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DAVID S. ROBINSON & ASSOCIATES, INC.

Marine Archaeological Consultants

CLb![TECHNICAL MEMORANDUM

Detailed Marine Archaeological Remote Sensing Survey

New Bedford Harbor Superfund Site – Unanticipated Discovery (Shipwreck 2)

Acushnet River, Fairhaven and New Bedford, Massachusetts

February 2017

Prepared for:

CR Environmental, Inc.
639 Boxberry Hill Road
East Falmouth, Massachusetts 02536

Prepared by:

David S. Robinson, M.A., R.P.A. (DSRA)
Christopher F. Wright, B.A., C.H. (CR)

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INTRODUCTION

The purpose of this report is to document the results of the marine archaeological investigations of an unanticipated find (July 5, 2016) and provide recommendations for handling the find to allow continued remediation of the New Bedford Harbor.

This Final Technical Memorandum presents the results and management recommendations from a detailed marine archaeological remote sensing survey performed by David S. Robinson & Associates, Inc. ("DSRA") and CR Environmental, Inc. ("CR Environmental") between July and December 2016, within the marine portion of the New Bedford Harbor Superfund Site ("NBHSS") located in the Acushnet River, between Acushnet, Fairhaven, and New Bedford, Massachusetts. The survey was conducted at the location of an "unanticipated discovery" of historical wooden ship remains ("NBHSS UAD-Shipwreck 2") that was made on July 5, 2016 during Jacobs Engineering, Inc.'s ("Jacobs") pre-dredge debris removal operations, being performed as part of the ongoing environmental remediation activities by the U.S. Environmental Protection Agency – Region 1 ("EPA") and the U.S. Army Corps of Engineers ("USACE-NAE") at the NBHSS. Upon making the discovery, Jacobs followed the procedures outlined in the Unanticipated Discoveries Plan ("UDP") that they developed specifically for the NBHSS in 2010 and reported the find to the EPA and USACE-NAE. On July 6, 2016, less than 24-hours after its discovery, DSRA (Jacobs's principal and 'on-call' archaeologist for the NBHSS through their contract with CR Environmental, principal marine surveyors for the NBHSS) was informed of the unanticipated discovery. Consisting of the submerged remains of an historical wooden ship, the find was described to DSRA as "a large timber…possibly having [attached to it] ribs… [and] boards with round 'peg like' holes in them." The position of the find was reported by Jacobs as 815398.47 / 2705752.03 (MA State Plane [feet]), a location situated near the northern edge of an area Jacobs has termed the "2015 Task 2 (Submarine Cable Crossing) Area" within the "Upper Harbor Management Area" of the NBHSS (Joshua Cummings [Jacobs], email to D. Robinson [DSRA], July 6, 2016). At the time of its discovery, the find was brought to the water's surface and kept immobile until its GPS position could be recorded and a photo of it taken (Figure 1). The find was then lowered slowly back down to the harbor floor and a temporary 250-foot- (76-meter-) radius exclusion zone was established around it. Remediation work activities then resumed at a different location within the NBHSS (Cummings to Robinson, personal communication, July 6, 2016).

Upon being informed of the unanticipated discovery, DSRA advised Jacobs to notify the Massachusetts Bureau of Underwater Archaeological Resources ("BUAR") and the Massachusetts Historical Commission ("MHC") of the find, as per Jacobs's 2010 NBHSS UDP, and recommended that a science-based management approach for the site be developed to inform the planning and execution of the systematic removal and documentation of the vessel's wooden remains. Removal of the ship remains will be required in order to complete environmental remediation activities at the location of the unanticipated discovery (Robinson to Cummings, personal communication [email and telecom], July 6, 2016).

DSRA recommended that CR Environmental complete a more-detailed high-resolution sidescan sonar survey of an area encompassing the 250-foot- (76-meter-) radius exclusion zone centered on the location of the unanticipated discovery to: a) confirm the adequacy of the size of the temporary

exclusion zone and adjust it as needed based on the actual size of the cultural deposit comprising the find site; and b) to begin to obtain the data necessary to plan the systematic removal of the ship remains. Survey lines were recommended to be run on a grid pattern and then diagonally across the find site to provide sonar images of the disturbed ship remains now exposed above the harbor floor from multiple angles. This survey was completed in July 2016 and CR Environmental's data was reviewed by DSRA. On August 1, 2016, DSRA reported in an email to Jacobs that the survey's data indicated that the exposed wreckage occupied a relatively small area and might not constitute the remains of an entire ship's hull. Consequently, DSRA recommended that the exclusion zone's radius could be reduced to 60 feet (18 meters) (Robinson to Cummings, August 1, 2016).

On August 15, 2016, DSRA communicated via email to Jacobs their recommendation that additional detailed survey be conducted to determine the limits of any buried elements of the UAD-Shipwreck 2 hull remains to help guide the eventual systematic removal of the wreckage during future debris removal site remediation activities (Robinson to Cummings, August 15, 2016). DSRA's recommended survey methodology included additional sub-bottom profiling, magnetometry and systematic (i.e., on a 3-foot [1-meter] grid) tile-probing from one of CR Environmental's small survey vessels with the locations of positive (for buried hull remains) and negative (no buried hull remains) probe results mapped with GPS and plotted in a site plan. CR Environmental commented that the magnetometer survey would be redundant and not likely to provide much additional information than the detailed magnetic data already acquired for the site during their 2016 re-survey of the Task 2 (Submarine Cable Crossing) Area. Based on their comment, additional magnetometer survey was not performed as part of the more-detailed survey conducted at the UAD-Shipwreck 2 find site.

In addition to the more detailed survey of the UAD-Shipwreck 2 area, DSRA also recommended that a plan for the removal and the documentation of the UAD-Shipwreck 2 ship remains, similar to that employed in 2009 for the other Upper Harbor shipwreck remains ("UAD-Shipwreck 1"), be prepared and submitted to the EPA, USACE-NAE, MHC, MBUAR, Tribes, and other stakeholders for comment. Any comments received would then be incorporated into a modification for DSRA's current MBUAR permit they hold for the underwater portion of the NBHSS (a different MBUAR permit from that which PAL holds for their intertidal work). The modification would cover the archaeological work that would happen during the wreckage's removal and would include the same level of documentation completed for the UAD-Shipwreck 1 find. Upon completion of the documentation and analysis/interpretation of the UAD-Shipwreck 2 find, DSRA would prepare a technical report covering all elements of the unanticipated discovery's investigation for submittal to the agencies and stakeholders, similar to the report produced for the UAD-Shipwreck 1 find.

All work conducted by DSRA and CR Environmental as part of this detailed marine archaeological remote sensing investigation of NBHSS UAD-Shipwreck 2 in the 2015 Task 2 (Submarine Cable Crossing) Area was completed in accordance with the above-referenced legislation and guidelines, as well as the Secretary of Interior's *Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716 1983) and *Standards and Guidelines for Identification* (1983), the NBHSS's *Plans and Procedures for Addressing Unanticipated Discoveries of Cultural Resources and Human Remains* (Jacobs 2010), the MBUAR's *Policy Guidance for the Discovery of Unanticipated Archaeological Resources* (updated September 28, 2006) included in the MBUAR Regulations (312 CMR 2), and the MHC's *Historic Properties Survey Manual: Guidelines for the Identification of Historic and Archaeological Resources in Massachusetts* (1992).

David S. Robinson, M.A., R.P.A., was responsible for the overall performance of the detailed marine archaeological remote sensing survey data acquired by CR Environmental at the location of the UAD-Shipwreck 2 site. Remote sensing survey data (i.e., sidescan sonar, magnetometer, subbottom profiler, and T-probe data) reviewed by DSRA for this investigation were acquired by CR Environmental, and post-processed and plotted by Christopher Wright. Chip Ryther (principal, CR), was responsible for the overall management of the data acquisition and the preparation of this report. This investigation was coordinated and performed with the direction and assistance of Jacobs's on-site NBHSS staff Mark Gouveia, Steve Fox, and Josh Cummings.

All supporting documentation collected during the course of this investigation is on file at David S. Robinson & Associates, Inc., 55 Cole Street, Jamestown, Rhode Island 02835. Raw and processed remote sensing survey data products are on file at CR Environmental, Inc., 639 Boxberry Hill Road, East Falmouth, Massachusetts 02536. DSRA and CR Environmental serve as temporary curation facilities for this information until such time as the Commonwealth of Massachusetts designates a permanent state repository.

METHODS

Data Acquisition

CR Environmental conducted the detailed marine remote sensing field survey of the UAD-Shipwreck 2 location on July 21, 2016 (using sidescan sonar) and December 2, 2016 (using sub-bottom profiler). Systematic subsurface probing with a manually-operated, stainless-steel T-probe was conducted by CR Environmental at the UAD-Shipwreck 2 location on December 5, 2016.

Precision navigation for the surveys was accomplished using a Hemisphere VS330 Real-time Kinematic Global Positioning System (RTK GPS). The horizontal accuracy of the system is approximately 0.4 inch (1.0 centimeter) horizontally and 0.8 inch (2.0 centimeters) vertically (Root Mean Squared 1-sigma). Horizontal accuracy in differential or float mode is approximately 1 foot (30.5 centimeters). RTK corrections were provided via NTRIP internet connection by KeyNetGPS, Inc. For sonar surveys, the RTK GPS serial output was split and interfaced to shipboard computers running HYPACK navigation software and Chesapeake Technology, Inc. SonarWiz 5 software.

Sidescan data were collected using an Edgetech, Inc. Model 4125 400/900-kHz digital sonar system. Using the higher resolution 900-kHz signal, the system has an effective across-track (athwart ship) resolution of 0.6 inch (1.5 centimeters). Data were collected by occupying transects alongside and above the UAD-Shipwreck 2 using swath ranges from 33 to 82 feet (10 to 25 meters) with a resultant feature resolution of approximately 0.6 to 1.6 square inches (4 to 10 square centimeters). Digital data from 57 sidescan sonar passes over the find location were recorded in .jsf format using SonarWiz software.

Sub-bottom profile data were collected using an Edgetech, Inc. Model 3200 2- to 16-kHz digital profiling system. The vertical resolution of the system is approximately 2 to 4 inches (6 to 10 centimeters). Data were collected by occupying a grid of transects alongside and above the discovery using a transect spacing of 10 feet (3 meters). Data were acquired using a 10-millisecond

wide-band pulse. A 33-foot (10-meter) profile range was specified to maximize the ping-rate and resultant along-track resolution. Digital data from 25 sub-bottom profiler passes were recorded in .xtf formats using SonarWiz software.

The probing effort was conducted by navigating CR Environmental's 26-x-8.5-foot (8-x-2.6-meter) vessel, R/V *Lophius,* along transects within the vicinity of the area of discovery identified during the sidescan sonar and sub-bottom surveys. A 3-foot (1-meter) spacing was taped-off (marked) from bow to stern along the port and starboard rails of the survey vessel. Each time the boat spudded down, nine probes were conducted along each of the rails for a total of 18 probes per stationary vessel location. The RTK GPS antenna was held above each of the probe locations to record positions. The vessel was then advanced along each transect to maintain a 3-foot (1-meter) probe separation. At each probe location technicians advanced a stainless-steel probe rod into the sediment until refusal. Probe penetration locations, depths and estimates of the substrate at refusal (e.g., mud, sand, wood) were recorded digitally at 162 locations (Appendix A). Subsets of the probe locations intersected the UAD-Shipwreck 2's exposed sidescan sonar targets of wood or other debris identified during the more detailed sidescan sonar survey, as well as buried sections of the acoustic target.

Data Processing

Processing of sidescan data included removal of the water column portion of records and correction of signal loss with distance using moderate Time Varied Gain (TVG) adjustments. The sonar imagery which best depicted the discovery were combined and exported as georeferenced .tif image files using 0.05-foot- (1.5-centimeter-) per-pixel resolution to facilitate accurate scaling of features. The images were projected in the Massachusetts (Mainland) State Plane grid, NAD83, US Feet. Waterfall imagery from each of the sonar files were exported in .jpg format using a resolution that honored the sonar system's 0.6-inch (1.5-centimeter) across-track resolution.

Sub-bottom profiles were examined for the presence of acoustic reflectors characteristic of buried features. Observed sub-bottom profiler acoustic reflectors were digitized and incorporated into an ArcGIS project to guide the probing effort and data analysis.

Probe point data were plotted in ArcGIS using different symbols coded for different refusal types. In order to better assist characterization of the spatial extent of the discovery and burial depth, probe sediment thickness observations were used to create a three-dimensional surface.

RESULTS AND RECOMMENDATIONS

Detailed Marine Archaeological Remote Sensing Survey of UAD-Shipwreck 2

Processed survey data provided by CR Environmental for the NBHSS NAD-Shipwreck 2 find site indicates that the wooden vessel's hull remains include portions that are exposed and buried that together extend horizontally along their longitudinal axis a distance of approximately 45 to 50 feet (14 to 15 meters) (Figure 2). About half of the hull remains documented through physical probing are buried beneath approximately 3 feet (1 meter) or less of harbor floor sediment, and are likely to be within the remediation dredging prism at this location, but were completely invisible to the

sidescan sonar (Figures 3 and 4). The remainder of the hull remains are exposed above the harbor floor and were visible in the more detailed sidescan sonar survey record that was made after the wreck was encountered and disturbed by debris removal activities (see Figure 2). Based on the relatively narrow width of the mapped hull remains, it appears that the NBHSS NAD-Shipwreck 2 find constitutes only a portion of the original vessel, perhaps the lower part of one side of the hull, extending from its turn-of-bilge where the hull transitions from its side to its bottom. This kind of preservation (i.e., the lowest part of a tilted hull that settled to the bottom and was then buried relatively quickly in anaerobic sediments, protecting it from colonization and destruction by damaging marine life) is not atypical.

The acquired survey data indicates the types of materials that are preserved at the site include a portion of a vessel's wooden hull, but little else of the ship. Iron fasteners and any other ferrous hull components, hardware or cargo, do not appear to be present, based on currently available data. This result is similar to what was observed in the remote sensing data associated with, and in the recovered materials from, the NBHSS NAD-Shipwreck 1 find – that is, that all of its iron fastenings and other iron hull components were corroded to the point where they no longer possessed any ferrous mass detectable with a magnetometer as single anomaly, or as a collection of anomalies, of significant size or duration.

It is important to note that the Task 2 (Submarine Cable Crossing) Area where the UAD-Shipwreck 2 find was made had been subjected to a comprehensive marine archaeological remote sensing identification survey by Dolan Research, Inc. ("Dolan") in 1999 (Cox, Jr. 2001), and a detailed re-survey by CR Environmental and DSRA in 2015 (Robinson and Wright 2016). Using a nominal 50-foot [15-meter] line spacing, multiple phases of the Dolan investigations eventually determined the area to be free of potentially significant submerged cultural resources (Cox, Jr. 2000, 2001; Marcos Paiva [USACE-NAE], personal communication with D. Robinson [DSRA], 2016). Removal of the abandoned submarine cables from the 2015 Task 2 (Submarine Cable Crossing) Area was planned as part of the pre-remediation dredging debris removal process; therefore, a high-resolution (25-foot [8-meter] trackline spacing) supplemental re-survey of the area was completed by CR Environmental and DSRA in 2015/2016. The results and recommendations from that supplemental re-survey were reported to Jacobs, EPA and the USACE-NAE by DSRA and CR Environmental in a letter report submitted in March 2016 (Robinson and Wright 2016). Based on the re-examination of the: 1) Dolan survey data; 2) newly-acquired CR Environmental data; and 3) descriptions of 14 sediment cores acquired by Batelle Memorial Institute ("Batelle"), DSRA concurred with the Dolan findings and recommendations. DSRA also concluded that identified sidescan sonar contacts and magnetic anomalies present within the 2015 Task 2 (Submarine Cable Crossing) Area represented miscellaneous harbor debris (including a section of wooden cribbing), vessel propeller scour marks in the harbor floor's soft sediments, or discarded tires, and that no potentially significant submerged cultural resources, including submerged paleosols with archaeological sensitivity for containing ancient Native American cultural deposits, were present. Consequently, no further marine archaeological investigation of the area was recommended (Robinson and Wright 2016).

As was the case in 2009 when NAD-Shipwreck 1 was encountered as an unanticipated discovery during debris removal operations in another portion of the Upper Harbor Management area that had been surveyed and cleared in 1999, both that shipwreck and the NBHSS UAD-Shipwreck 2 in the 2015 Task 2 (Submarine Cable Crossing) Area had virtually no detectable presence in either the sidescan sonar or magnetometer record. Only a single, isolated, low-amplitude (4.5 gammas),

short-duration (25 feet [8 meter]), monopolar magnetic anomaly (M111) was found at the NBHSS UAD-Shipwreck 2 (Figure 5) location (the presence of a buried shipwreck surveyed at such a close survey trackline interval would typically be indicated by a cluster of multiple magnetic anomalies associated with the central portion of the wreck surrounded by scattered ferrous debris). If the sub-bottom profiler had been able to penetrate the gaseous sediments of the harbor floor, it is likely that some element or elements of the ship remains would have been visible in the sub-bottom profile, as has been seen in profiles recorded over shipwrecks in other study areas (Figure 6).

The industry-standard suite of marine archaeological remote sensing equipment (sidescan sonar, marine magnetometer and subbottom profiler) and conservative 50-foot (15-meter) trackline spacing employed during the 1999 survey proved ineffective for identifying the buried remains of the two historical wooden shipwrecks that became unanticipated discoveries within the NBHSS. The current, state-of-the-art surveying and data processing equipment and the extremely conservative 25-foot (8-m) survey trackline interval that was used during the supplemental survey also proved ineffective at identifying the UAD-Shipwreck 2 historical wooden shipwreck. The significance of these unexpected results is difficult to overstate when considering the overall efficacy of marine remote sensing underwater archaeological identification surveys.

Recommendations

The NBHSS UAD-Shipwreck 2 find appears to be the remains of an historical wooden vessel possibly similar in age as the late eighteenth-early nineteenth century NBHSS UAD-Shipwreck 1 find of 2009 (Robinson, et al. 2010). Consequently, DSRA recommends that a detailed plan and revised MBUAR permit revision be developed and submitted for the NBHSS UAD-Shipwreck 2 find. This plan and revised MBUAR permit should describe the recommended methods for systematically removing the NBHSS UAD-Shipwreck 2 hull remains using the same procedure employed to recover the remaining timbers left behind at the NBHSS UAD-Shipwreck 1 site. That methodology involved a qualified marine archaeologist directing recovery of the hull remains from the recovery barge. Recovered ship hull timbers were sorted in real-time by the archaeologist. Retained shipwreck components were wrapped in plastic, and transferred to shore for documentation, while debris was simply discarded. DSRA recommends that this removal process be scheduled during the spring of this year, after warmer weather conditions arrive to the New England area, to facilitate and make safer the recovery, handling and wrapping, and transfer of the recovered vessel remains to shore.

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2008 *Draft Technical Report: Preliminary Assessment Searsport Harbor Shipwreck, Searsport, Maine* (PAL Report No. 2019). Submitted to the U.S. Army Corps of Engineers-New England District, Concord, MA. Submitted by PAL, Pawtucket, RI.

FIGURES

Figure 1. Portion of the NBHSS UAD-Shipwreck 2 find at the time of its unanticipated discovery during the debris removal phase of remediation activities (photograph by Joshua Cummings, Jacobs).

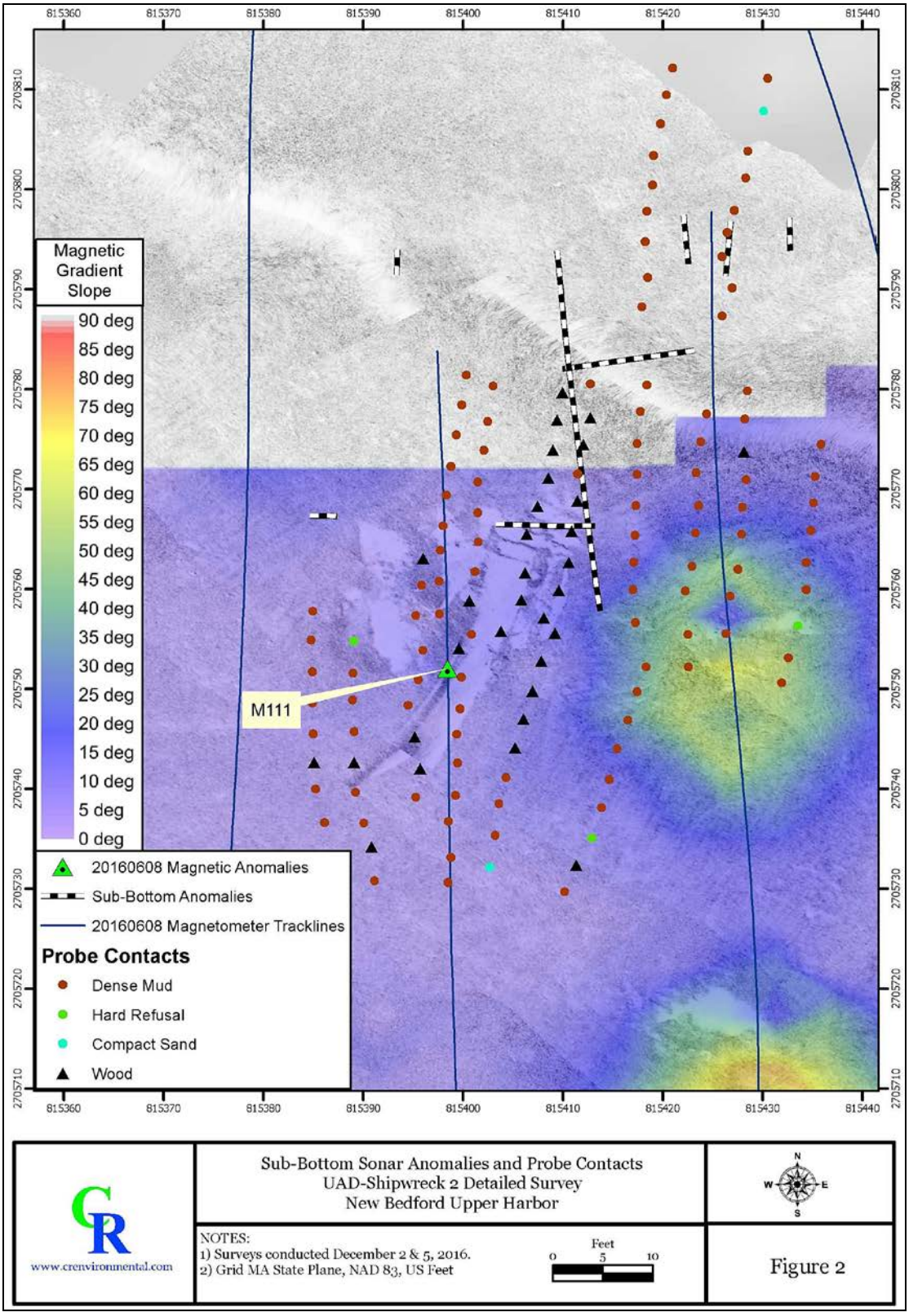

Figure 2. Plot of the 2016 detailed remote sensing survey and sub-surface probing results recorded post-discovery at the NBHSS UAD-Shipwreck 2 find site (figure courtesy of CR Environmental).

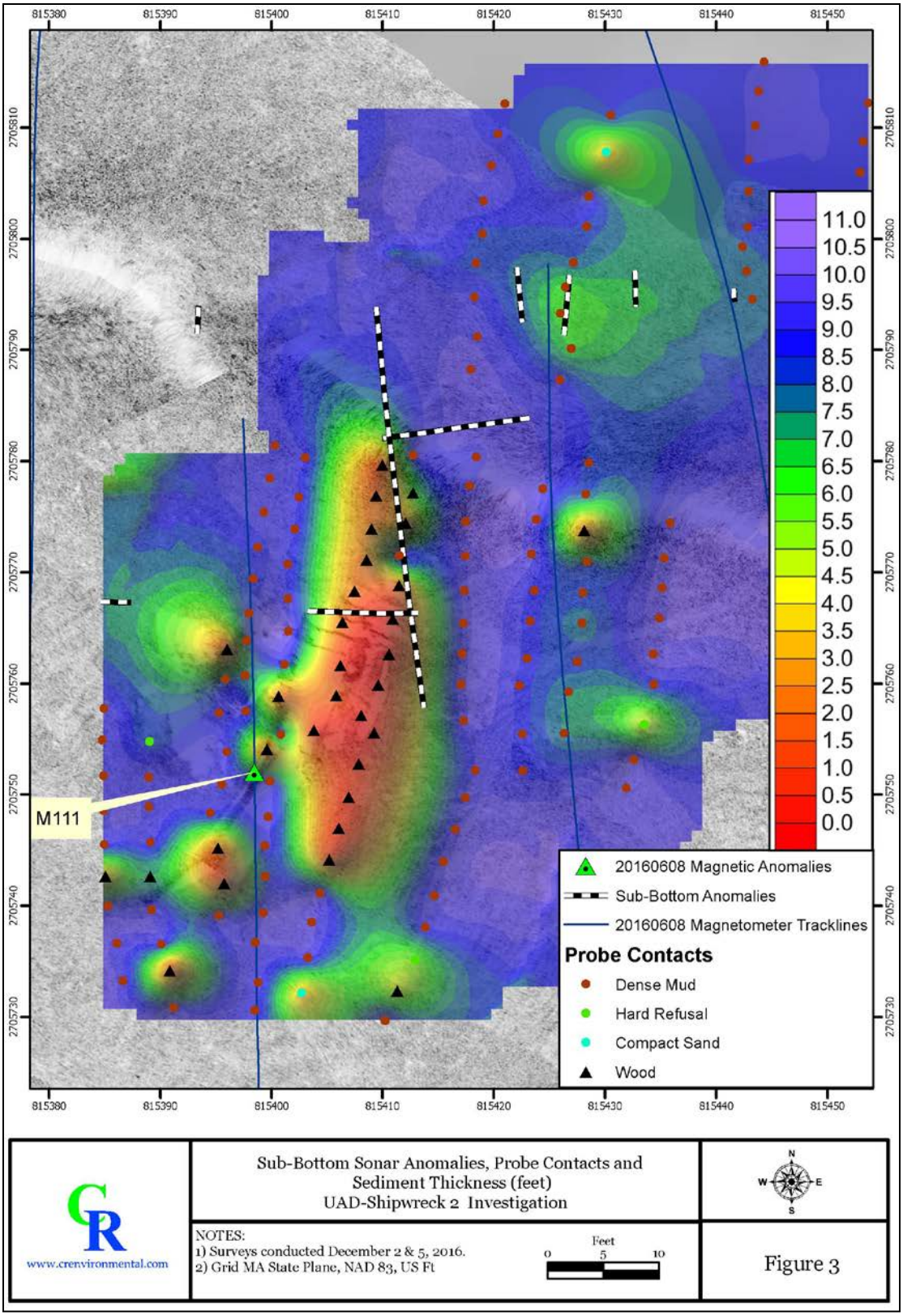

Figure 3. Color-contour plot of sediment thicknesses over the NBHSS UAD-Shipwreck 2 find site (figure courtesy of CR Environmental).

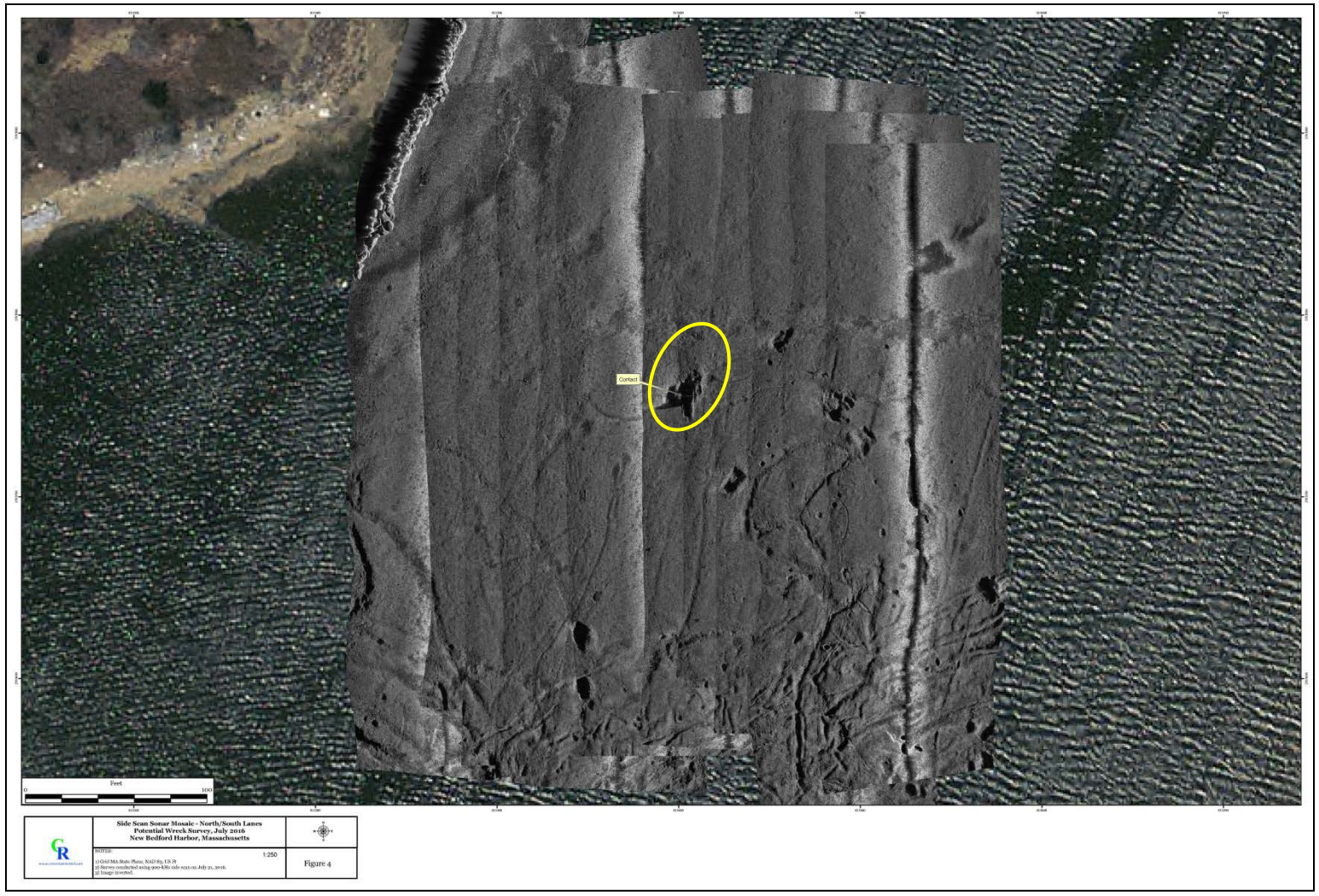

Figure 4. Sidescan sonar mosaic from the 2016 post-discovery detailed survey of the NBHSS UAD-Shipwreck 2 find site. The labeled sonar 'contact' represents the ship remains exposed by debris removal remediation activities. The yellow oval is the approximate limit of the archaeological deposit – note that its buried northern half detected through sub-surface probing is invisible in the sonar record (base figure courtesy of CR Environmental).

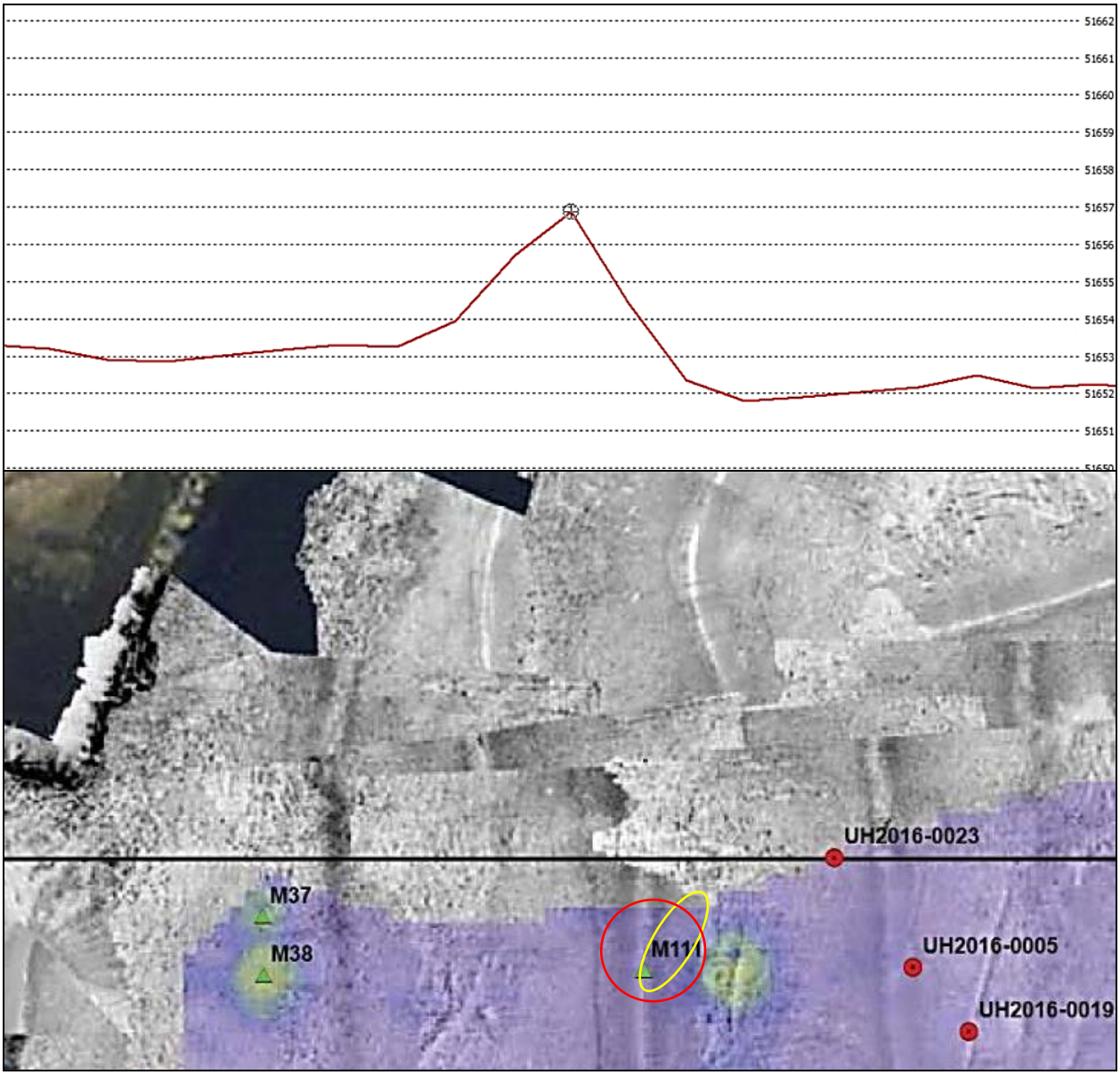

Figure 5. Raw data plot of single, isolated, low-amplitude (4.5 gammas), short-duration (25 feet [8 meter]), monopolar magnetic anomaly (M111) (top image), and excerpted plot of sidescan sonar mosaic base-map with overlying magnetic color-contour and point-plot of magnetic anomalies in the area of NBHSS UAD-Shipwreck 2 find, as recorded prior to the unanticipated discovery during the 2015 Task 2 (Submarine Cable Crossing) Area detailed re-survey (base images for figure courtesy of CR Environmental).

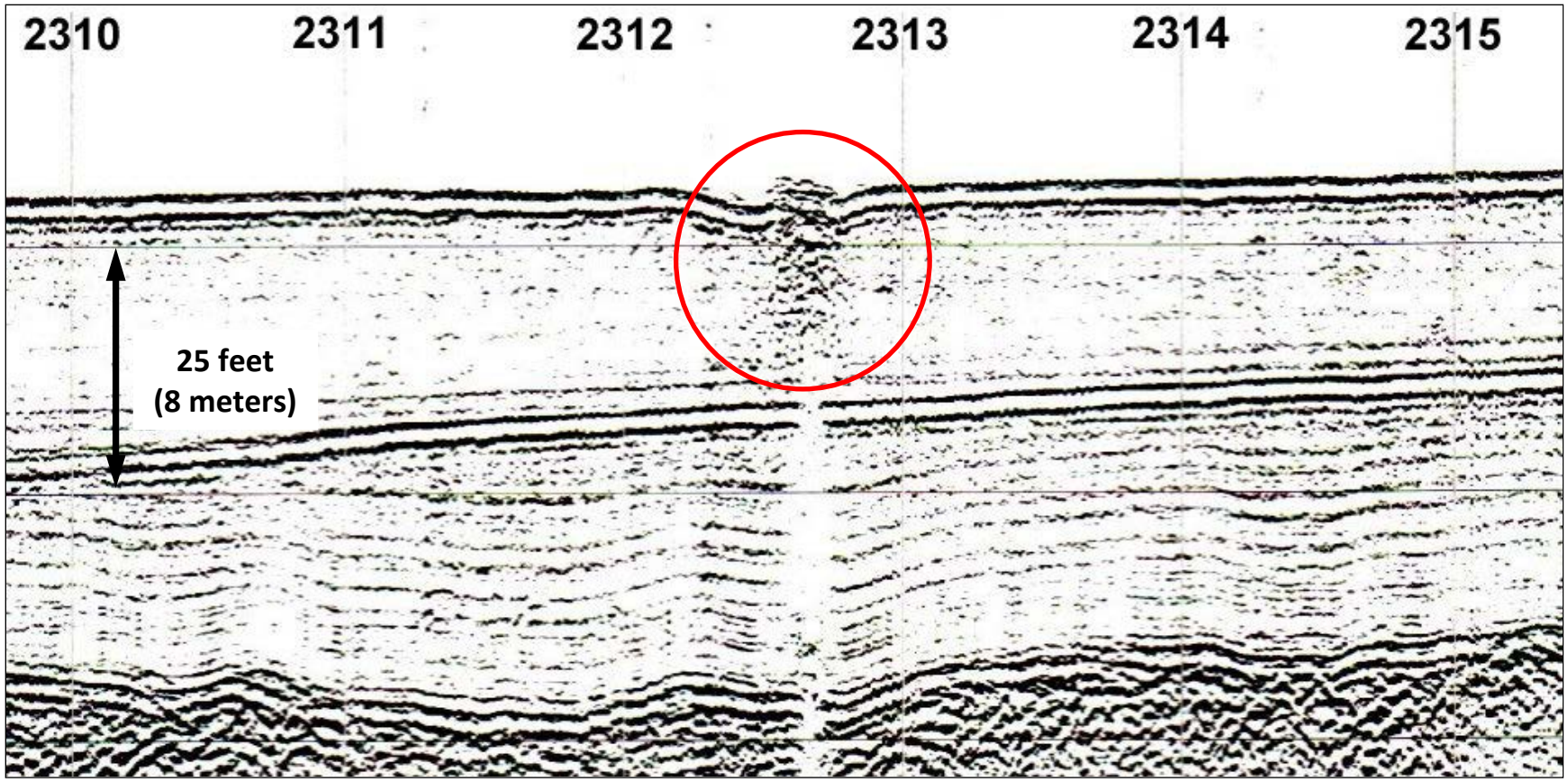

Figure 6. A representative example of a CHIRP sub-bottom profile record of a shipwreck (circled in red) embedded in the seafloor's surface (Robinson, et al. 2008).

APPENDICES

APPENDIX A:

UAD-SHIPWRECK 2 SUB-SURFACE PROBE SURVEY RESULTS

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Grid: State Plane NAD 83, **Ellipsoid**: WGS-84, **Zone**: MA-2001 MASSACHUSETTS MAINLAND , **Distance**: US Survey Foot

NOTES:

1- Values are in decimal feet; wd= water depth, pen= penetration

2- Probe stations are numbered starting at "1"

3- Sediment Thickness values are in decimal feet

4- Probes were advanced at 3 ft intervals from bow to stearn of the R/V Lophius along the port and starboard rails.

Station ID[2]	X	Y	LAT	LONG	TIME	DATE	NOTES[1]	SEDIMENT THICKNESS[3]	Sediment/Surface Classifiction at Refusal Point
1	815402.71	2705732.11	41.67113726	-70.91717549	10:27:53	12/5/2016	wd 6.4' pen 9'	2.6	Compact Sand
2	815403.27	2705735.31	41.67114603	-70.91717336	10:28:05	12/5/2016	wd 6.4' pen 16'	9.6	Dense Mud
3	815403.63	2705738.49	41.67115475	-70.91717196	10:30:00	12/5/2016	wd 6.4' pen 16'	9.6	Dense Mud
4	815404.36	2705741.11	41.67116193	-70.91716922	10:30:12	12/5/2016	wd 6.4' pen 16'	9.6	Dense Mud
5	815405.2	2705744.13	41.6711702	-70.91716607	10:30:24	12/5/2016	wd 6.4' pen 7'	0.6	Wood
6	815406.06	2705746.97	41.67117798	-70.91716285	10:30:43	12/5/2016	wd 6.5' pen 6.9'	0.4	Wood
7	815406.96	2705749.79	41.6711857	-70.91715949	10:30:53	12/5/2016	wd 6.6' pen 7'	0.4	Wood
8	815407.85	2705752.77	41.67119386	-70.91715616	10:31:06	12/5/2016	wd 6.6' pen 7'	0.4	Wood
9	815409.22	2705755.57	41.67120152	-70.91715107	10:31:18	12/5/2016	wd 3.9' pen 3.9'	0	Wood
10	815410.22	2705729.65	41.67113037	-70.91714806	10:54:21	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
11	815411.32	2705732.35	41.67113776	-70.91714397	10:54:42	12/5/2016	wd 7.6' pen 12'	4.4	Wood
12	815412.93	2705735.05	41.67114514	-70.91713801	10:54:56	12/5/2016	wd 6.7' pen 12'	5.3	Hard Bottom
13	815413.87	2705738.07	41.67115341	-70.91713449	10:55:19	12/5/2016	wd 6.7' pen 16'	9.3	Dense Mud
14	815414.67	2705740.89	41.67116113	-70.91713149	10:55:31	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
15	815415.48	2705743.97	41.67116957	-70.91712845	10:55:43	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
16	815416.54	2705746.82	41.67117737	-70.9171245	10:55:55	12/5/2016	wd 6.7' pen 16'	9.3	Dense Mud
17	815417.45	2705749.71	41.67118528	-70.9171211	10:56:05	12/5/2016	wd 6.8' pen 16'	9.2	Dense Mud
18	815418.32	2705752.15	41.67119196	-70.91711785	10:56:14	12/5/2016	wd 6.9' pen 16'	9.1	Dense Mud
19	815395.29	2705739.1	41.67115658	-70.91720247	11:22:05	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
20	815395.73	2705742.02	41.67116459	-70.91720078	11:22:17	12/5/2016	wd 6.6' pen 7'	0.4	Wood
21	815395.19	2705745.18	41.67117327	-70.91720268	11:22:26	12/5/2016	wd 6.7' pen 8'	1.3	Wood
22	815394.52	2705748.33	41.67118193	-70.91720505	11:22:34	12/5/2016	wd 6.7' pen 16'	9.3	Dense Mud
23	815395.56	2705750.89	41.67118893	-70.91720118	11:22:44	12/5/2016	wd 6.8' pen 16'	9.2	Dense Mud
24	815395.99	2705753.81	41.67119694	-70.91719954	11:22:53	12/5/2016	wd 6.8' pen 16'	9.2	Dense Mud
25	815395.29	2705757.33	41.67120661	-70.91720201	11:23:04	12/5/2016	wd 7.4' pen 16'	8.6	Dense Mud
26	815395.88	2705760.36	41.67121491	-70.91719978	11:23:12	12/5/2016	wd 7.4' pen 16'	8.6	Dense Mud
27	815396.01	2705763.09	41.6712224	-70.91719923	11:23:22	12/5/2016	wd 7.4' pen 8'	0.6	Wood
28	815386.63	2705733.25	41.67114069	-70.91723431	11:39:50	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
29	815386.11	2705736.59	41.67114987	-70.91723613	11:40:00	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
30	815385.27	2705739.95	41.6711591	-70.91723912	11:40:09	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
31	815385.07	2705742.66	41.67116654	-70.91723978	11:40:16	12/5/2016	wd 6.6' pen 9.3'	2.7	Wood
32	815384.99	2705745.47	41.67117426	-70.91724001	11:40:23	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
33	815384.91	2705748.55	41.67118271	-70.91724022	11:40:29	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
34	815384.91	2705751.7	41.67119136	-70.91724014	11:40:38	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
35	815384.79	2705754.88	41.67120008	-70.9172405	11:40:46	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
36	815384.96	2705757.72	41.67120787	-70.91723981	11:40:55	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
37	815391.17	2705730.79	41.67113386	-70.91721775	11:59:54	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
38	815390.84	2705734.18	41.67114317	-70.91721888	12:00:00	12/5/2016	wd 6.6' pen 6.8'	0.2	Wood
39	815390.09	2705736.53	41.67114963	-70.91722156	12:00:09	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
40	815389.25	2705739.61	41.6711581	-70.91722456	12:00:19	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
41	815389.08	2705742.64	41.67116641	-70.91722511	12:00:27	12/5/2016	wd 6.6' pen 13.6'	7	Wood
42	815389.14	2705745.68	41.67117476	-70.91722481	12:00:36	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
43	815388.97	2705748.87	41.67118351	-70.91722535	12:00:44	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
44	815389	2705751.53	41.67119081	-70.91722518	12:00:53	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
45	815389.07	2705754.74	41.67119962	-70.91722484	12:01:00	12/5/2016	wd 6.6' pen 14.6'	8	Hard Bottom
46	815398.52	2705730.6	41.6711332	-70.91719086	12:08:44	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
47	815398.79	2705733.1	41.67114005	-70.91718981	12:08:55	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud

Station ID[2]	X	Y	LAT	LONG	TIME	DATE	NOTES[1]	SEDIMENT THICKNESS[3]	Sediment/Surface Classifiction at Refusal Point
48	815398.56	2705736.69	41.67114991	-70.91719056	12:09:15	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
49	815399.24	2705739.34	41.67115717	-70.917188	12:09:28	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
50	815399.45	2705742.59	41.67116608	-70.91718715	12:09:39	12/5/2016	wd 6.6' pen 15'	8.4	Dense Mud
51	815399.4	2705745.39	41.67117377	-70.91718727	12:09:49	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
52	815399.7	2705747.97	41.67118084	-70.91718611	12:09:59	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
53	815399.85	2705751.17	41.67118962	-70.91718548	12:10:10	12/5/2016	wd 6.4' pen 16'	9.6	Dense Mud
54	815399.6	2705754.08	41.67119761	-70.91718632	12:10:21	12/5/2016	wd 6.4' pen 6.5'	0.1	Wood
55	815397.68	2705757.47	41.67120695	-70.91719326	12:33:16	12/5/2016	wd 6.4' pen 16'	9.6	Dense Mud
56	815397.64	2705760.73	41.6712159	-70.91719333	12:33:30	12/5/2016	wd 6.4' pen 14'	7.6	Dense Mud
57	815397.76	2705763.82	41.67122437	-70.91719281	12:33:40	12/5/2016	wd 6.4' pen 15'	8.6	Dense Mud
58	815397.99	2705766.3	41.67123118	-70.91719191	12:33:49	12/5/2016	wd 6.4' pen 15'	8.6	Dense Mud
59	815398.35	2705769.38	41.67123962	-70.91719051	12:33:57	12/5/2016	wd 6.4' pen 15'	8.6	Dense Mud
60	815398.78	2705772.23	41.67124743	-70.91718887	12:34:05	12/5/2016	wd 6.4' pen 15'	8.6	Dense Mud
61	815399.32	2705775.39	41.6712561	-70.91718681	12:34:15	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
62	815399.87	2705778.41	41.67126437	-70.91718472	12:34:26	12/5/2016	wd 6.6' pen 16'	9.4	Dense Mud
63	815400.34	2705781.38	41.67127251	-70.91718293	12:34:34	12/5/2016	wd 6.7' pen 16'	9.3	Dense Mud
64	815403.8	2705755.79	41.67120222	-70.9171709	12:43:29	12/5/2016	wd 6.7' pen 7'	0.3	Wood
65	815405.83	2705758.91	41.67121075	-70.9171634	12:43:40	12/5/2016	wd 7' pen 9'	2	Wood
66	815406.2	2705761.62	41.67121818	-70.91716197	12:43:49	12/5/2016	wd 6.4' pen 6.6'	0.2	Wood
67	815406.38	2705765.51	41.67122885	-70.91716122	12:43:56	12/5/2016	wd 6' pen 7.7'	1.7	Wood
68	815407.48	2705768.3	41.67123649	-70.91715712	12:44:04	12/5/2016	wd 6' pen 8.1'	2.1	Wood
69	815408.54	2705771.11	41.67124418	-70.91715317	12:44:12	12/5/2016	wd 6.2' pen 8'	1.8	Wood
70	815408.99	2705773.9	41.67125183	-70.91715145	12:44:21	12/5/2016	wd 6.1' pen 8.5'	2.4	Wood
71	815409.42	2705776.9	41.67126005	-70.91714981	12:44:28	12/5/2016	wd 6.2' pen 8'	1.8	Wood
72	815409.96	2705779.66	41.67126761	-70.91714776	12:44:36	12/5/2016	wd 6.2' pen 7.2'	1	Wood
73	815400.85	2705755.39	41.67120118	-70.91718171	13:21:29	12/5/2016	wd 6.2' pen 16'	9.8	Dense Mud
74	815400.64	2705758.84	41.67121065	-70.91718239	13:21:39	12/5/2016	wd 6.6' pen 7.5'	0.9	Wood
75	815401.2	2705761.71	41.67121852	-70.91718027	13:21:47	12/5/2016	wd 6' pen 15'	9	Dense Mud
76	815401.53	2705764.67	41.67122664	-70.91717899	13:21:55	12/5/2016	wd 5.8' pen 16'	10.2	Dense Mud
77	815401.51	2705767.6	41.67123468	-70.91717899	13:22:02	12/5/2016	wd 5.8' pen 15'	9.2	Dense Mud
78	815401.49	2705770.71	41.67124321	-70.91717898	13:22:10	12/5/2016	wd 5.8' pen 15'	9.2	Dense Mud
79	815402.12	2705773.86	41.67125184	-70.9171766	13:22:20	12/5/2016	wd 5.8' pen 15'	9.2	Dense Mud
80	815402.5	2705776.73	41.67125971	-70.91717514	13:22:28	12/5/2016	wd 5.9' pen 15'	9.1	Dense Mud
81	815403.05	2705780.29	41.67126947	-70.91717304	13:22:38	12/5/2016	wd 5.9' pen 15'	9.1	Dense Mud
82	815408.07	2705757.13	41.67120582	-70.91715524	13:30:43	12/5/2016	wd 3.2' pen 3.2'	0	Wood
83	815409.61	2705759.87	41.67121331	-70.91714954	13:30:52	12/5/2016	wd 4.4' pen 4.4'	0	Wood
84	815410.58	2705762.64	41.6712209	-70.91714592	13:31:02	12/5/2016	wd 5.8' pen 5.8'	0	Wood
85	815410.9	2705765.79	41.67122953	-70.91714467	13:31:15	12/5/2016	wd 5.8' pen 6'	0.2	Wood
86	815411.45	2705768.82	41.67123784	-70.91714258	13:31:23	12/5/2016	wd 5.2' pen 6.8'	1.6	Wood
87	815411.49	2705771.49	41.67124516	-70.91714237	13:31:31	12/5/2016	wd 5.4' pen 16'	10.6	Dense Mud
88	815412.05	2705774.44	41.67125325	-70.91714024	13:31:41	12/5/2016	wd 5.5' pen 8'	2.5	Wood
89	815412.74	2705777.16	41.6712607	-70.91713765	13:31:55	12/5/2016	wd 5.6' pen 12'	6.4	Wood
90	815412.77	2705780.49	41.67126984	-70.91713746	13:32:10	12/5/2016	wd 5.8' pen 15'	9.2	Dense Mud
91	815417.28	2705756.63	41.67120428	-70.91712155	13:45:22	12/5/2016	wd 5.5' pen 15'	9.5	Dense Mud
92	815417.06	2705759.89	41.67121323	-70.91712227	13:45:33	12/5/2016	wd 5.5' pen 15'	9.5	Dense Mud
93	815417.15	2705762.65	41.6712208	-70.91712187	13:45:43	12/5/2016	wd 5.7' pen 15'	9.3	Dense Mud
94	815417.26	2705765.38	41.67122829	-70.9171214	13:45:52	12/5/2016	wd 5.7' pen 15'	9.3	Dense Mud
95	815417.33	2705768.33	41.67123638	-70.91712107	13:46:00	12/5/2016	wd 5.6' pen 15'	9.4	Dense Mud
96	815417.45	2705771.43	41.67124489	-70.91712055	13:46:07	12/5/2016	wd 5.5' pen 15'	9.5	Dense Mud
97	815417.48	2705774.53	41.67125339	-70.91712037	13:46:15	12/5/2016	wd 5.6' pen 16'	10.4	Dense Mud
98	815417.8	2705777.75	41.67126223	-70.91711911	13:46:25	12/5/2016	wd 5.6' pen 15'	9.4	Dense Mud
99	815418.44	2705780.38	41.67126943	-70.91711671	13:46:32	12/5/2016	wd 5.7' pen 15'	9.3	Dense Mud
100	815426.33	2705755.5	41.67120101	-70.91708845	14:01:36	12/5/2016	wd 6.6' pen 14'	7.4	Dense Mud
101	815426.74	2705759.23	41.67121123	-70.91708686	14:01:46	12/5/2016	wd 6.6' pen 14'	7.4	Dense Mud
102	815427.53	2705761.96	41.67121871	-70.9170839	14:01:55	12/5/2016	wd 6.6' pen 15'	8.4	Dense Mud
103	815427.94	2705765.43	41.67122823	-70.91708231	14:02:07	12/5/2016	wd 6.6' pen 14'	7.4	Dense Mud

Station ID[2]	X	Y	LAT	LONG	TIME	DATE	NOTES[1]	SEDIMENT THICKNESS[3]	Sediment/Surface Classifiction at Refusal Point
104	815428.01	2705768.14	41.67123566	-70.91708199	14:02:17	12/5/2016	wd 6.6' pen 15'	8.4	Dense Mud
105	815428.39	2705770.9	41.67124323	-70.91708053	14:02:26	12/5/2016	wd 6.6' pen 15'	8.4	Dense Mud
106	815428.13	2705773.75	41.67125105	-70.91708141	14:02:35	12/5/2016	wd 6.7' pen 8'	1.3	Wood
107	815428.27	2705777	41.67125997	-70.91708081	14:02:45	12/5/2016	wd 6.7' pen 15'	8.3	Dense Mud
108	815428.52	2705779.8	41.67126765	-70.91707983	14:02:55	12/5/2016	wd 6.8' pen 15'	8.2	Dense Mud
109	815422.59	2705752.14	41.67119186	-70.91710222	14:15:07	12/5/2016	wd 5.2' pen 14'	8.8	Dense Mud
110	815422.54	2705755.4	41.6712008	-70.91710232	14:15:22	12/5/2016	wd 5.2' pen 14'	8.8	Dense Mud
111	815422.29	2705759.78	41.67121283	-70.91710313	14:15:32	12/5/2016	wd 5.2' pen 14'	8.8	Dense Mud
112	815422.97	2705762.22	41.67121951	-70.91710058	14:15:42	12/5/2016	wd 5.2' pen 14'	8.8	Dense Mud
113	815423.28	2705765.58	41.67122873	-70.91709936	14:15:50	12/5/2016	wd 5.3' pen 14'	8.7	Dense Mud
114	815423.65	2705768.33	41.67123627	-70.91709794	14:15:59	12/5/2016	wd 5.3' pen 14'	8.7	Dense Mud
115	815423.38	2705771.62	41.6712453	-70.91709884	14:16:12	12/5/2016	wd 5.2' pen 15'	9.8	Dense Mud
116	815423.83	2705774.71	41.67125377	-70.91709712	14:16:20	12/5/2016	wd 5.4' pen 15'	9.6	Dense Mud
117	815424.41	2705777.5	41.67126142	-70.91709493	14:16:31	12/5/2016	wd 5.4' pen 15'	9.6	Dense Mud
118	815431.94	2705750.56	41.67118734	-70.91706804	14:23:15	12/5/2016	wd 5' pen 15'	10	Dense Mud
119	815432.61	2705753.09	41.67119428	-70.91706553	14:23:25	12/5/2016	wd 5.1' pen 15'	9.9	Dense Mud
120	815433.54	2705756.28	41.67120301	-70.91706204	14:23:34	12/5/2016	wd 5.1' pen 9'	3.9	Hard Refusal
121	815434.4	2705759.9	41.67121293	-70.9170588	14:23:45	12/5/2016	wd 5.1' pen 14'	8.9	Dense Mud
122	815434.37	2705762.61	41.67122037	-70.91705885	14:23:53	12/5/2016	wd 5.1' pen 15'	9.9	Dense Mud
123	815434.87	2705765.83	41.67122919	-70.91705694	14:24:01	12/5/2016	wd 5.1' pen 15'	9.9	Dense Mud
124	815435.14	2705768.58	41.67123674	-70.91705588	14:24:09	12/5/2016	wd 5.1' pen 15'	9.9	Dense Mud
125	815435.32	2705771.24	41.67124403	-70.91705515	14:24:16	12/5/2016	wd 5.2' pen 15'	9.8	Dense Mud
126	815435.89	2705774.44	41.6712528	-70.91705299	14:24:25	12/5/2016	wd 5.2' pen 15'	9.8	Dense Mud
127	815450.85	2705791.24	41.67129862	-70.91699781	14:38:27	12/5/2016	wd 6.3' pen 15'	8.7	Dense Mud
128	815451.91	2705793.28	41.6713042	-70.91699388	14:38:51	12/5/2016	wd 6.5' pen 15'	8.5	Dense Mud
129	815452.3	2705795.73	41.67131092	-70.91699239	14:39:03	12/5/2016	wd 6.6' pen 15'	8.4	Dense Mud
130	815452.65	2705796.6	41.6713133	-70.91699109	14:39:58	12/5/2016	wd 6.6' pen 15'	8.4	Dense Mud
131	815452.48	2705799.53	41.67132134	-70.91699164	14:40:07	12/5/2016	wd 6.3' pen 15'	8.7	Dense Mud
132	815452.85	2705803.06	41.67133102	-70.9169902	14:40:15	12/5/2016	wd 6.2' pen 15'	8.8	Dense Mud
133	815452.94	2705805.94	41.67133893	-70.9169898	14:40:24	12/5/2016	wd 6.1' pen 15'	8.9	Dense Mud
134	815453.22	2705808.74	41.6713466	-70.9169887	14:40:52	12/5/2016	wd 6' pen 15'	9	Dense Mud
135	815453.71	2705812.2	41.67135609	-70.91698682	14:40:59	12/5/2016	wd 6.2' pen 15'	8.8	Dense Mud
136	815443.29	2705794.53	41.6713078	-70.9170254	14:48:00	12/5/2016	wd 6.3' pen 14'	7.7	Dense Mud
137	815442.75	2705797.06	41.67131475	-70.91702731	14:48:10	12/5/2016	wd 6.3' pen 14'	7.7	Dense Mud
138	815442.4	2705799.26	41.67132079	-70.91702854	14:48:17	12/5/2016	wd 6.3' pen 14'	7.7	Dense Mud
139	815442.86	2705801.01	41.67132559	-70.91702681	14:48:28	12/5/2016	wd 6.3' pen 15'	8.7	Dense Mud
140	815442.95	2705804.24	41.67133445	-70.9170264	14:48:37	12/5/2016	wd 6' pen 14'	8	Dense Mud
141	815442.94	2705807.05	41.67134216	-70.91702637	14:48:45	12/5/2016	wd 5.9' pen 15'	9.1	Dense Mud
142	815443.53	2705810.13	41.6713506	-70.91702413	14:48:54	12/5/2016	wd 5.9' pen 15'	9.1	Dense Mud
143	815443.85	2705813.25	41.67135916	-70.91702288	14:49:04	12/5/2016	wd 5.9' pen 15'	9.1	Dense Mud
144	815444.32	2705815.87	41.67136634	-70.9170211	14:49:14	12/5/2016	wd 6' pen 15'	9	Dense Mud
145	815425.97	2705787.27	41.6712882	-70.91708897	15:01:07	12/5/2016	wd 5.1' pen 14'	8.9	Dense Mud
146	815426.96	2705790.12	41.671296	-70.91708528	15:01:17	12/5/2016	wd 5.6' pen 12'	6.4	Dense Mud
147	815425.98	2705793.25	41.67130461	-70.91708879	15:01:29	12/5/2016	wd 5.8' pen 12'	6.2	Dense Mud
148	815426.46	2705795.64	41.67131116	-70.91708697	15:01:38	12/5/2016	wd 6' pen 12'	6	Dense Mud
149	815427.17	2705797.85	41.67131721	-70.91708432	15:01:46	12/5/2016	wd 6' pen 14'	8	Dense Mud
150	815428.36	2705801.1	41.6713261	-70.91707988	15:01:56	12/5/2016	wd 5.8' pen 14'	8.2	Dense Mud
151	815428.54	2705803.79	41.67133348	-70.91707915	15:02:04	12/5/2016	wd 5.6' pen 15'	9.4	Dense Mud
152	815430.13	2705807.78	41.6713444	-70.91707323	15:02:22	12/5/2016	wd 5.6' pen 8.6'	3	Hard Sand
153	815430.56	2705811.09	41.67135348	-70.91707158	15:02:31	12/5/2016	wd 5.5' pen 14'	8.5	Dense Mud
154	815417.92	2705788.21	41.67129093	-70.91711841	15:02:51	12/5/2016	wd 5.1' pen 15'	9.9	Dense Mud
155	815418.51	2705791.17	41.67129904	-70.91711618	15:03:02	12/5/2016	wd 5.6' pen 15'	9.4	Dense Mud
156	815418.26	2705794.75	41.67130887	-70.91711701	15:03:11	12/5/2016	wd 5.9' pen 15'	9.1	Dense Mud
157	815418.41	2705797.79	41.67131721	-70.91711638	15:03:21	12/5/2016	wd 5.7' pen 14'	8.3	Dense Mud
158	815419.02	2705800.42	41.67132441	-70.91711408	15:03:27	12/5/2016	wd 5.8' pen 14'	8.2	Dense Mud
159	815419.07	2705803.36	41.67133248	-70.91711383	15:03:34	12/5/2016	wd 5.6' pen 15'	9.4	Dense Mud

Station ID[2]	X	Y	LAT	LONG	TIME	DATE	NOTES[1]	SEDIMENT THICKNESS[3]	Sediment/Surface Classifiction at Refusal Point
160	815419.8	2705806.53	41.67134117	-70.91711107	15:03:43	12/5/2016	wd 5.5' pen 15'	9.5	Dense Mud
161	815420.39	2705809.39	41.671349	-70.91710884	15:03:51	12/5/2016	wd 5.4' pen 14'	8.6	Dense Mud
162	815420.99	2705812.11	41.67135646	-70.91710658	15:04:00	12/5/2016	wd 5.4' pen 14'	8.6	Dense Mud