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Evaluation of Potential for Sedimentation on Natural Oyster Bar 8-11 from Dike Construction at the Poplar Island Environmental Restoration Project

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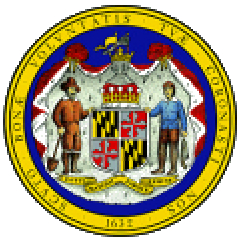

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INTRODUCTION

The Poplar Island Environmental Restoration Project (PIERP) is being constructed for the acceptance of fine-grained sediments dredged from the approach channels to the Port of Baltimore. A number of monitoring studies were developed during the design phase to insure that the containment area operated as anticipated and resulted in minimal ecological and environmental impacts to the surrounding areas. These monitoring efforts include studies of sediment quality, wetland vegetation, water quality, water column turbidity, and shellfish bed sedimentation. In addition, use of the site and adjacent areas by finfish and wildlife is part of the monitoring effort.

The oyster bar study described herein was designed to determine if impacts to the adjacent mapped natural oyster bar resulted from the construction of the containment dike surrounding Phase II of the island restoration site. This Natural Oyster Bay (NOB 8-11) lies immediately to the east of Jefferson and Coaches Island in Poplar Island Narrows (Figure 1). A portion of NOB 15-3, mapped as the coterminous triangular area immediately to the south of NOB 8-11 on Figure 1, was also surveyed as part of this project. For simplicity in the remainder of this report the two NOB's will be referred to as NOB 8-11. Dike construction utilized the placement of a sand containment berm that was faced with a rock revetment used for erosion protection. The potential for identifying any movement of sand from the perimeter dike into the area and over any oyster shell located in NOB 8-11 during the construction phase was the object of the monitoring effort in this report.

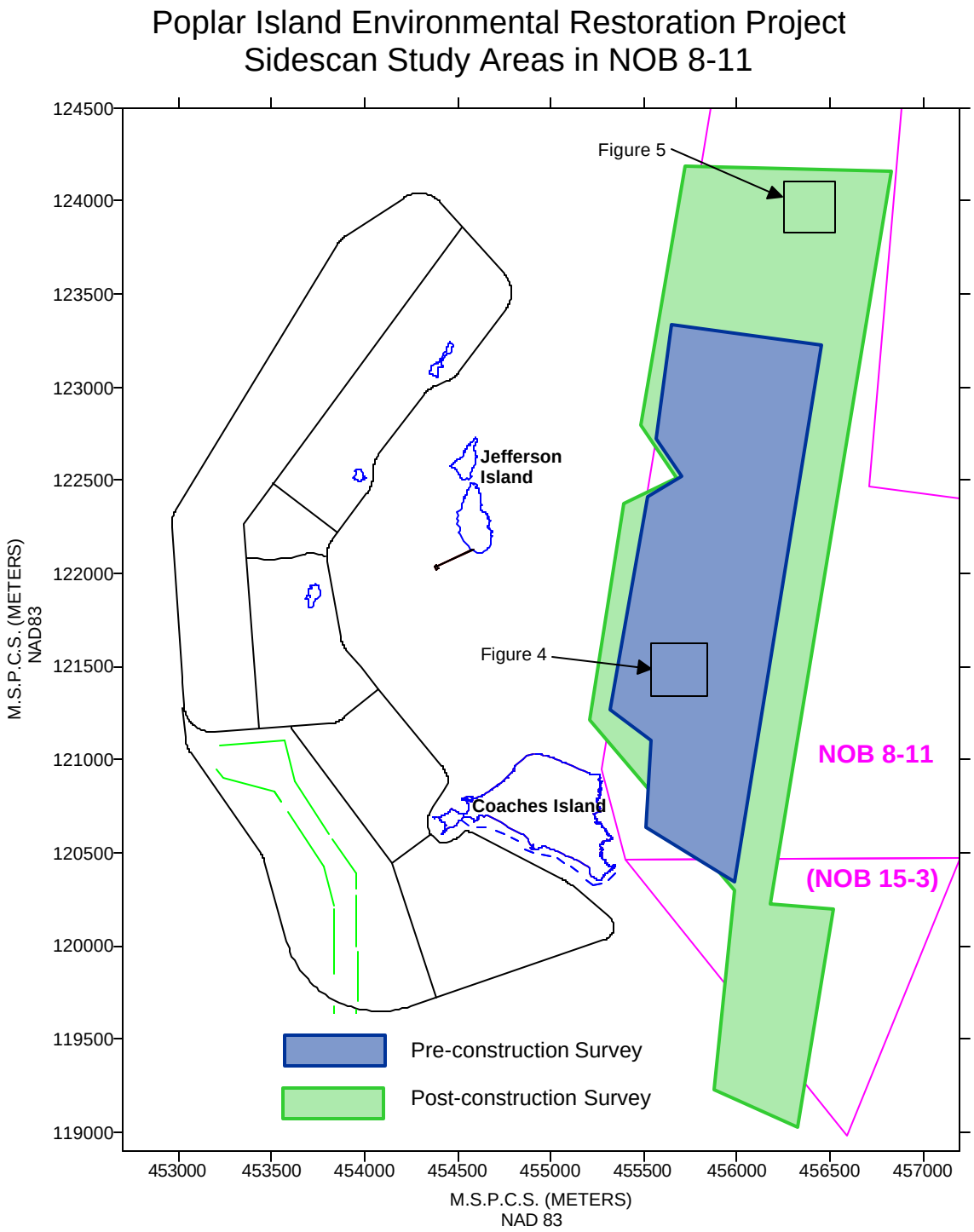

Figure 1: Location Map of study area showing location of Coaches and Jefferson Islands, PIERP dike locations and the location of NOB 8-11 and 15-3. The pre- and post- construction side scan surveys are shown by the hachured areas and identified in the legend. Locations of Figures 4 and 5 are also indicated.

METHODOLOGY

An initial side-scan sonar survey was conducted on August 15, 2000. The area of coverage is indicated by the blue cross hachured area on Figure 1. This survey utilized a Klein 2000 side-scan unit operating at a frequency of 100 kHz and interfaced with a DGPS for navigation. The system was rented from a vendor in Annapolis. A full digital mosaic of the results was prepared by Enviroscan, Inc using GeoDAS software marketed by Oceanic Imaging Consultants, Inc. Unfortunately, weather conditions and system settings produced results that were only fair on this date. Water column turbidity and surface waves resulted in acoustic data that were of less than ideal quality.

Although the entire bar was not surveyed, that portion located closest to the Phase II construction activities, and in sufficient water depths, was covered. Areas further away were not surveyed because a previous study at NOB 8-10 located to the west of the PEIRP did not show evidence of sediment movement any great distance from the dike construction area (Halka and Ortt, 2002). The shallow water areas located immediately east and southeast of Coaches Island was not covered because water depths were too shallow for boa access. Side-scan data quality is also further degraded in very shallow water depths because of the proximity of the acoustically reflective bottom to the equally reflective water surface and the shallow angle of incidence of the acoustic waves. Therefore, no attempt was made to obtain data in these very shallow areas, even though they were located within the plotted boundary of NOB 8-11.

Following construction, another side-scan sonar survey was conducted on August 8, 2001. This survey utilized an EdgeTech 272TD dual frequency towfish operating at 100kHz. Range was set at 100 m to each side of the fish and was interfaced to a DGPS unit for navigation. The limits of the surveyed area are shown by the green hachured area in Figure 1. The sonar was powered by an EdgeTech ACI trigger system connected to a PC running "SonarWiz " software produced by Chesapeake Technology for data collection. The mosaic was produced using "SonarWeb" software produced by Chesapeake Technology, Inc. Side scan operation and image production was conducted by Dr. Douglas Levin, Earth Mapping Laboratory, University of Maryland-Eastern Shore. As on the pre-construction survey date the area immediately to the east and southeast of Coaches Island was not surveyed due to shallow water depths. The surveyed area covered somewhat more of NOB 8-11 than the pre-construction survey, but most of the additional area covered was located away from the dike construction area and would be outside any area anticipated to be impacted by the construction activities.

Due to the shallow nature of the survey area the altitude of the towfish above the bottom on both the survey dates averaged only a few meters. The low altitude served to enhance resolution of bottom features, such as groupings of oyster shells, which stood above the bottom.

RESULTS

INITIAL SIDE-SCAN SURVEY

The initial side-scan sonar survey of NOB 8-10 was conducted in August 2000 to establish bottom acoustic reflectance characteristics prior to any construction activity at the PIERP site. Although the system settings and weather conditions resulted in side scan data that was only of fair quality, results were sufficient to determine that there were few, if any, oysters in the bar area that was surveyed. The surveyed area is shown by the diagonal blue colored hachure on Figure 1.

The sediments on the Bay bottom east of Poplar Island consist of medium to fine grain sands (Kerhin et al., 1988) covering a relatively shallow platform, which deepens in the channel area in the middle of Poplar Island Narrows. The large fetch in the area and the relatively high tidal currents flowing through the Narrows remove any fine-grained silts and clays from the area and only coarser sand sized particles remain on the bottom.

The sand bottom in the area reflects much of the acoustic energy generated by the side-scan sonar equipment. If the bottom is smooth and flat, or facing away from the side-scan unit, the record will appear lighter because much of the incident energy is reflected off the firm surface and away from the equipment sensors, much like light off a mirror. Much of the entire surveyed bottom area of NOB 8-11, consisted of a predominantly sandy bottom that reflected much of the incident energy. This resulted in the nearly featureless image shown in Figure 2. Much of the bottom area is generally featureless, indicating that it was smooth and flat on this survey date. To the southeast of the pound net a relatively large area was hydraulically dredged for clams prior to the survey date. The scars caused by the dredging operation appear as a moderately darker section just below the center of the image, due to the reflectance of more acoustic energy from the irregular and rough bottom. Isolated patches and spots of elevated acoustic reflectance are present to the northeast of the hydraulically dredged area. Some of these darker areas are isolated patches of harder pre-Holocene sediment with only a thin sand covering, similar to those identified to the west of the PIERP (Halka and Ortt, 2000). Some are probably small isolated patches of oyster shells. The southernmost portion of Figure 2, located east of Coaches Island, and closest to the future dike construction area, has an overall smooth and flat character with no evidence of either hydraulic clam dredging, oyster dredging, or oyster shell.

POST-CONSTRUCTION SIDE-SCAN SURVEY

The post construction survey, conducted on August 8, 2001 covered slightly more of the bottom area of NOB 8-11, and extended beyond the limits of the initial survey. The limits of this survey are shown as the green hachure on Figure 1. The bottom characteristics within the surveyed area were the same as shown on the pre-construction

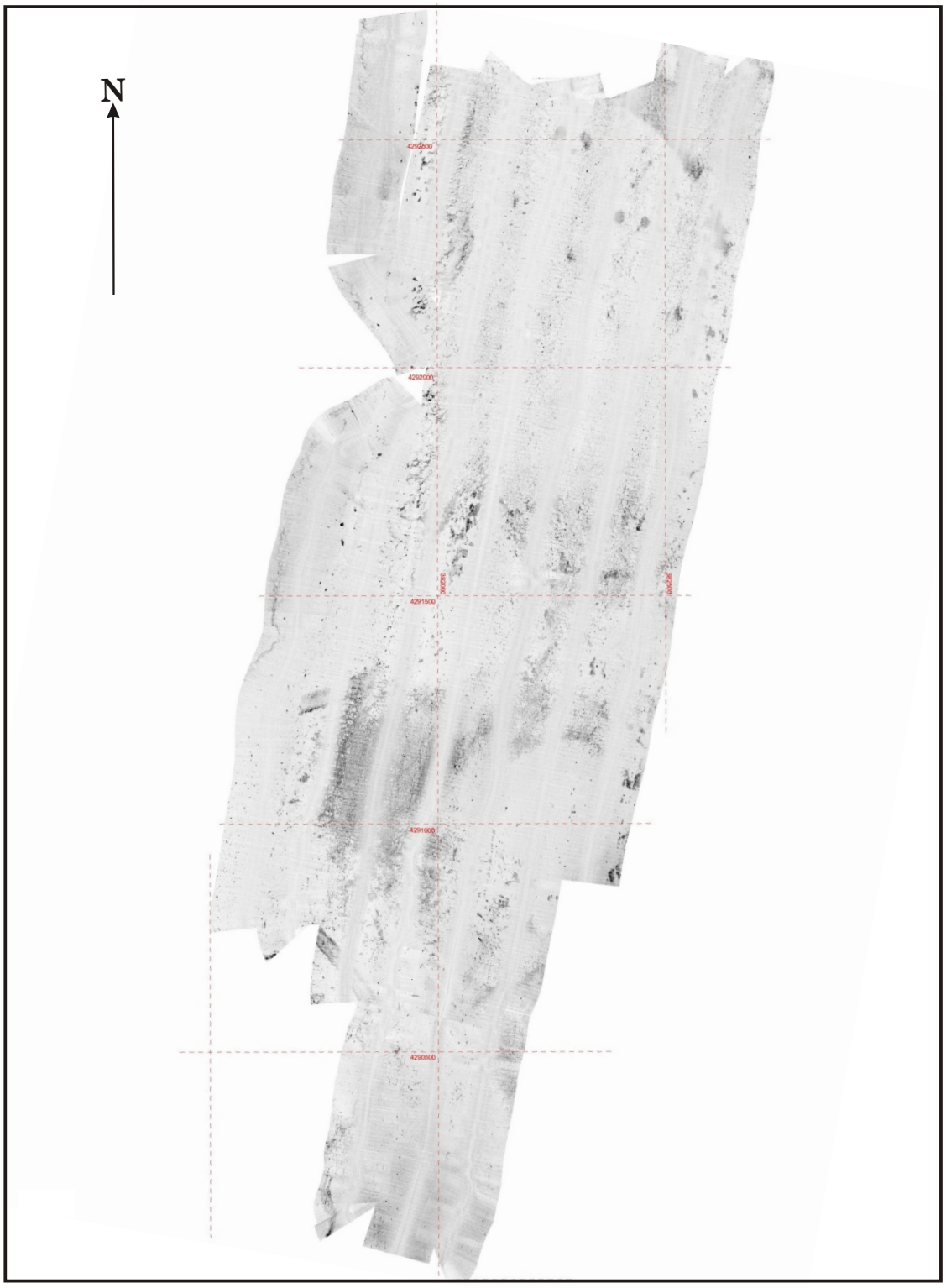

Figure 2: Pre-construction side-scan sonar mosaic collected within the area shown on Figure 1. Note the relatively reflection free nature of the smooth and flat sandy bottom in the area surveyed. See text for explanation of image quality. Survey conducted August 15, 2000.

survey (Figure 3). Most of the area remained predominantly smooth and flat, particularly in the vicinity of Coaches Island. The hydraulic clam dredging scars were still present in the same area as on the pre-construction survey, indicating that these scars can persist for a substantial length of time even in an area of relatively large fetch and tidal currents. A close up of the dredge area is shown in Figure 4,where the individual scars on the bottom can be clearly identified.

The area surveyed following completion of dike construction extended beyond the limits of pre-construction surveyed area. Coverage extended to the south to determine if the bottom characteristics in that area differed from the smooth sandy nature identified on the initial survey. Coverage extended to the north mainly to improve coverage within NOB 8-11, even though there was little chance that there would have been impacts detected at this distance from the construction activities. At the northern end of the surveyed area, large patches of bottom with different reflection characteristics were present (Figure 5). These were interpreted to represent numerous clusters of oyster shells on the bottom and were similar to bottom reflections observed on NOB 8-10 that were identified as oyster shells by diving (Halka and Ortt, 2002).

CONCLUSIONS

The Pre-construction side-scan sonar survey indicated that there was little oyster shell identified within the boundaries of NOB 8-11 to the east or southeast of Coaches Island. While small groupings of shell, and isolated individual shells that would be undetectable by the side-scan system, may have been present in the area, there were no large groupings identified. It would appear that, at this time, there are no commercially harvestable shells located in close proximity to the dike construction area.

A comparison of the pre- and post-construction side-scan sonar records in the vicinity of the dike construction area provided no indication that additional sediment moved into the boundary of NOB 8-11 as a result of construction activities. Proximal to the dike the bottom appeared to be largely smooth and flat sands both prior to and following construction. The hydraulic dredge scars that were identified on the pre-construction survey were still present following construction indicating that no sandy sediments moved into this vicinity and covered the scars. There was no evidence that dike construction activities had produced any movement of sand into the boundaries of NOB 8-11.

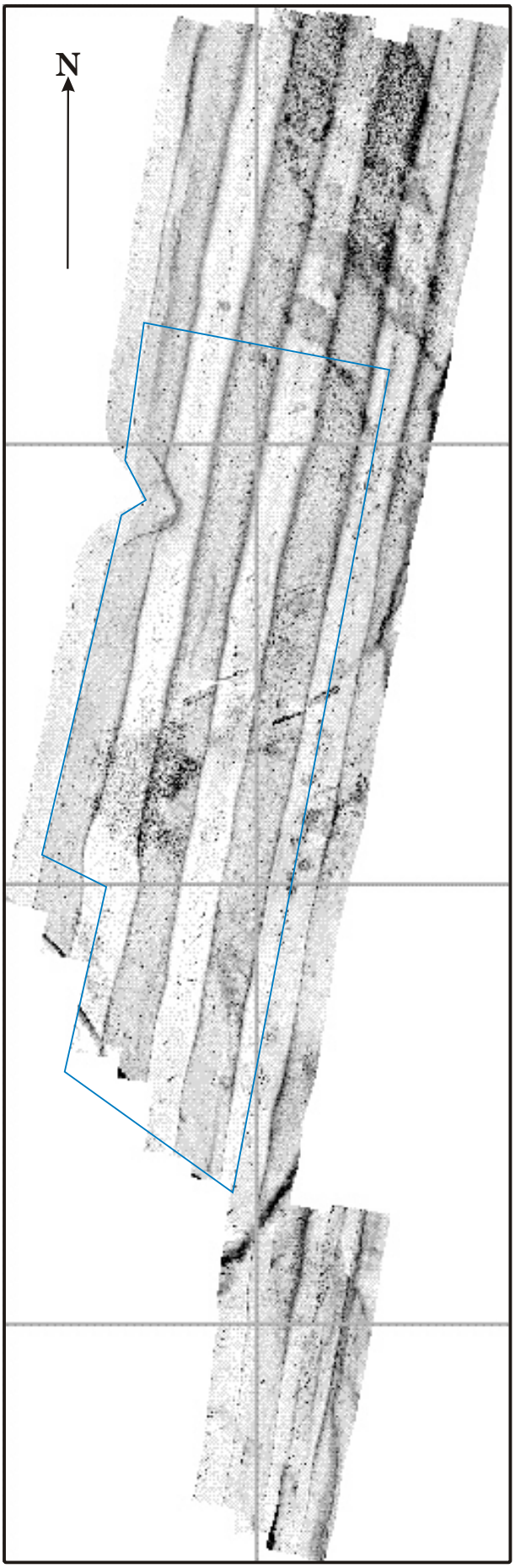

Figure 3: Post-construction side-scan sonar mosaic collected within the area shown on Figure 1. The pre-construction survey area shown on Figure 2 is outlined in blue for reference. See text for details. Survey conducted August 8, 2001.

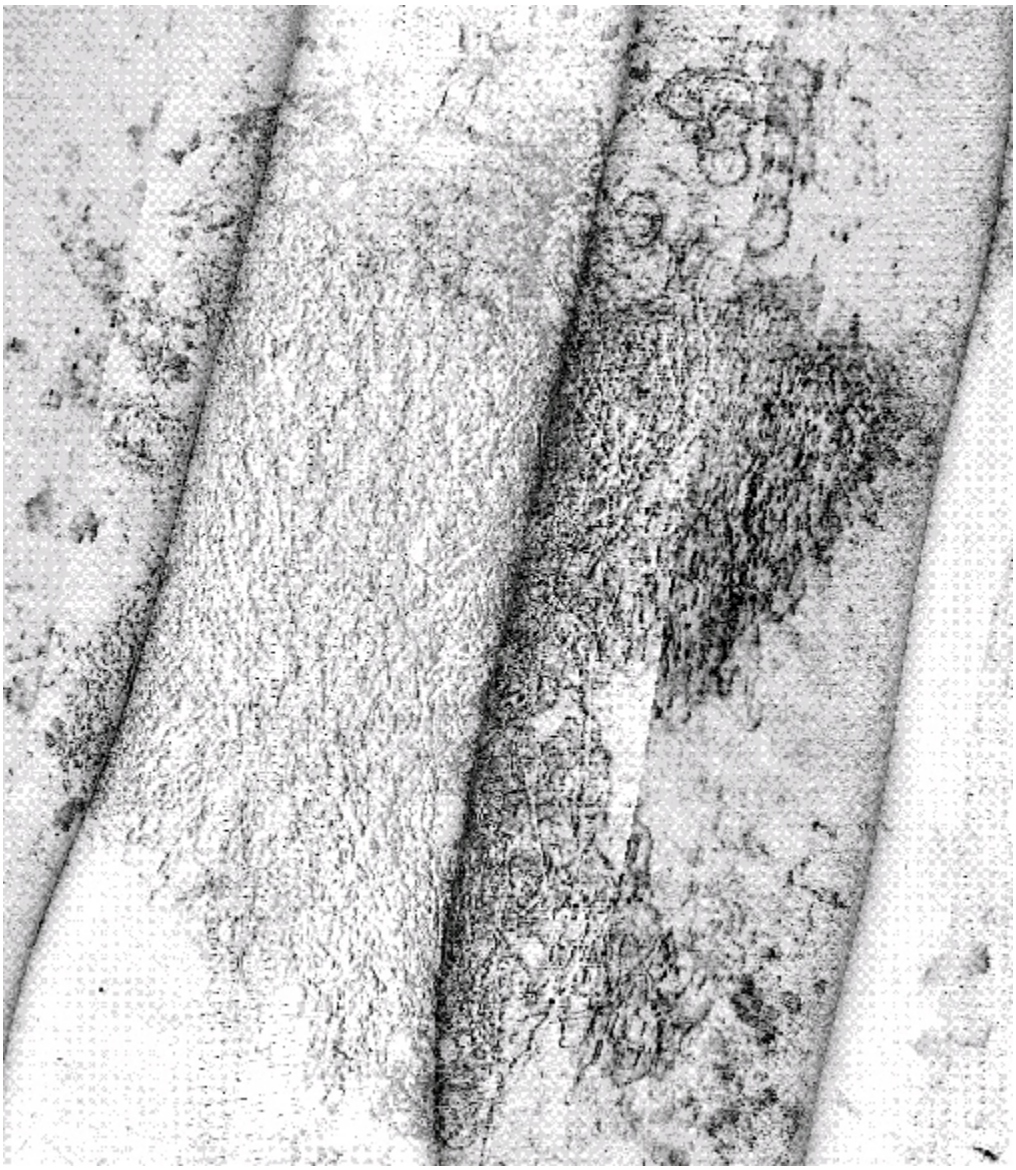

Figure 4: Side-scan sonar image of sandy bottom Northeast of Coaches Island showing evidence of hydraulic clam dredging scars. Location of this figure is indicated on Figure 1.

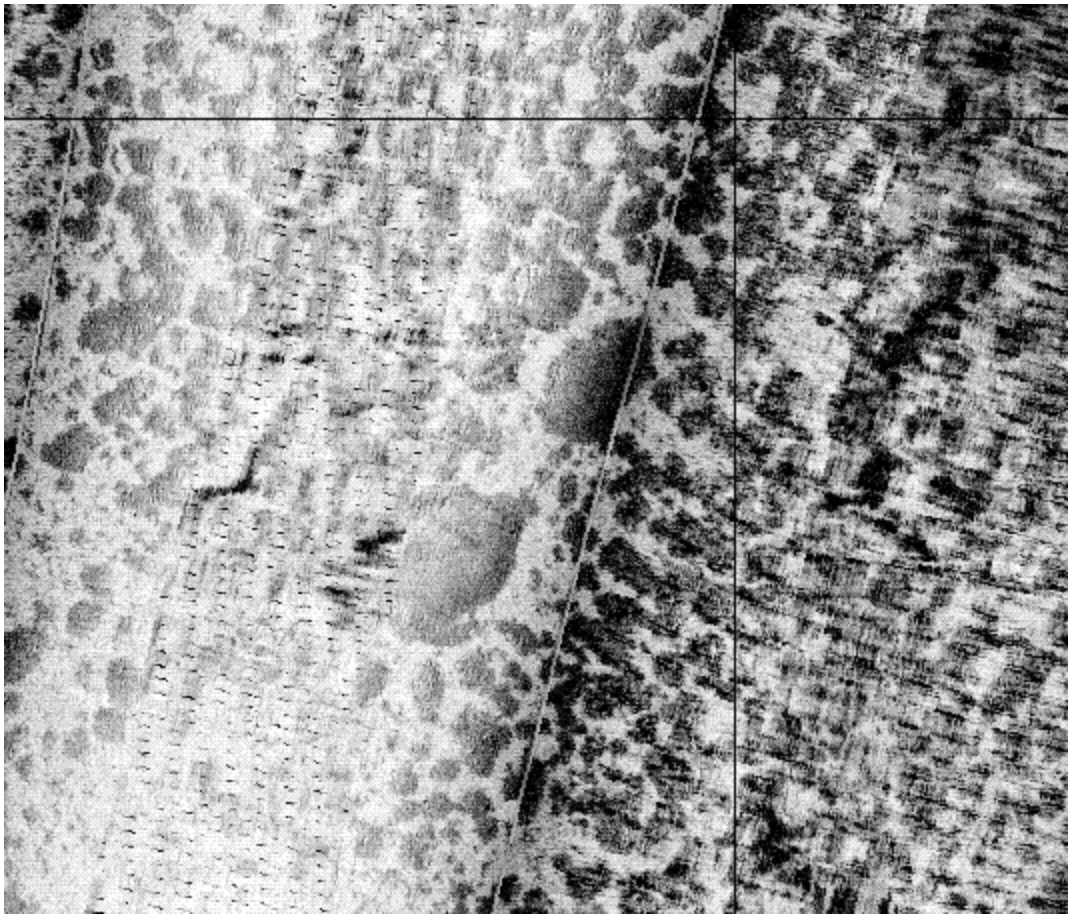

Figure 5 Side-scan sonar image of oyster shell clusters in the northern portion of the post-construction surveyed area. Location identified on Figure 1.

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