
RR50SW	C	8/11/2001	16:03	ST_I_ON_III	>4	2	>4	0	0	8.86	9.67	0.82	9.27	8.86	9.67	>9.27	0	0	0	0.11	3.26	1.92
RR50SW	G	8/13/2001	9:34	ST_I_ON_III	>4	2	>4	0	0	7.61	9.13	1.52	8.37	7.61	9.13	>8.37	0	0	0	0.27	2.83	1.46
RRCTR	A	8/11/2001	15:56	ST_I_ON_III	>4	2	>4	2	2.04	7.77	8.48	0.71	8.13	7.77	8.48	>8.13	0	0	0	1.03	3.32	2.25
RRCTR	B	8/11/2001	15:57	ST_I_ON_III	>4	2	>4	0	0	8.21	8.75	0.54	8.48	8.21	8.75	>8.48	0	0	0	1.96	2.77	2.6
RRCTR	E	8/12/2001	13:37	ST_I	>4	2	>4	4	0.21	8.8	9.24	0.43	9.02	8.8	9.24	>9.02	0	0	0	1.3	2.39	1.94

Appendix B3 (continued)

Station	Replicate	Date	Time	Methane			OSI	Surface Roughness	Low DO	Comments
				Min	Max	Mean				
Royal River										
RR100NW	D	8/12/2001	12:33	0	0	0	9	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, TUBES, VOIDS, RED CLASTS
RR100NW	E	8/12/2001	12:34	0	0	0	5	BIOGENIC	NO	CDM>P, BRN SANDY M>P, DENSE LG TUBES, RED CLASTS, WORMS @Z, SHELL BITS
RR100NW	F	8/12/2001	12:35	0	0	0	4	BIOGENIC	NO	CDM>P,BRN SANDY M>P,BURROW OPENING,TUBES,SHELL FRAGS,LG M CLUMP-FAR,WORM@Z
RR100NE	A	8/11/2001	16:54	0	0	0	99	BIOGENIC	NO	CDM>P, BRN SANDY M>P, CONDENSATION, DENSE LG TUBES
RR100NE	E	8/12/2001	14:25	0	0	0	4	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, CONDENSATION, DENSE TUBES
RR100NE	G	8/12/2001	14:27	0	0	0	6	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, CONDENSATION, TUBES
RR100SE	A	8/11/2001	16:41	0	0	0	9	INDETERMINATE	NO	CDM>P, TAN/BLK SANDY M, CONDENSATION, VOID?, M CLASTS?
RR100SE	B	8/11/2001	16:42	0	0	0	2	PHYSICAL	NO	CDM>P, BRN&BLK SANDY M, CONDENSATION, RED SED @SURF, PATCHY RPD,UNDERPEN
RR100SE	D	8/12/2001	14:09	0	0	0	5	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, TUBES, BURROW OPENING?, SHELL FRAG, WORM @Z
RR100SW	B	8/11/2001	16:07	0	0	0	4	PHYSICAL	NO	CDM>P,BRN/GRY SANDY M,UPEN,TUBES, WORM@Z,RED CLSTS,SHELL & LG RED M CLUMP-FAR
RR100SW	D	8/12/2001	13:46	0	0	0	9	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, CONDENSATION, LG TUBES, VOIDS, WORM @Z, RED CLASTS
RR100SW	E	8/12/2001	13:47	0	0	0	3	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, CONDENSATION, RED SED, TUBES, OX&RED CLASTS
RR150NE	A	8/11/2001	16:59	0	0	0	10	PHYSICAL	NO	CDM>P, TAN/BLK SANDY M, CONDENSATION, VOIDS, SM TUBES, RPD TOO DEEP?
RR150NE	C	8/11/2001	17:00	0	0	0	99	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, CONDENSATION, RPD?, LG VOID, TUBES, SLOPING TOPO
RR150NE	D	8/11/2001	17:01	0	0	0	99	PHYSICAL	NO	CDM>P, TAN/GRY SANDY M, CONDENSATION, TUBES, VOIDS, SLOPING TOPO, M CLAST, RPD?
RR200NW	E	8/12/2001	12:25	0	0	0	6	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, TUBES, WORM @Z
RR200NW	F	8/12/2001	12:26	0	0	0	5	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, TUBES, RED SED @SURF
RR200NW	H	8/13/2001	9:23	0	0	0	7	BIOGENIC	NO	CDM>P,BRN/BLK SANDY M,DENSE TUBES,VOID,LG QUAHOG SHELL,SHELL FRAGS,WORM@Z?
RR200SE	I	8/13/2001	9:49	0	0	0	99	INDETERMINATE	NO	UNDERPENETRATION-HARD BOTTOM, TUBES
RR200SE	J	8/13/2001	9:50	0	0	0	99	INDETERMINATE	NO	UNDERPENETRATION-HARD BOTTOM, LG CLAY CLUMPS, TUBES?
RR200SW	H	8/13/2001	9:56	0	0	0	8	PHYSICAL	NO	CDM>P, BRN/GRY&BLK SANDY M, DENSE TUBES, LG VOID, RED SED@Z, SHELL BITS, BURROW?
RR200SW	J	8/13/2001	9:57	0	0	0	8	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, VOIDS, TUBES, SHELL FRAGS, WORMS @Z
RR200SW	K	8/13/2001	9:58	0	0	0	9	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, RED SED@Z, TUBES, VOIDS, RED CLASTS
RR50NE	D	8/12/2001	14:21	0	0	0	9	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, CONDENSATION, TUBES, RED CLSTS, SM VOIDS-LWR LFT
RR50NE	E	8/12/2001	14:22	0	0	0	5	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, CONDENSATION, SM TUBES, RED CLASTS
RR50NE	F	8/12/2001	14:23	0	0	0	8	PHYSICAL	NO	CDM>P,BRN/GRY SANDY M,CONDENSATION,RED SED@SURF,LG TUBES,RED CLSTS,CLAY?,VOIDS
RR50NW	D	8/12/2001	12:39	0	0	0	7	BIOGENIC	NO	CDM>P, BRN/GRY SANDY M, DENSE TUBES, WORMS @Z
RR50NW	E	8/12/2001	12:40	0	0	0	5	PHYSICAL	NO	CDM>P, BRN SANDY M>P, RED SED @SURF, TUBES, RED CLSTS,LG WORM@Z,LG M CLUMP-FAR
RR50NW	F	8/12/2001	12:41	0	0	0	5	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M,SM TUBES,DIST SURF,RED CLSTS,VERT BURROW-OPNING,WORM@Z
RR50SE	D	8/12/2001	14:13	0	0	0	4	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, CONDENSATION, TUBES, SHELL FRAGS
RR50SE	E	8/12/2001	14:14	0	0	0	4	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, CONDENSATION, TUBES, RED SED @SURF, RED CLASTS
RR50SE	F	8/12/2001	14:15	0	0	0	99	PHYSICAL	NO	CDM>P, BRNISH GRY SANDY M>P, CONDENSATION, TUBES, RPD?
RR50SW	B	8/11/2001	16:02	0	0	0	99	PHYSICAL	NO	CDM>P, UNDERPEN-HARD BOTTOM, BRN&BLK SANDY M>P, RED SED@SURF,SHELLS, RED CLSTS
RR50SW	C	8/11/2001	16:03	0	0	0	8	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, TUBES, VOIDS, SM WORM @Z
RR50SW	G	8/13/2001	9:34	0	0	0	7	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, TUBES, VOIDS, RED SED @Z, SHELL FRAGS, WORMS @Z
RRCTR	A	8/11/2001	15:56	0	0	0	8	PHYSICAL	NO	CDM>P, BRN/GRY SANDY M, TUBES, LG VOIDS, LG RED M CLASTS, IRON OXIDE STREAKS
RRCTR	B	8/11/2001	15:57	0	0	0	9	BIOGENIC	NO	CDM>P, BRN/BLK SANDY M,TUBES,VERT BURROWS-OPNINGS,VOIDS,RED SED@Z,M CLUMPS-FAR
RRCTR	E	8/12/2001	13:37	0	0	0	4	PHYSICAL	NO	CDM>P, BRN/BLK SANDY M, CONDENSATION, TUBES, LG M CLUMP-FAR, SHELL BITS

Appendix B4
PDS Reference Area REMOTS® Sediment-Profile Imaging Data from the August 2001 Survey

Station	Replicate	Date	Time	Successional Stage	Grain Size (phi)			Mud Clasts		Camera Penetration (cm)				Dredged Material Thickness (cm)			Redox Rebound Thickness (cm)			Apparent RPD Thickness(cm)		
					Min	Max	Maj Mode	Count	Avg. Diam	Min	Max	Range	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
EREF																						
EREF1	B	8/12/2001	17:18	ST_I_ON_III	>4	3	>4	0	0	11.87	13.37	1.5	12.62	0	0	0	0	0	0	0.48	2.35	1.3
EREF1	C	8/12/2001	17:19	ST_I	>4	3	>4	0	0	13.05	14.17	1.12	13.61	0	0	0	0	0	0	0.53	2.57	1.47
EREF1	E	8/13/2001	11:57	INDET	>4	3	>4	0	0	13.37	14.17	0.8	13.77	0	0	0	0	0	0	NA	NA	NA
EREF2	C	8/12/2001	17:07	ST_I_ON_III	>4	3	>4	0	0	10.91	11.87	0.96	11.39	0	0	0	0	0	0	0.86	4.44	3.43
EREF2	D	8/12/2001	17:08	ST_I	>4	3	>4	1	1.05	7.06	8.45	1.39	7.75	0	0	0	0	0	0	0.59	2.57	1.69
EREF3	A	8/12/2001	17:11	ST_I	>4	3	>4	0	0	10.53	12.14	1.6	11.34	0	0	0	0	0	0	2.67	3.8	3.14
EREF3	B	8/12/2001	17:12	ST_I	>4	3	>4	0	0	8.82	9.3	0.48	9.06	0	0	0	0	0	0	2.35	3.8	3.15
EREF3	C	8/12/2001	17:12	ST_I	>4	3	>4	0	0	8.82	9.95	1.12	9.39	0	0	0	0	0	0	1.66	5.19	4.59
EREF5	A	8/12/2001	17:24	ST_I	>4	2	>4	0	0	1.76	2.94	1.18	2.35	0	0	0	0	0	0	NA	NA	NA
EREF5	B	8/12/2001	17:25	INDET	>4	2	>4	0	0	0.7	4.28	3.58	2.49	0	0	0	0	0	0	NA	NA	NA
EREF5	D	8/12/2001	17:27	INDET	>4	2	>4	0	0	20.91	20.91	0	20.91	0	0	0	0	0	0	NA	NA	NA
SEREF																						
SEREF1	A	8/12/2001	16:09	INDET	>4	3	>4	0	0	9.95	11.39	1.44	10.67	0	0	0	0	0	0	1.5	3.32	2.44
SEREF1	B	8/12/2001	16:12	INDET	>4	3	>4	0	0	11.34	11.98	0.64	11.66	0	0	0	0	0	0	NA	NA	NA
SEREF1	C	8/12/2001	16:13	INDET	>4	3	>4	0	0	12.83	13.48	0.64	13.16	0	0	0	0	0	0	NA	NA	NA
SEREF2	A	8/12/2001	16:26	ST_I	>4	3	>4	0	0	12.83	13.53	0.7	13.18	0	0	0	0	0	0	1.6	2.83	2.25
SEREF2	B	8/12/2001	16:26	INDET	>4	3	>4	2	0.8	12.62	12.99	0.37	12.81	0	0	0	0	0	0	NA	NA	NA
SEREF2	D	8/12/2001	16:28	INDET	>4	3	>4	0	0	10.48	12.19	1.71	11.34	0	0	0	0	0	0	NA	NA	NA
SEREF3	A	8/12/2001	16:00	ST_I_ON_III	>4	3	>4	0	0	10.32	10.91	0.59	10.61	0	0	0	0	0	0	NA	NA	NA
SEREF3	D	8/12/2001	16:02	INDET	>4	3	>4	0	0	8.45	9.47	1.02	8.96	0	0	0	0	0	0	NA	NA	NA
SEREF4	A	8/12/2001	16:18	ST_I	>4	3	>4	0	0	10.53	11.55	1.02	11.04	0	0	0	0	0	0	2.83	4.33	3.72
SEREF4	B	8/12/2001	16:19	ST_I	>4	3	>4	4	1.01	10.48	11.44	0.96	10.96	0	0	0	0	0	0	1.23	2.73	1.81
SEREF4	C	8/12/2001	16:19	ST_I	>4	3	>4	2	0.82	11.02	11.34	0.32	11.18	0	0	0	0	0	0	0.86	2.46	1.87
SREF																						
SREF2	B	8/12/2001	15:19	ST_I	>4	3	>4	0	0	4.65	5.61	0.96	5.13	0	0	0	0	0	0	0.96	3.1	2.58
SREF2	D	8/12/2001	15:21	INDET	0	-1	-1 to 0	0	0	0.05	0.05	0	0.05	0	0	0	0	0	0	NA	NA	NA
SREF5	A	8/12/2001	15:26	ST_I	>4	3	>4	2	1.02	12.83	13.26	0.43	13.05	0	0	0	0	0	0	2.41	3.32	2.96
SREF5	E	8/13/2001	11:03	ST_I	>4	3	>4	0	0	15.03	15.56	0.53	15.29	0	0	0	0	0	0	1.93	3.32	2.51
SREF5	H	8/13/2001	11:06	INDET	>4	3	>4	3	0.25	13.48	14.6	1.12	14.04	0	0	0	0	0	0	NA	NA	NA
SREF6	A	8/12/2001	15:33	INDET	>4	3	>4	3	0.63	7.54	8.72	1.18	8.13	0	0	0	0	0	0	1.87	3.58	3.2
SREF6	C	8/12/2001	15:34	ST_I	>4	3	>4	2	1.04	9.95	10.48	0.53	10.21	0	0	0	0	0	0	2.51	3.58	2.81
SREF6	D	8/12/2001	15:35	INDET	>4	3	>4	3	0.91	8.13	9.63	1.5	8.88	0	0	0	0	0	0	1.76	4.01	2.98
SREF7	B	8/12/2001	15:06	ST_I_ON_III	>4	3	>4	2	0.66	11.66	12.62	0.96	12.14	0	0	0	0	0	0	1.76	2.83	2.2
SREF7	D	8/13/2001	10:51	ST_I_ON_III	>4	3	>4	0	0	7.17	8.4	1.23	7.78	0	0	0	0	0	0	1.44	2.89	2.16
SREF8	D	8/12/2001	15:13	INDET	>4	3	>4	4	0.74	8.5	9.14	0.64	8.82	0	0	0	0	0	0	NA	NA	NA
SREF8	E	8/13/2001	10:45	INDET	>4	3	>4	2	0.49	12.62	13.16	0.53	12.89	0	0	0	0	0	0	NA	NA	NA
SREF8	G	8/13/2001	10:46	ST_I	>4	3	>4	5	0.25	9.52	10.21	0.7	9.87	0	0	0	0	0	0	2.09	2.78	2.44

Appendix B4 (continued)

Station	Replicate	Date	Time	Methane Min	Methane Max	Methane Mean	OSI	Surface Roughness	Low DO	Comments
EREF										
EREF1	B	8/12/2001	17:18	0	0	0	7	BIOGENIC	NO	AMBIENT TAN/GRY SANDY M, CONDENSATION, DENSE TUBES, SM BURROW OPENING, RED SED
EREF1	C	8/12/2001	17:19	0	0	0	3	PHYSICAL	NO	AMBIENT TAN/GRY SANDY M, DIST SURF, TUBES, SURF REWORKING?
EREF1	E	8/13/2001	11:57	0	0	0	99	BIOGENIC	NO	AMBIENT TAN SANDY M>P, CONDENSATION, DENSE TUBES, BURROW OPENING, RPD?
EREF2	C	8/12/2001	17:07	0	0	0	10	BIOGENIC	NO	AMBIENT TAN SANDY M>P, CONDENSATION, DENSE TUBES, HYDROID?, M CLUMP-FARFIELD
EREF2	D	8/12/2001	17:08	0	0	0	4	BIOGENIC	NO	AMBIENT TAN SANDY M>P, CONDENSATION, DENSE TUBES, RED CLST,BURROW OPNING?
EREF3	A	8/12/2001	17:11	0	0	0	6	PHYSICAL	NO	AMBIENT TAN SANDY M>P, CONDENSATION, DENSE TUBES, RPD DEEPER?
EREF3	B	8/12/2001	17:12	0	0	0	6	BIOGENIC	NO	AMBIENT TAN/GRY SANDY M, CONDENSATION, TUBES, BURROW OPENINGS
EREF3	C	8/12/2001	17:12	0	0	0	7	PHYSICAL	NO	AMBIENT TAN SANDY M>P, CONDENSATION, TUBES, SM BURROW OPENING, RPD TOO DEEP?
EREF5	A	8/12/2001	17:24	0	0	0	99	BIOGENIC	NO	AMBIENT BRN SANDY M>P, UNDERPEN, LG DENSE TUBES, WORM @Z?
EREF5	B	8/12/2001	17:25	0	0	0	99	INDETERMINATE	NO	AMBIENT BRN SANDY M>P, UNDERPEN, TUBES, DIST SURF, IRREG TOPO
EREF5	D	8/12/2001	17:27	0	0	0	99	INDETERMINATE	NO	AMBIENT TAN/GRY SANDY M, OVERPENETRATION, RED SED, WORM @Z
SEREF										
SEREF1	A	8/12/2001	16:09	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, TUBES
SEREF1	B	8/12/2001	16:12	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, DENSE TUBES
SEREF1	C	8/12/2001	16:13	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, TUBES, OBJECT AT SURFACE?
SEREF2	A	8/12/2001	16:26	0	0	0	4	BIOGENIC	NO	AMBIENT TAN/GRY SANDY M, OUT-OF-FOCUS, DENSE TUBES, RED SED?
SEREF2	B	8/12/2001	16:26	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, WHITE CLAY?, OX CLASTS
SEREF2	D	8/12/2001	16:28	0	0	0	99	PHYSICAL	NO	AMBIENT TAN/GRY SANDY M, OUT-OF-FOCUS, WHITE CLAY @SURF
SEREF3	A	8/12/2001	16:00	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, VOIDS, RPD DEPTH?
SEREF3	D	8/12/2001	16:02	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, RPD DEPTH?
SEREF4	A	8/12/2001	16:18	0	0	0	6	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, TUBES, M CLASTS?
SEREF4	B	8/12/2001	16:19	0	0	0	4	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, OX CLASTS
SEREF4	C	8/12/2001	16:19	0	0	0	4	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, OX&RED CLASTS, TUBES?
SREF										
SREF2	B	8/12/2001	15:19	0	0	0	5	PHYSICAL	NO	AMBIENT BRN/GRY SANDY M, OUT-OF-FOCUS, TUBES, UNDERPEN
SREF2	D	8/12/2001	15:21	0	0	0	99	INDETERMINATE	NO	UNDERPENETRATION, HARD BOTTOM, OUT-OF-FOCUS
SREF5	A	8/12/2001	15:26	0	0	0	5	PHYSICAL	NO	AMBIENT TAN/GRY SANDY M, OUT-OF-FOCUS, OX CLASTS?
SREF5	E	8/13/2001	11:03	0	0	0	5	PHYSICAL	NO	AMBIENT TAN SANDY M>P, CONDENSATION, TUBES, VOID?, RPD DEPTH?
SREF5	H	8/13/2001	11:06	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, CONDENSATION, TUBES, OX&RED CLASTS, RPD DEPTH?
SREF6	A	8/12/2001	15:33	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, TUBES, OX&RED CLASTS?
SREF6	C	8/12/2001	15:34	0	0	0	5	PHYSICAL	NO	AMBIENT TAN/GRY SANDY M, OUT-OF-FOCUS, OX CLASTS
SREF6	D	8/12/2001	15:35	0	0	0	99	PHYSICAL	NO	AMBIENT TAN/GRY SANDY M, OUT-OF-FOCUS, OX CLASTS?,TUBES,BURROW OPENING-RT?
SREF7	B	8/12/2001	15:06	0	0	0	8	PHYSICAL	NO	AMBIENT TAN/GRY SANDY M, OUT-OF-FOCUS,OX CLSTS, BURROW-OPNING?,TUBES
SREF7	D	8/13/2001	10:51	0	0	0	8	BIOGENIC	NO	AMBIENT TAN SANDY M, CONDENSATION, DENSE TUBES, VOID,FLOCK LYR?
SREF8	D	8/12/2001	15:13	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, OUT-OF-FOCUS, TUBES, OX&RED CLASTS
SREF8	E	8/13/2001	10:45	0	0	0	99	PHYSICAL	NO	AMBIENT TAN SANDY M>P, CONDENSATION, TUBES, OX CLASTS, RPD DEPTH?
SREF8	G	8/13/2001	10:46	0	0	0	5	PHYSICAL	NO	AMBIENT TAN SANDY M>P, CONDENSATION, TUBES, OX&RED CLASTS

Appendix C
January 1997 REMOTS® Data

Appendix C1

PDS 1997 REMOTS® Sediment-Profile Imaging Results Summary Over the Royal River Mound

Station	Camera Penetration Mean (cm)	Dredged Material Thickness Mean (cm)	Number of Reps w/ Dredged Material	RPD Mean (cm)	Successional Stages Present	Highest Stage Present	Grain Size Major Mode (phi)	Methane Present	OSI Mean	OSI Median	Boundary Roughness Mean (cm)
Royal River											
CTR	8.26	>8.26	3	0.87	I,III	ST_III	4 to 3	NO	6.3	6	1.73
50NE	11.23	>11.23	3	1.07	I,III	ST_I_ON_III	4 to 3	NO	5.7	7	1.55
100NE	13.62	>13.62	3	1.38	I,III	ST_I_ON_III	3 to 2	NO	6.0	7	0.99
150NE	12.43	>12.43	3	1.35	I	ST_I	3 to 2	NO	3.3	3	0.96
50SE	9.51	>9.51	3	1.44	I,III	ST_III	4 to 3	NO	4.7	4	3.42
100SE	8.91	>8.91	3	1.66	I,III	ST_I_ON_III	3 to 2	NO	5.0	4	0.96
200SE	12.37	>12.37	3	1.94	I,III	ST_III	4 to 3	NO	8.0	8	0.75
50SW	8.95	>8.95	3	1.35	I,III	ST_I_ON_III	4 to 3	NO	4.7	4	2.58
100SW	10.83	>10.83	3	1.09	I,III	ST_I_ON_III	>4	NO	4.0	3	1.90
200SW	5.69	>5.69	3	1.42	I	ST_I	3 to 2	NO	3.0	3	0.77
50NW	8.58	>8.58	3	1.58	I	ST_I	4 to 3	NO	3.7	4	1.35
100NW	12.57	>12.57	3	1.93	I,III	ST_I_ON_III	3 to 2	NO	5.3	4	1.03
200NW	16.28	>16.28	3	1.52	I,III	ST_III	>4	NO	6.0	8	1.25
AVG	10.71	>10.71	3	1.43					5.1	5	1.48
MAX	16.28	>16.28	3	1.94					8.0	8	3.42
MIN	5.69	>5.69	3	0.87					3.0	3	0.75

Appendix C2

PDS REMOTS® Sediment-Profile Imaging Data over the Royal River Mound from the 1997 Capping Survey

Station	Replicate	Date	Time	Successional Stage	Grain Size (phi)			Mud Clasts		Camera Penetration (cm)				Dredged Material Thickness (cm)			Redox Rebound Thickness (cm)			Apparent RPD Thickness (cm)		
					Min	Max	Maj Mode	Count	Avg. Diam	Min	Max	Range	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
100NE	A	1/15/1997	13:07	ST_I_ON_III	4	2	3 to 2	0	0	13.09	13.72	0.63	13.4	13.09	13.72	>13.4	0	0	0	0.47	2.15	1.12
100NE	B	1/15/1997	13:08	ST_I_ON_III	>4	2	3 to 2	0	0	12.25	13.19	0.94	12.72	12.25	13.19	>12.72	0	0	0	0.68	2.67	1.69
100NE	C	1/15/1997	13:09	ST_I	>4	1	3 to 2	3	0.39	14.03	15.45	1.41	14.74	14.03	15.45	>14.74	0	0	0	0.16	2.83	1.34
100NW	A	1/15/1997	12:21	ST_I_ON_III	4	1	3 to 2	0	0	13.3	15.08	1.78	14.19	13.3	15.08	>14.19	0	0	0	1.52	4.97	2.88
100NW	B	1/15/1997	12:22	ST_I	4	1	3 to 2	0	0	12.88	13.82	0.94	13.35	12.88	13.82	>13.35	0	0	0	0.26	2.72	1.3
100NW	C	1/15/1997	12:22	ST_I	4	2	3 to 2	0	0	10	10.37	0.37	10.18	10	10.37	>10.18	0	0	0	0.37	2.46	1.61
100SE	A	1/15/1997	12:40	ST_I	4	2	3 to 2	12	0.29	5.65	6.65	0.99	6.15	5.65	6.65	>6.15	0	0	0	0.1	1.83	1.13
100SE	B	1/15/1997	12:41	ST_I	4	1	3 to 2	0	0	10.37	11.15	0.79	10.76	10.37	11.15	>10.76	0	0	0	1.15	3.25	2
100SE	C	1/15/1997	12:42	ST_I_ON_III	4	2	3 to 2	2	0.37	9.27	10.37	1.1	9.82	9.27	10.37	>9.82	0	0	0	0.31	3.04	1.86
100SW	A	1/15/1997	12:30	ST_I_ON_III	>4	2	>4	1	0.29	12.59	13.78	1.19	13.19	12.59	13.78	>13.19	0	0	0	0.41	2.64	1.41
100SW	B	1/15/1997	12:31	ST_I	>4	3	>4	0	0	5.8	8.08	2.28	6.94	5.8	8.08	>6.94	0	0	0	0.16	1.97	0.62
100SW	C	1/15/1997	12:33	ST_I	4	2	3 to 2	8	0.32	11.24	13.47	2.23	12.36	11.24	13.47	>12.36	0	0	0	0.1	2.49	1.24
150NE	A	2/7/1997	16:47	ST_I	4	2	3 to 2	0	0	14.08	14.5	0.42	14.29	14.08	14.5	>14.29	0	0	0	0.05	2.15	1.14
150NE	B	2/7/1997	16:48	ST_I	4	2	3 to 2	0	0	14.24	15.34	1.1	14.79	14.24	15.34	>14.79	0	0	0	0.58	2.15	1.32
150NE	C	2/7/1997	16:49	ST_I	4	2	3 to 2	2	0.41	7.54	8.9	1.36	8.22	7.54	8.9	>8.22	0	0	0	0.26	2.77	1.58
200NW	A	1/15/1997	10:20	ST_I_ON_III	>4	2	4 to 3	0	0	13.87	15.6	1.73	14.74	13.87	15.6	>14.74	0	0	0	0.21	3.77	2.2
200NW	B	1/15/1997	10:20	ST_I	4	2	>4	2	0.33	17.7	18.32	0.63	18.01	17.7	18.32	>18.01	0	0	0	0.21	1.36	0.68
200NW	C	1/15/1997	10:22	ST_III	4	2	>4	0	0	15.39	16.79	1.4	16.09	15.39	16.79	>16.09	0	0	0	0.21	2.44	1.67
200SE	A	1/15/1997	10:37	ST_III	4	2	4 to 3	0	0	5.34	6.54	1.2	5.94	5.34	6.54	>5.94	0	0	0	1.78	3.56	2.72
200SE	B	1/15/1997	10:38	INDET	>4	3	4 to 3	0	0	20.37	20.37	0	20.37	20.37	20.37	>20.37	0	0	0	NA	NA	NA
200SE	C	1/15/1997	10:39	ST_I_ON_III	4	2	3 to 2	0	0	10.26	11.31	1.05	10.79	10.26	11.31	>10.79	0	0	0	0.16	2.72	1.16
200SW	A	1/15/1997	11:05	ST_I	4	2	3 to 2	15	0.37	2.57	3.56	0.99	3.06	2.57	3.56	>3.06	0	0	0	0.68	2.3	1.35
200SW	B	1/15/1997	11:06	INDET	3	2	3 to 2	8	0.28	0.52	1.2	0.68	0.86	0.52	1.2	>0.86	0	0	0	NA	NA	NA
200SW	C	1/15/1997	11:07	ST_I	>4	2	3 to 2	2	0.72	12.83	13.46	0.63	13.14	12.83	13.46	>13.14	0	0	0	0.58	2.62	1.49
50NE	A	1/15/1997	13:42	ST_I_ON_III	>4	2	4 to 3	0	0	10.26	10.63	0.37	10.45	10.26	10.63	>10.45	0	0	0	0.05	3.09	1.17
50NE	B	1/15/1997	13:42	ST_I_ON_III	4	2	4 to 3	4	1.32	10.79	13.3	2.51	12.04	10.79	13.3	>12.04	0	0	0	0.37	2.36	1.06
50NE	C	1/15/1997	13:43	ST_I	>4	2	4 to 3	0	0	10.31	12.09	1.78	11.2	10.31	12.09	>11.2	0	0	0	0.05	1.94	0.97
50NW	A	1/15/1997	13:52	ST_I	>4	2	4 to 3	5	0.22	6.91	8.38	1.47	7.64	6.91	8.38	>7.64	0	0	0	0.05	2.51	1.79
50NW	D	2/7/1997	15:43	ST_I	4	2	4 to 3	0	0	4.97	6.49	1.52	5.73	4.97	6.49	>5.73	0	0	0	0.1	2.77	1.43
50NW	E	2/7/1997	15:45	ST_I	4	2	3 to 2	0	0	11.83	12.88	1.05	12.36	11.83	12.88	>12.36	0	0	0	0.89	2.57	1.51
50SE	A	1/15/1997	13:33	ST_I	4	2	4 to 3	0	0	7.28	8.9	1.62	8.09	7.28	8.9	>8.09	0	0	0	0.05	1.94	1.4
50SE	C	1/15/1997	13:35	ST_III	>4	2	4 to 3	0	0	6.75	9.37	2.62	8.06	6.75	9.37	>8.06	0	0	0	0.26	2.51	1.4
50SE	D	2/7/1997	15:58	ST_I	>4	3	>4	0	0	9.37	15.39	6.02	12.38	9.37	15.39	>12.38	0	0	0	0.16	2.25	1.51
50SW	B	1/15/1997	14:16	ST_I_ON_III	>4	2	4 to 3	0	0	6.13	6.7	0.58	6.41	6.13	6.7	>6.41	0	0	0	0.05	2.57	1.14
50SW	D	2/7/1997	16:06	ST_I	>4	2	>4	8	0.29	8.43	13.56	5.13	10.99	8.43	13.56	>10.99	0	0	0	0.42	4.03	1.9
50SW	F	2/7/1997	16:08	ST_I	4	2	4 to 3	3	0.72	8.43	10.47	2.04	9.45	8.43	10.47	>9.45	0	0	0	0.26	2.36	1
CTR	B	1/15/1997	13:28	ST_III	>4	2	4 to 3	0	0	9.01	9.9	0.89	9.45	9.01	9.9	>9.45	0	0	0	0.05	1.73	0.69
CTR	D	2/7/1997	15:51	ST_I_ON_III	>4	3	4 to 3	0	0	7.64	10.68	3.04	9.16	7.64	10.68	>9.16	0	0	0	0.1	2.46	1.48
CTR	E	2/7/1997	15:52	ST_I_ON_III	4	2	4 to 3	0	0	5.55	6.81	1.26	6.18	5.55	6.81	>6.18	0	0	0	0.1	0.94	0.45

Appendix C2 (continued)

Station	Replicate	Date	Time	Methane Min	Methane Max	Methane Mean	OSI	Surface Roughness	Low DO	Comments
100NE	A	1/15/1997	13:07	0	0	0	7	PHYSICAL	NO	CDM>P, BLK SILT/BRN SAND, DM LYRING,THIN RPD,TUBES,VOIDS,PLANT MATERIAL,WORMS@Z
100NE	B	1/15/1997	13:08	0	0	0	8	PHYSICAL	NO	CDM>P, BRN SAND/BLK SILT,SED LYRS, TUBES, VOIDS, SM WORMS@Z
100NE	C	1/15/1997	13:09	0	0	0	3	BIOGENIC	NO	CDM>P,BLK/BRN SAND, SED LYRS, BURROW-OPENING,TUBES,RED CLSTS,WORMS @Z,RED SED
100NW	A	1/15/1997	12:21	0	0	0	9	PHYSICAL	NO	CDM>P, TAN/BLK&BRN SAND, DM LYR,RELIC RPD,VOIDS,TUBES,PLANT MAT.@Z,DEBRIS-FAR
100NW	B	1/15/1997	12:22	0	0	0	3	PHYSICAL	NO	CDM>P, TAN/BLK/BRN SAND, DM LYRS, RELIC RPD, GRY CLAY CHIPS
100NW	C	1/15/1997	12:22	0	0	0	4	PHYSICAL	NO	CDM>P, TAN/BLK&BRN SAND&CLAY, SM TUBES,BURROW,DEBRIS-FAR,SM WORMS@Z,WOOD@SURF
100SE	A	1/15/1997	12:40	0	0	0	3	PHYSICAL	NO	CDM>P, TAN/BLK&GRY SAND, RED CLSTS-LYR FAR, SHELLS, WORMS@Z
100SE	B	1/15/1997	12:41	0	0	0	4	PHYSICAL	NO	CDM>P,TAN/BLK&GRY MOTTLED SAND&CLAY, BURROWS,SM TUBES?,STICK-FAR,WORMS@Z
100SE	C	1/15/1997	12:42	0	0	0	8	PHYSICAL	NO	CDM>P, TAN/BLK&GRY MOTTLED SAND&CLAY, FLOCK LYR, TUBES,VOIDS,RED CLSTS,WORMS@Z
100SW	A	1/15/1997	12:30	0	0	0	7	BIOGENIC	NO	CDM>P, TAN SAND/BLK SILT&CLAY, BURROW-OPNING, TUBES, VOID,WOOD MAT.,RED CLST
100SW	B	1/15/1997	12:31	0	0	0	2	PHYSICAL	NO	CDM?, BLK SILT &CLAY, THIN RPD, LOW DO?, LG M CLUMP-FAR, ANEMOME, BURROW
100SW	C	1/15/1997	12:33	0	0	0	3	PHYSICAL	NO	CDM>P, TAN/BLK&BRN SAND&SILT, TUBES, PLANT MATERIAL,BURROW-OPNING,RED CLSTS
150NE	A	2/7/1997	16:47	0	0	0	3	PHYSICAL	NO	CDM>P, TAN/GRY SAND,SED LYRS=M/S/M, PLANT FRAGS,TUBES,RED SED@Z,ORG=ANENOME?
150NE	B	2/7/1997	16:48	0	0	0	3	PHYSICAL	NO	CDM>P, TAN&GRY SAND, SED LYRS=M/S/M, WIPR CLSTS,RELIC RPD,SHELL BITS,SM TUBES
150NE	C	2/7/1997	16:49	0	0	0	4	PHYSICAL	NO	CDM>P, TAN&GRY SAND, WIP CLSTS, WORMS @Z, SHELL BITS,RED CLSTS
200NW	A	1/15/1997	10:20	0	0	0	8	PHYSICAL	NO	CDM>P, TAN SAND/BLK/GRY SILT&CLAY=DM LAYERS, RELIC RPD, TUBES, VOID
200NW	B	1/15/1997	10:20	0	0	0	2	PHYSICAL	NO	CDM>P, BLK/GRY/BRN SANDY SILT, DM LYRS, RELIC RPD, TUBES, SHALLOW RPD, SHELL
200NW	C	1/15/1997	10:22	0	0	0	8	PHYSICAL	NO	CDM>P,TAN SAND/BLK&GRY SILT&CLAY,SED LYR-RELIC RPD,VOIDS,AMP STALK,BURROW,SHELL
200SE	A	1/15/1997	10:37	0	0	0	9	BIOGENIC	NO	CDM>P, TAN/BLK SAND&SILT, BURROW-OPENINGS, VOIDS
200SE	B	1/15/1997	10:38	0	0	0	99	INDETERMINATE	NO	CDM>P, OVERPEN, BLK SANDY SILT, LOW DO?, VOIDS
200SE	C	1/15/1997	10:39	0	0	0	7	PHYSICAL	NO	CDM>P, TAN/BLK&GRY SAND& CLAY, VOIDS, SHELL BITS, RED SED @SURF, WORMS@Z
200SW	A	1/15/1997	11:05	0	0	0	3	PHYSICAL	NO	CDM>P, BRN&GRY FINE SAND, TUBES, OX&RED CLSTS, UNDERPEN, PLANT FRAGS, SHELL
200SW	B	1/15/1997	11:06	0	0	0	99	PHYSICAL	NO	CDM>P, TAN&GRY SAND, UNDERPEN, SHELL, RED CLSTS, CLAY CHIP
200SW	C	1/15/1997	11:07	0	0	0	3	PHYSICAL	NO	CDM>P, TAN&GRY SAND/GRY CLAY, SED LYR=S/M, WIP CLST, ANENOME, PLANT MATERIAL
50NE	A	1/15/1997	13:42	0	0	0	7	PHYSICAL	NO	CDM>P, TAN/BLK&GRY SANDY M &CLAY, VOIDS, BURROW,SM TUBES,CHAET TUBE?,WORM@Z
50NE	B	1/15/1997	13:42	0	0	0	7	PHYSICAL	NO	CDM>P, TAN/BLK&GRY SANDY M, CLAY @Z, RED&WIPR CLSTS,SM TUBES,VOIDS,WORMS@Z
50NE	C	1/15/1997	13:43	0	0	0	3	PHYSICAL	NO	CDM>P, BLK SANDY SILT,WIP CLAST, RED SED, SM TUBES, SHALLOW RPD
50NW	A	1/15/1997	13:52	0	0	0	4	PHYSICAL	NO	CDM>P, TAN SAND/BLK&GRY MOTTLED SILT&CLAY, RED CLSTS, WHT CLAY@Z
50NW	D	2/7/1997	15:43	0	0	0	3	PHYSICAL	NO	CDM>P,TAN/BLK&GRY F SAND,BURROW-OPNING,FLOCK LYR,STICK,SHELLS,M CLSTS-FAR
50NW	E	2/7/1997	15:45	0	0	0	4	PHYSICAL	NO	CDM>P,TAN/BLK/BRN SAND=SED LYRS,RELIC RPD, PLANT MATERIAL @Z, WORM@Z
50SE	A	1/15/1997	13:33	0	0	0	3	BIOGENIC	NO	CDM>P, TAN/BLK&BRN SAND, LG BURROW-OPENING, SHELL BITS,RED SED
50SE	C	1/15/1997	13:35	0	0	0	7	PHYSICAL	NO	CDM>P, TAN SAND/BLK&GRY SILT&CLAY, VOIDS, M CLUMP-FAR,BURROW
50SE	D	2/7/1997	15:58	0	0	0	4	PHYSICAL	NO	CDM>P, TAN/BLK SANDY SILT, IRREG TOPO-SLOPING, TUBES, ORG DETRITUS
50SW	B	1/15/1997	14:16	0	0	0	7	PHYSICAL	NO	CDM>P, TAN/BLK&GRY MOTTLED SANDY M W/CLAY, VOIDS, TUBES,RED SED@Z,PLANT FRAGS
50SW	D	2/7/1997	16:06	0	0	0	4	PHYSICAL	NO	CDM>P, TAN/BLK SANDY SILT, SLOPING TOPO, RED SED, OX&RED CLSTS,ORG@Z?
50SW	F	2/7/1997	16:08	0	0	0	3	PHYSICAL	NO	CDM>P, BLK&TAN MOTTLED SAND&CLAY, WOOD?, RED CLSTS, PATCHY RPD
CTR	B	1/15/1997	13:28	0	0	0	6	PHYSICAL	NO	CDM>P, TAN/BLK&GRY SANDY SILT, WIPR CLSTS,VOIDS,BURROW,PLANT MATERIAL
CTR	D	2/7/1997	15:51	0	0	0	7	PHYSICAL	NO	CDM>P, TAN&BLK SANDY M, SLOPING TOPO, TUBES, VOIDS, RED SED @Z
CTR	E	2/7/1997	15:52	0	0	0	6	PHYSICAL	NO	CDM>P, BLK&BRN SANDY M, RED SED@SURF=WIP CLST, VOIDS, HYDROID

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