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Central Long Island Sound
Disposal Site
July 1996

Disposal Area Monitoring System DAMOS

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13. ABSTRACT

A monitoring survey was conducted at the Central Long Island Sound Disposal Site (CLIS) from 10 to 15 July 1996 as part of the Disposal Area Monitoring System (DAMOS) Program. Field operations were concentrated over the new CLIS 1995 disposal mound, as well as the historic New Haven 1993 (NHAV 93), CLIS 1994 (CLIS 94), and Mill-Quinnipiac River (MQR) mounds. The July 1996 field effort consisted of precision bathymetric and Remote Ecological Monitoring of the Seafloor (REMOTS®) surveys. These surveying techniques were employed to monitor the development of CLIS 95, as well as the stability, consolidation rates, and benthic recolonization of CLIS 94, NHAV 93, and MQR capped mounds.

The CLIS 95 mound is the newest bottom feature at the disposal site and is an example of a small, capped, dredged material disposal mound. An estimated barge volume of 16,300 m^3 of unacceptably contaminated dredged material (UDM) was deposited buoy, forming a small mound. The UDM deposit was then completely covered with 50,100 m^3 of capping dredged material (CDM).

The results of the July 1996 field effort indicate the formation of a small, but distinct, bottom feature on the CLIS seafloor. This sediment mound was found to be 3.75 m high at the apex and approximately 200 m in diameter. REMOTS® photographs documented deep Redox Potential Discontinuity (RPD) depths, mature benthic infaunal populations, and high Organism-Sediment Index (OSI) values, indicating rapid recolonization of these sediments.

The CLIS 94 mound, developed during the 1994-95 disposal season, is also an example of a capped mound. Approximately 129,000 m^3 of UDM and 161,000 m^3 of CDM were placed to form an irregular-shaped, moderate-sized disposal mound. A 0.25 m to 0.5 m decrease in mound height was discovered at the mound apex, while smaller cells of consolidation were detected over the broader southern region of the mound. The five REMOTS® stations occupied over the center of CLIS 94 displayed some improvement relative to the conditions found during the September 1995 survey. The NHAV 93 mound was developed during the 1993-94 disposal season as part of a large scale confined aquatic disposal (CAD) project. In 1993, approximately 590,000 m^3 of UDM dredged from the inner New Haven Harbor was deposited within the containment cell and capped to a thickness of 0.5 m to 1.0 m by 569,000 m^3 of CDM.

A total of eight bathymetric and five REMOTS® sediment-profile photography surveys have been conducted over the NHAV 93 mound since September 1993. At 2.5 years after the completion of capping operations, the July 1996 survey has shown 0.25 m to 0.75 m of consolidation over the majority of the mound with little change in size or shape. The results of the REMOTS® sediment-profile photography survey indicate the benthic community is continuing to recover as expected.

The MQR mound is a historic bottom feature formed along the southern boundary of CLIS. This capped sediment mound is actually composed of alternating layers of UDM and CDM deposited during the 1981-82, 1982-83, and 1993-94 disposal seasons. Approximately 65,000 m^3 of additional CDM was deposited over the MQR mound during

operational success of the 1979 capping project, many capped mounds have been developed over the CLIS seafloor.

Science Applications International Corporation (SAIC) conducted a monitoring survey at CLIS from 10 to 15 July 1996 as part of the DAMOS Program. The field efforts were concentrated over the newly completed CLIS 1995 mound, as well as three historic capped mounds, CLIS 1994 (CLIS 94), New Haven 1993 (NHAV 93), and Mill-Quinnipiac River (MQR). The July 1996 field operations consisted of precision bathymetric and Remote Ecological Monitoring of the Seafloor (REMOTS®) surveys.

1.2 CLIS 95

The CLIS 95 mound is the newest bottom feature at the disposal site and is an example of a small, capped mound. In September 1995, the CDA buoy was deployed at 41°08.660' N, 72°53.042' W (NAD 27) approximately 450 m southwest of the historic NHAV 74 mound apex (Figure 1-3). An estimated barge volume of 16,300 m^3 of UDM dredged from Milford and Bridgeport Harbors was deposited in close proximity to the CDA 95 buoy, forming a small mound.

Capping operations commenced on 30 October 1995 and continued through 4 March 1996. A total of 50,100 m^3 of CDM generated from dredging projects in the West River and Bridgeport Harbor was used to completely isolate the UDM deposit. The end result was a small, stable, completely capped mound yielding a CDM to UDM ratio of 3.1:1.0.

1.3 CLIS 94

The CLIS 94 mound is another capped mound developed on the CLIS seafloor during the 1994-95 disposal season. A disposal buoy (CDA 94) was positioned in close proximity to the small, historic CS-90-1 mound and received approximately 129,000 m^3 of UDM dredged from Norwalk and New Haven Harbors. The UDM deposit was then capped with a total of 161,000 m^3 of CDM from West River, Stony Creek, and Pine Orchard Marine Terminal. The resulting bottom feature was found to be an irregular-shaped, moderate-sized disposal mound, 630 m northeast of the historic NHAV 93 mound apex (Figure 1-3; Morris 1997). Furthermore, the sediments forming the CLIS 94 mound completely enveloped the historic CS-90-1 mound.

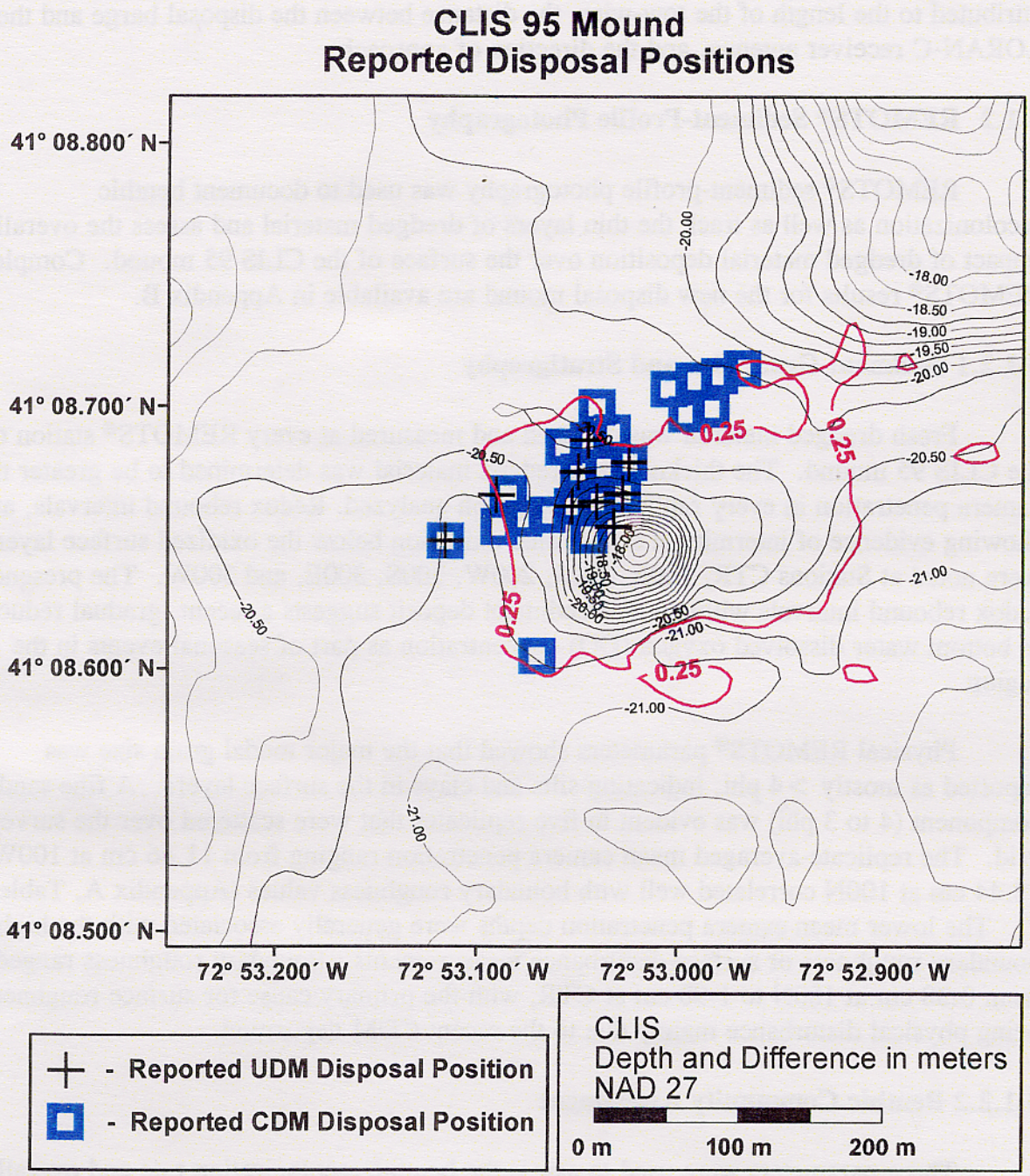


Figure 3-5. Distribution of reported barge release positions (UDM and CDM) over the detectable margins of the CLIS 95 mound

attributed to the length of the tow-wire, the distance between the disposal barge and the LORAN-C receiver antenna, and the direction of approach.

3.1.2 REMOTS® Sediment-Profile Photography

REMOTS® sediment-profile photography was used to document benthic recolonization as well as track the thin layers of dredged material and assess the overall impact of dredged material deposition over the surface of the CLIS 95 mound. Complete REMOTS® results for the new disposal mound are available in Appendix B.

3.1.2.1 Sediment Grain Size and Stratigraphy

Fresh dredged material was detected and measured at every REMOTS® station over the CLIS 95 mound. The thickness of dredged material was determined to be greater than camera penetration in every replicate photograph analyzed. Redox rebound intervals, areas showing evidence of intermittent or seasonal oxidation below the oxidized surface layer, were noted at Stations CTR, 100E, 200S, 200W, 300S, 300E, and 300W. The presence of redox rebound intervals within a new sediment deposit suggests a recent, gradual reduction in bottom water dissolved oxygen (DO) concentration as part of seasonal events in the region.

Physical REMOTS® parameters showed that the major modal grain size was reported as mostly >4 phi, indicating silts and clays in the surface layers. A fine sand component (4 to 3 phi) was evident in five replicates that were scattered over the survey grid. The replicate-averaged mean camera penetration ranging from 11.46 cm at 100W to 18.44 cm at 100N correlated well with boundary roughness values (Appendix A, Table 3-1). The lower mean camera penetration depths were generally associated with the higher boundary roughness or surface disturbance measurements. Boundary roughness ranged from 0.38 cm at 100N to 1.98 cm at CTR, with the primary cause for surface roughness being physical disturbance mainly due to the recent CDM deposition.

3.1.2.2 Benthic Community Assessment

Three parameters were used to assess the benthic recolonization rate and overall health of the project mounds relative to the CLIS reference areas. The apparent Redox Potential Discontinuity (RPD) depth, infaunal successional status, and the Organism-Sediment Index (OSI) were mapped on station location plots to outline the biological conditions at each station.

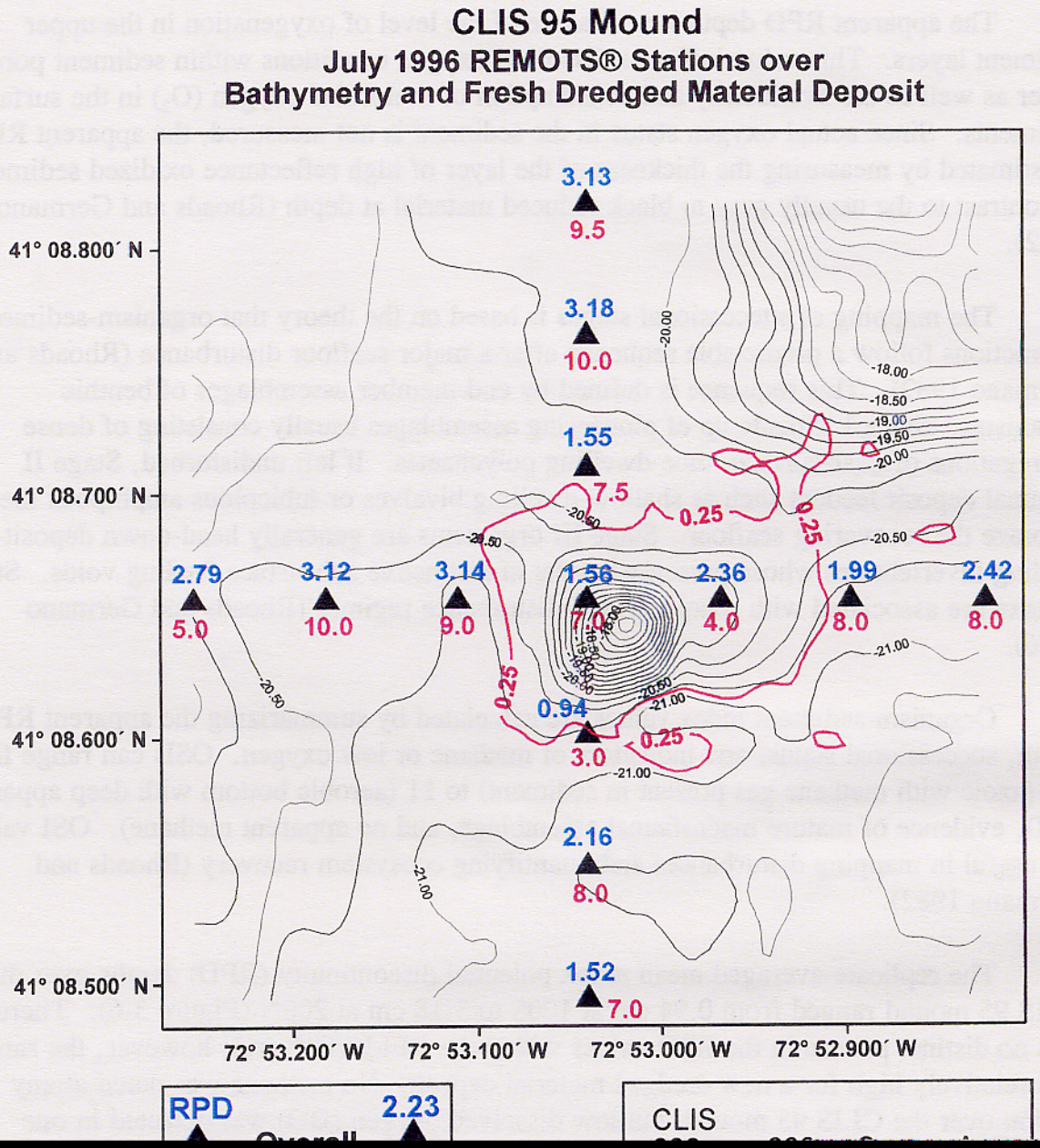
The apparent RPD depth is a measure of the level of oxygenation in the upper sediment layers. This value indicates dissolved oxygen conditions within sediment pore water as well as the availability and consumption of molecular oxygen (O_2) in the surface sediments. Since actual oxygen status in the sediment is not measured, the apparent RPD is estimated by measuring the thickness of the layer of high reflectance oxidized sediments in contrast to the usually gray to black reduced material at depth (Rhoads and Germano 1982).

The mapping of successional stages is based on the theory that organism-sediment interactions follow a predictable sequence after a major seafloor disturbance (Rhoads and Germano 1982). This sequence is defined by end-member assemblages of benthic organisms. Stage I is made up of pioneering assemblages usually consisting of dense aggregations of near-surface, tube-dwelling polychaetes. If left undisturbed, Stage II infaunal deposit feeders such as shallow-dwelling bivalves or tubicolous amphipods then colonize the recovering seafloor. Stage III organisms are generally head-down deposit-feeding invertebrates whose presence results in distinctive subsurface feeding voids. Stage III taxa are associated with relatively low-disturbance regimes (Rhoads and Germano 1986).

Organism-sediment index values are calculated by summarizing the apparent RPD depth, successional status, and indicators of methane or low oxygen. OSIs can range from -10 (azoic with methane gas present in sediment) to 11 (aerobic bottom with deep apparent RPD, evidence of mature macrofaunal assemblage, and no apparent methane). OSI values are useful in mapping disturbances and quantifying ecosystem recovery (Rhoads and Germano 1982).

The replicate-averaged mean redox potential discontinuity (RPD) depths over the CLIS 95 mound ranged from 0.94 cm at 100S to 3.18 cm at 200N (Figure 3-6). There was no distinct pattern in the RPD values within the REMOTS® grid; however, the range was relatively high for a new dredged material deposit. No methane was noted at any station over the CLIS 95 mound, but low dissolved oxygen (DO) was detected in one replicate of Station 100S, effecting the OSI value for that station.

With the exception of 100S, median OSI values were higher than expected for a sediment mound at five months postdisposal, ranging from 3.0 to 10.0 (Figure 3-6). Deep RPD depths and a mature benthic assemblage were the reasons for the elevated OSI values. The successional stage status of CLIS 95 was quite advanced for an area recovering from a recent benthic disturbance. Stage III activity was detected at every station over the CLIS 95 mound with most replicates being classified as Stage I on III. One replicate over Station 300W failed to show evidence of Stage III organisms in the surface or subsurface


CLIS 95 Mound
July 1996 REMOTS® Stations over
Bathymetry and Fresh Dredged Material Deposit
41° 08.800´ N
41° 08.700´ N
41° 08.600´ N
41° 08.500´ N
72° 53.200´ W
72° 53.100´ W
72° 53.000´ W
72° 52.900´ W
3.13
9.5
3.18
10.0
1.55
7.5
2.79
5.0
3.12
10.0
3.14
9.0
1.56
7.0
2.36
4.0
1.99
8.0
2.42
8.0
0.94
3.0
2.16
8.0
1.52
7.0
0.25
-20.00
-18.00
-18.50
-19.00
-19.50
-20.00
-20.50
-21.00
RPD
2.23
CLIS

A ring of dark, anoxic silts and clay surrounding a large, partially collapsed macrofaunal burrow surrounded by a chaotic fabric of oxidized and reduced sediments could also suggest a biological origin. The excavator or inhabitant of this burrow may have used this chamber to stockpile organic debris (food, waste material, etc.) which is now in the process of autolysis and decay. The aerobic microbes that expedite the decomposition and breakdown of organic material may be exhausting the limited supply of oxygen within the surrounding sediments causing the development of a pocket of anoxia.

The isolated nature of this disturbance and the presence of mixed layers of sediment within the photograph fails to provide strong evidence that would support one specific cause. As a result, a more detailed investigation of the area surrounding STA 9 is recommended. Additional REMOTS® photographs should be collected in close proximity to 41° 08.100′ N, 72° 50.112′ W (NAD 27) during the 1997 monitoring activity in an attempt to better characterize these sediments.

Another instance of disturbance within a CLIS reference area was detected in July 1994 as several REMOTS® photographs obtained from 2500W found evidence of heavy trawling activity (Morris and Tufts 1997). The action of a trawl net and chain sweep across the bottom had scoured the oxidized surface sediment layer and displaced all surface and shallow-dwelling organisms (Figure 4-5A). The resulting high boundary roughness values and chaotic surficial sediment layers made many of the replicate photographs invalid for comparison with the CLIS project mound data for the 1994 survey. However, the area recovered from the disturbance as expected and was utilized for comparisons with the disposal mound photographs in 1995 and 1996 (Figure 4-5B). The same outcome is predicted for the limited benthic disturbance detected at CLIS-REF in July 1996.

4.4 Disposal Site Management, Mound Stabilization, and Consolidation

The results of the bathymetric surveying activity performed at CLIS in 1994, 1995, and 1996 have indicated that the dredged material management strategy adopted in 1984 has been successful. For the past twelve years, disposal activity at CLIS has been controlled to achieve the construction of artificial containment cells on a relatively flat bottom. The ring of mounds formed by smaller disposal projects from 1984 through 1992 continues to maintain its integrity and support the central dredged material deposit.

The development of the CLIS 95 mound in close proximity to the NHAV 74 mound represents the continuation of the successful management strategy demonstrated with the construction of the NHAV 93 mound (Morris et al. 1996). Deposition of additional

Central Long Island Sound Disposal Site Reference Areas

Disturbed Surface Layer
No Apparent RPD

July 1994
2500W Station 3

A

Stage III Feeding Void
Mature Stage I Polychaete Worm Tubes

July 1996
2500W Station 2

B

Figure 4-5. REMOTS® photographs comparing the benthic conditions at, and displaying recovery over, Reference Area 2500W

volumes of dredged material to the northwest of CLIS 95 will provide a large lateral containment cell that utilizes the historic NHAV 74, SP, and NORWALK mounds as well as the southeastern ridge of NHAV 93 (Figure 4-6). The CLIS 94 mound to the northeast of the NHAV 93 mound complex begins to close another basin at CLIS that will utilize the slopes of STNH-N, NHAV 74, SP, and CLIS 91 (Figure 4-6). Future disposal activity should be directed to a point northeast of the NHAV 74 mound to complete that containment cell.

The wealth of time series data collected over the NHAV 93 and CLIS 94 mounds has provided significant insight into the process of disposal mound consolidation at CLIS. After a period of rapid settlement documented by the multiple bathymetric and REMOTS® sediment-profile photography surveys conducted during the 1993-94 disposal season, changes in the NHAV 93 mound morphology appear to have slowed (Morris et al. 1996). At 2.5 years after the completion of capping operations, precision bathymetry documents the continued, slow consolidation of the NHAV 93 mound on the CLIS seafloor, with a maximum loss in height of 0.5 to 0.75 m. These results concur with the technical studies performed in the late-1980s by the US Army Corps of Engineers, Waterways Experiment Station (WES), as well as the geotechnical analysis of sediments deposited at various capped mounds at CLIS for the DAMOS Program (Poindexter-Rollings 1990; Silva et al. 1994).

The findings of the September 1995 and July 1996 surveys suggest the behavior of the CLIS 94 mound appears to be following the same pattern. A period of rapid consolidation during the deposition of CDM was documented through the use of repetitive bathymetric surveys of this bottom feature (Morris 1997). The moderate consolidation represented in Figure 3-10 is expected to continue at a slow rate for the next five to ten years with little change in overall width or shape. Continued bathymetric monitoring of this capped mound is not a necessity; however, occasional monitoring will provide additional insight into the longer term behavior of silt/clay disposal mounds.

Repetitive bathymetric surveys over established disposal mounds are the primary tool used to quantify settlement by measuring apparent loss in mound height. The images obtained from the REMOTS® surveys are also helpful in consolidation studies by ruling out reduction in mound height due to erosion of the surficial sediment layers. The displacement of both ambient and deposited sediments can be generated by particle resuspension due to passage of storm events, or through transport by tidally derived bottom currents passing over dredged material deposits. The occurrence and severity of an erosional event can be documented by observing distinct changes in physical appearance within the top 20 cm of the sediment. Significant coarsening of sediment grains within the top 5 cm of the benthos (winnowing), high boundary roughness values (≥3.0 cm; scour),

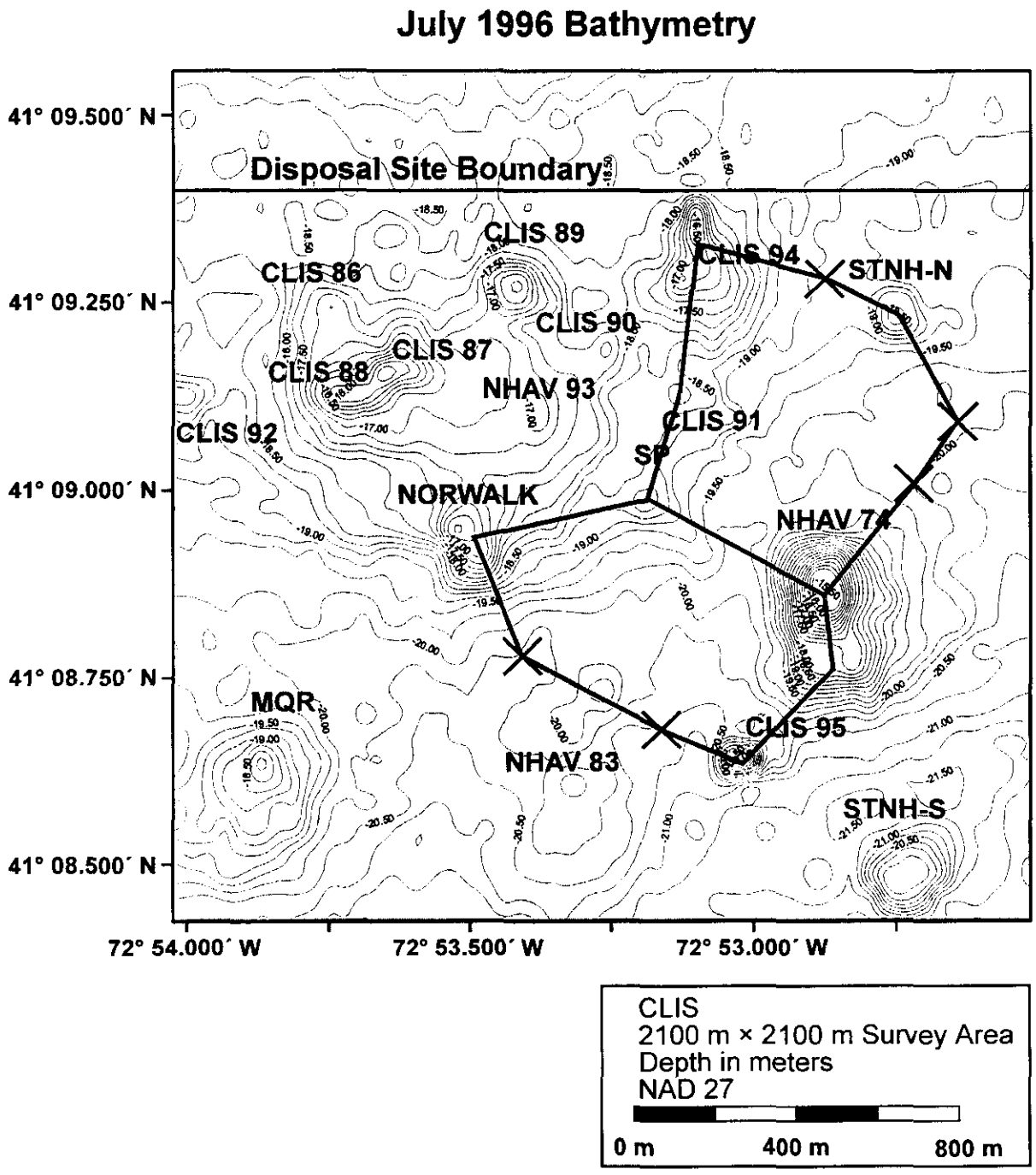


Figure 4-6. Bathymetric chart of the July 1996 2100 m × 2100 m survey area overlaid with suggested points for future disposal, 0.25 m contour interval

presence of a distinct nepheloid layer, or total absence of an RPD, are indications of possible sediment resuspension or erosion.

The depositional nature of the central Long Island Sound region provides adequate containment of the dredged material deposited within the confines of CLIS. The low current regime and restricted fetch associated with the central basin of Long Island Sound minimize the risk of storm waves and tidal flow transporting dredged material outside the disposal site boundaries. No sediment-profile photographs collected over the CLIS disposal mounds have detected conditions indicative of dredged material loss or movement within the past 11 years.

In the fall of 1985, evidence of moderate disposal mound erosion was documented at CLIS after the passage of Hurricane Gloria. REMOTS® images collected from six CLIS disposal mounds (CS-1, CS-2, FVP, MQR, STNH-N, and STNH-S) found small to moderate changes in replicate-averaged boundary roughness, RPD, and OSI values relative to the pre-storm, annual monitoring survey (Parker and Revelas 1989). However, the physical effects of the storm-induced currents and waves were restricted to the top 5 cm of sediment, and directly related to sediment shear strength, a function of composition and age of the deposit. As expected, mound centers displayed the most evidence of material movement, but it was concluded that all capping layers remained intact.

The NHAV 93 and CLIS 94 disposal mounds have been exposed to several strong storm events during the past several years. These storms typically generate current velocities and waves that surpass monthly averages, but tend to fall below the intensities caused by passage of a hurricane. Although fluctuations in RPD depth and OSI values related to SOD and hypoxia have been observed, neither disposal mound has displayed signs of erosion in the surficial sediment layers. Low boundary roughness values and the presence of silt and clay at the sediment-water interface reinforce the conclusion that the apparent loss in mound height over these mounds is directly attributable to consolidation of the dredged material deposit.

5.0 CONCLUSIONS

As the most active disposal site in New England, CLIS has been closely monitored since 1979. The July 1996 survey over CLIS was performed to delineate the areal extent and initial colonization of the disposal mound formed during the 1995-96 disposal season. In addition, monitoring of the CLIS 94, NHAV 93, and MQR mounds was conducted to document disposal mound consolidation and continued benthic habitat recovery.

The CLIS 95 mound is the newest bottom feature at the disposal site and is an example of a small, capped dredged material disposal mound. An estimated barge volume of 16,300 m^3 of UDM followed by 50,100 m^3 of CDM yielded a small, but distinct, bottom feature on the CLIS seafloor 3.75 m high and approximately 200 m in diameter, with a CDM to UDM ratio of 3.1:1.0. No bathymetric data documenting the interim stages of development were available. However, the compact nature of the deposit, the reported barge release positions, the CDM to UDM ratio, and the results of the benthic recolonization survey over CLIS 95 suggest the UDM deposit has been completely capped. Continued monitoring of the CLIS 95 mound is not a necessity, but the collection of bathymetric data over the next one to two years will add to our understanding of long-term consolidation patterns within capped dredged material disposal mounds.

The benthic conditions, as characterized by REMOTS® sediment-profile photography, indicate rapid benthic community recovery over the surface of the CLIS 95 mound. The OSI values calculated for the CLIS 95 mound met or exceeded that of the reference areas, facilitated by a higher organic content within the newly deposited sediments. Periodic monitoring of the infaunal community occupying the surface sediments of the CLIS 95 mound is recommended for the next several years to ensure that a decline in benthic conditions does not occur.

The continuing REMOTS® benthic community assessment for the centers of CLIS 94 and NHAV 93 indicates significant improvement over the majority of historic disposal mounds. However, some reduction in the quality of the benthic environment was detected at several stations, relative to the September 1995 survey. Stations 100N and 100S over CLIS 94 and Station 200N over NHAV 93 displayed lower OSI values in comparison to 1995 results, as well as indications of a low DO environment despite higher dissolved oxygen concentrations in the central Long Island Sound region. The decline in habitat quality at these stations may be attributed to high SOD rather than a hypoxic event in the overlying water. Barring a dramatic disturbance, complete benthic recovery should be achieved within the next few years as continued chemical oxidation and increased biological activity dissipate the organic load within the sediment deposits. Monitoring of

the benthic environment over the CLIS 94 and NHAV 93 mounds should continue for the next one to two years.

The bathymetric data collected over the CLIS 94, NHAV 93, and MQR mounds during the July 1996 field operations adds to the comprehensive time-series data set currently in existence for CLIS. Comparisons to earlier stages of development for the capped mounds find small to moderate pockets of consolidation over the surfaces of the three bottom features, suggesting the long-term behavior patterns are in agreement with the results of previous consolidation studies (Poindexter-Rollings 1990; Silva et al. 1994). All three mounds are expected to consolidate slowly over the next five to ten years as gradual pore water extrusion and compression of the underlying ambient material are driven by the weight of the dredged material deposits. It is recommended that bathymetric data be collected over the NHAV 93 mound on an every other year basis for the next five to ten years as the disposal mound fully consolidates to enhance our understanding of the physical processes and effects of consolidation within large sediment deposits.

Results from the July 1996 REMOTS® sediment-profile photography survey indicate that all three reference areas exhibited healthy benthic conditions as demonstrated by deep RPDs and mature benthic assemblages, yielding relatively high reference OSI values. However, one replicate photograph collected at STA 9, within a 300m of the center of CLIS-REF, exhibited an anomalous pocket of low reflectance material within a chaotic sediment fabric. Benthic disturbances that display these characteristics are often related to the deposition of non-ambient sediments, but are usually more widespread. The presence of a large macrofaunal burrow structure and the localized nature of this disturbance may suggest another origin. A detailed investigation of the seafloor surrounding STA 9 is recommended during the 1997 environmental monitoring effort at CLIS to better characterize these sediments.

Past DAMOS monitoring activity at the Long Island Sound disposal sites was performed in mid-summer (late July to August) to allow an increase in bottom water temperatures to increase bioturbational activity and promote benthic community recovery after the conclusion of the disposal season. This practice tended to promote the completion of community assessment activities during a period of seasonal hypoxia or near-hypoxia ($5.0\ mg \cdot l^{-1}$ to $3.0\ mg \cdot l^{-1}$), skewing the entire data set. Comparisons between the July 1996 benthic community assessment survey and previous data sets suggest that the improvement in benthic health is attributed to conducting community assessment survey operations in mid-July. The timing of 1996 survey activity at CLIS was successful in avoiding the recurring seasonal hypoxia in the central Long Island Sound region. As a result, the data collected during this survey did not exhibit the profoundly negative effects associated with the lower bottom water DO concentrations. The continued practice of conducting benthic

community assessment activities at CLIS and other Long Island Sound disposal sites between 30 June and 15 July should provide a more realistic perspective into the condition of the benthic environment.

6.0 REFERENCES

Cole, M. S. 1998. Monitoring cruise at the Central Long Island Sound Disposal Site, September 1997. Draft report submitted to US Army Corps of Engineers, New England District, Waltham, MA.

Fredette, T. J. 1994. Disposal site capping management: New Haven Harbor. Reprinted from Dredging '94, Proceedings of the Second International Conference, November 13-16, 1994. US Army Corps of Engineers, New England Division, Waltham, MA.

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). US Army Corps of Engineers, New England Division, Waltham, MA.

Long Island Sound Study (LISS). 1990. Status report and interim actions for hypoxia management. US Environmental Protection Agency, Region I, Boston, MA and Region II, New York, NY.

Morris, J. T. 1996. DAMOS site management plans. SAIC Report No. 365. US Army Corps of Engineers, New England Division, Waltham, MA.

Morris, J. T. 1997. Monitoring cruise at the Central Long Island Sound Disposal Site, September 1995. DAMOS Contribution No. 118 (SAIC Report No. 373). US Army Corps of Engineers, New England District, Waltham, MA.

Morris, J. T.; Tufts, G. J. 1997. Monitoring cruise at the Central Long Island Sound Disposal Site, July 1994. DAMOS Contribution No. 117 (SAIC Report No. 327). Final report submitted to the US Army Corps of Engineers, New England District, Waltham, MA.

Morris, J. T.; Charles, J.; Inglin, D. 1996. Monitoring surveys of the New Haven capping project, 1993-1994. DAMOS Contribution No. 111 (SAIC Report No. 319). US Army Corps of Engineers, New England Division, Waltham, MA.

Murray, P. M. 1996. Recolonization of the Mill-Quinnipiac River disposal mound (MQR): Results of a REMOTS® survey, August 1992. DAMOS Contribution No. 104 (SAIC Report No. C107). US Army Corps of Engineers, New England Division, Waltham, MA.

Murray, P. M.; Selvitelli, P. 1996. DAMOS navigation and bathymetry standard operating procedures. SAIC Report No. 290. US Army Corps of Engineers, New England Division, Waltham, MA.

NOAA. 1991. Second summary of data on chemical contaminants in sediments from the National Status and Trends Program. National Oceanographic and Atmospheric Administration Tech. Mem. NOS OMA 59. Rockville, MD.

Parker, J. H.; Revelas, E. C. 1989. 1985 Monitoring surveys at the Central Long Island Sound Disposal Site: An assessment of impacts from disposal and Hurricane Gloria. DAMOS Contribution No. 57 (SAIC Report No. SAIC-87/751 & C57). US Army Corps of Engineers, New England Division, Waltham, MA.

Poindexter-Rollings, M. E. 1990. Methodology for analysis of subaqueous sediment mounds. Tech. Report D-90-2. US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

Rhoads, D. C.; Tenore, K., Browne, M. 1975. The role of resuspended bottom mud in nutrient cycles of shallow embayments. Estuarine Research, Vol. I. 563-579.

Rhoads, D. C.; Germano, J. D. 1982. Characterization of organism-sediment relations using sediment-profile imaging: An effective 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.

SAI. 1979. Stamford-New Haven disposal operation: Monitoring survey report. DAMOS Contribution No. 1. US Army Corps of Engineers, New England Division, Waltham, MA.

SAIC. 1995. Sediment capping of subaqueous dredged material disposal mounds: An overview of the New England experience, 1979-1993. DAMOS Contribution No. 95 (SAIC Report No. SAIC-90/7573&C84). US Army Corps of Engineers, New England Division, Waltham, MA.

Silva, A. J.; Brandes, H. G.; Uchytil, C. J.; Fredette, T. J.; Carey, D. 1994. Geotechnical analysis of capped dredged material mounds. Reprinted from Dredging '94, Proceedings of the Second International Conference, November 13-16, 1994.

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Appendix A

Appendix A, Table 2-1

CLIS REMOTS® Camera Stations

CLIS 1996 REMOTS® Stations			
North American Datum of 1927			
Area	Station	Latitude	Longitude
CLIS 1995 MOUND 41° 08.660′ N 72° 53.042′ W	CTR	41° 08.660′ N	72° 53.042′ W
	100N	41° 08.714′ N	72° 53.042′ W
	200N	41° 08.768′ N	72° 53.042′ W
	300N	41° 08.822′ N	72° 53.042′ W
	100S	41° 08.605′ N	72° 53.042′ W
	200S	41° 08.551′ N	72° 53.042′ W
	300S	41° 08.497′ N	72° 53.042′ W
	100E	41° 08.660′ N	72° 52.970′ W
	200E	41° 08.660′ N	72° 52.899′ W
	300E	41° 08.660′ N	72° 52.827′ W
	100W	41° 08.660′ N	72° 53.113′ W
	200W	41° 08.660′ N	72° 53.184′ W
	300W	41° 08.660′ N	72° 53.256′ W
Reference Areas			
2500W 41° 09.254′ N 72° 55.569′ W	STA 1	41° 09.138′ N	72° 55.697′ W
	STA 2	41° 09.305′ N	72° 55.593′ W
	STA 3	41° 09.242′ N	72° 55.547′ W
	STA 4	41° 09.254′ N	72° 55.508′ W
4500E 41° 09.254′ N 72° 50.565′ W	STA 5	41° 09.312′ N	72° 50.551′ W
	STA 6	41° 09.301′ N	72° 50.424′ W
	STA 7	41° 09.168′ N	72° 50.430′ W
	STA 8	41° 09.255′ N	72° 50.575′ W
CLISREF 41° 08.085′ N 72° 50.109′ W	STA 9	41° 08.100′ N	72° 50.112′ W
	STA 10	41° 08.058′ N	72° 50.154′ W
	STA 11	41° 08.066′ N	72° 50.015′ W
	STA 12	41° 08.156′ N	72° 50.064′ W
	STA 13	41° 08.228′ N	72° 50.092′ W
Supplemental Areas			
NHAV 1993 MOUND 41° 09.122′ N 72° 53.453′ W	CTR	41° 09.122′ N	72° 53.453′ W
	200N	41° 09.230′ N	72° 53.453′ W
	200S	41° 09.014′ N	72° 53.453′ W
	200E	41° 09.122′ N	72° 53.310′ W
	200W	41° 09.122′ N	72° 53.596′ W
CLIS 1994 MOUND 41° 09.343′ N 72° 53.099′ W	CTR	41° 09.343′ N	72° 53.099′ W
	100N	41° 09.397′ N	72° 53.099′ W
	100S	41° 09.289′ N	72° 53.099′ W
	100E	41° 09.343′ N	72° 53.028′ W
	100W	41° 09.343′ N	72° 53.171′ W

Appendix A, Table 3-1

REMOTS® Parameters Summary Table for the CLIS 95 Disposal Mound

Station	Mean RPD (cm)	Median OSI	Mean Camera Penetration (cm)	Mean Boundary Roughness (cm)
CTR	1.56	7.0	13.79	1.98
100N	1.55	7.5	18.44	0.38
100S	0.94	3.0	12.31	1.60
100E	2.36	4.0	18.25	0.66
100W	3.14	9.0	11.46	0.85
200N	3.18	10.0	17.20	0.91
200S	2.16	8.0	14.52	0.84
200E	1.99	8.0	16.51	1.05
200W	3.12	10.0	14.95	0.68
300N	3.13	9.5	14.32	1.15
300S	1.52	7.0	16.21	0.56
300E	2.42	8.0	14.90	0.94
300W	2.79	5.0	14.59	0.98

Appendix A, Table 3-2

REMOTS® Parameters Summary Table for the CLIS 94 Disposal Mound

Station	Mean RPD (cm)	Median OSI	Mean Camera Penetration (cm)	Mean Boundary Roughness (cm)
CTR	1.09	3	14.71	1.15
100N	3.38	6	15.79	1.01
100S	1.66	4	18.12	0.90
100E	3.09	10	15.83	0.35
100W	2.19	6	17.72	0.56

Appendix A, Table 3-3

REMOTS® Parameters Summary Table for the NHAV 93 Disposal Mound

Station	Mean RPD (cm)	Median OSI	Mean Camera Penetration (cm)	Mean Boundary Roughness (cm)
CTR	2.77	9.0	14.97	0.64
200N	1.37	3.0	15.76	0.51
200S	1.45	3.0	16.74	0.49
200E	2.21	6.0	15.06	0.63
200W	2.32	8.0	15.73	0.75

Appendix A, Table 3-4

REMOTS® Parameters Summary Table for the CLIS Reference Areas

REMOTS® Parameters Summary Table CLIS Reference Areas

Station	Mean RPD (cm)	Median OSI	Mean Camera Penetration (cm)	Mean Boundary Roughness (cm)
2500W				
STA1	2.28	9.00	11.92	0.84
STA2	2.27	8.00	13.17	1.55
STA3	1.75	4.00	12.33	2.36
STA4	2.60	7.00	14.03	1.01
4500E				
STA5	1.67	4.0	10.60	1.38
STA6	1.51	8.0	12.18	1.26
STA7	2.55	8.0	14.26	1.05
STA8	2.62	6.0	13.50	0.65
CLIS-REF				
STA9	2.39	7.0	12.81	0.83
STA10	2.02	8.0	11.40	0.66
STA11	2.38	9.0	10.59	0.74
STA12	1.94	5.0	11.40	0.32
STA13	2.04	8.0	12.50	0.92

Appendix B

Appendix B

REMOTS® Data from the CLIS 95 Mound

Station	Replicate	Date	Successional	Grain Size (phi)			Mud Clasts		Camera Penetration				Dredged Material Thickness				Redox Rebound Thickness			Apparent RPD Thickness				Methane	OSI	Surface	Low	Comments
			Stage	Min	Max	Maj Mode	Count	Avg Diam	Min	Max	Range	Mean	Area	Min	Max	Mean	Min	Max	Mean	Area	Min	Max	Mean			Roughness	DO	
CTR	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	10.16	12.86	2.71	11.51	151.89	6.41	12.76	11.12	0	0	0	11.557	0.1	2.66	0.95	NO	7	PHYSICAL	NO	DGP,collapsed oxygenated void,patches of sulfidic
CTR	B	7/11/96	ST_III	3	>4	4 to 3	0	0	10.11	11.41	1.3	10.78	84.48	4.64	10.76	7.2	0	0	0	23.625	0.78	3.44	2.15	NO	4	PHYSICAL	NO	DGP,burrow on interclast void
CTR	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	18.12	20.05	1.93	19.09	259.27	17.97	20.05	19.08	1.82	4.32	3.07	22.2	0.51	2.49	1.59	NO	8	INDET	NO	DGP,S/M,active void?
100N	A	7/11/96	ST_I_ON_III	3	>4	4 to 3	0	0	16.82	17.45	0.62	17.13	234.81	17.13	17.45	17.27	0	0	0	23.262	1.02	2.33	1.69	NO	8	BIOGENIC	NO	DGP,dissected worm at depth,layered fabric,old DM?
100N	B	7/11/96	ST_I_ON_III	3	>4	4 to 3	0	0	20.26	20.26	0	20.26	272.24	5.99	20.15	19.69	0	0	0	NA	NA	NA	NA	NO	99	INDET	NO	DGP,OVERPEN,active feeding void at depth,retracted anemone?S/M,old DM?
100N	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	17.65	18.18	0.52	17.92	241.84	17.65	18.23	17.83	0	0	0	19.994	0.51	1.93	1.4	NO	7	PHYSICAL	NO	DGP,active void at depth,camera shear artifact,stranded tube,erosional?old DM? SPHYSICAL
100S	E	7/18/96	ST_III	3	>4	>4	0	0	11.25	12.55	1.3	11.9	161.76	4.69	12.81	11.9	0	0	0	14.635	0.15	1.98	1.02	NO	3	INDET	NO	DGP,S/M,patchy RPD
100S	F	7/18/96	ST_I_ON_III	3	>4	>4	0	0	11.61	12.6	0.99	12.11	165.09	9.37	12.6	12.14	0	0	0	16.282	0.41	1.78	1.17	NO	7	BIOGENIC	NO	DGP,feeding void at depth S/M
100S	G	7/18/96	ST_III	3	>4	>4	0	0	11.67	14.17	2.5	12.92	179.99	6.04	14.11	13	0	0	0	8.54	0.05	1.41	0.62	NO	-2	PHYSICAL	YES	DGP,shallow RPD,shell fragment,erosional
100E	A	7/11/96	INDET	3	>4	>4	0	0	19.74	19.74	0	19.74	271.83	19.84	20.05	19.89	0	0	0	NA	NA	NA	NA	NO	99	INDET	NO	DGP,overpen IND stage fresh DM?
100E	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	16.56	20.21	1.67	19.4	246.19	18.48	20.26	19.67	2.54	7.51	5.02	28.178	1.37	2.99	2.01	NO	99	INDET	NO	DGP,slight OP,S/M
100E	D	7/18/96	ST_I_ON_III	3	>4	>4	3	0.54	15.42	15.78	0.36	15.6	209.83	15.42	15.99	15.81	0	0	0	38.052	0.26	4.25	2.71	NO	4	PHYSICAL	NO	DGP
100W	A	7/11/96	ST_III	2	2	>4	0	1.46	10.63	11.57	0.94	11.1	9999	10.63	11.57	11.1	0	0	0	0	NA	NA	NA	NO	99	PHYSICAL	NO	DGP,clasts on surface, pulaway camera disturbance?macrofaunal burrow,worm,mid dPH / SICAL
100W	B	7/11/96	ST_I_ON_III	3	>4	4 to 3	0	0	13.82	14.5	0.68	14.16	194.4	7.28	14.66	14.17	5	7	8	30.108	0.16	4.66	2.38	NO	9	PHYSICAL	NO	DGP,active void at depth,burrow?,S/M
100W	C	7/11/96	INDET	3	>4	>4	0	0	8.64	9.58	0.94	9.11	102.21	2.88	9.42	7.72	0	0	0	49.55	0.42	6.13	3.89	NO	99	INDET	NO	DGP,camera shearing/fracture?,S/M
200N	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	15.45	16.07	0.63	15.76	214.05	7.75	15.92	15.6	0	0	0	21.554	0.21	5.81	3.82	NO	10	BIOGENIC	NO	DGP,active voids,burrow,stage I assem,S/M,old DM?
200N	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0	18.07	18.75	0.68	18.41	246.35	4.01	18.8	17.73	0	0	0	30.174	0.62	4.22	2.18	NO	8	INDET	NO	DGP,active void middepth,S/M,old DM?
200N	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0.53	16.72	18.12	1.41	17.42	234.22	16.67	18.07	17.22	0	0	0	51.218	0.42	6.98	3.74	NO	10	PHYSICAL	NO	DGP,active feeding voids reduced wiper clasts,old DM
200S	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	13.82	14.87	1.05	14.34	191.51	13.61	14.71	14.1	4.35	6.96	5.65	34.597	0.99	3.35	2.45	NO	9	INDET	NO	DGP,active feeding void,worm at depth,old DM?
200S	B	7/11/96	ST_I_ON_III	3	>4	>4	1	0.61	14.61	15.44	0.84	15.03	204.3	11.31	15.5	14.89	0	0	0	28.753	0.94	3.82	2.09	NO	8	PHYSICAL	NO	DGP,camera shear,old DM
200S	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	13.87	14.5	0.63	14.19	190.11	10.21	14.34	13.98	2.73	4.66	4.5	27.151	0.63	2.98	1.93	NO	8	PHYSICAL	NO	DGP,active void at depth,S/M sulfidic,old DM
200E	A	7/11/96	ST_I_ON_III	3	>4	4 to 3	0	0	15.39	15.76	0.37	15.58	214.68	15.29	15.97	15.55	0	0	0	27.963	0.68	4.45	2.23	NO	8	INDET	NO	DGP,worm at depth,S/M
200E	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0	15.03	16.81	1.78	15.92	215.55	14.82	16.81	15.62	0	0	0	25.088	0.42	3.61	1.78	NO	6	PHYSICAL	NO	DGP,worm middepth,S/M,air bubble on mirror
200E	C	7/11/96	ST_III	3	>4	>4	0	0	17.54	18.53	0.99	18.04	247.08	9.32	18.74	17.93	8	7.5	7	13.897	0.05	3.3	1.97	NO	4	PHYSICAL	NO	DGP,camera artifact(reduced clast in RPD),sulfidic
200W	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	12.25	13.35	1.1	12.8	235.92	13.04	17.69	17.2	6	8	7	42.556	2.46	3.51	3.06	NO	10	PHYSICAL	NO	DGP,mulinia or tellinaceans,neyphtes?in RPD,S/M
200W	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0	16.16	16.49	0.31	16.33	223.7	6.09	16.65	16.36	1.68	8.12	4.9	45.252	0.89	4.35	3.26	NO	10	PHYSICAL	NO	DGP,wiper clast smear on RPD?,void
200W	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	15.39	16.02	0.63	15.71	214.12	15.44	16.07	15.81	5	7	6	42.35	0.89	5.18	3.05	NO	10	BIOGENIC	NO	DGP,active void in RPD;S/M
300N	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0	13.25	14.19	0.94	13.72	185.34	13.09	14.03	13.51	0	0	0	49.364	1.2	4.71	3.55	NO	10	BIOGENIC	NO	DGP,macrofaunal burrow?,worms middepth,S/M old DM
300N	C	7/11/96	ST_I_ON_III	3	4	>4	0	0	14.24	15.8	1.36	14.92	201.81	14.08	15.34	14.84	0	0	0	37.91	1.57	3.51	2.7	NO	9	INDET	NO	DGP,active feeding voids, large shell frag S/M old DM?
300S	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	14.24	14.82	0.58	14.53	194.93	0.94	14.53	14	1.63	6.25	3.94	15.912	0.25	2.08	1.21	NO	7	BIOGENIC	NO	DGP,active voids,worms at depth
300S	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0	14.55	15.02	0.47	14.79	201.08	14.4	15.08	14.77	3.58	9.05	6.3	18.701	0.1	1.78	1.28	NO	7	BIOGENIC	NO	DGP,possible collasped void,mollusc,farfield
300S	C	7/11/96	ST_I_ON_III	3	>4	>4	4	0.46	19	19.63	0.63	19.32	263.24	14.29	19.68	19.19	1.52	9.8	5.56	28.861	1.07	2.99	2.08	NO	8	INDET	NO	DGP,S/M
300E	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	15.18	16.02	0.84	15.6	219.23	15.39	16.28	15.58	4.45	7.7	6.08	45.61	0.63	5.97	3.58	NO	10	BIOGENIC	NO	DGP,active & collasped voids,sulfidic
300E	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0	12.67	14.03	1.36	13.35	181.97	12.67	14.03	13.24	0	0	0	29.225	0.1	3.35	2.22	NO	8	BIOGENIC	NO	DGP,active feeding void,S/M
300E	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	15.44	16.06	0.62	15.75	221.53	5.96	16.06	15.79	0	0	0	20.506	0.57	2.54	1.46	NO	7	INDET	NO	DGP,macrofaunal burrow,collasped void, sulfidic at depth Stage III?
300W	A	7/11/96	ST_I	3	>4	>4	0	0	15.5	16.65	1.15	16.07	216.75	2.88	16.6	15.54	4.21	8.07	6.14	27.43	1.07	2.49	1.96	NO	4	PHYSICAL	NO	DGP,live mulinia,erosional, stranded tubes
300W	B	7/11/96	ST_III	3	>4	>4	1	1.23	14.55	15.23	0.68	14.89	207.9	14.5	15.55	14.75	6	8	7	34.142	1.57	3.56	2.47	NO	5	PHYSICAL	NO	DGP,reduced wiper clast S/M
300W	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	12.25	13.35	1.1	12.8	173.67	11.94	13.51	12.66	5	7	6	50.344	0.89	5.34	3.92	NO	11	INDET	NO	DGP,macrofaunal burrow,mulinia S/M

Appendix C

Appendix C

REMOTS® Data from the CLIS 94 Mound

Station	Replicate	Date	Successional	Grain Size (phi)			Mud Clasts		Camera Penetration				Dredged Material Thickness				Redox Rebound Thickness			Apparent RPD Thickness				Methane	OSI	Surface	Low	Comment
			Stage	Min	Max	Maj. Mode	Count	Avg.Diam	Min	Max	Range	Mean	Area	Min	Max	Mean	Min	Max	Mean	Area	Min	Max	Mean			Roughness	DO	
CTR	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	13.51	13.82	0.31	13.66	184.54	13.25	13.82	13.52	0	0	0	20.793	0.63	2.2	1.49	NO	7	PHYSICAL	NO	DGP;sulfidic;feeding voids;burrow at depth
CTR	B	7/11/96	ST_I	3	>4	>4	2	0.69	14.66	15.39	0.73	15.03	205.51	4.61	15.55	14.84	0	0	0	8.223	0.05	1.94	0.72	NO	2	INDET	NO	DGP;reduced clasts at surface;sulfidic
CTR	C	7/11/96	ST_I	3	>4	>4	0	0	14.24	16.65	2.41	15.45	218.25	7.96	17.7	16.22	0	0	0	8.648	0.42	1.68	1.05	NO	3	PHYSICAL	NO	DGP;shallow RPD;collapsed burrow;sulfidic
100N	A	7/11/96	ST_I	3	>4	>4	0	0	15.92	16.23	0.31	16.07	215.45	7.91	16.23	15.78	0	0	0	44.916	1.15	4.82	3.38	NO	6	BIOGENIC	NO	DGP;sulfidic;S/M;layered fabric
100N	B	7/11/96	ST_I_ON_III	3	>4	>4	3	0.66	15.81	17.12	1.31	16.47	223.11	15.97	17.17	16.47	0	0	0	NA	NA	NA	NA	NO	99	PHYSICAL	NO	DGP;sulfidic;reduced wiper clasts obscures most of RPD
100N	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	14.14	15.55	1.41	14.84	206.42	7.64	15.5	15.12	0	0	0	NA	NA	NA	NA	NO	99	PHYSICAL	NO	DGP;wiper smear RPD;worm at depth;burrow/void
100S	A	7/11/96	ST_I	3	>4	4 to3	1	0.49	17.02	17.44	0.42	17.23	232.63	12.57	17.43	17.05	0	0	0	27.387	0.94	3.51	2.13	NO	4	PHYSICAL	NO	DGP;layers of old DM and Shell;S/M
100S	B	7/11/96	ST_I	3	>4	>4	0	0	19.3	20.64	1.34	19.97	256.27	18.43	20.05	18.93	3.82	6.29	5.05	19.157	0.05	3.3	1.34	NO	-1	PHYSICAL	YES	DGP;patchy RPD;shell hash
100S	C	7/11/96	ST_I	3	>4	>4	3	0.45	16.68	17.63	0.95	17.16	230.6	12.84	17.37	16.64	0	0	0	21.151	0.42	2.74	1.51	NO	4	PHYSICAL	NO	DGP;layer of old DM;clasts on surface;patchy RPD
100E	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	18.22	18.32	0.1	18.27	248.49	6.75	18.43	17.79	9	10	9.5	43.761	1.36	5.92	3.18	NO	10	BIOGENIC	NO	layered fabric DM;DGP
100E	B	7/11/96	ST_I	3	>4	>4	0	0	14.61	15.39	0.79	15	204.31	11.2	15.29	14.96	0	0	0	21.125	0.47	3.09	1.53	NO	4	BIOGENIC	NO	DGP;sulfidic;layers of old DM
100E	D	7/11/96	ST_I_ON_III	3	>4	>4	0	0	14.13	14.29	0.16	14.21	192.39	14.08	14.45	14.24	4.98	7.8	7.5	59.994	2.98	5.6	4.55	NO	11	INDET	NO	DGP;feeding void with sorted particles
100W	A	7/11/96	ST_I	3	>4	>4	0	0	18.32	18.32	0	18.32	247.61	9.26	18.63	18.14	4	6	5	38.694	0.32	4.79	2.96	NO	5	BIOGENIC	NO	DGP;layered old DM;sulfidic;layered fabric
100W	B	7/11/96	ST_I	3	>4	>4	2	0.88	17.05	17.84	0.79	17.45	236.62	16.84	18.05	17.3	0	0	0	NA	NA	NA	NA	NO	99	INDET	NO	DGP;sulfidic;reduced wiper clasts
100W	C	7/11/96	ST_I_ON_III	3	>4	>4	2	0.95	16.95	17.84	0.9	17.39	236.1	17	17.84	17.31	0	0	0	8.918	0.31	3.09	1.42	NO	7	PHYSICAL	NO	DGP;reduced clasts on surface

Appendix D

Appendix D

REMOTS® Data from the CLIS NHAV 93 Mound

Station	Replicate	Date	Successional	Grain Size (phi)				Mud Clasts		Camera Penetration				Dredged Material Thickness				Redox Rebound Thickness			Apparent RPD Thickness				Methane	OSI	Surface	Low	Comments
			Stage	Min	Max	Maj	Mode	Count	Avg Diam	Min	Max	Range	Mean	Area	Min	Max	Mean	Min	Max	Mean	Area	Min	Max	Mean			Roughness	DO	
CTR	A	7/11/96	ST_I_ON_III	3	>4	>4		0	0	14.76	15.71	0.94	15.24	204.25	7.8	15.6	14.82	2.93	4.98	3.96	35.655	1.41	3.72	2.77	NO	9	BIOGENIC	NO	DGP;sulfidic;voids;hydroids?
CTR	B	7/11/96	ST_I	3	>4	>4		1	1.55	13.87	14.4	0.52	14.14	196.71	14.45	14.5	14.38	0	0	0	NA	NA	NA	NA	NO	99	PHYSICAL	NO	DGP;reduced wiper clast at surface;sulfidic;hydroids
CTR	C	7/11/96	ST_I_ON_III	3	>4	>4		3	1.63	15.29	15.76	0.47	15.52	211.86	5.88	15.76	15.37	0	0	0	NA	NA	NA	NA	NO	99	PHYSICAL	NO	DGP;feeding void;sulfidic;reduced wiper clast;hydroids
200N	A	7/11/96	ST_I	3	>4	>4		0	0	16.49	16.91	0.42	16.7	224.41	16.44	16.75	16.39	3.51	5.45	4.48	20.916	0.94	1.36	1.26	NO	3	BIOGENIC	NO	DGP,sulfidic;relic void
200N	B	7/11/96	ST_I	3	>4	>4		2	0.53	14.24	15.03	0.79	14.63	193.21	7.07	15.18	14.28	0	0	0	15.02	0.47	2.83	1.48	NO	3	PHYSICAL	NO	DGP,sulfidic;reduced wiper clast surface
200N	C	7/11/96	ST_I	3	>4	>4		0	0	15.79	16.1	0.32	15.95	216.85	8	16.1	15.65	2.85	5.23	4.04	19.502	0.42	2.84	1.36	NO	3	BIOGENIC	NO	DGP,sulfidic;wiper smear,sulfidic
200S	A	7/11/96	ST_I	3	>4	>4		0	0	15.95	16.95	1	16.45	222.9	4.79	17.05	15.94	0	0	0	9.295	0.05	2.37	1.48	NO	3	BIOGENIC	NO	DGP; possible stage III;feeding void below RPD?
200S	B	7/11/96	ST_I_ON_III	3	>4	>4		0	0	14.74	15.1	0.36	14.92	203.39	15.05	15.16	14.98	3.65	5.31	4.48	21.885	1.26	1.97	1.58	NO	8	INDET	NO	DGP;collapsed feeding voids;S/M,sulfidic
200S	C	7/11/96	ST_I	3	>4	>4		3	0.51	18.79	18.89	0.11	18.84	255.35	14.16	18.95	18.58	0	0	0	17.559	0.47	3.05	1.26	NO	3	BIOGENIC	NO	DGP;sulfidic;shell at surface;hydroids
200E	A	7/11/96	ST_I	3	>4	>4		0	0	15.86	16.65	0.79	16.26	217.74	15.81	16.6	16	4.14	5.39	4.76	44.998	1.1	5.08	3.44	NO	6	PHYSICAL	NO	DGP,sulfidic;shell frags,hydroids
200E	B	7/11/96	ST_I_ON_III	3	>4	>4		1	0.71	14.14	14.92	0.79	14.53	197	5.13	15.03	14.22	3.46	5.44	4.45	23.315	0.52	3.04	1.64	NO	8	PHYSICAL	NO	DGP;sulfidic;void at mid depth;reduced wiper clast
200E	C	7/11/96	ST_I	3	>4	>4		0	0	14.24	14.55	0.31	14.4	193.39	14.14	14.45	14.31	3.04	5.03	4.03	21.744	0.37	2.77	1.56	NO	4	INDET	NO	DGP;sulfidic,S/M
200W	A	7/11/96	ST_I_ON_III	3	>4	>4		0	0	16.7	17.28	0.58	16.99	227.94	16.44	17.07	16.75	0	0	0	41.962	0.79	3.61	3	NO	9	INDET	NO	DGP;sulfidic,S/M
200W	B	7/11/96	ST_I_ON_III	3	>4	>4		2	0.73	17.17	17.75	0.58	17.46	234.87	17.28	17.8	17.39	3.77	6.75	5.26	23.818	0.21	2.57	1.76	NO	4	PHYSICAL	NO	DGP;relic void;reduced wiper clasts in RPD,sulfidic
200W	D	7/18/96	ST_I_ON_III	3	>4	>4		0	0	12.2	13.3	1.1	12.75	171.98	4.61	13.09	12.59	0	0	0	29.259	1.15	3.09	2.21	NO	8	PHYSICAL	NO	DGP;feeding voids;sulfidic; some shell

Appendix E

Appendix E

REMOTS® Data from the CLIS Reference Areas

Station	Replicate	Date	Successional Stage	Grain Size (phi) Min	Max	Maj Mode	Mud Clasts Count	Avg Diam	Camera Penetration Min	Max	Range	Mean	Dredged Material Thickness Area	Min	Max	Mean	Redox Rebound Thickness Min	Max	Mean	Apparent RPD Thickness Area	Min	Max	Mean	Methane	OSI	Surface Roughness	Low DO	Comments
2500E																												
STA1	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	10.94	11.62	0.68	11.28	0	0	0	0	3.98	6.49	5.24	42.406	1.82	3.83	3.08	NO	11	PHYSICAL	NO	active feeding voids,stage I tubes,sulfidic at depth,erosional
STA1	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0.78	10.94	11.62	0.68	11.28	0	0	0	0	0	0	0	30.308	0.96	3.23	2.18	NO	9	PHYSICAL	NO	boundary roughness;dragged down anemone,erosional
STA1	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	12.62	13.77	1.15	13.19	0	0	0	0	0	0	0	21.357	0.58	2.3	1.58	NO	8	BIOGENIC	NO	active voids at depth,shell hash
STA2	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	9.89	13.66	3.77	11.78	0	0	0	0	5	6	5.5	27.375	0.21	3.4	1.96	NO	6	INDET	NO	,void at depth,erosional
STA2	B	7/11/96	ST_I	3	>4	>4	0	0	14.58	14.74	0.16	14.66	0	0	0	0	3.18	5.78	4.48	39.713	1.77	4.22	2.9	NO	5	BIOGENIC	NO	dense stage i tubes,some shell,
STA2	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	12.71	13.44	0.73	13.07	0	0	0	0	0	0	0	24.337	0.16	3.26	1.94	NO	6	INDET	NO	active feeding void at depth,S/M,some shell
STA3	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	13.96	14.64	0.68	14.3	0	0	0	0	3.49	5.73	4.61	30.779	0.26	4.37	2.5	NO	9	INDET	NO	active feeding void or fracture?at depth,macrofaunal burrow,hydroids
STA3	B	7/11/96	ST_I	3	>4	>4	0	0	12.55	12.97	0.42	12.76	0	0	0	0	0	0	0	26.647	0.78	3.7	2.08	NO	4	PHYSICAL	NO	possible stage III,voids at frame edge left?dense stage I tubes
STA3	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	6.93	12.92	5.99	9.92	0	0	0	0	0	0	0	5.203	0.1	1.51	0.67	NO	2	PHYSICAL	YES	sloping topography,active voids,old dm?
STA4	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	14.32	14.74	0.42	14.53	0	0	0	0	0	0	0	47.855	1.67	5.62	3.72	NO	10	INDET	NO	feeding void at depth,feeding pit,dense stage I tubes
STA4	B	7/11/96	ST_I	3	>4	>4	0	0	12.71	14.38	1.67	13.54	0	0	0	0	4.17	7.46	5.81	39.029	1.77	3.96	2.8	NO	5	BIOGENIC	NO	poss9ble stage III?deep RPD;collapsed feeding void?
STA4	C	7/11/96	ST_I_ON_III	3	>4	>4	3	0.65	13.54	14.48	0.94	14.01	0	0	0	0	0	0	0	15.306	0.26	2.34	1.28	NO	7	BIOGENIC	NO	active void with fecal pellets,macrofaunal burrow (or drag down)with reduced claBIOGENIC
4500E																												
STA5	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	7.85	8.79	0.94	8.32	0	0	0	0	0	0	0	42.092	0.94	4.08	3.22	NO	10	INDET	NO	sulfidic,worms at depth
STA5	B	7/11/96	ST_I	3	>4	>4	1	1.32	10.57	12.14	1.57	11.36	0	0	0	0	0	0	0	22.91	0	0	0	NO	3	PHYSICAL	NO	clasts of clay at surface,sulfidic
STA5	c	7/11/96	ST_I	3	>4	>4	1	0.53	11.31	12.93	1.62	12.12	0	0	0	0	0	0	0	18.186	0.16	4.71	1.79	NO	4	INDET	NO	sulfidic;shell frags in sed,reduced clast in RPD,erosional,voids?
STA6	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	14.29	14.97	0.68	14.63	0	0	0	0	0	0	0	28.175	1.67	2.37	1.99	NO	8	PHYSICAL	NO	active feeding voids,hydroids,sulfidic
STA6	B	7/11/96	ST_I_ON_III	3	>4	>4	4	0.56	10.1	12.56	2.46	11.33	0	0	0	0	0	0	0	22.052	0.47	2.51	1.59	NO	8	PHYSICAL	NO	sulfidic,clasts on surface,shell,void at depth,old DM,stageIII?
STA6	C	7/11/96	ST_I	3	>4	>4	0	0	10.26	10.89	0.63	10.57	0	0	0	0	0	0	0	13.581	0.37	2.25	0.95	NO	3	PHYSICAL	NO	sulfidic,shallow RPD;old DM?
STA7	A	7/11/96	ST_I	3	>4	>4	0	0	14.97	15.23	0.26	15.1	0	0	0	0	3.87	5.97	4.92	54.243	2.77	5.39	4.11	NO	7	BIOGENIC	NO	some smearing of RPD,some shell
STA7	B	7/11/96	ST_I_ON_III	3	>4	>4	1	0.94	11.46	13.61	2.15	12.54	0	0	0	0	4	6	5	26.62	0.42	2.83	1.94	NO	8	INDET	NO	active feeding voids with sorted particles burrow?
STA7	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	14.76	15.49	0.73	15.13	0	0	0	0	0	0	0	22.253	0.16	2.51	1.59	NO	8	INDET	NO	active feeding voids,reduced wiper clast at surface,some shell,patchy RPD
STA8	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	13.14	13.87	0.73	13.51	0	0	0	0	0	0	0	33.807	1.31	3.03	2.42	NO	9	INDET	NO	many active voids,worms at depth,puzzle fabric(trawler dist?)
STA8	B	7/11/96	ST_I	3	>4	>4	0	0	12.41	12.98	0.58	12.69	0	0	0	0	0	0	0	31.541	0.89	3.87	2.26	NO	5	PHYSICAL	NO	anemone dragged down by camera
STA8	C	7/11/96	ST_I	3	>4	>4	1	0.54	13.98	14.6	0.63	14.29	0	0	0	0	7	8	7.5	43.419	2.56	3.98	3.17	NO	6	INDET	NO	deep RPD,sulfidic at depth
CLIS-REF																												
STA9	A	7/11/96	INDET	3	>4	>4	0	0	14.11	15.31	1.2	14.71	202.6	7.61	15.13	14.67	0	0	0	25.946	1.15	3.12	1.91	NO	99	PHYSICAL	NO	smearing of RPD,fresh DM? chaotic fabric
STA9	B	7/11/96	ST_I_ON_III	3	>4	>4	0	0	12.6	13.07	0.47	12.84	0	0	0	0	0	0	0	37.149	0.36	4.01	2.69	NO	9	BIOGENIC	NO	edge of active void at depth,collapsed void(camera artifact?)
STA9	C	7/11/96	ST_I	3	>4	>4	0	0	10.47	11.3	0.83	10.89	0	0	0	0	0	0	0	36.265	1.56	3.7	2.57	NO	5	INDET	NO	possible stage III?feeding tube?S/clay
STA10	A	7/11/96	ST_III	3	>4	>4	0	0	8.75	9.27	0.52	9.01	0	0	0	0	0	0	0	22.759	0.52	3.44	1.78	NO	8	BIOGENIC	NO	active feeding voids/tubes,mulinia?,sulfidic
STA10	B	7/11/96	ST_I_ON_III	3	>4	>4	1	1.13	12.49	13.3	0.81	12.89	0	0	0	0	0	0	0	43.125	0.05	4.72	3.39	NO	10	BIOGENIC	NO	artifact reduced clast at surface;shallow feeding void/burrow?
STA10	C	7/11/96	INDET	3	>4	>4	1	0.9	11.98	12.64	0.66	12.31	0	0	0	0	5.33	6.9	6.12	12.771	0.5	1.36	0.9	NO	3	INDET	NO	possible stage III?shallow RPD,reduced clast at surface,some shell
STA11	A	7/11/96	ST_I	3	>4	>4	0	0	9.09	9.95	0.86	9.52	0	0	0	0	0	0	0	20.219	0.56	2.39	1.44	NO	3	PHYSICAL	NO	some reduced material in RPD,S/clay,erosional
STA11	B	7/11/96	ST_I_ON_III	3	>4	>4	1	0.91	10	11.07	1.07	10.53	0	0	0	0	3.4	4.87	4.14	34.651	0.61	3.65	2.52	NO	9	PHYSICAL	NO	worm at depth,feeding mound?
STA11	C	7/11/96	ST_I_ON_III	3	>4	>4	0	0	11.57	11.88	0.3	11.73	0	0	0	0	3.15	5.13	4.14	43.612	1.88	4.37	3.17	NO	10	BIOGENIC	NO	active voids with worms at depth,tube
STA12	A	7/11/96	ST_I	3	>4	>4	0	0	11.12	11.47	0.36	11.29	0	0	0	0	3.81	5.13	4.47	36.793	1.73	3.45	2.62	NO	5	BIOGENIC	NO	some shell in RPD,no voids
STA12	B	7/11/96	ST_I_ON_III	>4	>4	>4	3	1.15	11.67	11.88	0.2	11.78	0	0	0	0	0	0	0	10.687	0.05	2.94	1.63	NO	8	PHYSICAL	NO	void at depth with organism,feeding pit or burrow at surface,chaotic fabric,old Physical
STA12	C	7/11/96	ST_I	3	>4	>4	2	2.27	10.91	11.32	0.41	11.12	0	0	0	0	0	0	0	22.178	0.51	2.59	1.57	NO	4	PHYSICAL	NO	erosional?reduced clasts in RPD(oldDM?),PULLAWAY
STA13	A	7/11/96	ST_I_ON_III	3	>4	>4	0	0	13.4	14.21	0.81	13.81	0	0	0	0	7	7	7	38.534	1.62	4.06	2.86	NO	9	INDET	NO	feeding voids at depth,feeding pit left?
STA13	B	7/11/96	ST_I	4	>4	>4	4	0.95	11.88	12.84	0.96	12.36	0	0	0	0	7.5	8.5	8	26.549	0.36	3.5	1.93	NO	4	INDET	NO	reduced wiper clasts in RPD (oldDM?)collapsed voids
STA13	D	7/18/96	ST_I_ON_III	3	>4	>4	3	0.72	11.78	12.08	0.3	11.93	0	0	0	0	2.95	5.79	4.37	34.278	1.67	3.25	2.47	NO	9	BIOGENIC	NO	reduced clasts(old DM?) near surface
STA13	E	7/18/96	ST_I_ON_III	3	>4	>4	0	0	11.07	12.69	1.62	11.88	0	0	0	0	0	0	0	12.631	0.3	1.41	0.89	NO	7	PHYSICAL	NO	large macrofaunal burrow,erosional,tubes at surface

Appendix F

Appendix F, Table 1

Summary of UDM Disposal at the CDA 95 buoy

permittee	project	disparea	dispdate	wtd	xtd	ytd	ztd	latdeg	latmin	longdeg	longmin	cyvol
CITY OF MILFORD	MILFORD HARBOR	CLIS	02-Oct-95	0	26545	43996.2	0	41	8.689	72	53.047	500
CITY OF MILFORD	MILFORD HARBOR	CLIS	03-Oct-95	15045.5	0	43996.1	0	41	8.668	72	53.093	600
CITY OF MILFORD	MILFORD HARBOR	CLIS	03-Oct-95	0	26545	43996	0	41	8.664	72	53.055	625
CITY OF MILFORD	MILFORD HARBOR	CLIS	04-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	975
CITY OF MILFORD	MILFORD HARBOR	CLIS	05-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	700
CITY OF MILFORD	MILFORD HARBOR	CLIS	07-Oct-95	0	26545	43996	0	41	8.664	72	53.055	600
CITY OF MILFORD	MILFORD HARBOR	CLIS	07-Oct-95	0	26545	43996	0	41	8.664	72	53.055	700
CITY OF MILFORD	MILFORD HARBOR	CLIS	08-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	550
CITY OF MILFORD	MILFORD HARBOR	CLIS	08-Oct-95	0	26545	43996	0	41	8.664	72	53.055	575
CITY OF MILFORD	MILFORD HARBOR	CLIS	09-Oct-95	0	26545	43996	0	41	8.664	72	53.055	975
CITY OF MILFORD	MILFORD HARBOR	CLIS	10-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	825
CITY OF MILFORD	MILFORD HARBOR	CLIS	11-Oct-95	0	26545	43996	0	41	8.664	72	53.055	725
CITY OF MILFORD	MILFORD HARBOR	CLIS	12-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	700
CITY OF MILFORD	MILFORD HARBOR	CLIS	13-Oct-95	0	26545	43996	0	41	8.664	72	53.055	975
CITY OF MILFORD	MILFORD HARBOR	CLIS	13-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	775
CITY OF MILFORD	MILFORD HARBOR	CLIS	16-Oct-95	0	26544.8	43995.9	0	41	8.656	72	53.034	750
CITY OF MILFORD	MILFORD HARBOR	CLIS	16-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	700
CITY OF MILFORD	MILFORD HARBOR	CLIS	17-Oct-95	0	26544.8	43996	0	41	8.669	72	53.03	800
CITY OF MILFORD	MILFORD HARBOR	CLIS	18-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	600
CITY OF MILFORD	MILFORD HARBOR	CLIS	18-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	600
CITY OF MILFORD	MILFORD HARBOR	CLIS	19-Oct-95	0	26544.8	43996	0	41	8.669	72	53.03	750
CITY OF MILFORD	MILFORD HARBOR	CLIS	19-Oct-95	0	26544.8	43996.1	0	41	8.681	72	53.027	625
CITY OF MILFORD	MILFORD HARBOR	CLIS	20-Oct-95	0	26544.8	43996	0	41	8.669	72	53.03	700
CITY OF MILFORD	MILFORD HARBOR	CLIS	23-Oct-95	0	26544.8	43996	0	41	8.669	72	53.03	775
CITY OF MILFORD	MILFORD HARBOR	CLIS	24-Oct-95	0	26544.9	43996	0	41	8.666	72	53.043	800
CITY OF MILFORD	MILFORD HARBOR	CLIS	25-Oct-95	0	26544.8	43996	0	41	8.669	72	53.03	875
CITY OF MILFORD	MILFORD HARBOR	CLIS	25-Oct-95	0	26545	43996.1	0	41	8.677	72	53.051	650
SHELL OIL CO	SHELL OIL MARINE TERMINAL DOCK	CLIS	11-Nov-95	15045.7	0	43996	0	41	8.651	72	53.118	1875
										Total UDM yd³		21300
										Total UDM m³		16285.98

Appendix F, Table 2

Summary of CDM Deposition at the CDA 95 buoy

permittee	project	disparea	dispdate	wtd	xtd	ytd	ztd	latdeg	latmin	longdeg	longmin	cyvol
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	30-Oct-95	0	26545.3	43996	0	41	8.656	72	53.091	750
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	31-Oct-95	0	26545.2	43996	0	41	8.659	72	53.079	875
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	31-Oct-95	0	26545.3	43996	0	41	8.656	72	53.091	925
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	01-Nov-95	0	26545.2	43996	0	41	8.659	72	53.079	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	01-Nov-95	0	26545.3	43996	0	41	8.656	72	53.091	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	02-Nov-95	0	26545.2	43996	0	41	8.659	72	53.079	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	02-Nov-95	0	26544.8	43996	0	41	8.669	72	53.03	850
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	03-Nov-95	0	26545	43996	0	41	8.664	72	53.055	850
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	06-Nov-95	0	26544.8	43996.1	0	41	8.681	72	53.027	875
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	06-Nov-95	0	26544.9	43996	0	41	8.666	72	53.043	900
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	08-Nov-95	0	26545	43996	0	41	8.664	72	53.055	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	08-Nov-95	0	26544.9	43996	0	41	8.666	72	53.043	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	09-Nov-95	0	26545	43996.1	0	41	8.677	72	53.051	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	09-Nov-95	0	26545	43996	0	41	8.664	72	53.055	1000
SHELL OIL CO	SHELL OIL MARINE TERMINAL DOCK	CLIS	12-Nov-95	15045.7	0	43996	0	41	8.651	72	53.118	1400
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	13-Nov-95	0	26545	43996.1	0	41	8.677	72	53.051	1000
SHELL OIL CO	SHELL OIL MARINE TERMINAL DOCK	CLIS	16-Nov-95	15045.7	0	43996	0	41	8.651	72	53.118	1200
SHELL OIL CO	SHELL OIL MARINE TERMINAL DOCK	CLIS	16-Nov-95	15045.7	0	43996	0	41	8.651	72	53.118	1100
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	16-Nov-95	0	26545	43996	0	41	8.664	72	53.055	875
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	17-Nov-95	15045.5	26545	0	0	41	8.607	72	53.072	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	17-Nov-95	0	26545	43996	0	41	8.664	72	53.055	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	18-Nov-95	0	26544.9	43996.1	0	41	8.679	72	53.039	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	20-Nov-95	0	26544.9	43996.1	0	41	8.679	72	53.039	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	20-Nov-95	0	26544.9	43996	0	41	8.666	72	53.043	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	21-Nov-95	0	26545	43996	0	41	8.664	72	53.055	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	21-Nov-95	0	26545	43996.1	0	41	8.677	72	53.051	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	22-Nov-95	0	26545	43996.1	0	41	8.677	72	53.051	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	27-Nov-95	0	26544.9	43995.9	0	41	8.653	72	53.046	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	28-Nov-95	0	26545	43996.1	0	41	8.677	72	53.051	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	28-Nov-95	0	26544.9	43996.1	0	41	8.679	72	53.039	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	29-Nov-95	0	26544.9	43996	0	41	8.666	72	53.043	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	30-Nov-95	0	26544.9	43996.1	0	41	8.679	72	53.039	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	30-Nov-95	0	26545	43996.1	0	41	8.677	72	53.051	925
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	04-Dec-95	0	26544.9	43996	0	41	8.666	72	53.043	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	05-Dec-95	0	26545	43996.1	0	41	8.677	72	53.051	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	05-Dec-95	0	26545	43996.1	0	41	8.677	72	53.051	925
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	06-Dec-95	0	26544.9	43996.1	0	41	8.679	72	53.039	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	07-Dec-95	0	26545	43996.1	0	41	8.677	72	53.051	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	07-Dec-95	0	26545	43996.1	0	41	8.677	72	53.051	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	08-Dec-95	0	26545	43996.2	0	41	8.689	72	53.047	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	12-Dec-95	0	26545	43996.2	0	41	8.689	72	53.047	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	13-Dec-95	0	26545	43996.2	0	41	8.689	72	53.047	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	13-Dec-95	0	26544.9	43996.2	0	41	8.692	72	53.035	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	14-Dec-95	0	26544.5	43996.2	0	41	8.701	72	52.986	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	14-Dec-95	0	26544.6	43996.2	0	41	8.699	72	52.998	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	15-Dec-95	0	26544.4	43996.3	0	41	8.717	72	52.97	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	15-Dec-95	0	26544.5	43996.3	0	41	8.714	72	52.982	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	18-Dec-95	0	26544.5	43996.2	0	41	8.701	72	52.986	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	18-Dec-95	0	26544.5	43996.2	0	41	8.701	72	52.986	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	26-Dec-95	0	26544.5	43996.3	0	41	8.714	72	52.982	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	27-Dec-95	0	26544.6	43996.3	0	41	8.712	72	52.995	650
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	27-Dec-95	0	26544.6	43996.3	0	41	8.712	72	52.995	900
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	28-Dec-95	0	26544.5	43996.2	0	41	8.701	72	52.986	600
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	29-Dec-95	0	26544.5	43996.3	0	41	8.714	72	52.982	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	04-Jan-96	0	26544.5	43996.3	0	41	8.714	72	52.982	900
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	30-Jan-96	0	26544.7	43996.3	0	41	8.709	72	53.007	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	31-Jan-96	0	26545.3	43996.1	0	41	8.669	72	53.087	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	01-Feb-96	0	26545	43996.2	0	41	8.689	72	53.047	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	06-Feb-96	0	26545	43996.1	0	41	8.677	72	53.051	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	07-Feb-96	0	26544.9	43996.1	0	41	8.679	72	53.039	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	08-Feb-96	0	26545.1	43996.2	0	41	8.687	72	53.059	950
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	13-Feb-96	0	26545	43996.3	0	41	8.702	72	53.043	925
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	15-Feb-96	0	26545	43996.1	0	41	8.677	72	53.051	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	15-Feb-96	0	26545	43996.3	0	41	8.702	72	53.043	975
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	22-Feb-96	0	26545	43996	0	41	8.664	72	53.055	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	23-Feb-96	0	26545	43996.1	0	41	8.677	72	53.051	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	27-Feb-96	0	26545.1	43996	0	41	8.661	72	53.067	1000
ASSOC AT THE GUILFORD YC	WEST RIVER	CLIS	04-Mar-96	0	26545	43996.2	0	41	8.689	72	53.047	950
										Total CDM yd³		65500
										Total CDM m³		50081.3