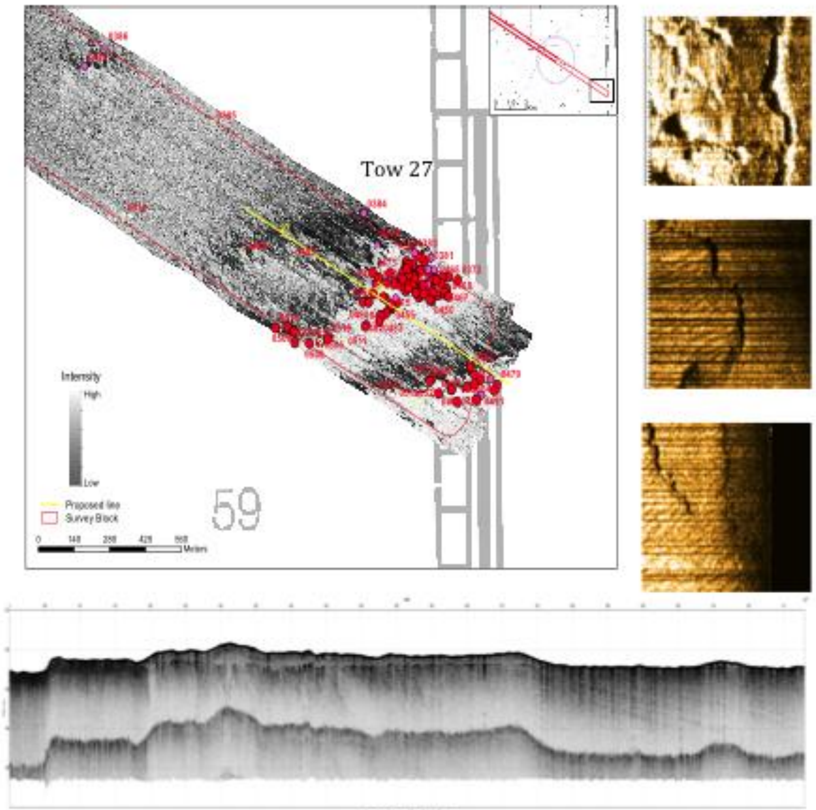
Hardbottom and Cultural Resource Surveys of the Post 45 Charleston Harbor Project Study Area, Charleston, South Carolina



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Submitted to:
United States Army Corps of Engineers
Charleston, SC District
January 2013

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Abstract

The Center for Marine and Wetland Studies (CMWS) at Coastal Carolina University (CCU) has conducted geophysical mapping to delineate hardbottom areas and to identify possible cultural resources in the proposed Charleston Harbor entrance channel extension and improvement areas of the navigation channel. Data consisting of side scan sonar, sub-bottom profiles, magnetics, and single beam bathymetry were collected between October and December, 2012. Following initial examination of the geophysical data records, groundtruthing was conducted in late 2012 and early 2013. A combination of geophysical data, sediment grabs, and video tows revealed areas of known, probable, and possible hard bottom throughout the study area. In addition, 421 magnetic anomalies were identified and examined. Two anomalies in the lower harbor area (sites LH1-009 and LH5-013) were identified as possibly containing culturally significant material. While no further investigation is recommended for the vast majority of the magnetic anomalies, LH1-009 and LH5-013 are recommended for visual inspection. All raw and processed geophysical data, maps, and interpretations are contained in a digital volume accompanying this report.

1.0 INTRODUCTION

The Center for Marine and Wetland Studies (CMWS) at Coastal Carolina University (CCU) has conducted geophysical mapping to delineate hardbottom areas and to identify possible cultural resources in the proposed Charleston Harbor entrance channel extension and improvement areas of the navigation channel (figure 1). Mapping efforts were also completed, with the same objectives, in the proposed Ocean Dredged Material Disposal Site (ODMDS) expansion area as well as hardbottom habitat only in the South Carolina Department of Natural Resources and EPA coordinated monitoring zones. The geophysical efforts consisted of side scan sonar, sub-bottom profiling, and magnetic mapping within identified survey limits (appendix 1). In addition mapping efforts extended 75 m either side of the proposed outer channel extension toe offshore and 50 m outside the proposed ODMDS expansion area. Hydrographic surveys were conducted to supplement bathymetric surveying previously undertaken by the United States Army Corps of Engineers, Charleston, SC. The goals of this geophysical study are specifically to 1) identify hardbottom throughout the entire study area, 2) identify cultural resources throughout the entire study area with the exception of the ODMDS monitoring zones, and 3) to characterize sub-bottom reflectors in the entrance channel. Magnetic and side scan sonar data were evaluated to identify anomalies consistent with cultural resources in accordance with provisions of Section 106 of the National Historic Preservation Act of 1966 and the Abandoned Shipwreck Act of 1987. Groundtruthing of the geophysical data consisted of video transects and sediment grabs.

For the hardbottom identification objective, the side scan sonar revealed areas of high backscatter intensity in several areas within the ODMDS and proposed channel extension. Video groundtruthing, comparison with sub-bottom profiles, and sediment grabs help to further characterize areas of high backscatter intensity. Generally speaking, changes in backscatter intensity owed to either changes in sediment composition and texture, or presence of hardbottom/ledges. A combination of geophysical and groundtruthing data were used to delineate areas of seafloor exhibiting quality habitat.

Sub-bottom profiles were used to contour seafloor, top of modern sediment, and top of rock surfaces. These contour maps were then used to construct sediment thickness isopachs. The study area contains variable sediment thickness of 0-4.5 m. Sub-bottom profiles varied throughout the study area, sometimes revealing several obvious reflectors and other times appearing homogeneous. In some cases, sediments were very thin or absent in the sub-bottom records while other data records indicated thick sediments. These observations were useful for corroboration of side scan records and delineation of hardbottom as areas of thick sediment accumulations will not have hardbottom exposed at the sea floor.

Magnetic anomaly maps were constructed and reveal 421 anomalies greater than 5 nanoTeslas (nT). These targets were evaluated and found to be largely consistent with pipelines, channel markers, bridges, and other modern features or debris. Anomalies vary widely in duration and intensity and were interpreted in combination with raw (full resolution) side scan records and/or video for the most complete characterization.

Historical research, consultation with South Carolina Institute of Archaeology & Anthropology (SCIAA), and examination of prior cultural resource studies were also used to constrain these data (Watts, 1984, 1995; Spirek, 2012).

Field work was conducted during the fall and winter of 2012-2013. The work was divided into two phases. Phase one included geophysical mapping and data reduction. Phase two included video and sediment grab groundtruthing and a small amount of additional geophysical mapping. Preliminary interpretations from phase one and an approach for phase two were described to various state and federal agencies in the Nov 29, 2012 Post 45 Habitat/Cultural Resources Assessment meeting at the Charleston District Corps of Engineers offices a meeting with the United States Army Corps of Engineers (USACE) Charleston District. Data were provided to this Interagency Coordination Team with descriptions and plans for locations of groundtruthing efforts prior to commencement of phase two. Following a reasonable review period, responses from the Interagency Coordination Team was used to refine and maximize the phase two effort.

In this report, we present descriptions of methods, rational for identification and mapping of select hardbottom features, and images of data collected. Appendix 4 includes all field notes. These notes contain dates, times, and weather conditions during all survey/mapping activities. The accompanying external hard drive includes the full volume of raw digital data, ESRI geodatabases, metadata records, and a copy of this report. The accompanying DVD set includes all video data.

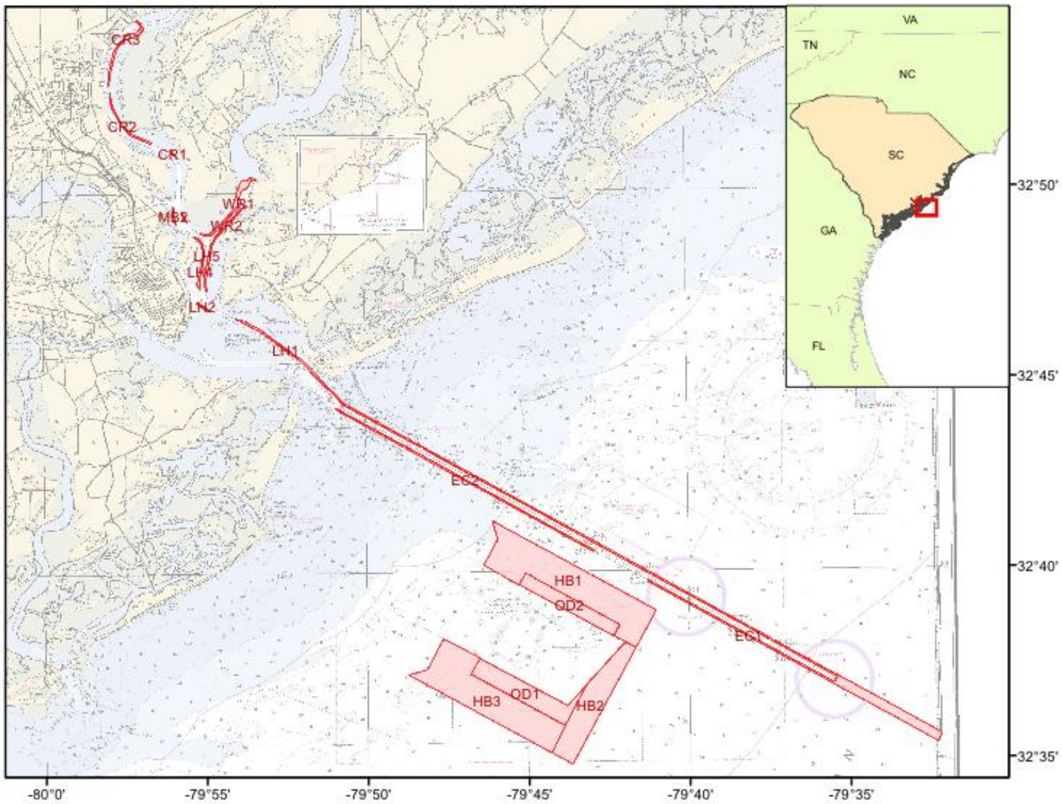

Figure 1. Vicinity map of mapping corridors for hardbottom habitat and cultural resources assessment in the proposed Charleston Harbor entrance channel extension and improvement areas of the navigation channel.

2.0 METHODS

Geophysical mapping was conducted during October, 2012 – January, 2013. Areas within the harbor were mapped using CCU's 24 foot Privateer. In the main channel leading through the jetties, the proposed extension area, and the ODMDS, the *R/V Cape Fear* was used in order to accommodate 24-hour operations during weather windows suitable for data collection. Groundtruthing was completed aboard the *R/V Silver Crescent*. Data are reported relative to State Plane NAD 1983 SC International Feet and NAVD 88 datum.

2.1 Side Scan Sonar

Side scan sonar surveys were completed with CCU's Klein 3000 (500 kHz) side scan sonar (figure 2). On the CCU Privateer, the sonar towfish was rigged on the port side davit with variable layback as required by depth to maintain a constant altitude from seafloor. On the *R/V/ Cape Fear* the side scan was rigged through the starboard side of the A frame with layback adjusted to maintain constant towfish altitude. All laybacks and other rigging adjustments were documented in field notes and applied in post processing. The side scan was towed in tandem with the magnetometer as often as conditions allowed. Lane spacing, defined by cultural resources requirements for the magnetometry, was 20 m. The beam pattern was narrowed for maximum resolution in raw records, but still provided greater than 50% overlap.

2.1.1 *Side Scan Data Processing*

Post processing included navigation merging, demultiplexing, slant range correction, destriping, beam pattern correction, and mosaic construction with Xsonar and ShowImage software packages developed by the USGS Woods Hole Science Center (Danforth, 1997). The nadir was removed from each line of data prior to mosaicing, allowing port and starboard channels to be merged, thus removing the water column portion of the data record. Mosaics were output as 25 cm pixel resolution geotiffs for import to ESRI ArcGIS. Raw records at full resolution were used for cultural resources interpretation. The complete workflow is shown in figure 3.

2.2 Magnetics

A Geometrics G-882 marine magnetometer was used to measure total magnetic field intensity (figure 4). The instrument consists of a cesium vapor magnetometer in a towfish, 100 m of cable to tow the instrument and transmit data, and a topside computer with acquisition software. Total field intensity is controlled in part by distance between sensor and target among other factors. Towfish altitude above seafloor was therefore maintained as constant as mapping conditions allowed. Vessel position was integrated with the magnetic signal through the MagLog Lite software interface. This acquisition software also allows for monitoring of signal intensity in real time to ensure data quality. On the CCU Privateer, the towfish was configured on the starboard side from a tow extension pipe. The towfish was configured with variable layback, tow point, and depressor weight configuration as conditions and depths required. On the *R/V/ Cape Fear* the towfish was deployed from port side with the tow extension pipe with 50 m of

Figure 2. Top: Photograph of Klein 3000 dual frequency side scan sonar. Bottom: Geometrics G-882 marine magnetometer (left) and CCU's video tow system.

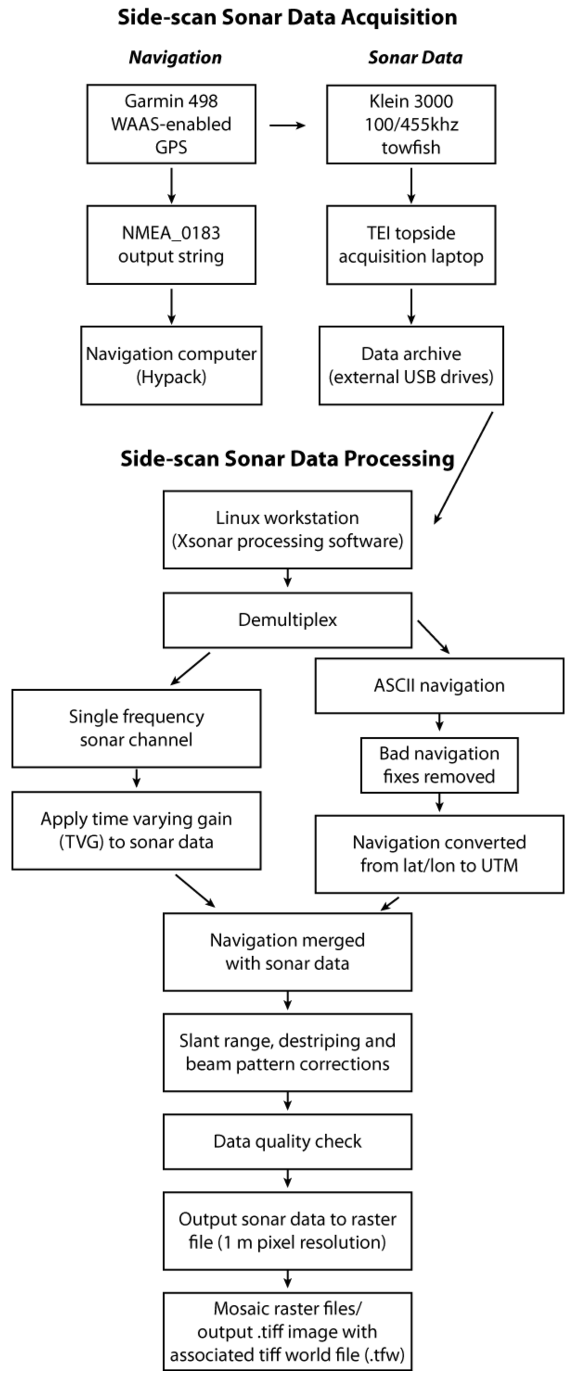

Figure 3. Side scan sonar data acquisition and processing workflow.

layback, using the nosecone tow point and depressor weight. All laybacks and other rigging adjustments were documented in field notes and applied in post processing. The magnetometer was towed in tandem with the side scan sonar as often as conditions allowed at a lane spacing of 20 m and ship speed maximum of 5-7 knots.

2.2.1 *Magnetic Data Processing*

The magnetometer data files (.int) were processed with MagPick v3.22 and QPS Dmagic v7.3.2. Magnetometer profile data were first imported into MagPick to remove diurnal variations. In order to use smoothed profile data as diurnal variations, raw profile data were smoothed using the Robust smoothing method with a spline smoothing parameter of 1.00e-4, smooth window of 100m, and smooth order of 1. Raw magnetometer data were then corrected for diurnal variations and were normalized by subtracting the smoothed profile data. Corrected data were gridded using spline interpolation with an X and Y interval of 2m and a tension of 0.25 for 250 iterations with a convergence limit of 0, and max and min data values as data limits. Data were filtered during the gridding process using the median value. The grids were clipped to remove areas not covered by data with a clip radius of 30m from each data point. Gridded data were then imported into Fledermaus Dmagic v7.3.2 to re-grid (.sd) for import to ESRI ArcGIS.

The ESRI Spatial Analyst Surface Analysis tools were used to produce 5nT interval contour lines from the 5m spatial resolution magnetometry grids. The complete workflow is shown in figure 4.

2.3 Sub-bottom Profiling

CHIRP sub-bottom data were acquired aboard the UNC-Wilmington's *R/V Cape Fear* in November 2012, using an EdgeTech sb512i CHIRP sub-bottom reflection sonar with Edgetech Discover acquisition software (figure 5). Data were acquired at a ship speed of ~2-3 knots. Towfish navigation was obtained by a topside NorthStar 965 DGPS receiver. The sub-bottom reflection profiles were acquired using a .5-8 kHz CHIRP signal with a 5 ms sweep. All surveys are georeferenced in NAD 1983 South Carolina State Plane Feet unless otherwise noted.

2.3.1 *Sub-bottom Data Processing*

The CHIRP sub-bottom data were processed using SIOSEIS and Seismic Unix seismic processing software packages. The final processed data have been heave corrected and trace balanced for noise reduction. The data were also depth corrected to account for tidal variations in water depth and the depth of the fish in the water column (figure 6, 7). Since fish depth is not directly recorded in the CHIRP data, the approximate fish depth was determined by correlating seafloor depth in the CHIRP data with measurements made by a georeferenced multibeam survey of the channel area provided by the Army Corps of Engineers. CHIRP sub-bottom data is recorded in two-way-travel time (TWT) in seconds, or the time it takes for a sound wave to travel down to the seafloor and be reflected back to the instrument. In general, an average sound velocity in seawater of 1525 m/s is used to convert TWT to depth, keeping in mind that TWT represents twice the reflector depth (e.g., Depth = {TWT * 1525 m/s}/2). Seafloor

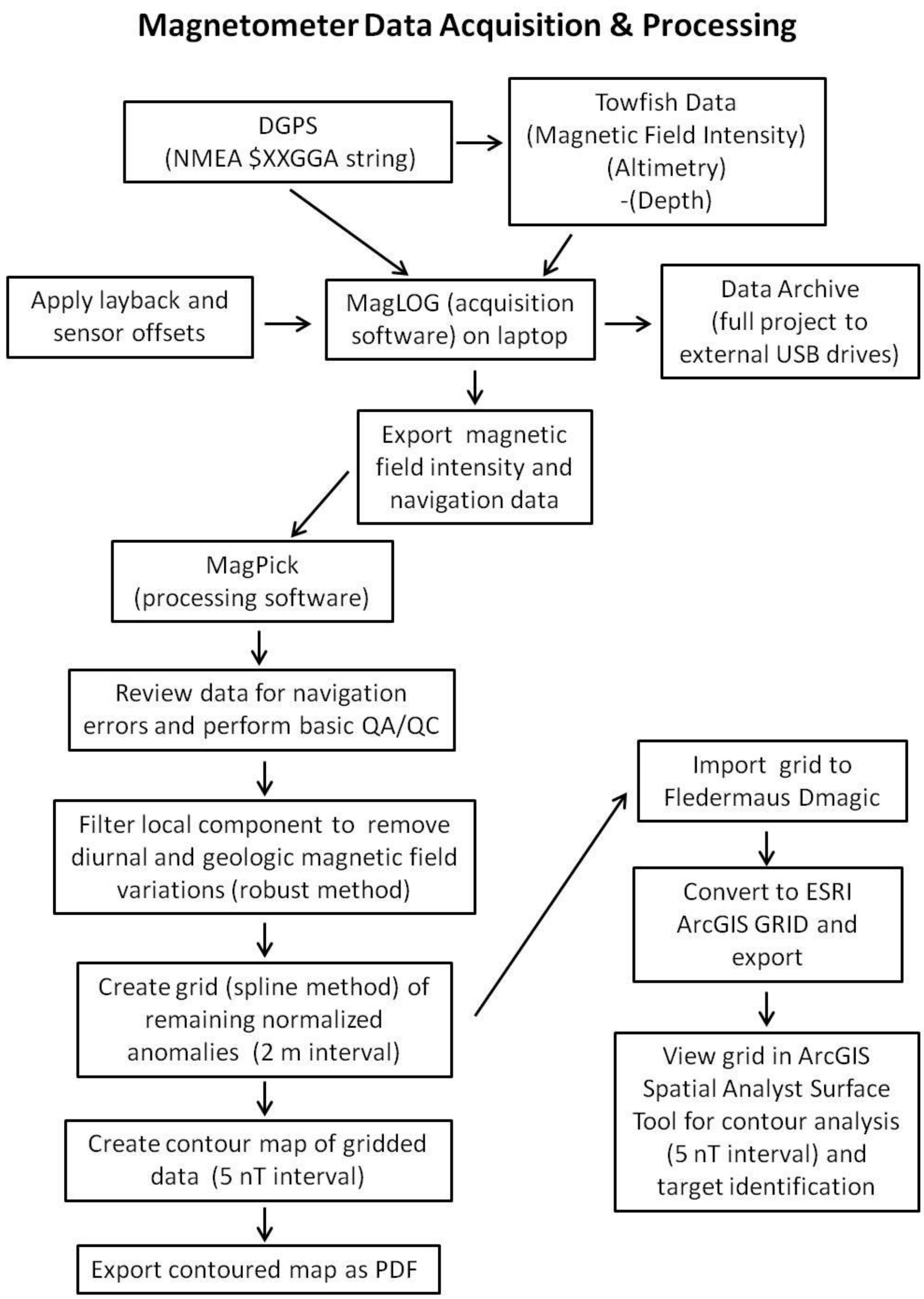

Figure 4. Magnetometry data acquisition and processing workflow.

Figure 5. Photo showing the EdgeTech sb512i CHIRP sub-bottom reflection sonar.

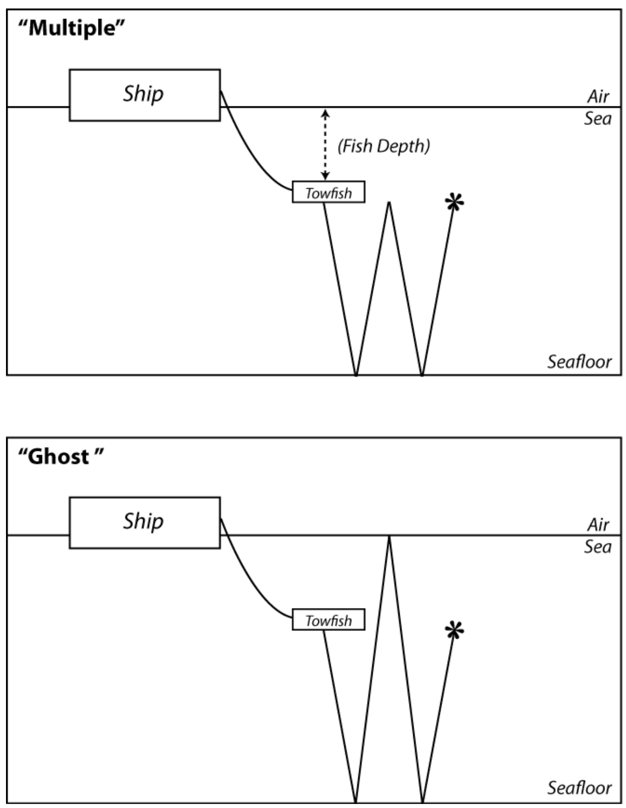

Figure 6. Illustration of towfish geometry relative to sea surface showing seafloor and multiple ray paths.

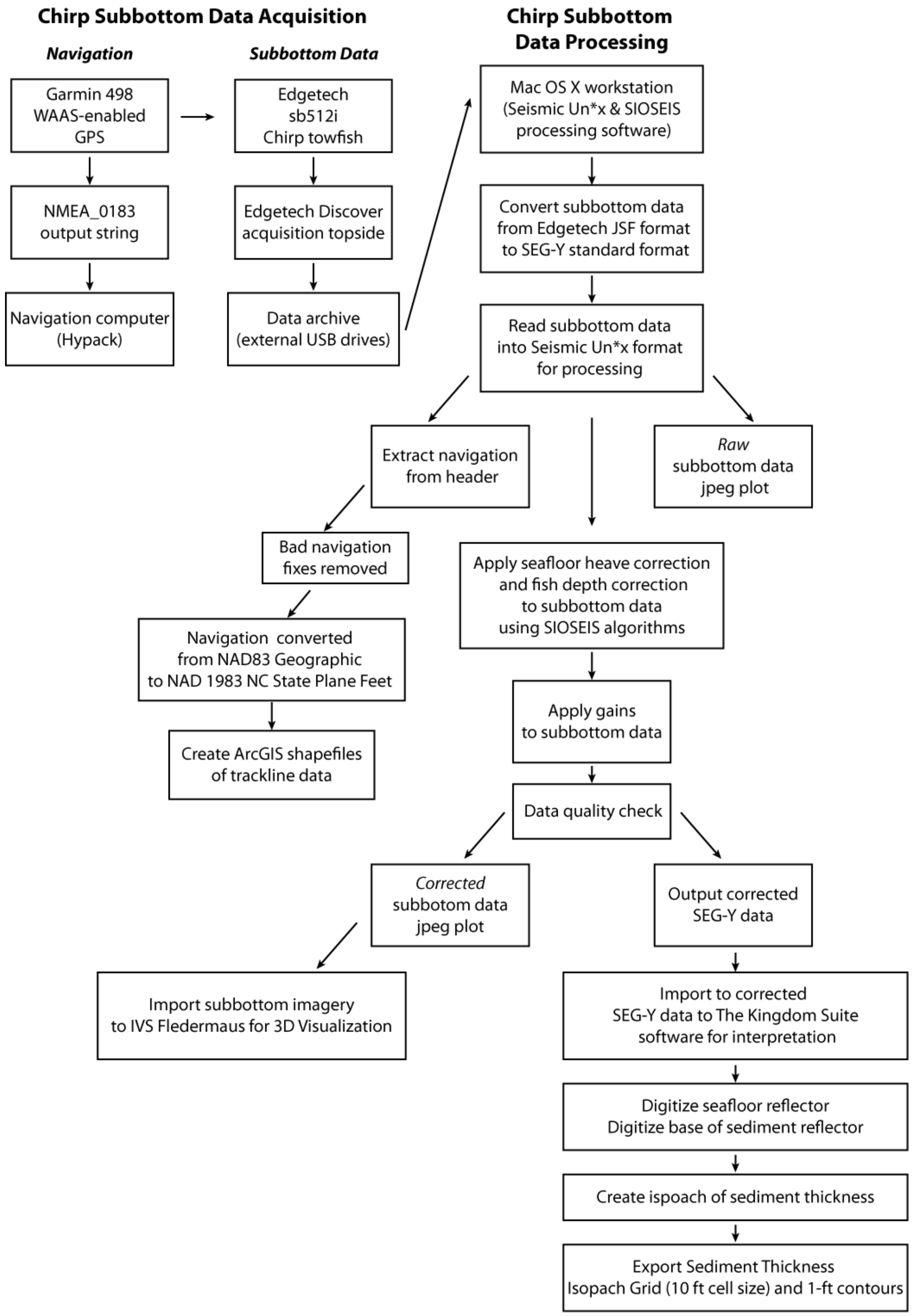

Figure 7. CHIRP sub-bottom data acquisition and processing workflow.

multiple and "ghost" reflectors (illustrated below) occur below ~.035 s (TWT) in most of the CHIRP profiles.

2.3.2 *Subsurface Layer and Isopach Map Creation*

Three horizons (seafloor, base of surficial modern sediment [*minimum depth to top of rock]*, and base of relict sediment [*maximum depth to top of rock*] were digitized from the CHIRP sub-bottom profiles using The Kingdom Suite (Seismic Micro Technology, Inc.) seismic interpretation software. All of these horizons were gridded using an inverse distance weighting algorithm and then used to compute modern sediment thickness, relict sediment thickness and paleo-channel depth isopach grids, which were then imported to ESRI ArcGIS 9.3. In the main entrance channel and survey extension areas, the data is divided into 4 segments: center of the main channel, southern flank of the main channel, northern flank of the main channel and channel extension. Bounding boxes around these segments were used to constrain the surface interpolation and provide a more realistic and better surface fit for the shape of the channel.

2.3.3 *3-D Visualization*

CHIRP sub-bottom profile imagery was imported into IVS Fledermaus as georeferenced vertical "curtains". The digitized horizons (base of surficial modern sediment and base of relict sediment) were imported as xyz point objects for interpretation overlay.

2.4 Hydrographic Surveying

Single beam surveys were conducted with a Real-Time Kinematic Global Positioning System (RTK-GPS). A virtual base station using the South Carolina Geodetic Survey's real time virtual network was used to broadcast real-time corrected GPS data to the roving unit collecting single beam data. Virtual base station point was moved accordingly to ensure distance to suvey area did not exceed 5km. Positional accuracy was determined by comparison of established benchmark values versus collected data. For the offshore sections of the entrance channel and the ODMDS, data were collected aboard the *R/V Cape Fear* and tidal data were applied to the DGPS poisiton using a tide file from a NOAA tidal station located in Charleston SC.

Single beam data acquisition was conducted aboard a 20 ft Carolina Skiff outfitted with a Knudsen Mini-Sounder (210 kHz) , TSS DMS-05 motion reference unit, Ashtech Z-Xtreme GPS receiver, and dual frequency GPS antenna. Sound velocity profiles conducted at the beginning and end of surveying each day were used to determine sound velocity. All instrument and water level offsets were measured and entered into HYPACK. HYPACK software was used for navigation and data acquisition. A diagram illustrating single beam data acquisition and processing workflow is provided in (figure 8). All raw and processed data can be found in the digital files accompanying this report.

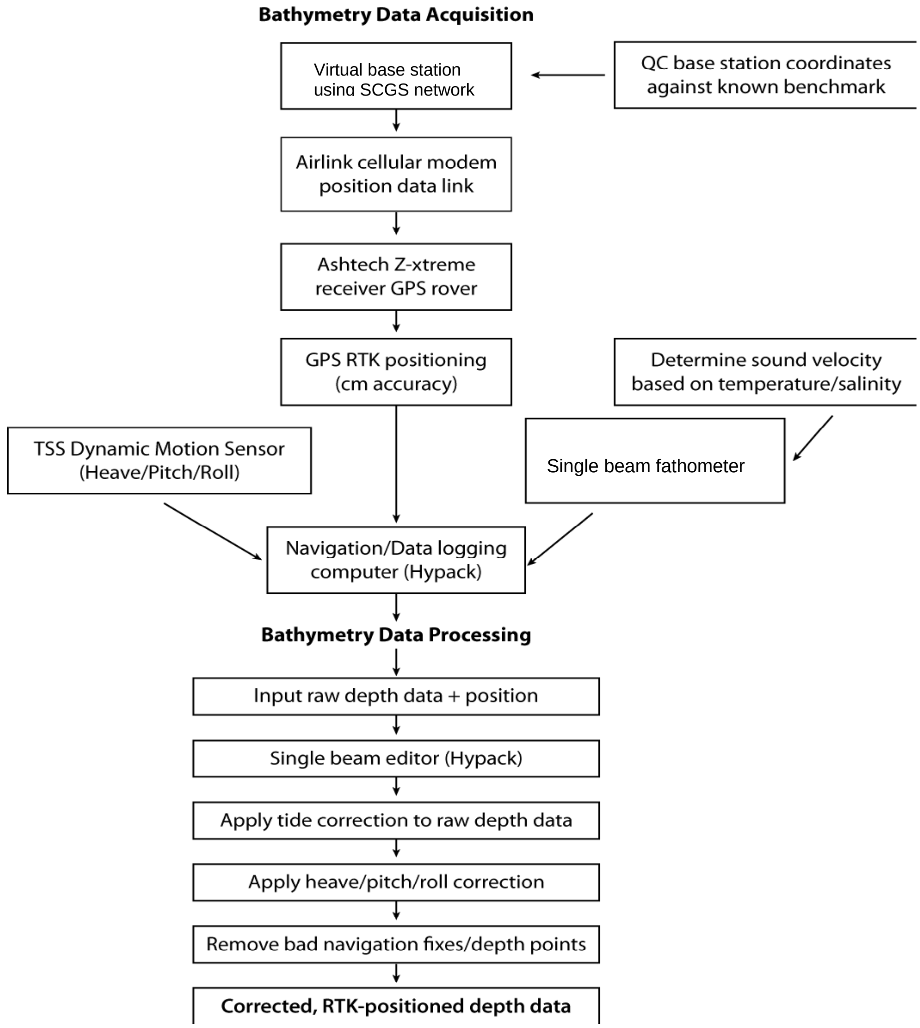

Figure 8. Single beam acquisition and data processing workflow diagram.

2.4.1 *Data Procesing*

Raw depth and position data were merged, heave/pitch/roll and tide corrections were applied, and data were processed to produce a corrected, RTK-positioned depth with HYPACK software. Initial outlier points were removed using the HYPACK Single Beam editor and exported as a text file.

2.5 Groundtruthing

2.5.1 *Video*

Video was collected with a submersible camera mounted on a three-wheel cart (figure 2). The camera was positioned to look downward and slightly in front of the cart. Video data were time-synchronized with the GPS time stamp and recorded to DVDs. After data collection, all video was reviewed and changes in bottom type were noted by time (position). Bottom type was coded by sediment type, bathymetry, and biological features. For example, changes between flat, sandy bottom and rocky ledges were coded. High-relief bottom (ledges) were coded and distinctions were made between ledges possibly associated with drowned marsh deposit and rocky ledges sometimes covered with heavy emergent growth.

2.5.2 *Sediment Grabs*

A Ponar type grab sampler was used to collect sediment grabs aboard the South Carolina Department of Natural Resource's *R/V Silver Crescent*. Two sediment grabs were collected along each video transect. Samples were placed in labeled plastic bags for subsequent analysis. At CCU, sediment samples were subsampled, dried, and sieved at one-phi increments. Visual classification according to the Unified Soil Classification System was used to qualitatively describe the range of sediment textures throughout the study area.

Sediments largely consist of fine-coarse sands. Some areas contained extensive coarse grains and shell hash. Fines were typically less than 10%. Basic sediment descriptions by video line number and position are listed in Table 1. Full detail of the sediment analysis including sieve size fractions are located in Appendix 3.

Table 1. Sediment grab descriptions, corresponding video tow lines, and grab positions.

Sample #	Tow line	lat	long	Verbal Description
01_1922	1A	32.625764°	-79.791150°	<5% shell hash, Moderately sorted, medium grained sand
01_2_1929	1A	32.629782°	-79.795204°	~30% shell hash, Poorly sorted, medium grained sand
02_1934	2A	32.629843°	-79.788740°	~5% shell hash, Moderately well sorted sand, fine to medium grained sands
02_2_1941	2A	32.631368°	-79.789618°	~25% broken shell, Poorly sorted, fine-medium grained sands
03_1906	3A	32.615234°	-79.778505°	~30% shell hash, sand
03_2_1911	3A	32.616589°	-79.779729°	See appendix 3
04_1849	4A	32.603251°	-79.766642°	~20% shell hash
04_2_1855	4A	32.601652°	-79.767674°	~50% shell hash, Poorly sorted, fine-medium grained sand
05_1838	5A	32.603252°	-79.757880°	~35% shell hash, sand
05_2_1842	5A	32.603200°	-79.761424°	~10-15% shell hash, Moderately well sorted sand, medium grained sand
06_1912	6A	32.644146°	-79.694641°	~40% shell hash, Poorly sorted sand
06_2_1925	6A	32.645796°	-79.698146°	~70% shell hash, Poorly sorted, medium grained sand
07_1935	7A	32.651277°	-79.696851°	~5% shell hash, very fine grained sand
07_2_1940	7A	32.650639°	-79.699922°	<5% shell hash, Moderately-well sorted, fine-medium grained sand
08_1956	8A	32.655565°	-79.717573°	~70% shell hash, Poorly sorted, medium grained sand

Table 1 continued

08_2_2001	8A	32.653738°	-79.715569°	~50% shell hash, Moderately well sorted sand, coarse to medium grained sands
09_1947	9A	32.658015°	-79.710077°	~5% shell hash, Moderately well sorted sand, fine to medium grained sands
09_2_1951	9A	32.657833°	-79.712776°	<5% shell hash, Moderately well sorted, fine-medium grained sand
10_1725	10A	32.658990°	-79.729846°	~25% shell hash, Poorly sorted sand, coarse to medium grained sands
10_2_1732	10A	32.659475°	-79.732036°	~70% shell hash, Poorly sorted, medium grained sand
11_1949	11A	32.665420°	-79.740092°	~25% shell, Moderately-well sorted, medium grained sand
11_2_1951	11A	32.665760°	-79.742846°	<5% shell hash, Moderately-well sorted, fine-medium grained sand
12_1740	12A	32.669031°	-79.737169°	~45 shell hash
12_2_1745	12A	32.671788°	-79.738388°	~80% shell hash, Poorly sorted, medium-coarse grained sand
13_1749	13A	32.674446°	-79.742074°	~60% shell hash, Poorly sorted, medium-coarse grained sand
13_2_1752	13A	32.675029°	-79.744430°	~65% shell hash, fine grained sand
14_1800	14A	32.669579°	-79.748625°	~50% shell hash, Poorly sorted sand, fine to medium grained sands
14_2_1811	14A	32.668869°	-79.751102°	~60% shell hash, Poorly sorted, medium grained sand
15a_2_2143	15A	32.686817°	-79.766494°	~50% shell hash, Poorly sorted, medium-coarse grained sand
15a_2139	15A	32.685600°	-79.764589°	~60% shell hash, Poorly sorted, medium-coarse grained sand
16_1744	16A	32.616226°	-79.592034°	See appendix 3
16_2_1748	16A	32.616576°	-79.594074°	~70% shell hash, Poorly sorted, medium-coarse grained sand

Table 1 continued

17_1825	17A	32.652399°	-79.659892°	~10% shell hash, Moderately-well sorted, medium grained sand
17_2_1828	17A	32.652857°	-79.661035°	~40% shell hash, Poorly sorted, medium-fine sand
18_1921	18A	32.663721°	-79.683516°	~10-15% shell hash, Moderately well sorted sand, medium grained sands
18_2_1927	18A	32.661097°	-79.678008°	~25% shell hash, Moderately-well sorted, medium grained sand
19_32_1849	19A_32A	32.677905°	-79.712385°	~10% shell hash, Poorly sorted, medium grained sand
19_32_2_1900	19A_32A	32.678913°	-79.716503°	~5% shell hash, Moderately sorted, medium grained sane
1a_2207	1A	32.629080°	-79.794945°	~10% shell hash, Moderately-well sorted, fine-medium grained sand
20_1846	20A	32.615954°	-79.708702°	~25% shell hash, Poorly sorted, fine-medium grained sand
20_2_1849	20A	32.615218°	-79.712702°	~40% shell hash, Poorly sorted, medium grained sand
22_1941	22A	32.588096°	-79.728879°	~10-15% shell hash, Moderately-well sorted, medium grained sand
22_2_1944	22A	32.590621°	-79.728421°	~50% shell hash, Poorly sorted, medium-coarse grained sand
23_2_2013	23A	32.647926°	-79.722712°	~60% shell hash, Poorly sorted, medium grained sand
23_2008	23A	32.649451°	-79.716459°	See appendix 3
24_1803	24A	32.619008°	-79.758372°	<5% shell hash, Moderately-well sorted, fine-medium grained sand
24_1813	24A	32.615998°	-79.754661°	~70% shell hash, Poorly sorted sand, coarse to medium grained sands
25_2_2027	25A	32.657423°	-79.741926°	~5% shell hash, Moderately well sorted sand, fine-medium grained sands
25_2024	25A	32.659110°	-79.739444°	~20% shell hash, Moderately-well sorted, fine-medium grained sand

Table 1 continued

26_1821	26A	32.612392°	-79.748083°	~60% shell hash, Poorly sorted, medium grained sand
26_2_1826	26A	32.610921°	-79.744847°	Moderately well sorted sand no noticeable shell hash, fine-medium grained sands
26_2228	26A	32.611765°	-79.746993°	~40% shell hash, Poorly sorted, medium grained sand
27_1702	27A	32.594384°	-79.540670°	~45% shell hash
27_2_1710	27A	32.592733°	-79.536705°	~15% shell, Poorly sorted, medium grained sand
27_2027	27A	32.594280°	-79.538979°	~50% shell hash, Moderately-well sorted, medium grained sand
28_1721	28A	32.606210°	-79.568020°	~35% shell hash
28_2_1731	28A	32.607874°	-79.571808°	~50% shell hash, Poorly sorted, medium grained sand
28-2014	28A	32.605948°	-79.566914°	10-15% shell hash, Moderately well sorted, fine-medium grained sand
29_1735	29A	32.613319°	-79.582146°	~40% shell hash, Moderately-well sorted, fine-medium grained sand
29_2_1741	29A	32.614354°	-79.584947°	See appendix 3
30_1754	30A	32.622759°	-79.606089°	~60% shell hash, Moderately-well sorted, coarse-medium grained sand
30_2_1758	30A	32.625871°	-79.612479°	<50% shell hash, Poorly sorted, medium grained sand
31_1822	31A	32.693919°	-79.745881°	~10% shell hash, Moderately-well sorted, fine-medium grained sand
31_2_1827	31A	32.695091°	-79.748554°	~25% shell hash, Poorly sorted sand, coarse to medium grained sands
33_1805	33A	32.631905°	-79.624550°	~50% shell hash, Poorly sorted, medium grained sand
33_2_1808	33A	32.633485°	-79.627715°	~15% shell hash, Poorly sorted, fine-medium grained sand

Table 1 continued

34_1815	34A	32.642439°	-79.646194°	~60% shell hash, Poorly sorted, medium-coarse grained sand
34_2_1819	34A	32.643442°	-79.648155°	See appendix 3
5_2221	5A	32.603135°	-79.648155°	~50% shell hash, Poorly sorted, medium grained sand

3.0 GENERAL DISCUSSION AND HABITAT ASSESSMENT

3.1 Overview of Data and Habitat Characterization

The side scan sonar data varied throughout the study area in backscatter intensity (figure 9). Areas of high backscatter intensity are generally characterized as either hardbottom or coarse, sometimes shelly sediments swept into bedforms. The survey and interpretation methods for habitat characterization in the ODMDS and Entrance Channel extension were presented at the Nov 29, 2012 Post 45 Habitat/Cultural Resources Assessment meeting at the Charleston District Corps of Engineers offices. These are summarized below for ease of evaluation of the groundtruth targets and priorities selected and proposed within this interim report.

Similar geophysical methods were used in mapping and delineating potential hardbottom habitat areas in the previous ODMDS expansion in the 1990s and initial results are consistent with previous work in the vicinity of the ODMDS (Gayes and Viso, 2006).

3.2 Geophysical Interpretation of Surficial Habitat

Side scan and sub-bottom records were analyzed to characterize sea floor habitat into three classes of mappable geophysical units.
These are:

1. areas of clear hardbottom habitat (Probable Hardbottom)

2. areas where hardbottom substrate existing at the sea floor is highly unlikely (Absence of Hardbottom)

3. areas where localized outcrop of hardbottom substrate are exposed the sea floor is possible but limited and patchy in aerial extent. (Possible Hardbottom).

Probable Hard Ground

Sub-bottom profiling of these areas typically shows very thin (less than 50 cm) or no surficial sediment cover overlying older potentially indurated substrate. Occasionally, strong subsurface reflectors can be traced from depth to where they intersect the sea floor, often forming a surficial expression such as change in slope or standing relief on the sea floor. The sea floor is often coincident or nearly coincident with the transgressive ravinement. Hard ground areas in the region tend to exhibit strong acoustic impedance (reflectivity) in sub-bottom records at or very near the sea floor (figure 10, 11). Penetration of the acoustic signal is impeded at the sea floor as evidenced by absence of coherent reflectors with depth; sometimes also expressed as strong “ringing” of multiples of the acoustic signal between the sea floor and surface of the ocean.

Broad areas of generally high backscatter on side scan sonar records typically characterize probable hard ground areas. Indurated material standing exposed in relief on the sea floor as ledges or mounds frequently form mappable linear or curvilinear ledges in the side scan record. Occasionally, such ledges may stand in relief sufficient to cast “shadows” in the sonar record allowing an estimate of relief of the ledge. Coarse shell

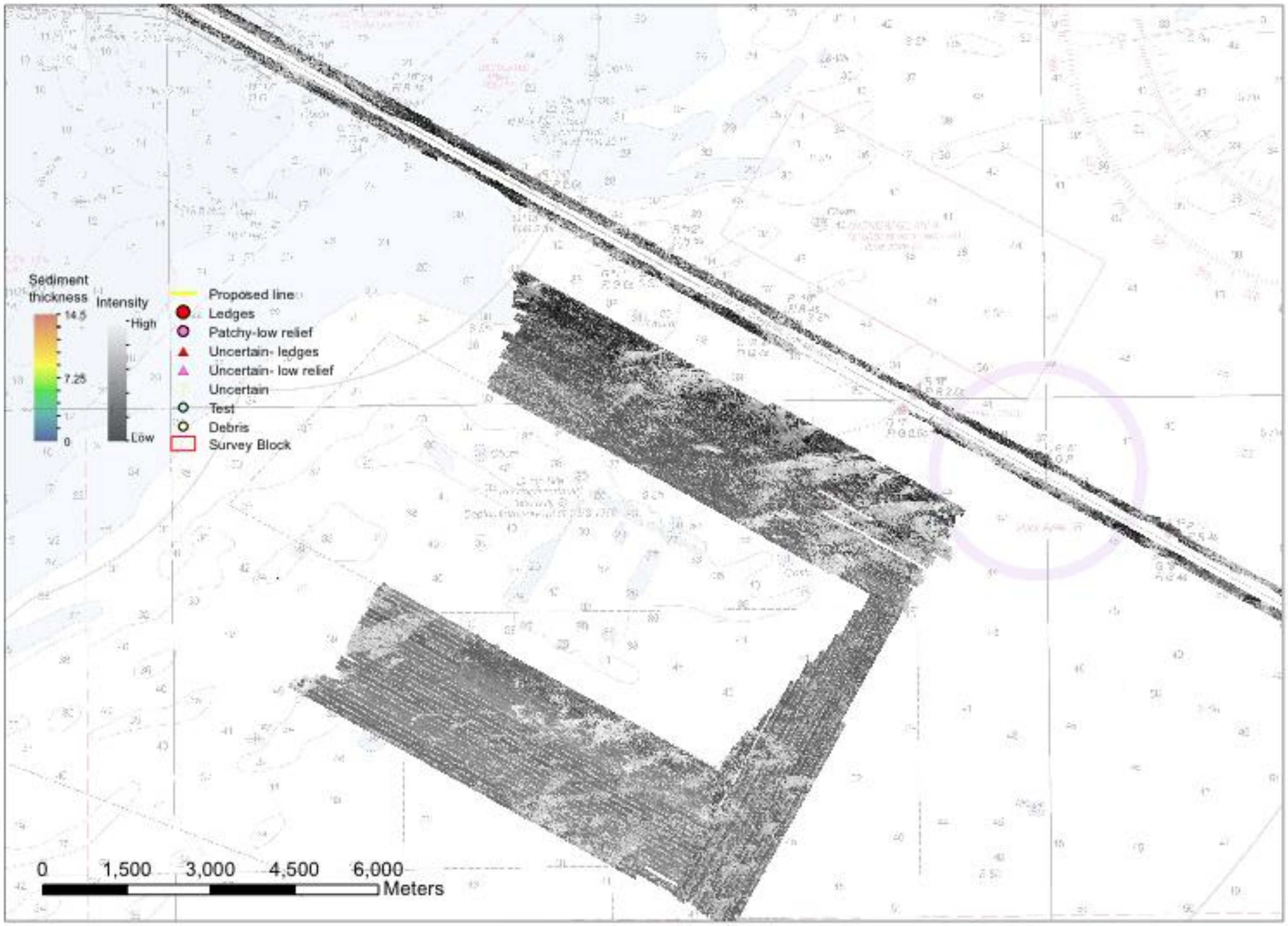

Figure 9. Side scan sonar (backscatter intensity) mosaic in Post 45 ODMDS and entrance channel.

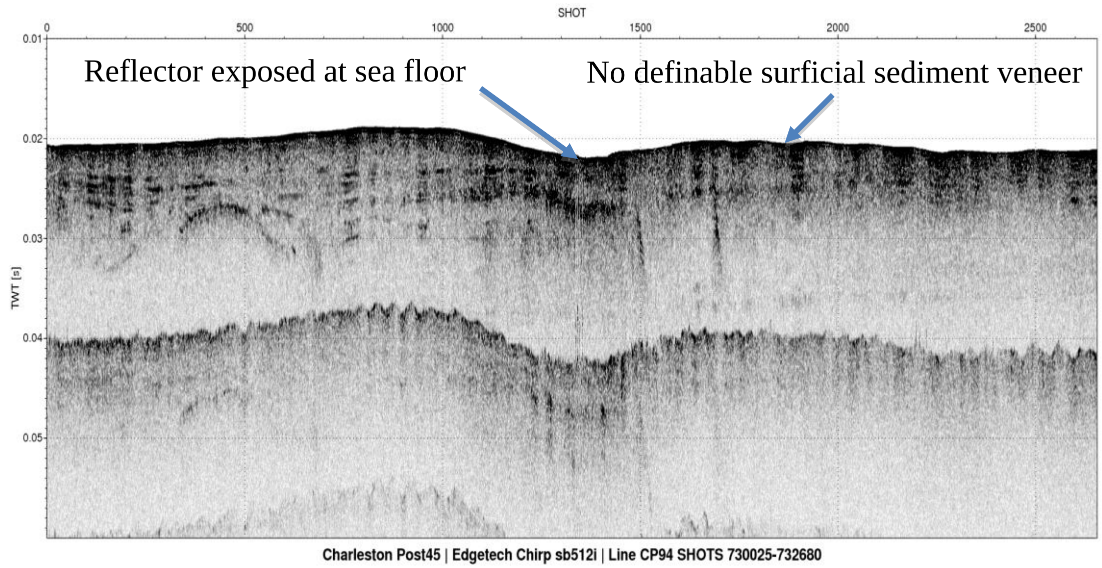

Figure 10. Sub-bottom profile (Line 94) showing examples where older, tilted reflectors are evident at or near the sea floor with little or no overlying surficial sediment cover. Hard ground habitats are highly likely to be found in such areas.

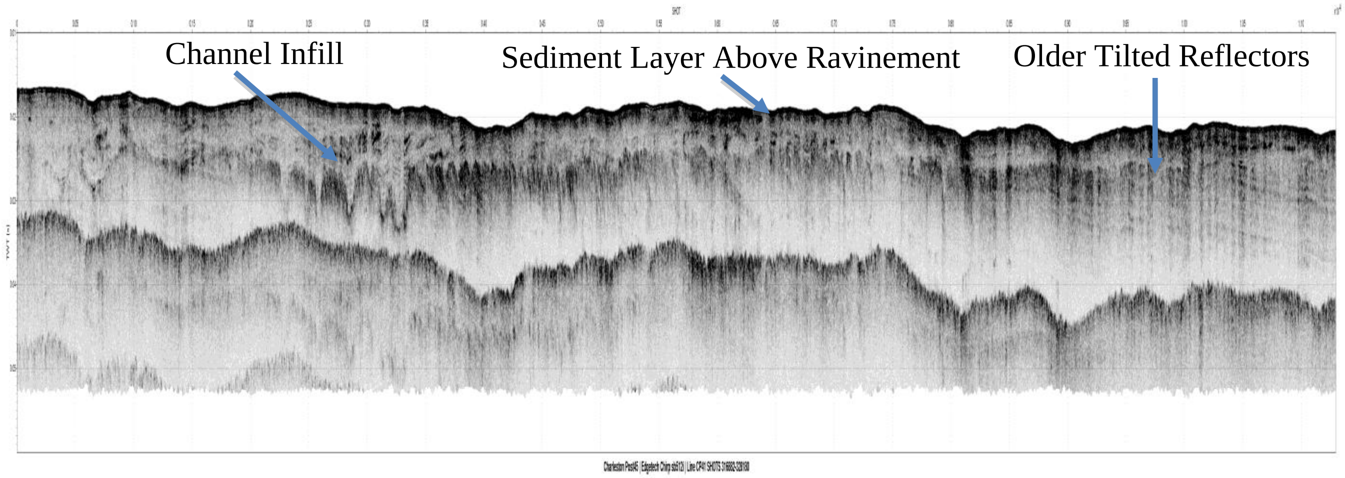

Figure 11. Sub-bottom profile (Line 41) showing examples where a definable thickness (>4 meters) of sediment infilling within a definable and laterally continuous channel and above a flat lying ravinement surface. In such areas older, tilted and potentially indurated substrate that could form hard grounds is separated from the sea floor and presence of hard grounds is highly unlikely.

hash lags (also high backscatter) frequently heavily rippled are common within the ledge areas. Locally, patches of lower backscatter (fine sand) are often present within the broader field of outcrop.

This type of habitat is known to be present within the region and has been previously identified in the Southwest corner ODMDS (Gayes and Viso, 2006).

Absence of Hard Ground

In other areas, there is clear geophysical evidence of the absence of hardbottom habitat exposed at the sea floor. Such areas are typically characterized by varying thicknesses of recent sediment cover (usually sand) overlying a well-defined and laterally mappable “ravinement” surface in sub-bottom profile data. Locally, relatively thick sections of sediment coincide with seismically-defined relict fluvial and/or tidal channel incisions. Theses channel features, now backfilled with thick sediments, result from paleo-drainage networks incised into a more thoroughly indurated, potentially hardbottom habitat forming substrate. In addition, sand ridges and other large-scale sedimentary bed forms, may overlie hard substrate separating potential hard grounds and the sea floor by several meters of unconsolidated sand.

In these areas, side scan sonar records typically exhibit lower overall backscatter and variability. Wave and current driven sedimentary bedforms are also commonly apparent in side scan records of these areas.

Possible Hard Grounds

On the inner continental shelf in the vicinity of the ODMDS there are known areas of “low relief” hard grounds. In these areas a very thin, and potentially mobile, veneer of sand typically covers hard substrate with relatively low physical relief. Such areas are often expressed as patchy high backscatter areas in side scan sonar interspersed with coarse shell hash rippled lenses and patches of bedforms starved of finer (low backscatter) sand. Chirp records show very thin veneers of surficial sediment above a definable strong, largely flat lying near surface reflector. Such areas can be locally found either as transition between extensive hard ground areas and increasing percentage cover and thickness of sediment or as patches of low lying partially sand covered areas independent of easily defined (high relief) hard grounds. As a result the character of acoustic signatures is often a hybrid between extensive hard grounds and more extensive sand sheets.

3.3 Groundtruthing Geophysical Data and Interpretations

Geophysical survey methods such as side scan and chirp are remote sensing mapping tools that report responses of the system to an active pulse of acoustic signal. The character and spatial geometries of the response are valuable in interpretation of sea floor and shallow subsea habitats and deposits.

For many settings, such as areas of extensive high relief hard grounds or incised channel fills, a very high degree of confidence can be placed on interpretation of the remote sensing of the area (figures 10, 11). For other settings, such as low relief hard grounds the acoustic response can be more complex and interpretations, particularly of boundaries and transition in habitat, more subjective.

As with all remote sensing, physical groundtruthing of mappable response is necessary to calibrate and increase confidence on interpretation and mapping products. Thus a series of sites were selected to groundtruth the geophysical interpretations and refine spatial mapping of the three habitat classes defined here as: probable hard ground, possible hard ground and absence of hard ground.

3.3.1 *Habitat interpretation and groundtruth site selection procedures*

Sub-bottom data

The chirp sub-bottom profile data were analyzed and:

1. Areas with measurable (>1 m) surficial sediment overlying a definable and mappable unconformity surface defined. In these areas, there is high confidence that no hard ground substrate will exist at or near the sea floor (Absence of hard ground, figure 11).

2. Areas showing very limited or no significant surficial sediment veneer were defined as probable hard ground areas based on chirp data alone (figure 12). In areas where there is clear evidence of strong inclined reflectors truncated at or very near the sea floor there is high confidence that hard ground habitat will be found in the area; particularly where such reflectors may extend through and stand in relief above the surrounding sea floor. In other areas where sediment cover is very thin or near the resolution of the system there is greater uncertainty in whether hard grounds may be present. These areas were classified as "possible hard ground" areas.

Side Scan Sonar Data

The side scan data were analyzed and:

1. A regional side scan sonar mosaic of the study area was established to discern broad spatial patterns of backscatter (intensity and geometry)(figure 9). This regional image was subdivided into areas of internally similar backscatter response with emphasis on defining areas with characteristics similar to other known habitat types previously mapped in the region. Extensive hard ground areas are typically well defined from such mosaics, but individual outcrops or ledges are less well defined on this mosaic scale.

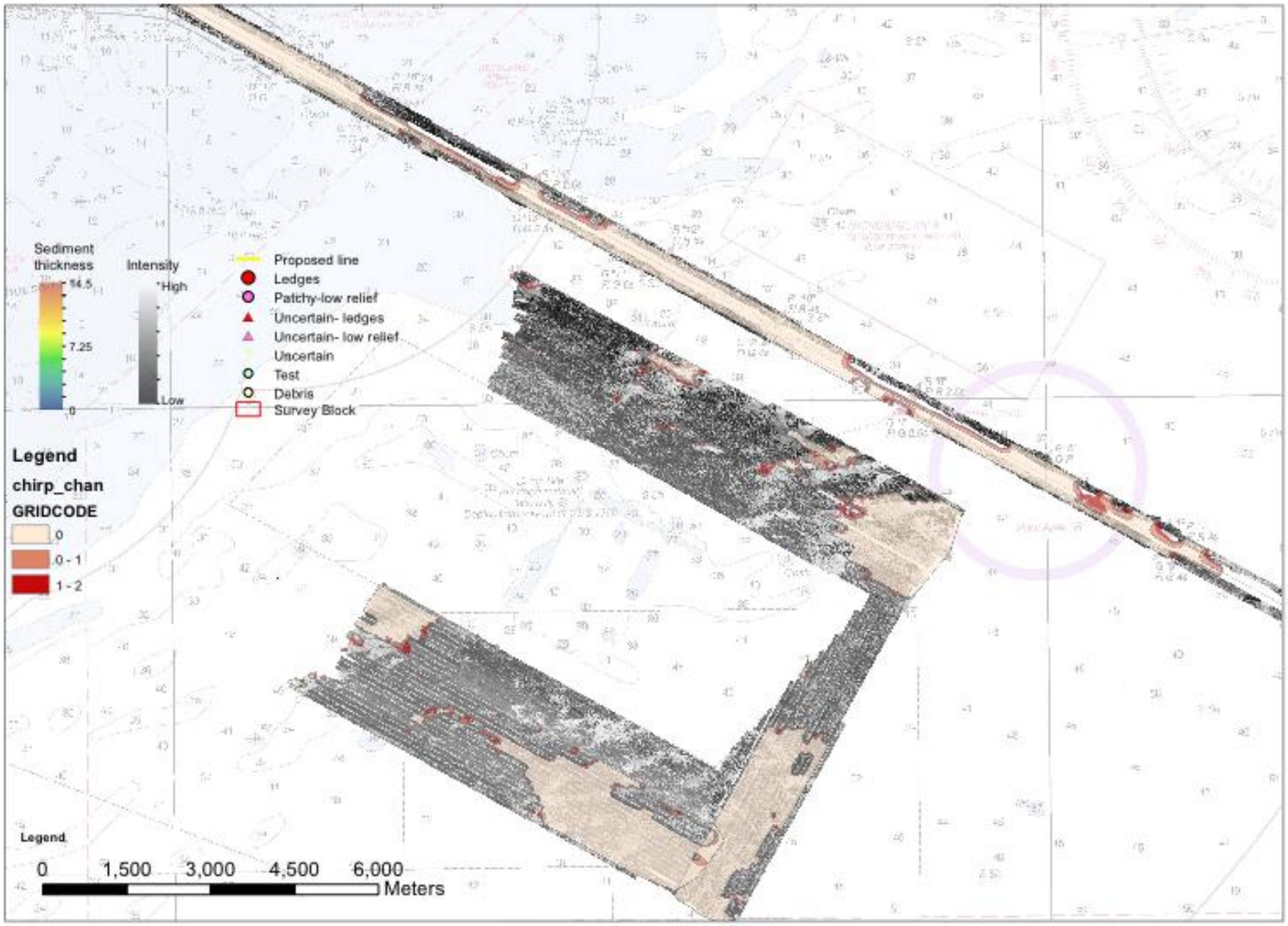

Figure 12. Side scan sonar (backscatter intensity) mosaic and Chirp (sediment thickness) in Post 45 ODMDS and entrance channel.

2. Every individual side scan record (high frequency channel) was reviewed with slant-range correction to identify possible hard ground targets based on backscatter intensity, geometry and similarity to other known hard ground sites previously mapped in the area (figure 13). This format provided the highest resolution record of any given location. The position of each target identified was logged with a classification of the habitat interpretation along with a tiff image of the target. At this point, 738 targets were classified as:

    a. High confidence hard grounds (often exhibiting characteristics of ledges or relief of outcroping surfaces).

    b. Probable, likely low relief hardbottoms.

    c. Potential ledge outcrops but not definitive on the records potentially due to angle of crossing the feature or subtlety of the signal.

    d. Potential low relief hardbottom outcrops but not definitive on the records potential due to angle of crossing the feature or subtlety of the signal.

    e. Acoustic response that has some character of regional hard grounds but low confidence (uncertain) for the potential of hard ground habitat.

    f. Locations that may not show evidence of hardbottom habitat but form a distinctive pattern or response that could benefit from groundtruthing of overall interpretations and final map interpreted products.

Integrating the sub-bottom profile interpretations and regional side scan mosaic characterization with locations of specific side scan targets (as prioritized above) resulted in four potential combinations:

1. Presence of hard grounds highly probable based on interpretations of the sub-bottom data, regional side scan mosaic **<u>and</u>** individual high resolution side scan record of selected targets (high confidence).

2. Absence of hard grounds based on the sub-bottom, regional side scan mosaic **<u>and</u>** individual high resolution side scan record of selected targets (high confidence).

3. Presence of hard grounds possible based on interpretations of the sub-bottom data, regional side scan mosaic **<u>and</u>** individual high resolution side scan record of selected target (medium confidence).

4. Presence of hardbottom habitat possible based on interpretations of **<u>one or more but not all</u>** sub-bottom data, regional side scan mosaic or individual high resolution side scan record of selected target (lower confidence).

From this analysis a series of tracklines were identified for direct observation (video, figure 14) of bottom habitat to most efficiently calibrate and refine geophysical habitat mapping. The video tracklines covered the range of possible bottom types predicted by the combinations of geophysical data described above.

Analysis of side scan records in the area of the ODMDS surveyed for the cultural resource assessment resulted in a strong spatial clustering of possible targets. These were also recommended for camera tows.

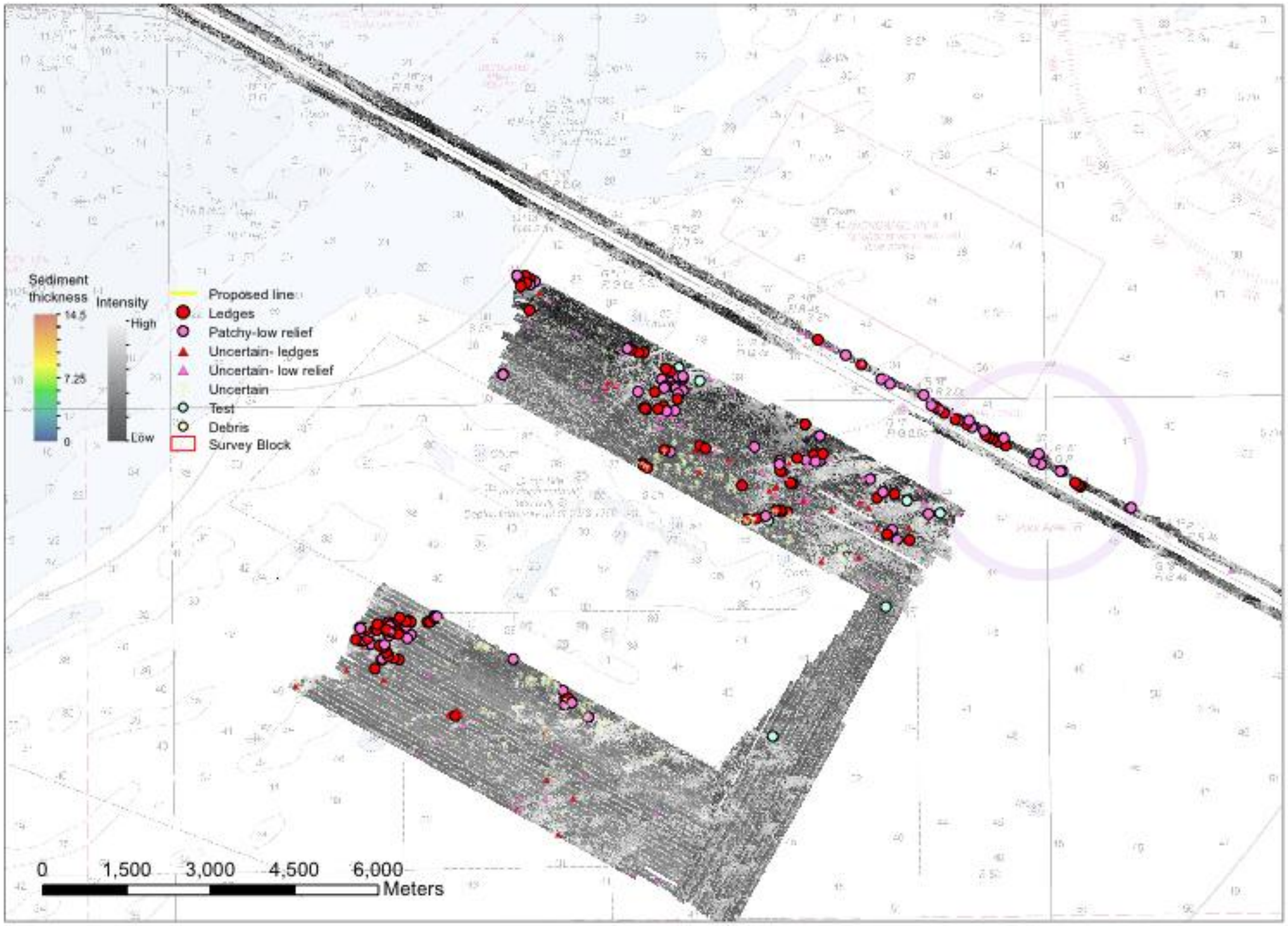

Figure 13. Side scan sonar (backscatter intensity) mosaic overlain with individual targets from full resolution sonar files in Post 45 ODMDS and entrance channel.

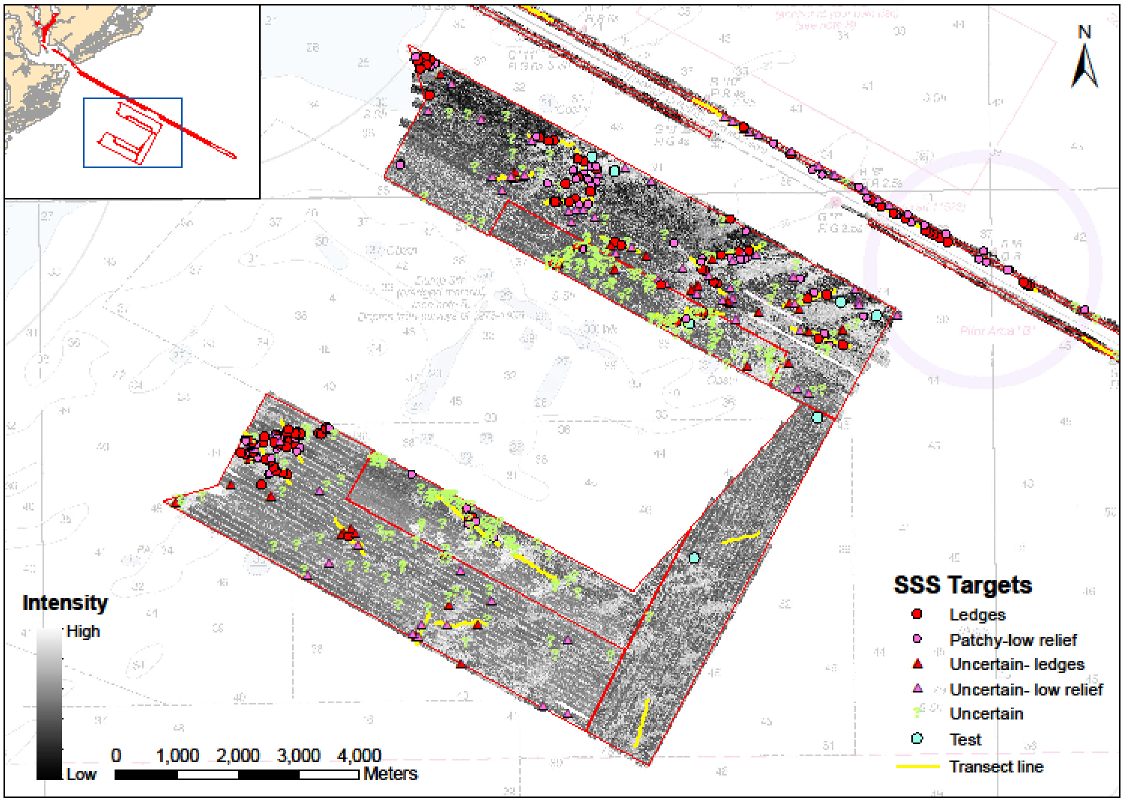

Figure 14. Mosaic of side scan sonar collected at the ODMDS site. Target classifications from individual side scan lines is also shown. Note clustering of high confidence picks (red and pink circles) as well as clustering or more uncertain signals (green question marks). Lines for video tow verification/groundtruthing are also shown (yellow).

3.4 HARDBOTTOM HABITAT CLASSIFICATION MAPPING

Habitat classification maps were established for the areas within the proposed modified Charleston ODMDS, entrance channel, and channel extension defined for the Post-45 study (e.g. figures 15-19, figures in Appendix 3). The capacity of the data to resolve habitat ranges from mapping scale with limited confidence in the potential for high quality hardbottom habitat at any one location (mosaics of sonar backscatter) to datasets with very high confidence in the nature of habitat on the sea floor but with extremely limited spatial coverage (bottom video imagery). By integrating across diverse datasets, each with their particular strengths for the purpose of defining and mapping habitat, three classes of sea floor habitat were mapped.

The specific data sources integrated for the Post 45 habitat study include:

1. Mosaics of side scan sonar backscatter integrated to provide a mapping scale image of sea floor character across the entire survey area.
2. Surficial sediment thickness maps developed from interpretation of individual chirp sub-bottom profiler records showing areas where surficial sediment cover is below the resolution of the instrument (20 cm), between 0-1 m and between 1-2 meters thick.
3. Interpretation of individual high-resolution side scan sonar records, corrected for slant range, for sites with backscatter characteristics and patterns consistent with known regional hardbottoms.
4. Video imagery of camera tow transects located at sites to validate/test sonar and chirp interpretations.

These datasets were used to generate three classes of map coverage; hardbottom, probable hardbottom and possible hardbottom.

Hardbottom

Areas identified and mapped as hardbottom habitat exhibit strong indicators that hardbottom sea floor is present across several data types. Such areas are characteristically:

- Mappable as coherent fields of high backscatter response of the sea floor. Hardbottom setting may exhibit a mottled backscatter response or clear fabric of linear patterns within an overall high backscatter response reflecting trends of outcroping substrate and patchy thin veneers of sediment within the hardbottom areas.
- Found within areas where surficial sediment thickness, between the sea floor and regionally coherent subsurface reflectors interpreted as the top of older and potentially indurated deposits, is minimal (0-1 m in thickness) on chirp sub-bottom profiles.
- Locations with clear patches of high backscatter sea floor frequently exhibiting irregular mounds and/or strong linear ledges and/or relief locally

high enough to result in a shadow effect to the incident acoustic signal and full resolution (not mosaicked) side scan records.

- Found to have physical outcrops of indurated substrate visible on video camera transects of the sea floor. Hardbottom habitats visually identified were parameterized by the relief of the outcropping substrate (high (>1 foot) and low relief) and by the presence of hardbottom invertebrate communities (extensive, sparse or no benthic growth evident).

Fields mapped as “Hardbottom” are not mapped as continuous or individual hardbottom outcrops but define areas where an abundance of outcrops and quality habitat is expected to exist interspersed with patches of course shelly / sandy sediment.

Probable Hardbottom

Areas mapped as “Probable” hardbottom typically possessed most but not all of the characteristics of hardbottom listed above. As video documentation is limited to only a finite number of transects, heavier weighting is placed on the side scan and sub-bottom profile signals. Probable hardbottom on the following maps are expected to represent areas of transition away from areas confidently mapped as hard grounds where one or more signatures on side scan and chirp sub-bottom profiles is less confidently interpreted as hardbottoms. Typically these areas may be expected to have patches of outcropping sea floor but limited signals of high relief (high quality habitat).

Possible Hardbottom

Areas mapped as “possible” hardbottom were often defined as possessing minimal surficial sediment thickness (<1m thick) and exhibiting mappable high backscatter sea floor on full resolution and mosaicked side scan images. Relatively few ledges or signs of relief on the sea floor where identified in these areas on the full resolution side scan records. Video data, when available, documented no hard ground habitat supporting typical invertebrate communities. Review of video data from some of these areas showed evidence of clear erosion and deflation of the sea floor into older sediment that resulted in extensive shell lags frequently organized into large ripple fields. In other areas, particularly in the outer section of the channel extension very clear outcrops with considerable relief (up to 1 meter) were observed on side scan and video data but did not support typical hardbottom invertebrate communities. These areas appear to be outcrops of cohesive back-barrier (salt marsh) depositions being actively exhumed by the modern ravinement (marine unconformity) surface but too unconsolidated to support typical hardbottom communities. As the surficial sediment in these areas is limited and is actively being eroded local areas of older more indurate substrate within these areas is certainly possible and should be expected locally.

The composite map of data layers used for habitat interpretation and mapping (sonar mosaic, surficial sediment thickness, high resolution sonar hardbottom targets and video transect data) for the ODMDS and Entrance Channel are shown.

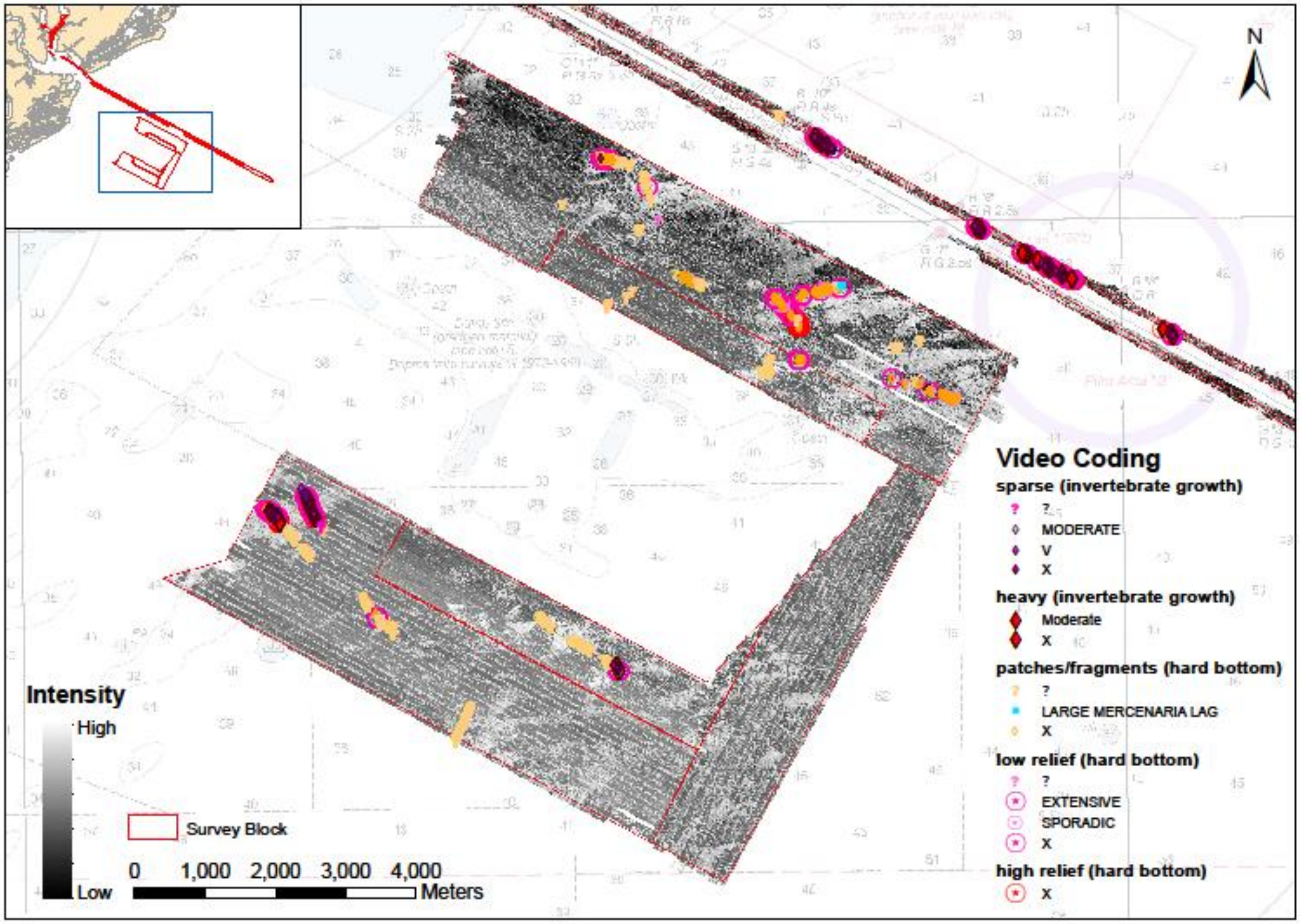

Figure 15. Side scan sonar (backscatter intensity) mosaic overlain with geocoded video observations (groundtruth) in Post 45 ODMDS and entrance channel.

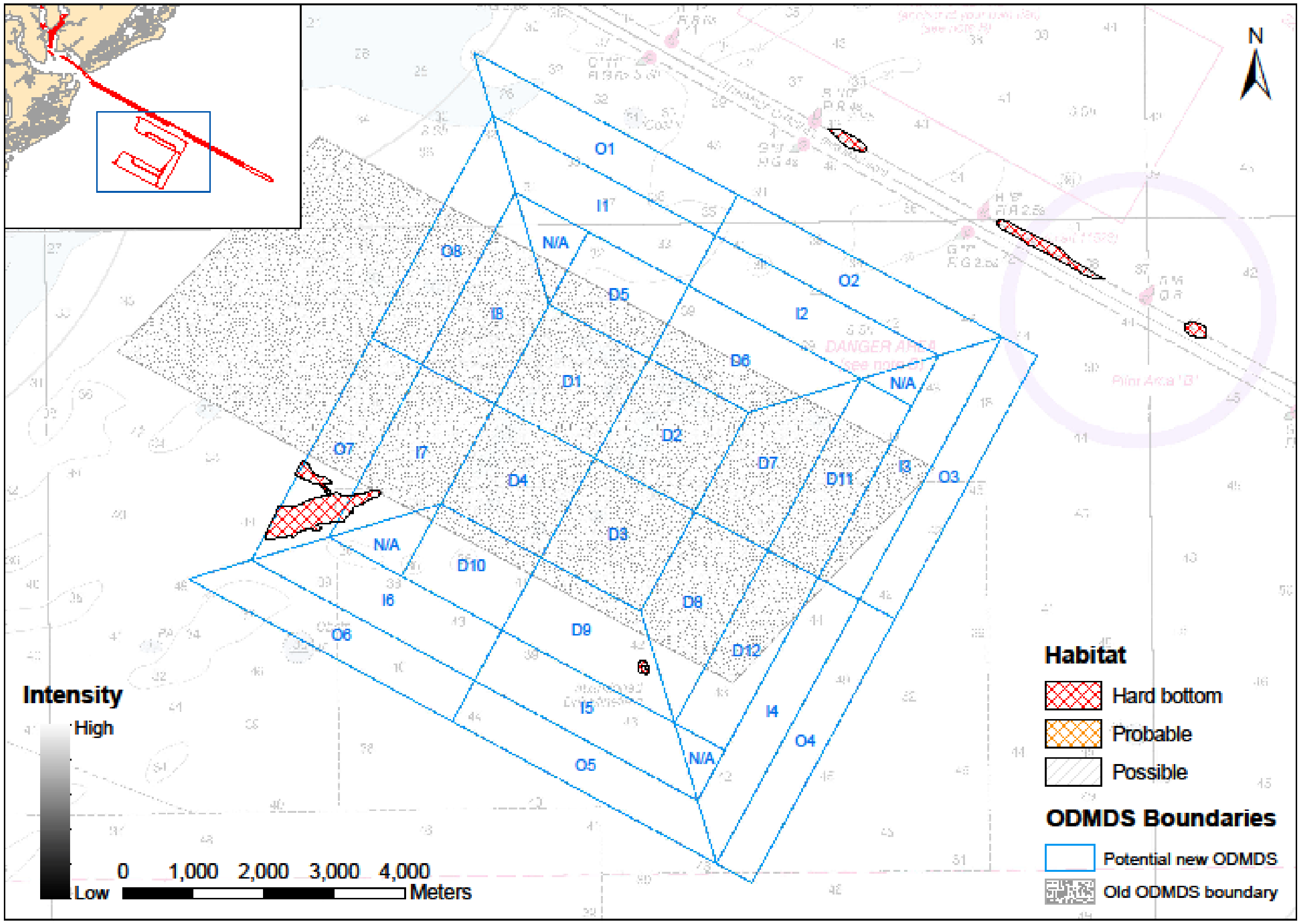

Figure 16. Areas of hardbottom habitat from side scan sonar (backscatter intensity), sediment thickness (Chirp), and geocoded video (groundtruth) in Post 45 ODMDS and entrance channel.

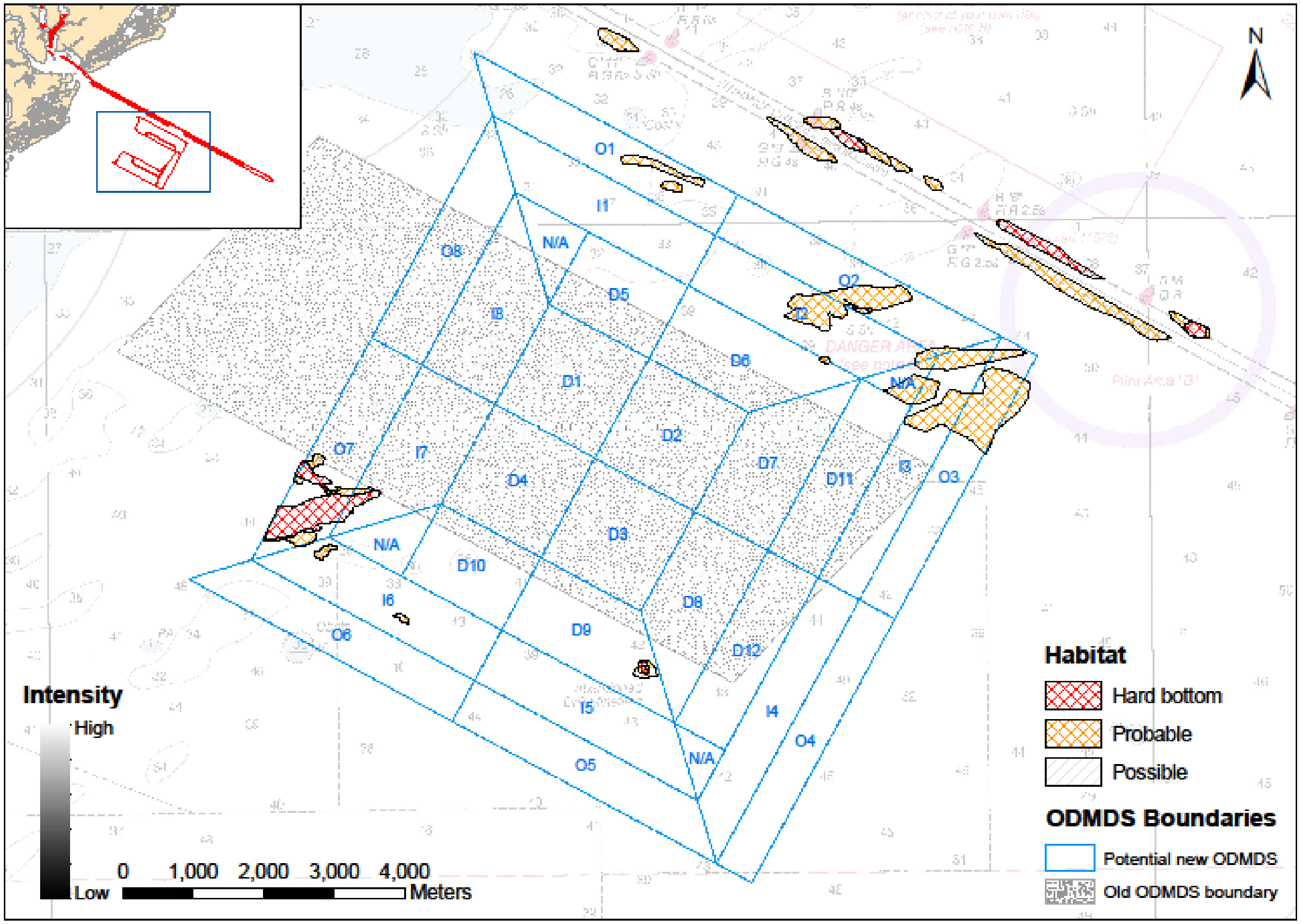

Figure 17. Areas of hardbottom habitat and probable hardbottom habitat from side scan sonar (backscatter intensity), sediment thickness (Chirp), and geocoded video (groundtruth) in Post 45 ODMDS and entrance channel.

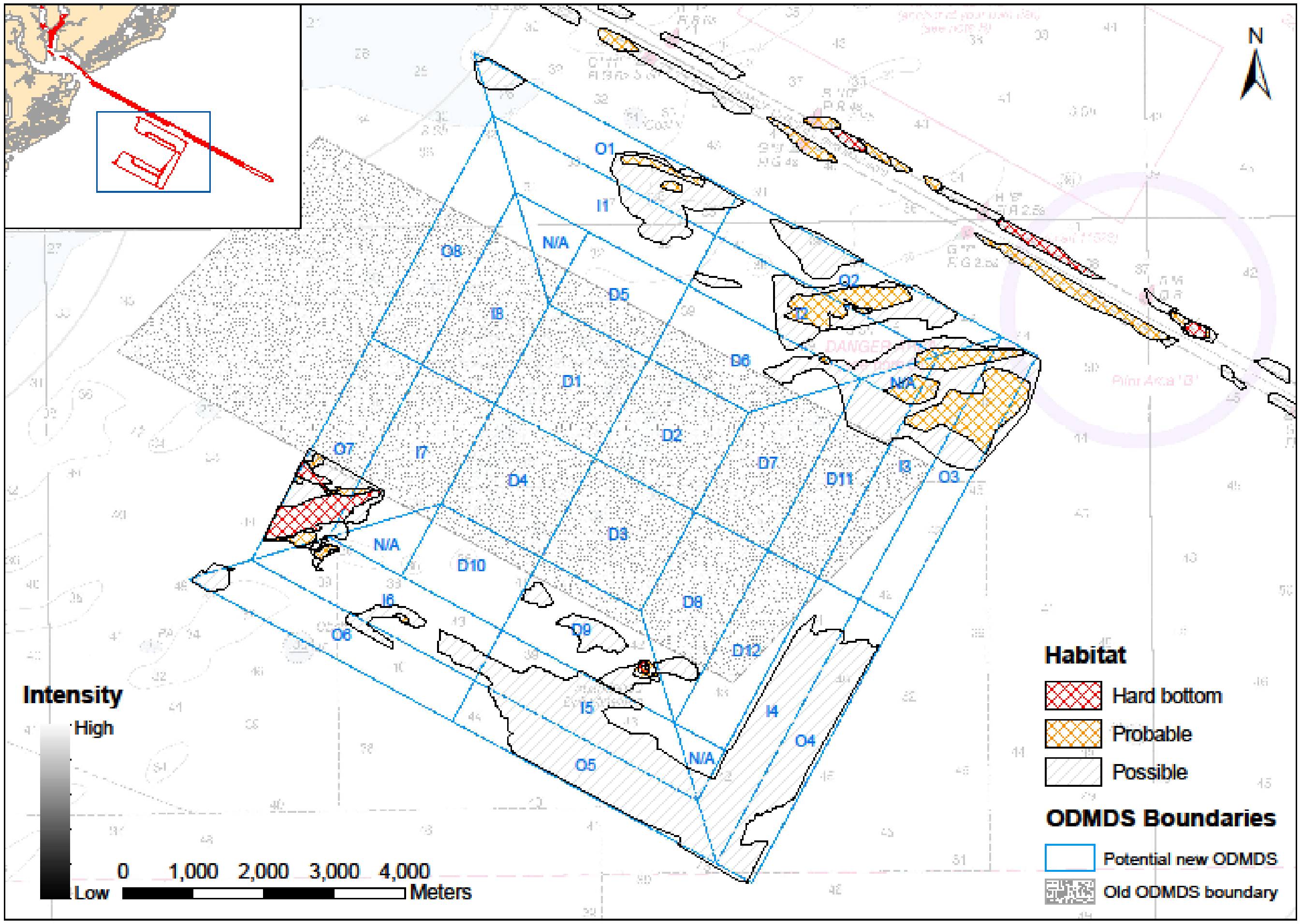

Figure 18. Areas of hardbottom habitat, probable hardbottom habitat, and possible hardbottom habitat from side scan sonar (backscatter intensity), sediment thickness (Chirp), and geocoded video (groundtruth) in Post 45 ODMDS and entrance channel.

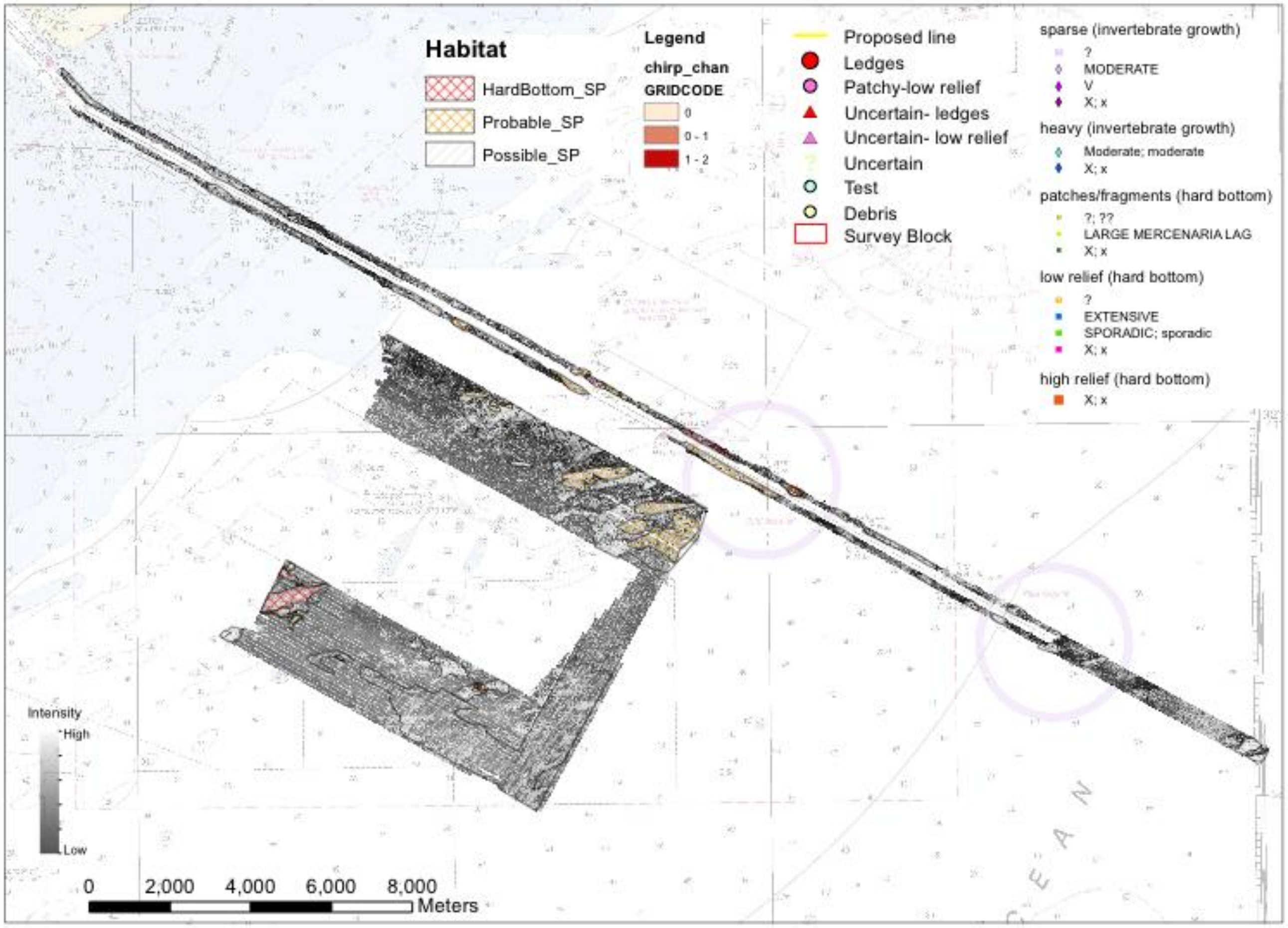

Figure 19. Areas of hardbottom habitat, probable hardbottom habitat, and possible hardbottom habitat from side scan sonar (backscatter intensity), sediment thickness (Chirp), and geocoded video (groundtruth) overlain on side scan mosaic in Post 45 ODMDS and entrance channel.

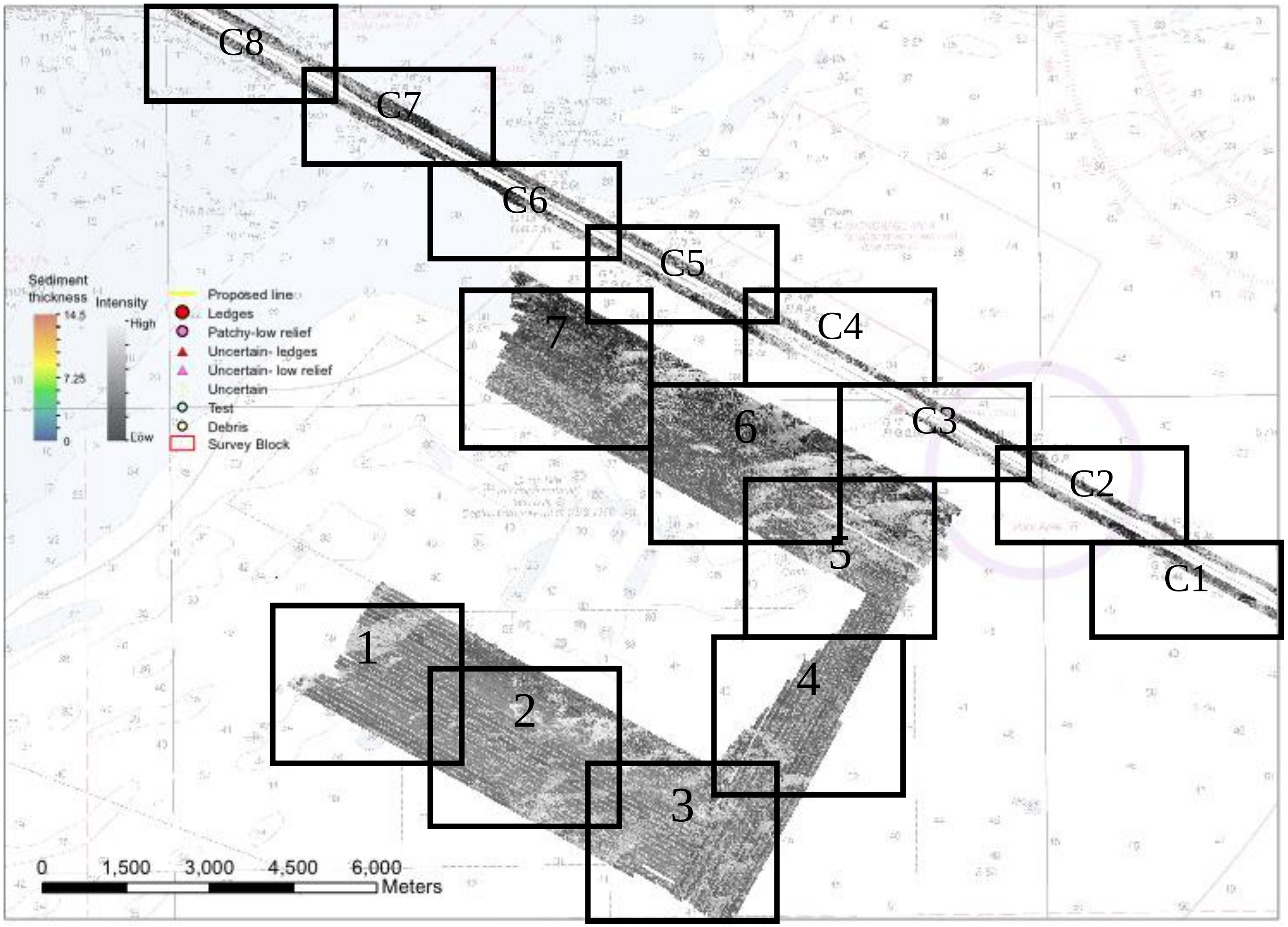

Figure 20. Data layers for habitat interpretation are shown in habitat appendix at a scale of 1:16000 for the areas defined below (ODMDS Areas 1-7, and Channel/Extension Areas C1-C-8 can be found in Appendix 2).

4.0 GENERAL DISCUSSION AND INTERPRETATION OF SUB-BOTTOM PROFILES

4.1 Geologic Framework

The general seafloor morphology across the channel extension and ODMDS survey areas consists of a series of NE/SW trending sediment ridges. These ridges appear to be part of a surficial sand sheet that contains most of the modern sediment in this region. Locally, modern sediment accumulation across the ridges is up to 3-4.5 m, while elsewhere the surficial sediment thickness decreases to 1 foot or less. Elsewhere the sub-bottom is often relatively homogenous, with some high amplitude, chaotic returns near the seafloor and acoustically transparent material below. In many cases, these areas are indicative of hardbottom or consolidated seafloor sediments. Figures 21-32 show reflector picks gridded into various surfaces including seafloor and top of rock, and isopachs of various intervals including modern sediment thickness.

4.2 Sediment Thickness and Sub-bottom Surfaces

The base of surficial modern sediment is defined as the most recent transgressive surface (figures 21, 25, 29). Isopach maps of sediment thickness above this layer (*modern sediment thickness*) indicate the minimum thickness of sediment that is mostly unconsolidated (figures 22, 26, 30). The base of relict sediment (*depth to top of rock*) was digitized in areas where there is a traceable, high amplitude reflector that indicates a transition to harder subsurface material (i.e. rock)(figures 23, 27, 31). The isopach map of sediment thickness above this layer indicates the maximum potential sediment thickness in these areas and includes both modern and relict (likely Pre-Holocene) seafloor sediment as well as paleochannel infill (figures 24, 28, 32). The relict seafloor sediment and paleochannel infill may be semi-consolidated as it is not possible to determine the exact nature of the infill from sub-bottom data. Survey areas with no observable sediment thickness are likely hardbottom areas, but may have a thin sediment veneer that is not resolvable with the Chirp sub-bottom data.

4.3 Main Entrance Channel and Extension Survey Area

In general, very little modern or relict sediment is observed in and around the main entrance channel and extension areas, with the exception of a few paleochannel incisions and small areas of stratified sediment inshore on the northern side of the channel. A single subsurface reflector in the channel extension area suggests there may be some sediment above this reflector; however, most of the extension area is relatively featureless in the Chirp sub-bottom data, which is often suggestive of hardbottom seafloor with little acoustic penetration. Similarly, Chirp profiles within the main channel show very little acoustic character, indicating most of the sediment has likely been removed.

4.4 ODMDS Survey Area

The ODMDS survey area consists of 3 sub-areas (Box 1 – north of the ODMDS; Box 2 – east of the ODMDS; Box 3 – south of the ODMDS)(figures 21-24). Extensive paleochannel networks with large amounts of relict sediment infill are observed in Boxes 1 and 3. Outside these paleochannel areas, the maximum sediment thickness is typically 3-4.5 m. The top of rock and transgressive surface reflector are indistinguishable in Box 2, thus it is unclear whether the thin sediment cover observed here is modern or relict. Absence of sub-bottom reflectors and no observable sediment thickness in the northeastern corner of Box 1, the southern portion of Box 2 and the northwestern corner and central portions of Box 3 suggest possible extensive hardbottom areas.

4.5 Hardbottom Habitat Summary

The analysis of geophysical data, corroborated by video groundtruthing provides a sound means of providing a conservative estimate for areas of hardbottom, probable hardbottom, and possible hardbottom. These areas should be interpreted with the understanding that they are based upon geophysical remote sensing and groundtruthing for verification of geophysical characterization. These estimates are based on mapping throughout the proposed ODMDS and harbor entrance channel extension and navigation channel improvement areas. The estimates represent totals within the study area and are not estimates of total area to impacted by the proposed improvements and extension.

Estimates grouped by general area are:

Entrance Channel
Hardbottom: 78.1 acre (3400989.0 sq ft) (31,596 sq m)
Probable: 230.0 acre (10019856.3 sq ft) (93,088 sq m)
Possible: 804.2 acre (35030062.3 sq ft) (325,440 sq m)

ODMDS
Hardbottom: 151.5 acre (6597631.8 sq ft) (61,294 sq m)
Probable: 607.1 acre (26444189.2 sq ft) (245,675 sq m)
Possible: 4400.4 acre (191682531.8 sq ft) (1,780,790 sq m)

Areas of individual polygons in the following figures and Appendix 2 can be seen in the shapefiles included with the accompanying digital materials.

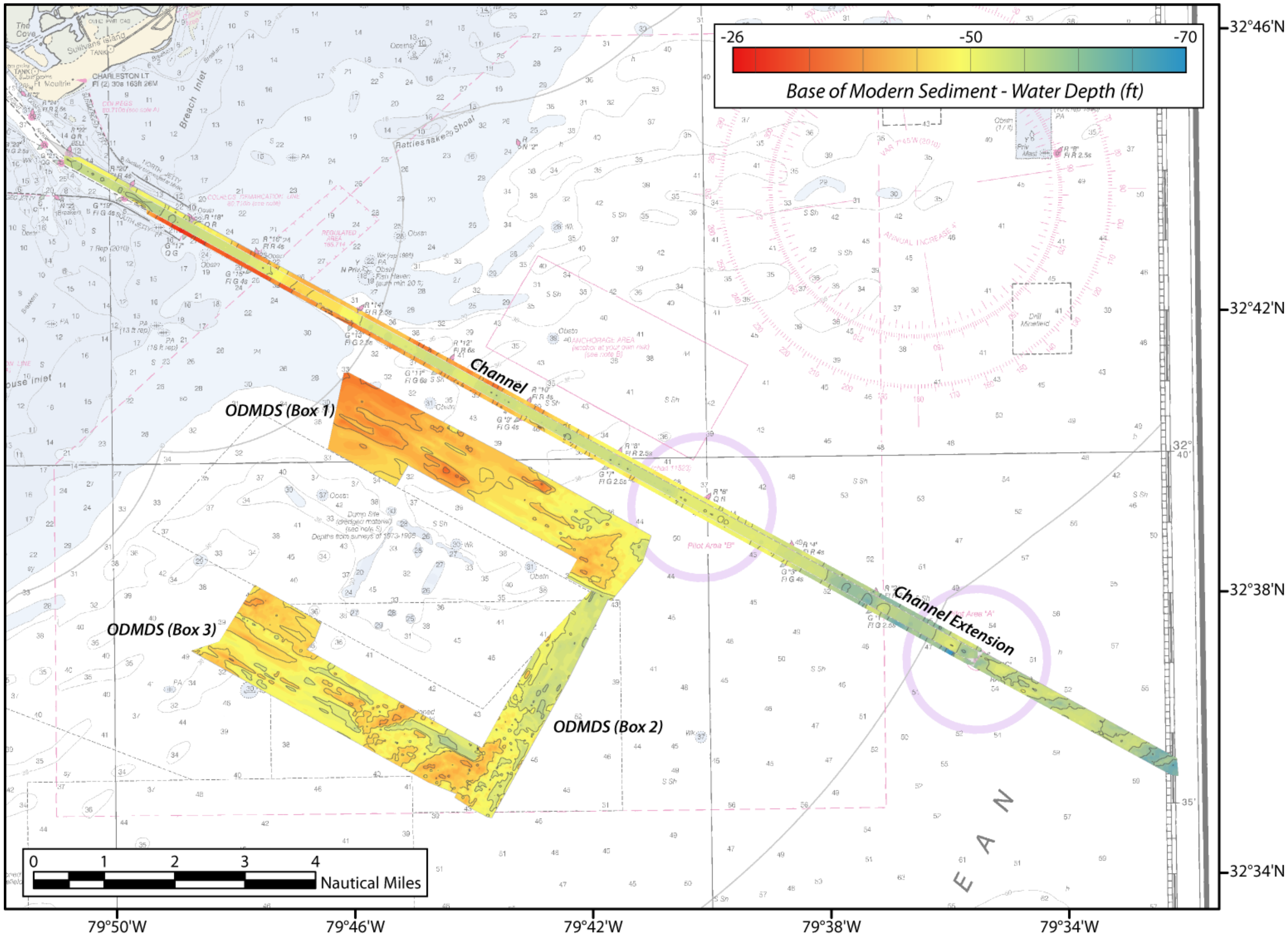

Figure 21. Depth to transgressive surface (base of modern sediment) grid derived from Chirp sub-bottom profiles for all survey areas. Contours are every 5 feet.

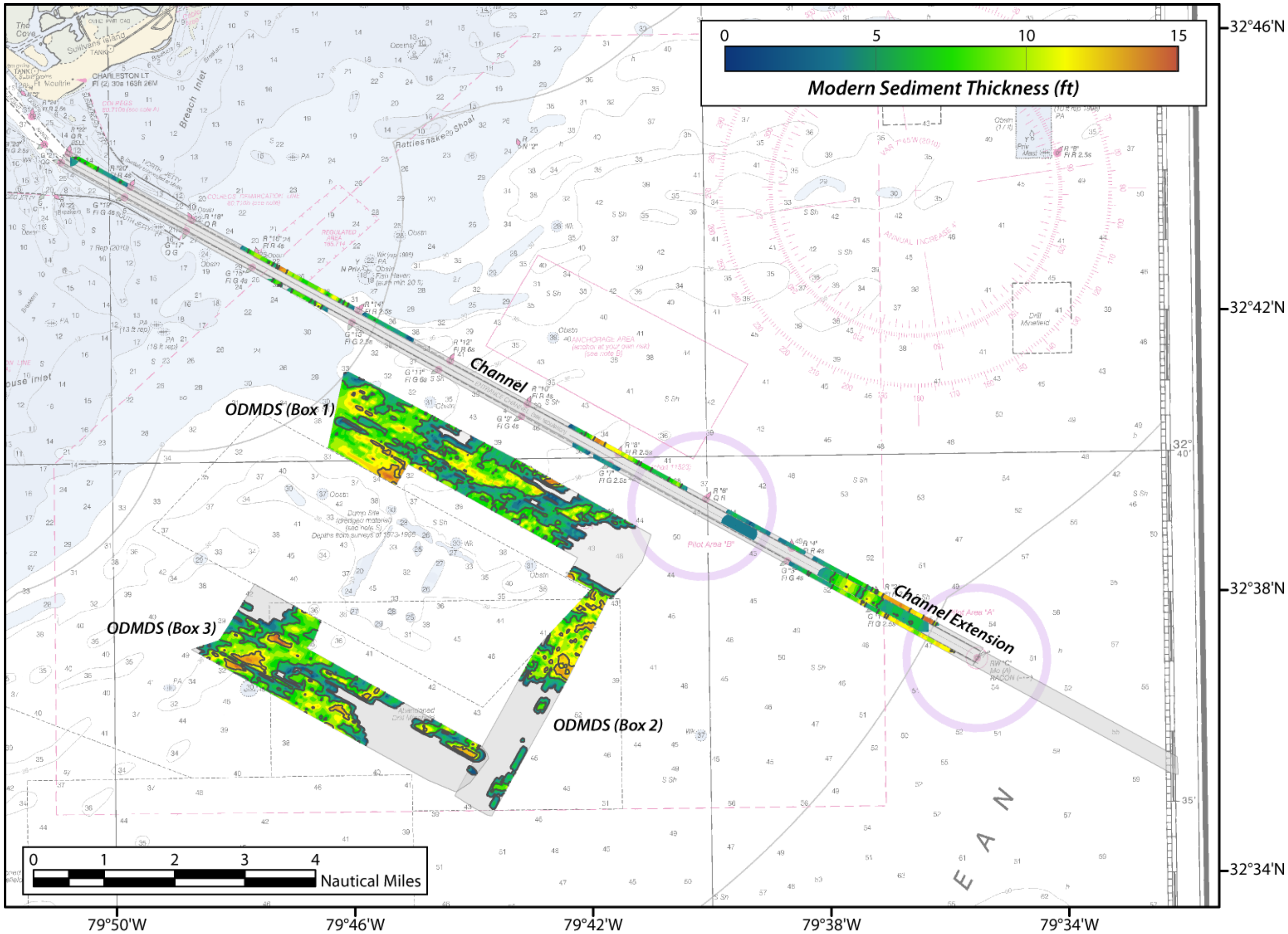

Figure 22. Thickness of modern sediment above the transgressive surface (minimum mappable sediment thickness) derived from Chirp sub-bottom profiles for all survey areas. Contours are every 5 feet.

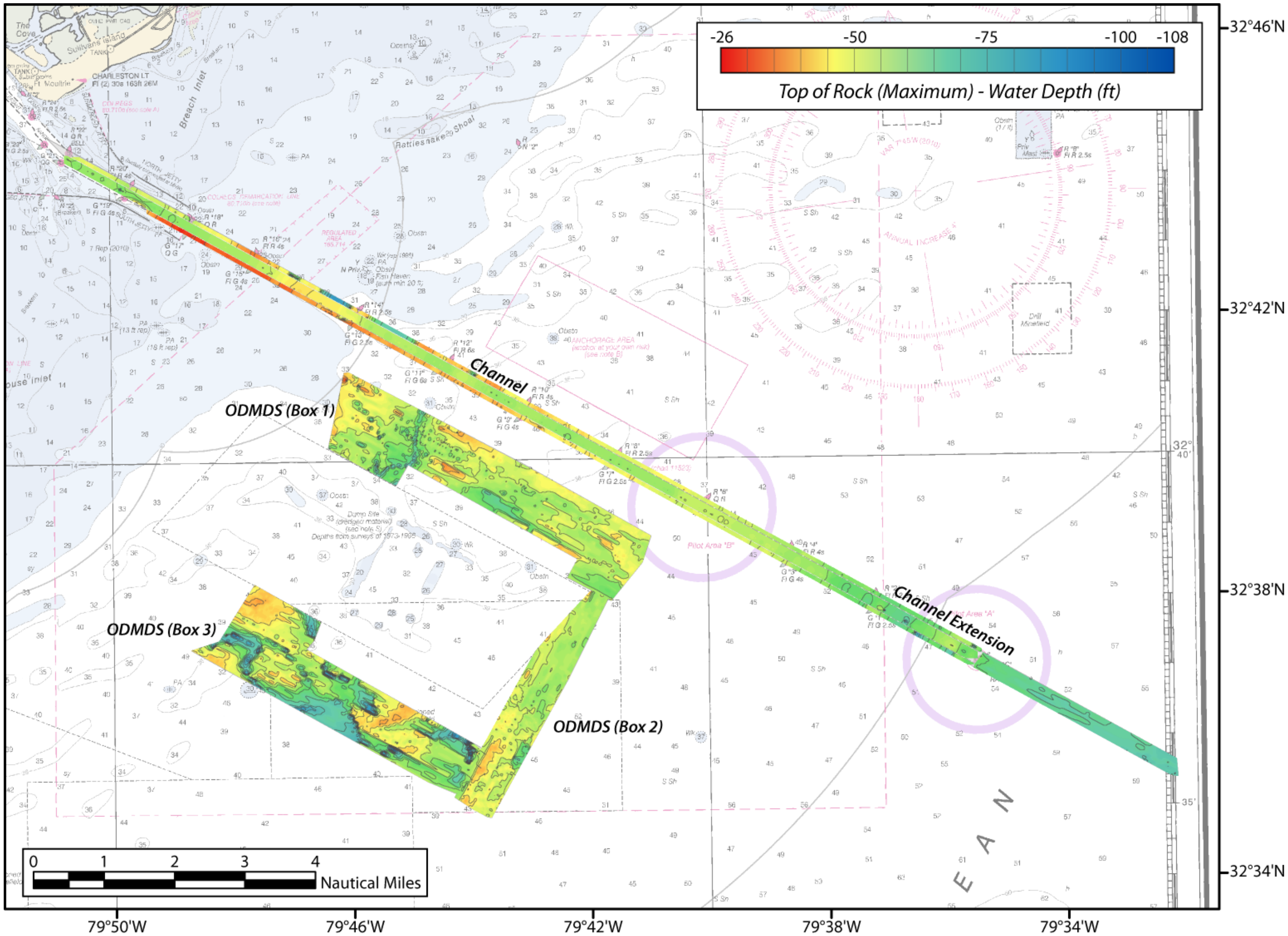

Figure 23. Depth to top of rock (base of modern and relict sediment) grid derived from Chirp sub-bottom profiles for all survey areas. Contours are every 5 feet.

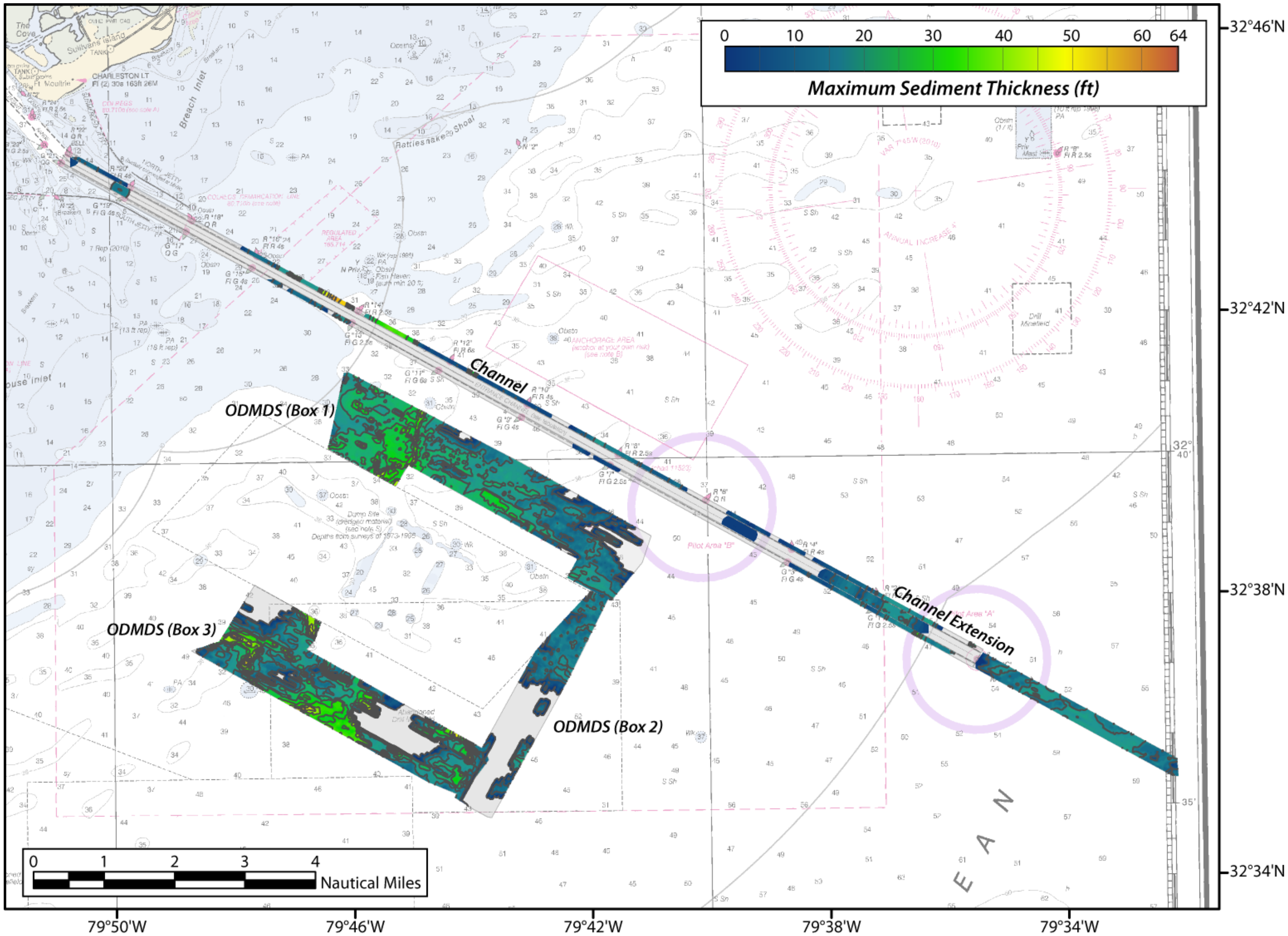

Figure 24. Maximum thickness of modern and relict sediment derived from Chirp sub-bottom profiles for all survey areas. Contours are every 5 feet.

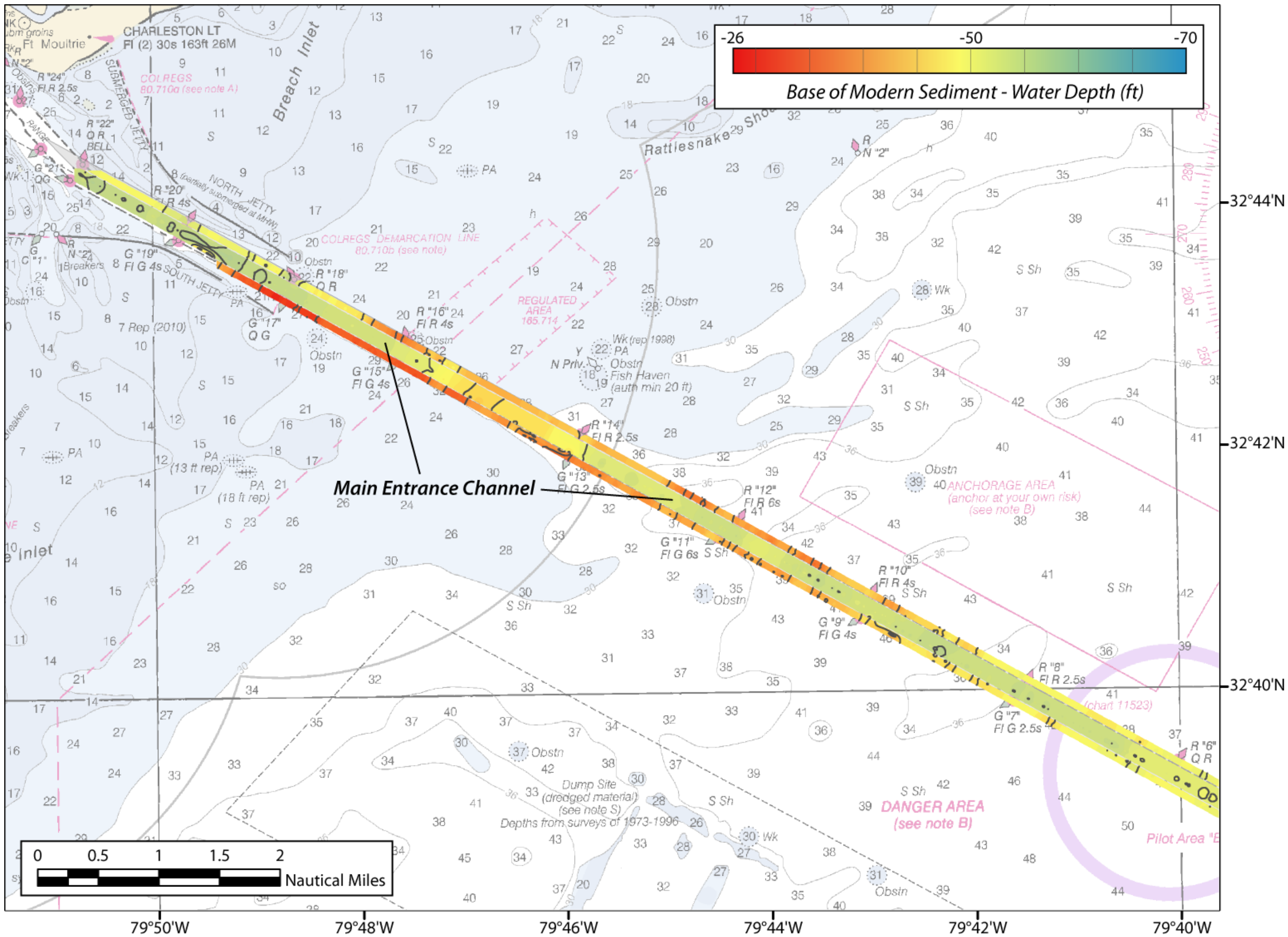

Figure 25. Depth to transgressive surface (base of modern sediment) grid derived from Chirp sub-bottom profiles for the main entrance channel survey area. Contours are every 5 feet.

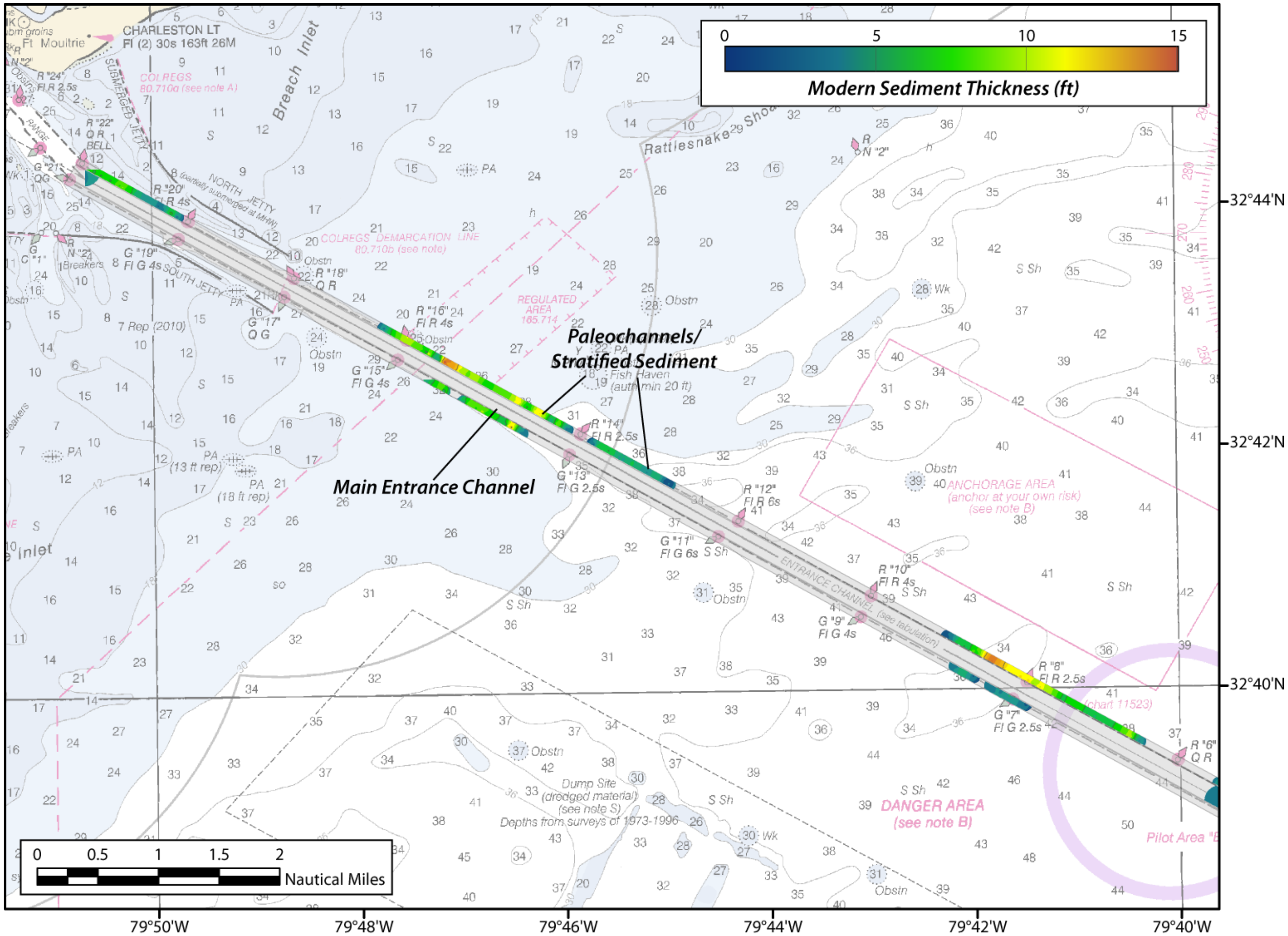

Figure 26. Thickness of modern sediment above the transgressive surface (minimum mappable sediment thickness) derived from Chirp sub-bottom profiles for the main entrance channel survey area. Contours are every 5 feet.

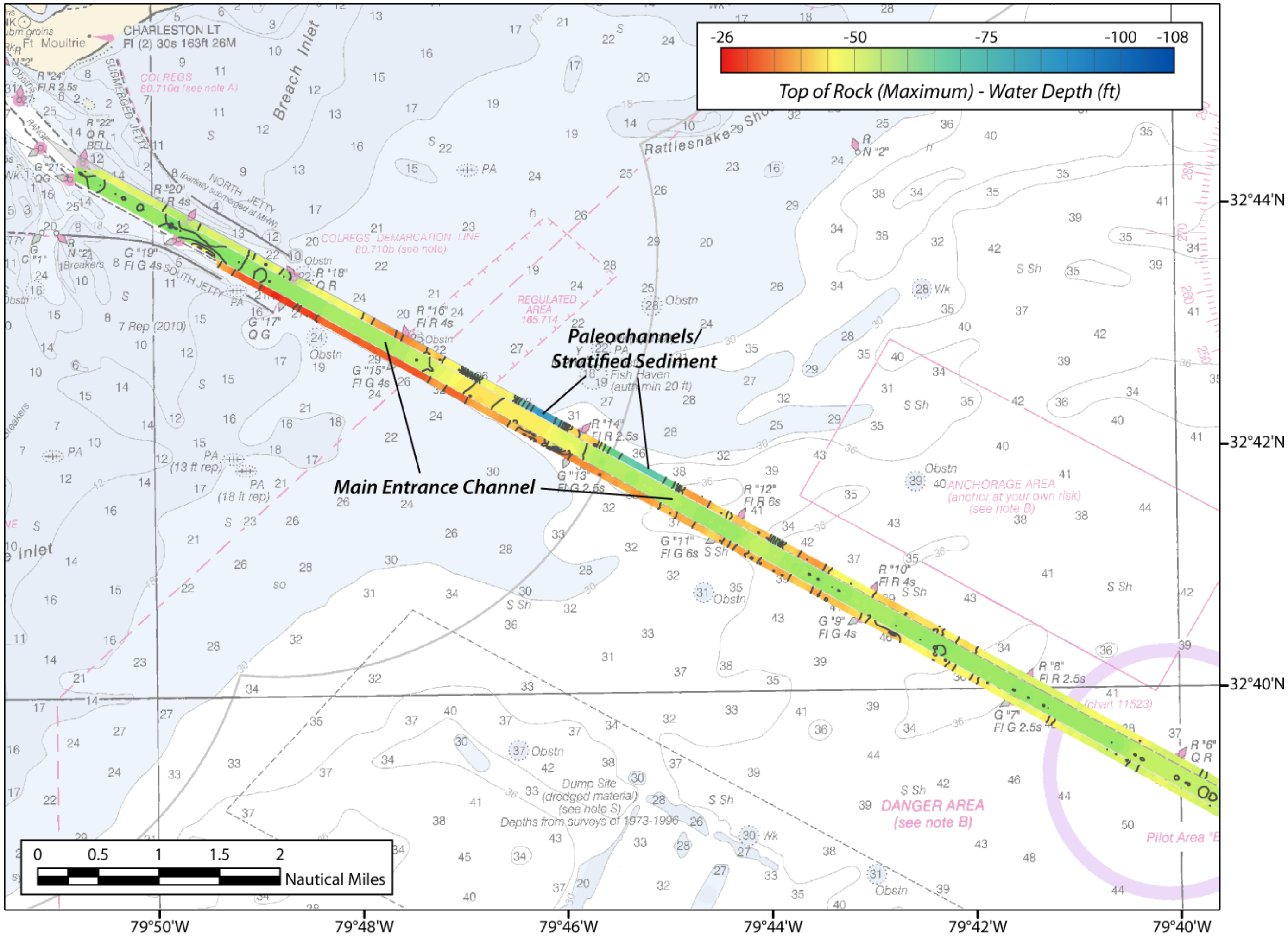

Figure 27. Depth to top of rock (base of modern and relict sediment) grid derived from Chirp sub-bottom profiles for the main entrance channel survey area. Contours are every 5 feet.

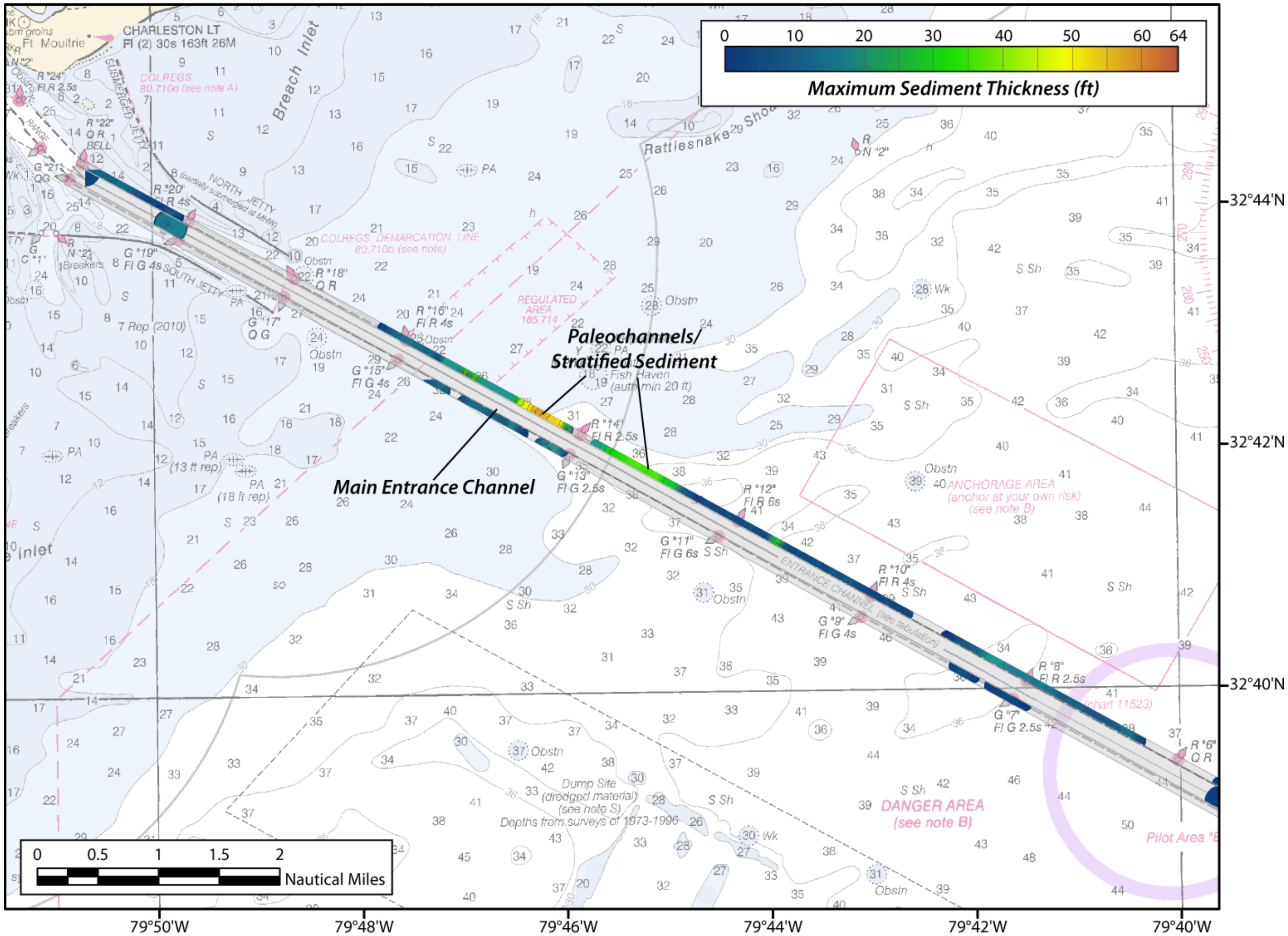

Figure 28. Maximum thickness of modern and relict sediment derived from Chirp sub-bottom profiles for the main entrance channel survey area. Contours are every 5 feet.

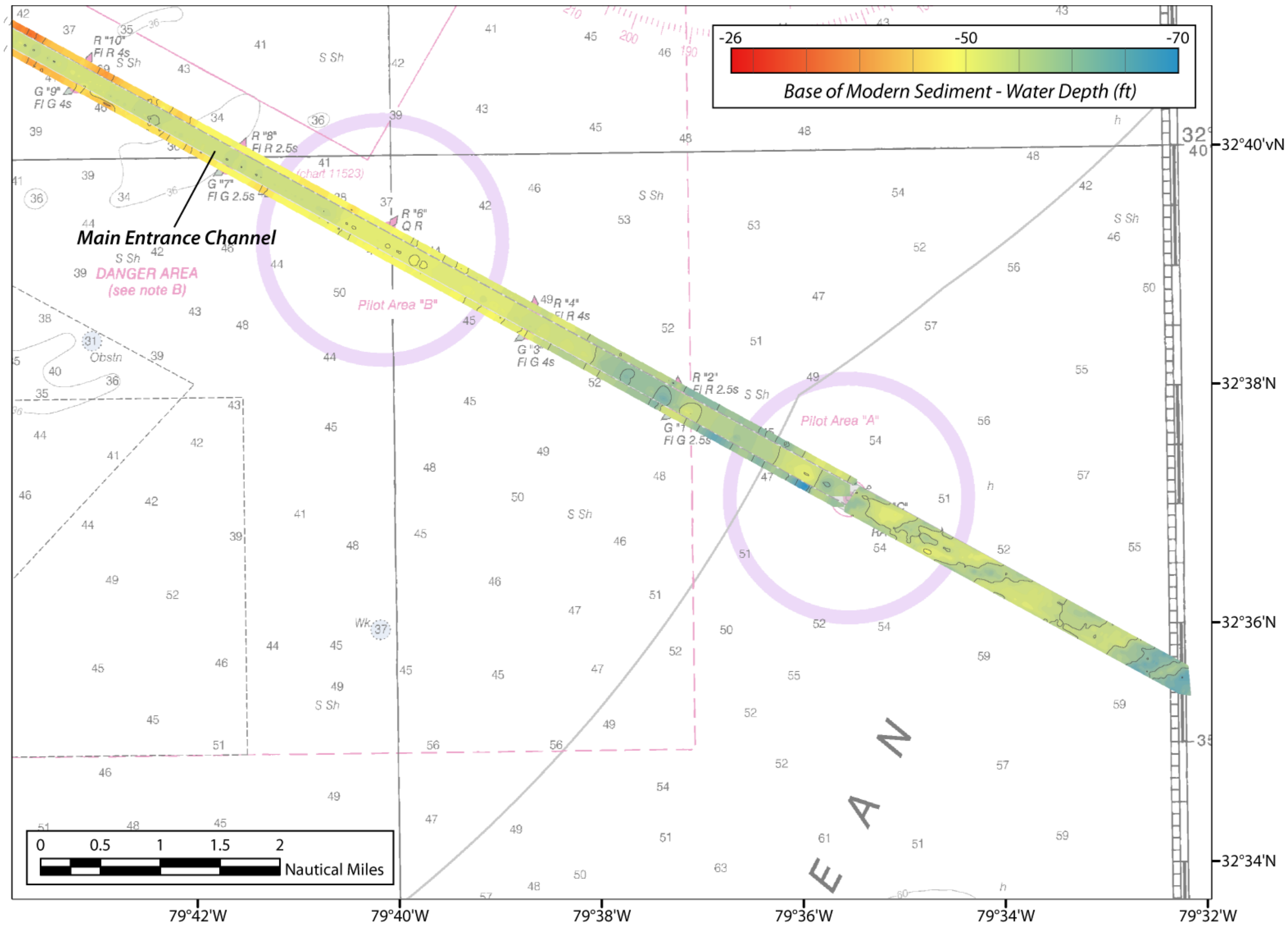

Figure 29. Depth to transgressive surface (base of modern sediment) grid derived from Chirp sub-bottom profiles for the entrance channel extension survey area. Contours are every 5 feet.

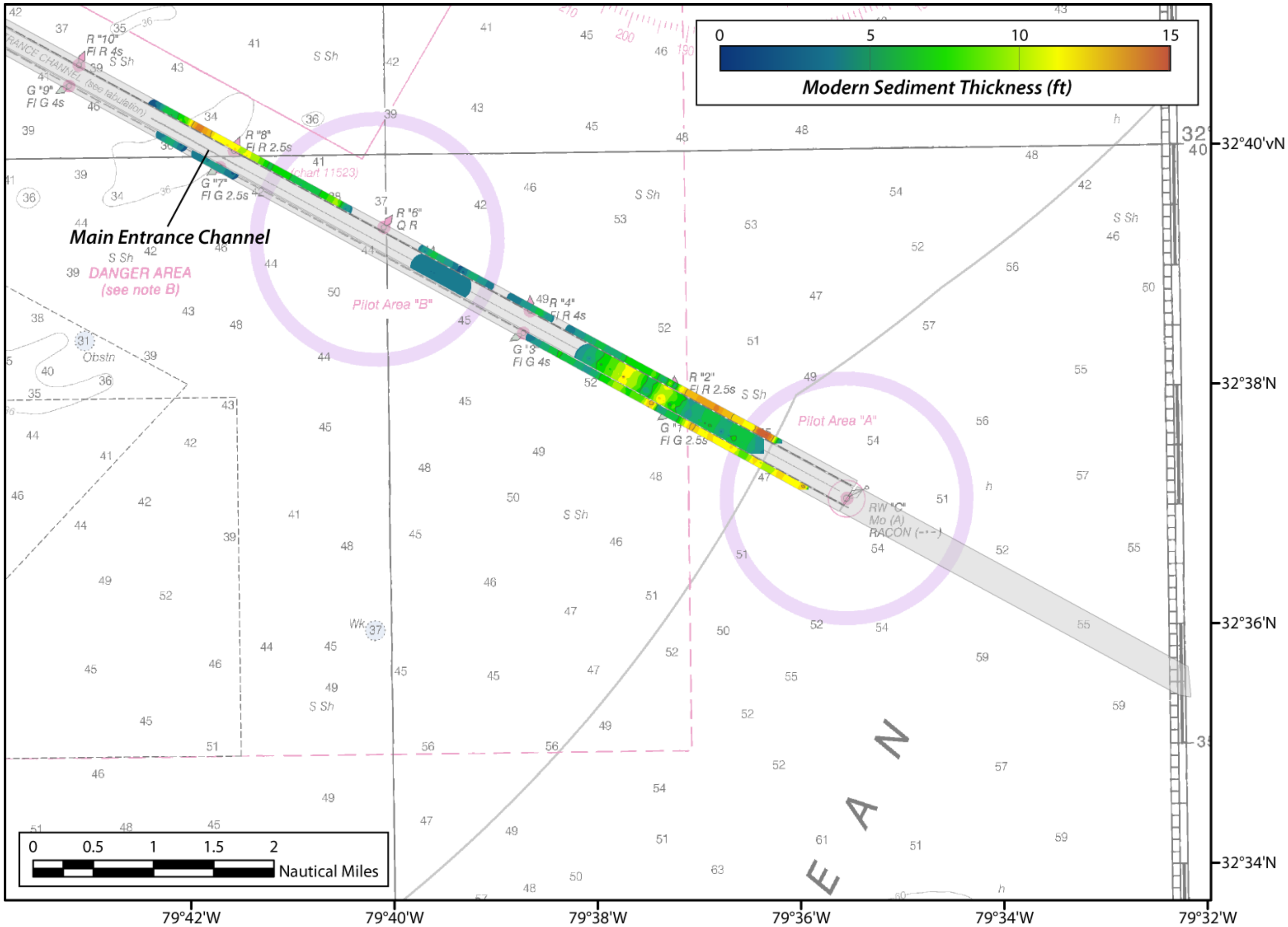

Figure 30. Thickness of modern sediment above the transgressive surface (minimum mappable sediment thickness) derived from Chirp sub-bottom profiles for the entrance channel extension survey area. Contours are every 5 feet.

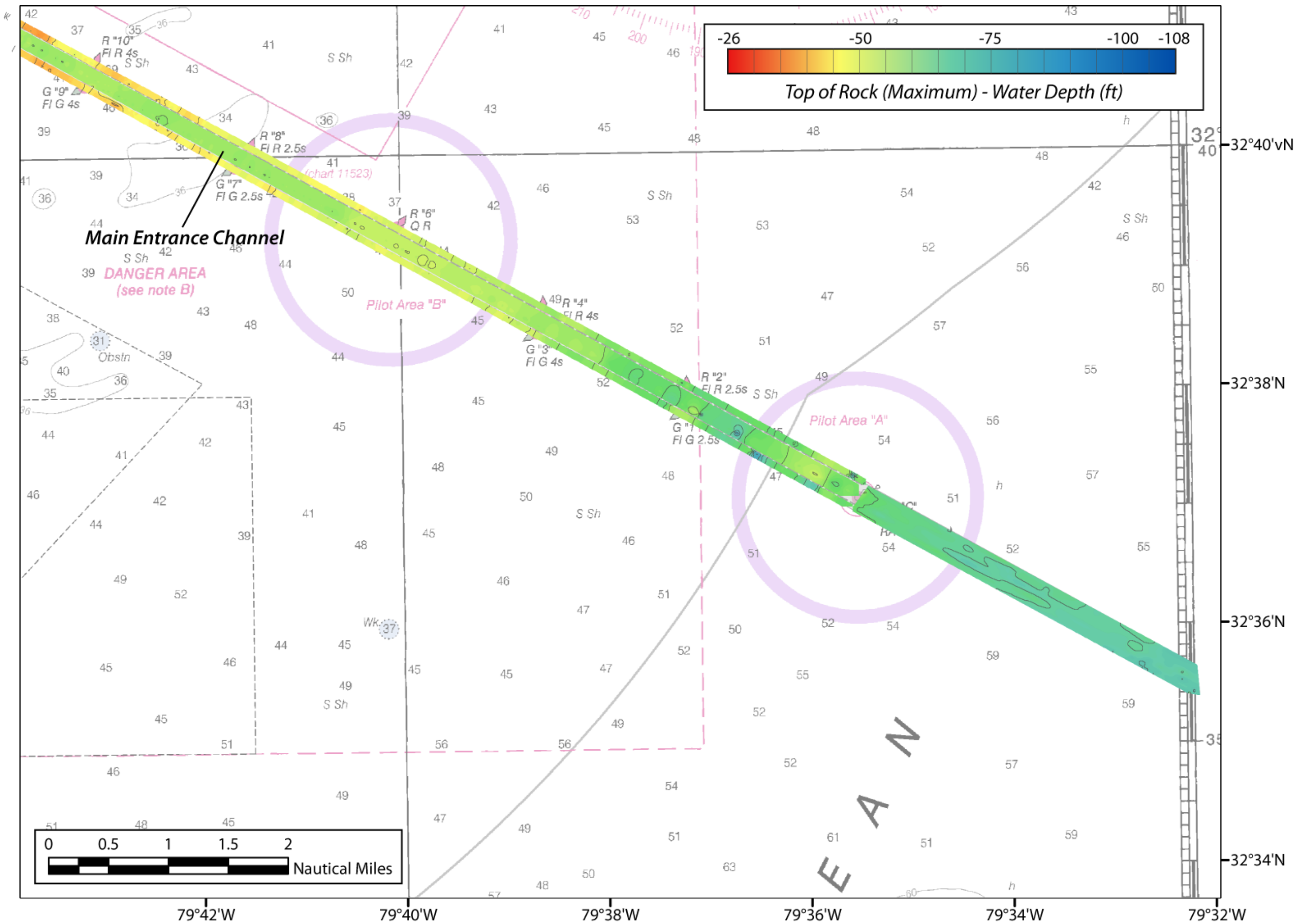

Figure 31. Depth to top of rock (base of modern and relict sediment) grid derived from Chirp sub-bottom profiles for the entrance channel extension survey area. Contours are every 5 feet.

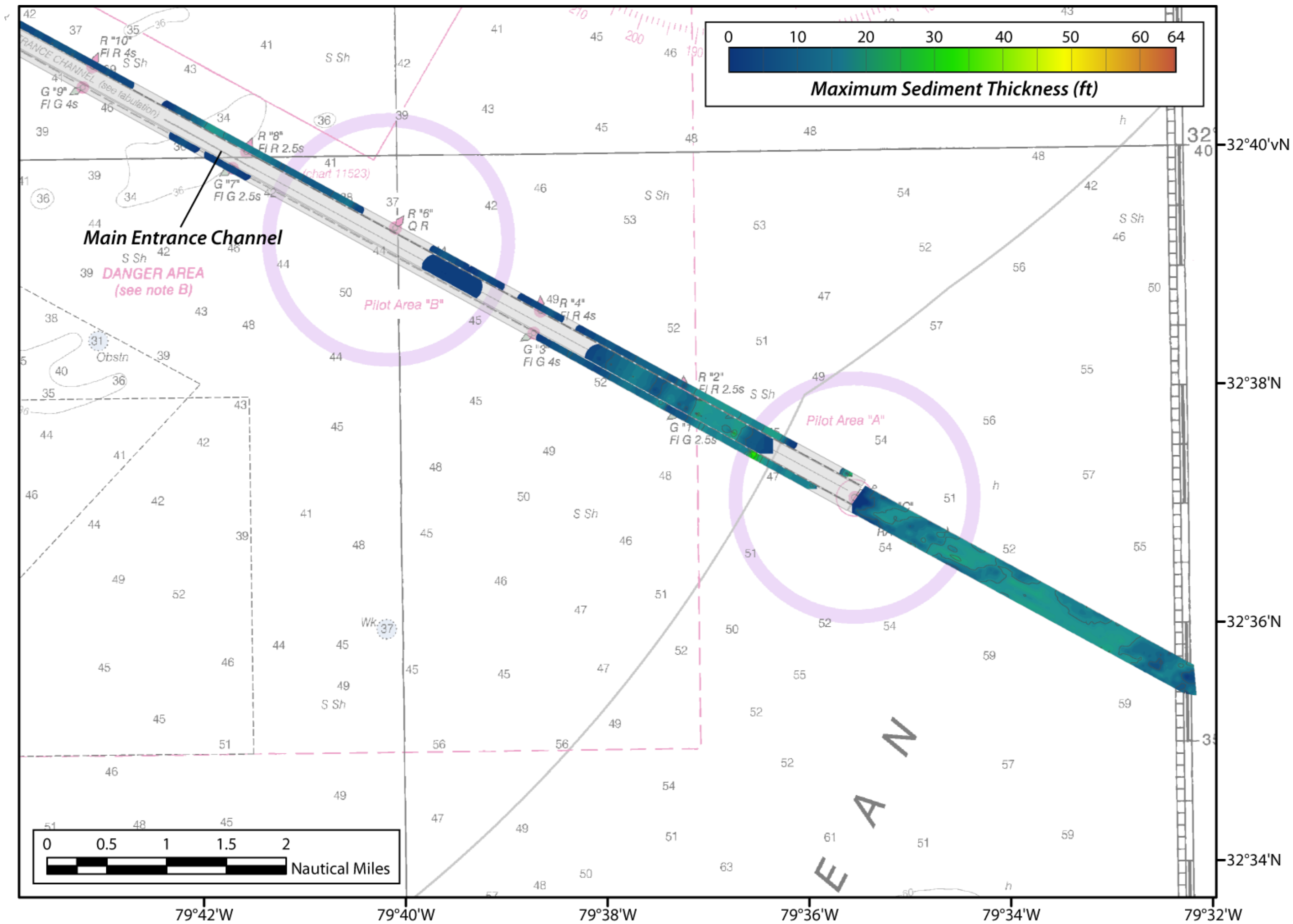

Figure 32. Maximum thickness of modern and relict sediment derived from Chirp sub-bottom profiles for the entrance channel extension survey area. Contours are every 5 feet.

5.0 CULTURAL RESOURCES ANALYSIS

5.1 Introduction and Project Background

Proposed channel and harbor improvement areas for Charleston Harbor and the expansion of the Charleston Harbor Ocean Dredged Material Disposal Site (ODMDS) include potentially significant areas for maritime cultural heritage. A remote sensing survey, with limited ground truthing through video acquisition, incorporates within the Area of Potential Effect (APE) all potential areas for expansion, as well as an additional 75 m on each side of the proposed outer channel extension toe offshore, improvements inshore and up river, and 50 m outside the ODMDS expansion areas. This survey is intended to identify any cultural resources within potential dredge anchoring locations or near proposed dredging areas.

The survey was conducted according to guidelines provided by the USACE and the South Carolina State Historic Preservation Office. The survey and report reflect the provisions of Section 106 of the National Historic Preservation Act of 1966 (36 CFR 800, *Protection of Historic Properties*) and the Abandoned Shipwreck Act of 1987 (National Park Service 1990). Magnetometer and side-scan sonar surveys were conducted within the defined limits of the survey area as identified on the USACE-furnished maps (Appendix 1), avoiding redundancy with previous cultural resources efforts. The purpose of the work was to discover and document sonar and/or magnetic anomalies that might represent cultural resources or other objects that may impact the determination of proposed dredging and disposal areas.

The remote sensing archaeological survey was designed to identify potential cultural resources, to evaluate any confirmed archaeological or historic resources, and to evaluate their eligibility for the National Register of Historic Places (NRHP) in partial compliance with Section 106. The Principal Investigator (Archaeology), Cheryl Ward,[1] designed the study methods, carried out the review of remotely acquired data, and interpreted side scan and magnetometer data, in addition to writing this report on the cultural resource survey. The cultural resource survey was carried out between October 2012 and January of 2013.

5.2 Prehistoric and Historic Overview

Today, the Charleston harbor is characterized by a mobile shoreline and barrier reef system. Marsh and swamp deposits line almost the entire shoreline of the harbor, and are readily eroded and transported by tidal currents and wave action, as well as severe storm effects, from their coastal location to deeper locations offshore and in the estuary.

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Beach features in the near-shore environment are characterized by coarser particles as finer sediments are moved to more protected and deeper parts of the harbor and offshore. Erosion along the shoreline is significant in both protecting and revealing maritime cultural resources, and may have played a role in moving evidence of both historic and prehistoric use of barrier island complexes, river margins, and shorelines throughout the harbor into the harbor itself.

Some submerged landscapes retain evidence of prehistoric habitation in stratified contexts, and others preserve artifacts that have been subject to significant conflation through natural processes (see for example Marks 2006; Marks and Faught 2003; Faught and Gusick 2011). Research in this area continues to build a body of evidence that is not yet sufficient to provide broad generalizations. Sandy barrier islands may preserve such sites as well, though beneath meters of sand as the islands experience geomorphological processes that reshape them and cause shoreward drift. Such movement may be relatively quick; a Civil War-era lighthouse surveyed by the author is now offshore in 3-4 m of water in the Gulf of Mexico off St. George (Ward et al. 2006). A local example of a similar phenomenon can be seen in the Morris Island lighthouse built in 1876. Once located on land, this lighthouse is now more than 300 m from shore, completely surrounded by water. Historic period habitation sites and maritime features such as jetties, docks, or warehouses may thus be represented in deposits affected by geomorphological change in the historic present. Similar movement of the shoreline is documented for the east side of Daniel Island (Poplin and Jateff 2009), where natural geological processes account for a shoreline that has moved about 16-28 m landward since 1833.

Typically, such sediment-rich environments assist in the preservation of maritime resources by providing a protective layer that excludes oxygen, depriving the most destructive biological organisms of access to what otherwise might be a significant food resource. Submerged habitation sites, shoreline commercial structures, and shipwrecks all have the potential to serve as unique contributors to understanding the past through the preservation of a rich variety of organic artifacts and ecofacts seldom found on most terrestrial sites. These sites, in addition to benefitting from anaerobic environmental conditions, also include features that act as walls to protect materials inside and trap sediment, further contributing to the preservation of archaeological evidence of past human behavior.

Prehistoric Cultural Overview

Cultural patterns associated with prehistoric populations on the South Carolina coastal plain are demonstrated by archaeological evidence for consistent patterns of behavior in the Southern Atlantic states. Anderson (1977) and Anderson and Logan (1981) offer detailed synopses of previous research in the coastal region. Regional variations seem to reflect proximity to the Atlantic Ocean, and chronological divisions are correlated with environmental change and subsistence patterns, visible in artifacts as well as the remains of food and food-associated waste.

Paleoindian Period (14,000-10,000 years ago)

The Paleoindian period in South Carolina (14,000 to 10,000 years ago) corresponds with the end of the Pleistocene, when sea level was more than 200 feet below current levels and the climate generally much colder. Some of the earliest archaeological sites in North America may be present in South Carolina, where exploration of sites like the Topper Site near Allendale seem to demonstrate an even older component (Goodyear 2005). Archaeologists have reconstructed the pattern of cultural adaptation for this period primarily from diagnostic projectile points found in the region (Anderson 1990:174 1993).

In general, Paleoindian groups can be characterized as high mobility hunter-gatherers with a possible focus on exploitation of megafauna along river drainages and terraces (Anderson and Logan 1981:13; Gardner 1974). Paleoindian points recovered in the lower Coastal Plain are isolated finds for the most part, but Albert Goodyear's excavations at the Topper Site (38AL23) have provided stratified Paleoindian assemblages. The projectile points, side scrapers and drills typical of this period are typically basally thinned and side-notched or fluted and lance-shaped (Trinkley and Tippett 1980; Goodyear 2005). Hunting received the most emphasis in subsistence efforts, but wild plant foods also made a significant contribution to Paleo-Indian diets (Griffin 1952). By about 12,000 years ago, Pleistocene megafauna populations were significantly reduced, and the cooler and drier environment gave way to a moister and warmer period. A number of dominating mammal species including giant sloth, camel, horse, mastodon and mammoth were extinct by 10,000 years ago. The change was accompanied by a change in human food collection strategies, and the adaptations to change seem to characterize the patterns seen in the Archaic Period when deer hunting and exploitation of smaller mammals is the focus of subsistence activities.

Archaic Period (10,000-3,500 years ago)

The Archaic Period is associated with dramatic environmental change that identifies the Holocene introduction in the Middle Atlantic era (Trinkley and Tippett 1980) and is divided into an Early period (10,000-8000 BP), Middle and Preceramic Late Archaic periods (8000-4500 BP), and a Ceramic Late Archaic period (4500-3500 BP). The former savannah-like, grassy character of the Coastal Plain was transformed relatively quickly into a boreal environment that begins as an oak-hickory forest with colder and moister climate regimes than today. By the end of the phase, woodland flora and fauna are well established. Physical remains of a wider variety of plants, different tool types, and a reduction in certain types of animal bone support the interpretation that prehistoric peoples made greater use of plant food sources than in the Paleo-Indian period. A variety of stemmed points characteristic of Archaic cultural traditions existed and little is known about Early Archaic site distribution (Anderson and Logan 1981:13). There is a tendency for finds of corner- and side-notched projectile points to occur along river terraces, which may suggest a preference for settlement there or, alternatively, more intensive modern visitation of these regions. Anderson and Hanson (1988) identify a seasonal mobility pattern for this period that includes aggregation camps and winter base camps further inland but springtime foraging camps in the Lower Coastal Plain, including in the Charleston Harbor region.

A population increase is suggested for the entire Archaic period, indicating successful adaptation to the Holocene environment, which gradually became warmer, but supported an oak-hickory forest until about 4000 years ago on the coast. Koob (1976) identified several sites from this period in Berkeley and Charleston Counties, represented by surface scatters of lithic debris and projectile points revealed by plowing. As the sea level rose, local conditions became more unpredictable, reflecting changes in the level of precipitation, and by about 4,000 years ago, pine forest was the dominant ecozone in the Lower Coastal Plain.

Archaeologists working in the Ceramic Late Archaic Period (4500-3500 BP) continue to develop refinements in understanding its characteristics. The traditional viewpoint is that a major technological shift occurs when ceramics, some of the first in the Americas, are introduced, but that the same pattern of cultural adaptations exists, with the addition of shellfish exploitation. Stallings (Fairbanks 1942) is a fiber-tempered ceramic that relied on the epiphyte Spanish moss to improve the quality of local clay sources. Its appearance about 4,500 years ago suggests a more sedentary subsistence regime as the accumulation of ceramic objects indicates storage areas and more permanent habitation. Production ends at about 3500 BP and smaller shellfish midden sites replace the massive shell rings that characterize the Stallings-era Late Archaic.

Archaeologically, the following Thom’s Creek ceramic tradition straddles the end of the Archaic and the beginning of the Woodland Period, so it is not a secure chronological or cultural marker. Thom’s Creek ceramics have been identified on Daniel Island (Trinkley and Tippett 1980:95) and in secondary deposition in the Wando River east of Daniel Island (Albright 1980). Woodland Period sites, unlike the Paleoindian and Archaic examples, are directly focused on fresh water, and especially upon productive estuaries.

A relatively egalitarian cultural group became gradually more stratified as populations increased, and archaeologists identify this time period by studying Stallings and Thom’s Creek pottery, along with pottery impressed with nets, cords, or fabric like that of more northern examples (Trinkley and Tippett 1980). The best known Ceramic Late Archaic sites are the round or oval rings of shell and other artifacts surrounding a relatively sterile area in the center; located in tidal marsh waters, the rings are interpreted as an indication of seasonal sedentism linked to exploitation of nearby productive shellfish beds (Trinkley 1985). Inland, sites produce similar assemblages of ceramics and lithics, but lack the direct association with shellfish middens. The seasonality of the resources is emphasized.

Woodland Period (3,500-1,100 years ago)

Woodland Period sites are found throughout the South Carolina coastal zone, and usually are identified by the presence of shell midden sites near tidal marshes; ceramic and lithic scatters in a range of ecological zones also are relatively frequent (Trinkley 1982). Sea level fluctuations in the early part of the period even out by 2,000 years ago, and the expanding tidal creek zone is accompanied by small, probably single house, sites with shell middens shifting to a wider variety of sizes and densities in the interior in a pattern that reinforces the pattern of seasonal mobility. Ceramic traditions expand to include a variety of decorative modes and different tempers that are seen throughout the Southeastern United States when native peoples shared a preference for complicated stamp pottery and temple mound complexes like those from the Pee Dee culture in North Carolina (Ferguson 1971) or the Savannah and Irene cultures in Georgia.

Mississippian Period (1,100-450 years ago)

Stable climatic conditions and adaptation to riverine and estuarine environments supported the growth of larger populations that were loosely grouped into macro-bands at base camp sites often located where the tidal flow of fresh water mingles with that of the sea (Anderson 1989). Individual sites are much larger than Archaic sites, and exchange networks spanned larger areas. Over time, seasonal villages and maize horticulture gradually expand hierarchical ranking systems and employ more intensive agricultural methods, usually accompanied by complicated stamped ceramics 900-800 years ago (Anderson 1993). Raw materials from copper to shell were used to make elaborate and more traditional decorative artifacts, and networks of exchange expanded across regions, but in the Lower Coastal Plain, the generalized fishing-hunting-gathering subsistence patterns continued with a gradually increasing presence for stored foods and horticulture. Mortuary ceremonies are more visible and involve larger numbers of individuals; cemeteries with rich grave offerings also are much more visible. Mississippian period sites are identifiable primarily by ceramics and are present throughout the Charleston Harbor watershed. With the first European contact along the shores of the Lowcountry, the prehistoric period ends. In the Carolinas, this is in the first quarter of the 16^{th} century.

Implications for Prehistoric Submerged Cultural Resources

During the Pleistocene, the South Carolina Coastal Zone and the rivers that drain into Charleston Harbor were submerged. Evaluation of erosion along recent shorelines, especially after major storms, suggests that material culture associated with both prehistoric and historic habitation of the Charleston Harbor region regularly is redeposited in the harbor or along the deeper bends and pockets of the rivers that flow into it. Although such geological features may harbor artifacts, most of the prehistoric submerged cultural resource contexts within the study area are likely to have been destroyed, resulting in isolated finds of artifacts that may indicate cultural affiliation and a chronological link (Albright 1980; Harris et al. 1993: 60; Watts 1986:6).

Inundated prehistoric sites can yield significant information when they remain in context (Marks and Faught 2003; Marks 2006; Faught and Gusick 2011). Submerged prehistoric sites have been successfully located by applying the techniques used on terrestrial sites through remote sensing, bathymetry, and archaeological transect surveys. Successful practices include locating ridges in the landscape that overlook less elevated areas, and identifying nearby drowned resources such as potential water sources including springs and streams. Contour maps developed through underwater bathymetry provide the same type of information that is reviewed on land, and seeking these sites, even when submerged, can provide deposits of artifacts that may be identified as part of the same assemblage, even if stratigraphic coherence is sometimes obscured (Ruppé 1979).

No areas of the present project provide such geological markers, and with the current state of technology, it is extremely difficult to actively locate skin or wooden watercraft such as those that are known to have been used by native inhabitants of the Carolina coast, perhaps as early as 8000 years B.P., the date of the oldest known logboats in North America (Leshikar 1988). It is also not yet possible to use remote sensing devices operated from a boat to detect the types of small scatters of small artifacts often associated with inorganic site components such as ceramic sherds and stone tools or weapons. Nonetheless, such artifacts are known to exist on the harbor bottom, in secondary deposition, though no specific sites or artifacts of cultural significance within Charleston Harbor have been brought to the attention of professional archaeologists (Albright 1980; Harris et al. 1993). Prehistoric sites will be considered as possible cultural resources in the harbor, but it is not part of the research design of this project to actively seek them out since characteristic geological features are not present and there are no reports of in situ prehistoric finds, to the knowledge of this author.

Historical Overview

Charleston Harbor provides an environment that is rich in prehistoric and historic human activity, and its geological setting is characterized by sediment types, especially heavy muds, that are well known for preserving shipwrecks and their contents. Plantations located along river ways, including the Wando, Cooper and Ashley Rivers, relied on watercraft for movement of supplies and produce, as well as for non-commercial traffic (figure 33). A number of abandoned watercraft from all historic periods have been documented along rivers in South Carolina, built into the bank to harden it, left to rot, or perhaps lost in storms (for example, the Mepkin Abbey Boat 38BK48, the Browns Ferry Vessel 38GE57, and the Malcolm Boat 38CH803 from the 18^{th} and 19^{th} centuries). Such examples, and those of more recent historical vessels, provide details of the structure and operation of maritime affairs in the colony and later state that are unavailable through other means.

In addition, the position of Charleston Harbor as a major port from the 17^{th} century through today means that significant historical periods may be represented in watercraft remains buried in its sediments. From early colonial working vessels such as pilot boats, sloops, and other cargo vessels to warships lost in naval engagements in the

Figure 33. Mortier Portion of Pierre Mortier's "Carte Particuliere de la Caroline" first published in Amsterdam in 1696. The map illustrates the Charleston Harbor with its anchorages, channel depth, and names of property owners throughout the area.

Revolutionary War, blockaders and blockade runners in the Civil War (see especially Spirek 2012 and Spirek and Amer 2004), and *H.L. Hunley*, the first submarine to actively destroy its target, Charleston Harbor has seen ship losses within the study areas, and it is possible that such ships, or the facilities at which they moored, could be discovered by the remote sensing survey. The many smaller craft which were lost or abandoned in the harbor are also significant contributors to its maritime heritage, but are much more difficult to find in the dynamic environment of the active port. Table 2 provides a list of shipwrecks historically documented in the harbor.

5.3 Documentation of Vessel Losses

Table 2. This list of ship losses reflects consultation with archaeological and historical works and individuals (Spirek & Amer eds. 2004, Watts 1986, Gaines 2008, Spirek 2012). The Stone Fleets are composed of 14 and 16 ships; Spirek (2012) has identified the First Stone Fleet, but the Second has not been located precisely.

The First Stone Fleet includes the barks AMAZON and LEONIDAS; whaling barks AMERICA, FORTUNE, AMERICAN; whalers ARCHER, COURIER, HERALD, MARIA THERESA, REBECCA SIMS, ROBIN HOOD, WILLIAM LEE; TENEDOS; merchant ship KENSINGTON; and ship L.C. RICHMOND among the 14. The Second Stone Fleet includes ships MAJESTIC, METEOR; barks MARCIA, MARGARET SCOTT; whalers MECHANIC, NEWBURYPORT, POTOMAC, NEW ENGLAND; ship PERI, whaling barks MESSENGER, NOBLE; merchant brig STEPHEN YOUNG, TIMOR, merchantman BOGOTA, and merchantman bark JUBILEE among others.

Date	Vessel name	Description	Disposition and Location
15 Dec 1733	ABIGAIL & ANN	10 guns	Wraggs Wharf
12 Sep 1742	Long boat	Lost with 4 cannon	Inside harbor from Fort Sumter
8 July 1743	William Pandridge's boat	Boat	Sunk between Ft. Sumter & Sullivan's Island
4 May 1752	BENNET GALLEY	rowed galley	Lost at Buchannan's Wharf
15 Sep 1752	Mr. Edward's pilot boat	Pilot Boat	lost at The Exchange
15 Sep 1752	POLLY	Unknown	Lost at Wappoo Creek
30 Sep 1752	VINE	Unknown	Lost off Cummings Pt.
21 Mar 1757	GOOD INTENT	Unknown	Lost between Shutes Folly and Crab Bank
4 May 1759	FRANKLAND	Snow	Lost 1/4 mile south of Fort Sumter
14 March 1760	ANNE	Unknown	Lost off Cummings Pt.
4 May 1761	DANIEL	Unknown	Lost in the Middle Ground
4 March 1769	unidentified	Unknown	Wraggs Wharf
25 Feb 1775	CHARMING SALLY	cargo vessel	79:54.20W 32:47.00N
Sep 1775	4 unidentified ships	Hulks	Hog Island Channel
28 July 1776	HMS ACTAEON	frigate (British)	Lost between Forts Sumter & Moultrie; burned

Table 2 continued

1 Nov 1777	LILANEEUR	ship (French)	Lost off Cummings Pt.
March 1780	11 vessels	includes 4 frigates	Scuttled in mouth of Cooper River
9 Mar 1780	BRICOLE	Frigate	Lost between Charleston city and Shutes Folly
9 Mar 1780	TRUITE	Frigate	Lost between Charleston city and Shutes Folly
9 Mar 1780	QUEEN OF FRANCE	Frigate	Lost between Charleston city and Shutes Folly
14 Oct 1780	FRIENDSHIP	Unknown	Lost in the Middle Ground
30 June 1781	LORD NORTH	Warship	79.53W, 32.46N
9 Aug 1781	HMS THETIS	Warship	79.55.40W, 32.47.30N
28 Dec 1781	JAMAICA	Unknown	Inside harbor from Fort Sumter
1 Feb 1785	SWIFT	Unknown	79.50.30W, 32.44N
9 Apr 1786	FRIENDSHIP	Unknown	Off Fort Johnson
5 June 1787	HOPE	Unknown	79.50.30W, 32.45N
13 May 1802	MARY	Unknown	79.53.30W, 32.45.30N
20 May 1803	SALLY	Schooner	Pritchard's Wharf
7 May 1804	BLAKE	Schooner	Lost off Cummings Pt.
7 Sep 1804	CHRISTOPHER	slave ship	Charleston Wharf
7 Sep 1804	CONCORD	Brig	Priolaeaus Wharf
7 Sep 1804	MARY	Schooner	Ham's Wharf
18 Jan 1805	unidentified	"Mr. White's sloop"	South end of Daniel's Island.
1 Feb 1806	GEORGE	Sloop	79.50.30W. 32.45N
2 Jun 1806	AURORA	Unknown	Lost off Cummings Pt.
13 Dec 1806	JOHN	slave ship	Lost off Cummings Pt.
18 Feb 1809	unidentified	SC coasting schooner	NW end of Sullivan's Island
1 Dec 1809	JOHN	Sloop	Lost off Cummings Pt.
31 Aug 1812	REGULUS	schooner (Spanish)	79.43.30W, 32.45.30N
1 April 1813	GALLATIN	Revenue cutter (U.S.A.)	Blakes Wharf
16 August 1814	ROSE	Unknown	Lost between Shutes Folly and Middle Ground
20 July 1818	MARY	Schooner	Lost between Shutes Folly and Crab Bank
16 Nov 1820	YOUNG ROMP	Sloop	Lost off Cummings Pt.

Table 2 continued

9 Mar 1822	unidentified	ferry boat	Lost between Shutes Folly and Crab Bank
28 Sep 1822	CERES	Unknown	79.55.00W, 32.46.55N
28 Sep 1822	ENTERPRISE	Sloop	Lost at SW end of Shutes Folly
28 Sep. 1822	GRAMPUS	Schooner	Lost between Shutes Folly and Crab Bank
28 Sep. 1822	MARK-TIME	Schooner	NW end of Sullivan's Island
28 Sep. 1822	PALMYRA	Brig (Spanish pirates)	Tip of Patriots Point
28 Sep. 1822	ROSALIE	schooner (Spanish)	Patriots Point, off bow of USS Yorktown
15 Sep 1824	unidentified	Sloop	79.53.40W, 32.47.10N
14 Nov 1824	S.S. COLUMBIA	Unknown	Western end of Sullivan's Island
26 Aug 1826	HELEN	Sloop	79.50.30W, 32.44N
8 Dec 1830	boat	Saylor Huffman's vessel	Western side of Drum Island, north of bridge
29 Aug 1851	MATAMORAS	Brig	Lost off Crab Bank
7 Sep 1854	ELSABELLA	Schooner	North Atlantic Wharf
7 Sep 1854	PARTIER	Schooner	Commercial Wharf
Jan 1861	4 unidentified ships	"hulks"	In channels outside harbor
19-20 Dec 1861	16 ships	First Stone Fleet*	In channels outside harbor
25/6 Jan 1862	14 ships	Second Stone Fleet**	In channels outside harbor
12 Apr 1862	SAMUEL ADAMS	wooden schooner	Western end of the Isle of Palms
20 Oct 1862	MINHO	iron screw steamer (British)	¼ mile south of Fort Moultrie
19 Mar 1863	GEORGIANA	steamer (iron blockade runner)	Lost off Isle of Palms (scavenged)
6 Apr 1863	C.S.S. ETIWAN	side-wheel steamer	79.53.30W, 32.45.00N
6 Apr 1863	C.S.S. MARION	side-wheel steamer transport (Confederate)	Mouth of Wapoo Creek
8 Apr 1863	U.S.S. KEOKUK	blockader (ironclad)	Shallows off Morris Island
11 Apr 1863	STONEWALL JACKSON (LEOPARD)	side-wheel, 2-masted steamer; British blockade runner	Off Sullivan's Island 1.5 mi from Breach Inlet Battery
19 May 1863	NORSEMAN	blockade runner	Isle of Palms (on land)
5 Jun 1863	C.S.S. STONO	Warship	Lost on breakwater near Fort Moultrie

Table 2 continued

10 Jun 1863	RUBY	side-wheel steamer; British blockade runner	West of Folly Island; Lighthouse Inlet
19 Jun 1863	RACCOON	side-wheel steamer (British)	Lost near Moultrie House; Drunken Dick Shoal East of Fort Moultrie
30 Aug 1863	C.S.S. SUMTER	Steamer	Main channel near Fort Sumter
6 Dec 1863	U.S.S. WEEHAWKEN	monitor-class iron ship	Sunk in a storm off Morris Island
2 Feb 1864	PRESTO	side wheel steamer (British)	Struck MINHO off Fort Moultrie
17 Feb 1864	H.L. HUNLEY	Submarine	Lost off Sullivan's Island (recovered)
17 Feb 1864	U.S.S. HOUSATONIC	sloop-of-war	Lost off Sullivan's Island (excavated)
28 Mar 1864	U.S.S. KINGFISHER	wooden sailing bark	Ran ashore on Combahee River bank
9 Aug 1864	PRINCE ALBERT	iron side-wheel steamer (British blockade runner)	Struck MINHO on Drunken Dick Shoal
31 Aug 1864	MARY BOWERS	sidewheel steamer (iron blockade runner)	Lost on GEORGIANA off Isle of Palms
6 Oct 1864	CONSTANCE DECIMA	sidewheel steamer (iron blockade runner)	Lost on GEORGIANA off Isle of Palms
22 Oct 1864	FLORA (ANNA)	sidewheel steamer (British, iron)	Southern bank of Maffitt's Chanel, sighted off three forts
23 Oct 1864	C.S.S. FLAMINGO	sloop-rigged sidewheel steamer	Drunken Dick Shoal east of Fort Moultrie near Battery Rutledge
27 Nov 1864	BEATRICE	iron screw steamer (iron, British)	Drunken Dick Shoal east of Fort Moultrie
4 Jan 1865	RATTLESNAKE	blockade runner	Burned between western jetty and Sullivan's Island off Breach Inlet
15 Jan 1865	U.S.S. PATAPSCO	blockader (ironclad)	Struck a mine below Fort Sumter (38CH270)
20 Jan 1865	JOHN RANDOLPH	transport (iron, Confederate)	Sullivan's Island
14 Feb 1865	CELT (COLT) (SYLPH)	blockade runner	Breakwater off Sullivan's Island (Buoy No. 2)
18 Feb 1865	C.S.S. CHARLESTON	steamer (ironclad)	Charleston Harbor; 79.55.21W, 32.47.29N
18 Feb 1865	C.S.S. CHICORA	steamer (ironclad ram)	Charleston Harbor; 79.55.21W, 32.47.29N
18 Feb 1865	C.S.S. INDIAN CHIEF	Schooner	Town Creek, Charleston Harbor

Table 2 continued

18 Feb 1865	C.S.S. PALMETTO STATE	steamer (ironclad)	South end of Drum Island
21 Feb 1874	PORDICHO	wrecking bark	South end of Daniel's Island.
13 Apr 1875	ELLA ANNA	Unknown	Between Forts Sumter and Moultrie
23 Apr 1908	STONEWALL	Sloop	Between Forts Sumter and Moultrie
?	"four hulks"	Unknown	Between the tip of Patriots Point and Castle Pickney, Shutes Folly Island
?	MAJOR BUTT	concrete wreck	Shoreline between Ravenel Bridge and USS Yorktown
?	unidentified	unknown vessel	W side Drum Island, just S of bridge
?	unidentified	unknown vessel	79.55.30W, 32.47.40N
?	unidentified	unknown vessel	Off bow of USS YORKTOWN
?	unidentified	two wrecks	S of Remely's Pt. boat ramp

Europeans explored and settled the coastal regions of the Carolinas beginning as early as 1514. As was the case throughout the Americas, waterways provided the most efficient means of transportation and commerce, and settlement locations demonstrate their importance. In addition to indigenous local craft such as logboats and canoes, expanded dugouts (periaguas), small ships, and coastal traders were built by European/American colonists.

The first European contact was with Spanish explorers and plantation owners seeking labor (Coker 1987). In 1514, Luis Vasquez de Ayllon began his efforts to find a local source of labor for his Caribbean plantations. In 1521, his agent Francisco Gordillo sailed north along the coast from Florida, but offered no positive results. A patent from the King of Spain in 1523 permitted de Ayllon to explore the coast and establish a colony. A reconnaissance in 1525 was followed by a major investment in three ships with 600 colonists and 100 horses in 1526 (Edgar 1998:21; Morison 1971:332). Their landing place is still debated, but they established the colony of San Miguel de Gualdape with labor by enslaved Africans. It survived less than a year, and after a severe winter characterized by hunger, disease, poor supplies, and difficulties with natives, de Ayllon died, leaving the 150 remaining colonists to return to Hispaniola on two of the ships, one of which sank (Coker 1987:2).

Other early explorations included mapping of the Carolina coastline by Verrazzano, sailing for Francois I of France in search of a route to China in 1524 (Morison 1971:314). His route took him to Cape Fear, North Carolina, and then south along the east coast of South Carolina for about 100 miles. Though Verrazzano realized he had reached a New World rather than China, the French did not continue his explorations.

Instead, Spanish explorer Hernando de Soto's travels within the Southeast took him from north of Florida to the Mississippi River, passing through both the sand hills and piedmont of South Carolina and reinforcing Spanish claims in the region. The establishment of a Spanish colony at Punta Santa Elena in Port Royal Sound, considered to be the best natural harbor in the region, in 1559 by King Philip II was another effort to retain the area and buffer Spanish claims in Florida from other European powers. A hurricane destroyed three of the four ships and about a quarter of the 100 men on the expedition died, so that colony also failed (Edgar 1998: 22-26).

French exploration returned in 1562 under Jean Ribaut, who claimed the Port Royal area in the name of Charles IX, King of France. The colony disbanded within a year, and it was abandoned, but in 1564, a second group under Rene de Laudonniere selected the St. Johns River in Florida to establish Fort Caroline (Coker 1987:3). This provoked the Spanish government that saw the French colony as a threat to the treasure fleets returning to Spain, and Philip II of Spain sent a force to capture it. The French defenders were all put to death after a successful land assault, but three years later, other French forces attacked and took Fort Caroline back, killing all the Spanish prisoners (Morison 1971:470). In 1566, the Spanish returned to Port Royal, and for 20 years, until St. Augustine was burned and abandoned, the colony served as an outpost of Spanish territoriality.

It was, however, the role of the English that is most significant in the settlement of the Carolinas. English colonies in Barbados, Bermuda, and north of Virginia were established in the first half of the 17th century, and a few unsuccessful attempts were made to expand into the territory south of Virginia and north of Spanish Florida. Only in the 1660s would the combination of religious persecution in France, economic difficulties in Barbados, and sufficient knowledge of the New World contribute to the success of a vibrant colony based at Charleston. King Charles II of England granted a charter to a group of eight men as "absolute lords and proprietors" of a colony established between Virginia and Spanish Florida in March, 1663. Native peoples assisted the English in establishing a settlement on the west bank of the Ashley River in 1670, and within ten years, more than 1,000 residents were reported (Coker 1987:8).

Because Barbados was experiencing an economic crisis related to the transition from a tobacco to a sugar-based economy, a significant proportion of the new colony's population emigrated from the island. In February 1671, the Barbadians, who were generally wealthier, Anglican, and of a higher social class began to arrive and immediately moved beyond Charles Towne up the Cooper River, navigable for about 40 miles, to establish plantations in the Goose Creek area. The Barbadians brought with them an established system of slavery that protected white colonists from a climate perceived as being too hot for them to labor, and the Cooper River became the major artery for settlement, transport and communication (Heitzler 1983:12-13).

In 1680, HMS *Richmond* arrived in Charles Towne with 45 French protestant refugees (Huguenots) who had emigrated via England to the New World. Many of these settlers moved up the Cooper River beyond the Barbadians (Heitzer 1983:13), but some stayed in the Charles Towne locality. The colony provided basic support to the settlers who used the Cooper River as a conduit to the west (Rogers 1984:6-7).

Once the earliest colonists had moved from the less defensible location originally chosen for them to the peninsula known as Oyster Point between the Ashley and Cooper Rivers in 1680, settlement of that central location known as Charles Towne and of the land along the rivers began in earnest. The new site was more defensible and incorporated a better harbor. It also supported settlers who occupied James and Edisto Island locations, and high land along Hobcaw and Shem Creeks, and supplied provisions to Barbados.

By the end of the 17th century and the time of Queen Anne's War in the first quarter of the 18th century, colonists had realized that trading with native Indians was more profitable than enslaving them (Orvin 1973:17-19). Economic and social motives prompted a strong trade in cured deer skins and furs from the native peoples who sought beads, trinkets, run, powder and shot (Orvin 1973:20). Weir (1983:143) estimated that by 1715, 53,000 skins reached England through the efforts of about 200 traders. A little over a decade later, more than 300 individuals were registered as trading directly with the native populations (Meriwether 1940:15). Charles Towne was the major hub of economic activity in a region that extended for several hundred miles, and the importance of the trade with native peoples was such that the British government appointed an official to supervise it.

Residents of the Charleston Harbor area sought to diversify with other commodities. Poor quality rice crops already had been harvested in the last quarter of the 17^{th} century, but when rice fields were established in the lowland swamps rather than on high ground, rice rapidly replaced skins in external trade (Sellers 1970:6-7, 150). By 1720, rice was the leading export. As Charleston had become the third largest harbor in North America by the early 18^{th} century, colonists also began an industry focused on naval stores and supplying hemp for cordage. The Southern longleaf pine is described as “the most prolific resin tree in America,” and it was an ideal source for naval stores (tar, pitch, resin and turpentine) (Williams 1935:169). By 1722, colonists had developed a huge market and exported more than 60,000 to 70,000 barrels of naval stores each year (Merrens 1977: 69).

Trade in naval stores continued, along with a somewhat reduced trade in skins, as a new product was introduced. As settlements expanded, the rice culture became an important part of the economic and subsistence lifeways of European-origin colonists and native Africans. The rivers that feed into the Charleston Harbor were vital in moving all three cargoes into the commercial context. It was common for skins to be loaded into small boats in the freshwater portions of the rivers, and then for the boats to come downstream to Charlestown (Orvin 1973:59). Along the Cooper River, the area around Fair Forest Swamp became known for its contribution to the naval stores trade, and buyers and sellers met there. Orvin (1973: 58) notes that skilled craftsmen at plantations included coopers, and that each plantation had a cooperage for building barrels. The barrels, filled with resin, were hauled on wooden sleds by oxen and then taken to a creek or stream to be loaded onto sloops and taken to Charleston.

The large number of plantations along the shores of Charleston Harbor, and further upstream along the Cooper, Ashley, and Wando Rivers, proved to be an attraction to visitors from further upstream who approached the area in canoes or small watercraft, along with their produce and products such as rice, as well as to a wide variety of transit watercraft that could easily thread the shoals and shifting channels of the region. Merrens (1977: 181) notes that Governor James Glen wrote to the Lords Commisioners for Trade and Plantation in England in 1751, describing a constant flow of periaguas, canoes and boats from upstream producers to the city, returning with goods desired by the planters.

Of utmost importance to this economic network was the transportation of cash crops such as indigo and rice from plantations further up the rivers down to the markets of Charleston, often in flat-bottomed barges or small sailing schooners that would not have been out of place on European rivers (Orvin 1973: 69). Surveys in the Cooper River area have located sailing craft like these from the early 19^{th} century (Harris et al. 1993). One plantation owner had two sailing schooners, one for each of his plantations (Harris et al.: 1993: 21).

Waterways were the most important aspect of colonial settlement and trade, and Charleston benefitted from its position as the major harbor for vessels arriving from Europe and other American ports, bringing manufactured goods in scarce supply in the new townships. Agricultural products from throughout the region were carried downstream to the docks of Charleston for export. Coker notes that the pattern of subsidies for the major export products (naval stores, timber, rice, indigo) from Britain made the city dependent on agriculture and natural resources, and it did not need to expand into an industrial base (1987:43-44). It supplied vessels enroute to and from the Caribbean, and served as a supplier for backcountry settlers as far away as North Carolina and Georgia. Its primary competitor in the southeast was Savannah, further inland. Between 1765 and 1770, about 450 to 500 vessels called at the port (Sellers 1970:11-12), aided by the English acquisition of Spanish territories in Florida and the lack of a port there. This new access replaced the declining trade in furs (Sellers 1970:44-45) that reflected the increasing settler population in the hinterland and the decrease in native peoples there.

Throughout this period of development, Charleston was the center of the slave trade of the southern colonies. The Carolina low country produced rice and indigo, and later cotton, all crops requiring a large work force, generally made up of African slaves. The slave population expanded greatly, and by 1703 outnumbered white residents of the area. By 1725, more than twice as many residents were enslaved or freed Africans or descendants of Africans, a ratio that continued up to the Revolution (Edgar 1998:69). The plantation style of agriculture demanded a massive labor force, and economics made it cheaper to buy people than to employ them. "Between 1700 and 1775, 40 percent of the Africans imported into North America came through Charleston" (Edgar 1998:67).

By the time of the Revolutionary War, Charleston and its surroundings were hotly contested, with control shifting from American to British forces. During the American Revolution, parts of the Carolina backcountry supported the British, creating an atmosphere of conflict that saw Tory/British supporters and Whig/Republicans disrupting settlements and agriculture (Savage 1956:207, 214-218). Less disarray was visible along the coast, where merchants, shippers, and plantation owners strongly supported the Republican cause. Still, naval and commercial shipping in the Charleston area was considered to be at considerable risk.

The Revolutionary War took a heavy toll on Charleston. Lord Campbell's departure from Charleston in 1775 effectively ended British rule in the colony. Fears that the British would attack Charleston were alleviated by the blockade of main channels into the harbor that fall. In the spring of 1776, South Carolina drafted a constitution, only the second of the rebellious colonies to do so. Armed patrols by schooners POLLY and DEFENCE, the brigantine COMET, and the ships BETSY and PROSPER were intended to protect the rebels (Fraser 1976:80-82). The British responded immediately to the constitution by sending 11 ships and 2,900 army regulars under the command of General Sir Henry Clinton and Sir Peter Parker to take Charleston, but locals defeated the force in what came to be known as the Battle of Sullivan's Island (figure 34) (Edgar 1998:226-7).

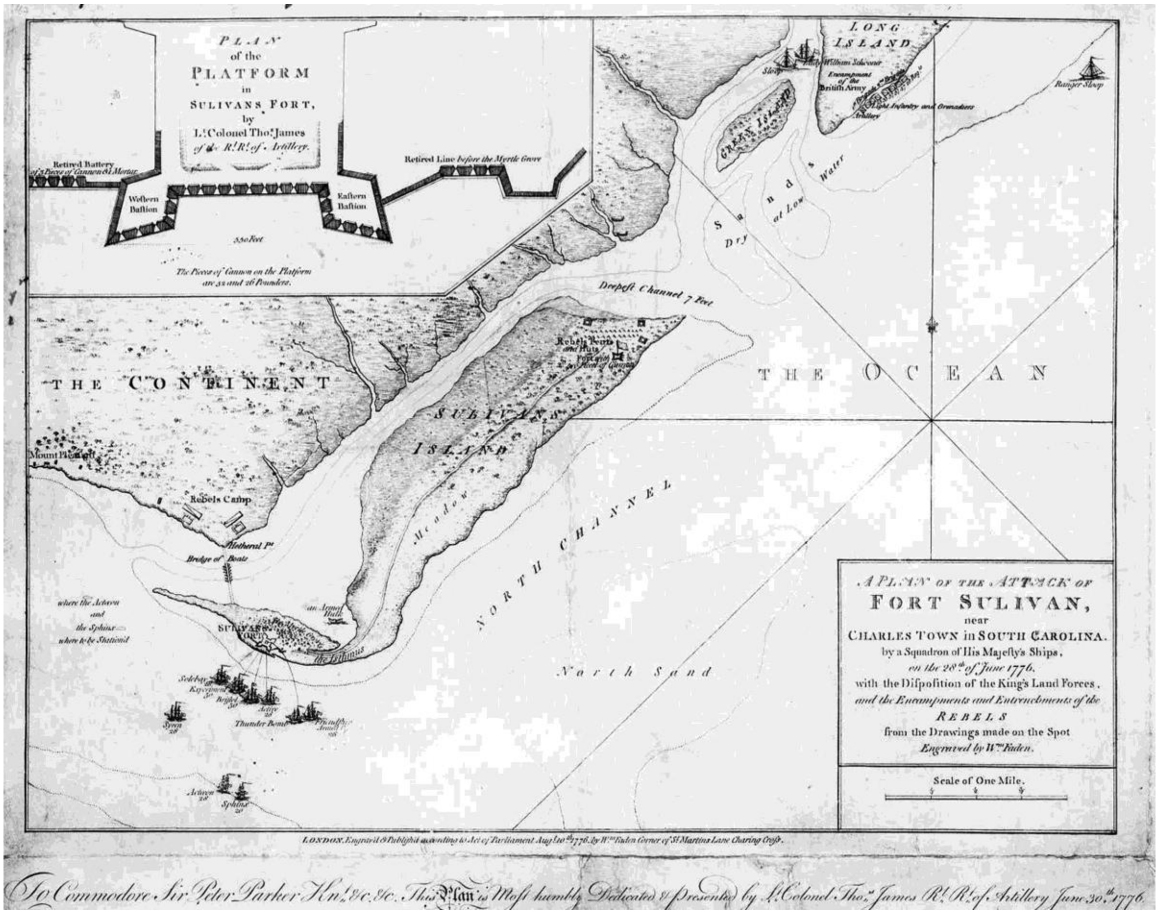


Figure 34. 1776 Sketches drawn by British forces were combined into this 1776 map illustrating the disposition of American defenses include illustrations of the British squadron, including HMS ACTEON, which sank and has not been relocated.

British capture of Savannah in 1778 laid the groundwork for the capture of Charleston, though it took them until May of 1780 to complete the task (Labaree et al., 1999:146).

A British fleet moved into the North Edisto River in February of 1780, disembarking 6,000 troops about 20 miles from Charleston. General Clinton had the troops move up the coast from sea island to sea island in concert with the British fleet southeast of the city. The British captured Fort Johnson in early March, giving them command of the southern approach to the harbor and controlling the west bank of the Ashley River (Weir, 1983:331-331; Fraser, 1976:119-121). By this time, four armed frigates and some barges were all that protected the approach to Charleston harbor, and the American General Lincoln ordered the frigates and seven other vessels to be scuttled near the mouth of the Cooper River with a boom strung to connect the masts of the submerged ships, slowing British progress into the harbor but not stopping it. By mid-May, British troops had taken the last open seaport in the colonies, and Charleston became a haven for South Carolina Tories (supporters of the King) under British control until they evacuated the city on December 14, 1782, essentially ending the war in South Carolina (Edgar 1998:237-240).

Outside the harbor itself, plantations became liabilities, and were evacuated, and anyone on the harbor's waters was likely to be focused on the transportation of military supplies (Orvin 1973:101). For example, one expedition designed to remove the British from Moncks Corner during the final year of the war resulted in four British supply craft being burned to the waterline. A bit further to the north, the American expedition surprised about 100 men busy loading their loot from nearby plantations onto two boats (Orvin 1973:101).

Overall, at least 24 vessels are known to have been lost or abandoned within Charleston Harbor during the Revolution, including the 11 vessels mentioned above and four others that were scuttled in Hog Island channel earlier in the conflict. These all were sunk for military purposes to serve as obstructions to navigation. In addition the British warships HMS ACTAEON, grounded off Fort Moultrie in 1776, and HMS THETIS, lost in the 1782 abandonment, are recorded. The privateer LORD NORTH, the vessel JAMAICA, and the vessel FRIENDSHIP also sank during the occupation.

It was during the Revolutionary War that naval shipbuilding began in Charleston, roughly in the area of the Charleston Naval Complex today. The South Carolina State Navy leased much of Paul Pritchard's shipyard at Hobcaw beginning in 1778, and stayed there until the occupation of 1780. Subsequently, Cochran's shipyard on the south side of Shipyard Creek was designated as the builder for a warship in 1799 when the 28-gun frigate JOHN ADAMS was given to the United States government (McNeil 1985:19-20). It was not until the early 20th century that naval shipbuilding returned, however.

After the Revolutionary War, commercial maritime activity built up slowly, along with a population of at least 16,000, making Charleston the commercial center of the lower South. The American shipping industry benefited from European conflicts between 1793 and 1815, and despite high risk and a large number of losses, the profit was high, especially on goods going to and from the West Indies. Ships could leave Charleston and reach Britain or Europe as quickly as those sailing out of New York or Boston, and by the beginning of the 19th century, nearly 49,000 tons passed out of the harbor, reaching a peak in 1808 of 53,011 tons. Cotton, especially the long-staple, sea island cotton of South Carolina's coastal plain, was an important component of this trade. More than 3,000 tons of cotton were exported in a single year ending in September of 1800 (Petit 1976:170). By 1834 approximately 33,000 tons were produced, an elevenfold increase. The pattern of small manufacturing development and agricultural production was almost entirely subsumed in the establishment of cotton as a cash crop.

Cotton was the primary commodity grown for export in the backcountry of South Carolina, and the bulky bales had to be moved from small agricultural hamlets to mercantile centers. River traffic increased significantly, though steam power did not make much of an impact except along coastal routes or within the port of Charleston as railroads and roads received significant government investment. By 1860, railroads connected every part of the state to Charleston or Columbia, and more cotton reached Charleston's docks by rail than by water (Edgar 1998:283). Construction of state roads and bridges also reduced waterborne traffic.

Production of cotton ensured the continuation of the African slave trade through Charleston, and had enormous economic and social impacts. Charleston became the center of a planter aristocracy and successful merchants and maritime operators exchanged Cooper River cotton for the manufactured goods and luxury products not yet produced in the South. Before the Civil War, South Carolina was one of the wealthiest states per capita, excluding slaves, at $2,017, surpassed only by the other slave-holding states of Mississippi and Louisiana. Economic indicators such as personal property, real estate value, bank deposits and exports were all on the increase. Charleston, headquarters of the state bank, also held nearly seventy-five percent of all private banking capital in the state (Edgar 1998:284-5). More than 40,000 people lived in the city, the most densely populated part of South Carolina, and its center for trade, politics and economy by 1860.

Lincoln's election in 1860 saw South Carolinians began to take actions that would affect the nation's future, beginning with the mass resignation of South Carolina's congressional delegation in Washington. The state legislature called for a state convention to consider the issue of secession, and on December 20, 1860, at Charleston, the 169 delegates of the Secession Convention unanimously claimed the state's right and need to secede from the United States (Edgar 1998:350-2).

Like the Revolutionary War, the Civil War had tremendous negative effects on the state of South Carolina and the city of Charleston. Cadets from the Citadel prevented STAR OF THE WEST from re-supplying Fort Sumter in 1861, leading to the true initiation of the War Between the States with the fort's bombardment. The success of the bombardment contributed to an initial state of euphoria across the South. Charleston Harbor again was a critical asset to each side of the conflict (figure 35). Prior to the outbreak of hostilities, Captain John Hamilton had already created floating batteries placed to oppose the Federal troops at the unfinished Fort Sumter. Based on British and

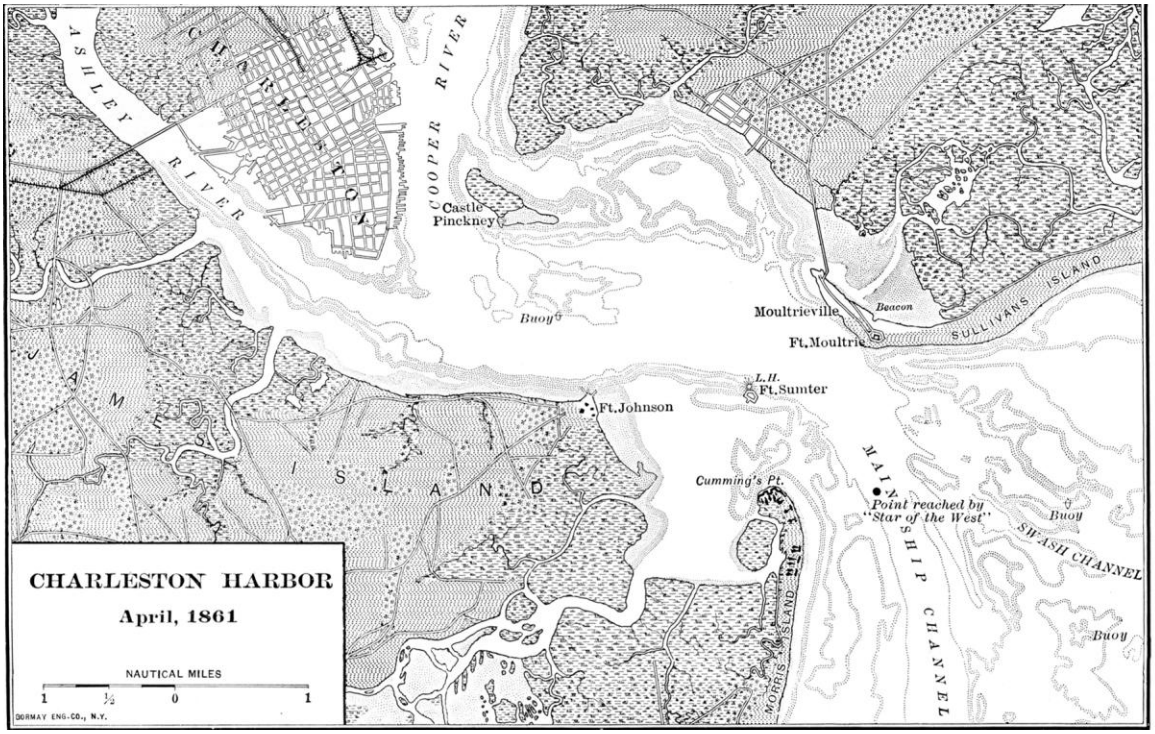


Figure 35. Civil Charleston Harbor and its shifting shoals, tidal flows, and especially the batteries and forts ranged against Union forces were of interest to the public as well as to combatants (reproduced in Hart, 1907: 244).

French designs used during the Crimean War of 1854, the batteries had an iron-covered casemate on one face of a barge. Just two days before the bombardment of Sumter the floating battery was grounded on the west end of Sullivan's Island (Coker 1987:207-8).

Shutting off trade to Charleston was a keystone in Union strategies, and on April 19, President Lincoln proclaimed a blockade of Southern ports, which was almost laughable as the nation had few naval vessels that could enforce the blockade. Immediately, blockade runners became a regular feature of the shipping channel in Charleston Harbor, and when the frigate NIAGARA arrived on May 11 of 1861, it did not slow that traffic. By the end of the year, however, Union naval forces captured Port Royal, giving the Union one of the best harbors on the east coast and control of southern harbors from above Georgetown to New Smyrna, Florida, with the sole exception of Charleston (Hayes 1961:365).

In order to curtail an active trade or foreign aid that could support the Confederate cause, the Union decided to blockade the port with what became known as the "stone fleet." Federal troops supervised the weighting of a 16 old ships, mostly whalers, with stone and sank them across the mouth of the main shipping channel in December of 1861. The stone fleet's efficacy was almost immediately diminished by the force of the natural scouring of the tides as new channels were made by the redirected tidal waters of the harbor. Blockade runners continued to successfully evade the Union force, and a fleet of Union navel vessels were detached to enforce the blockade. The blockaders included innovative and advanced naval warcraft such as NEW IRONSIDES, a steam-driven vessel able to carry the cannon of a traditional sailing man-of-war as a "broadside ironclad" (Coker 1987:257). The steam-powered vessel was redundantly rigged as a bark, but had no masts for most of its active and distinguished career. The defensive design caused great consternation to the Confederates, as it is reported that the vessel took 70 hits off Fort Moultrie and on another occasion while supporting the grounded Union vessel WEEHAWKEN, it took 50 hits without major damage (Canney 1993:15-20).

Blockade runners, sometimes built overseas, and sometimes modified locally, were both sailing schooners carrying a few bales of cotton or fast steamers purchased or constructed like FLORA, FLAMINGO or PRESTO specifically to escape the blockading Union warships. At least a dozen ships were sunk or destroyed during efforts to enter or leave Charleston Harbor in defiance of the blockade. By 1863, Charleston was the major blockade running port for private companies, and fewer than 7 percent of ships were lost of more than 168 attempts by steam-powered vessels to clear Charleston and Wilmington (Wise 1983:223, 254-257). First to strike at the Union, Charleston was one of the last port cities of the Confederacy captured by Union forces, holding out until February of 1865. The defenses and ingenuity of the natives of the city and General Beauregard created in the annals of naval history some unique accomplishments that include floating batteries, torpedo boats, semi-submersible David class vessels, and successful deployment of the submarine H.L. HUNLEY.

The new designs for armored ships were quickly adopted and adapted by both Union and Confederate navies. Charleston privateers were issued letters of marque, and had an early success, but did not seriously impact Union-based mercantile shipping (Coker 1987:211). Floating batteries, torpedo boats, and a new type of semi-submersible were threats to the blockaders. Torpedo boats were a local innovation that literally took the battle to the enemy, in this case, with a torpedo (casket of gunpowder) sparred off the bow (Coker 1987:256-7). Two attempts at attacks on Union vessels, including NEW IRONSIDES in August 1863, put the Federal forces on alert for any approaching craft. Another type of vessel put into service against the Union was the semi-submersible David class vessel. The David hulls were cigar-shaped and lightly armored. Powered by a steam engine, when underway the vessel could take on water ballast and submerge to a point where only the cockpit coaming and smoke stack were above the water. Like the torpedo boats, a spar with an explosive charge was the only offensive weapon the four-person vessel carried (Coker 1987:257-261; Scharf 1996:758).

Another innovative attack vessel was a true submarine–H.L. HUNLEY, designed and built in Mobile, and then transferred to Charleston. Like the Davids, HUNLEY had a cigar-shaped hull and required little iron to build. Powered by a hand-cranked propeller, two crews were lost before the first successful attack on an enemy ship. On February 17, 1864, HUNLEY left its berth, probably on the Isle of Palms, and avoided patrolling and anchored Union vessels, circling the steam sloop-of-war HOUSATONIC before placing its the spar torpedo in the starboard quarter. The resulting explosion destroyed HOUSATONIC, which sank in four minutes (Coker 1987:264-5; Scharf 1996:760-1). HUNLEY never returned from that historic voyage, but at least some of crew survived the attack for a time as the intact remains of the *Hunley* were recently identified about 600 m from HOUSATONIC (National Park Service 1998:60).

More traditional warcraft included several ironclad vessels built in Charleston yards, which constantly struggled to secure supplies of iron and tools. PALMETTO STATE and CHICORA were built in Charleston and combat-ready by October of 1862. CHICORA was 150 feet long, 35 feet abeam, with a draft of 12 feet (Coker 1987:224; Scharf 1996:670). COLUMBIA and CHARLESTON, also newly built ironclads, were later added to the Confederate naval forces (Still 1971:79-97, 91, 112), and though they lacked powerful engines, they were part of Charleston Harbor's network of defenses. CHARLESTON was the largest ironclad built at 180 feet long, 36 feet breadth, with a draft of 12.5 feet; it entered service only in early 1864 (Coker 1987:232). An attack on the Union fleet by CHICORA and PALMETTO STATE prompted the Union to send a fortified squadron that included monitors and NEW IRONSIDES to enforce the blockade more firmly.

The Union fleet arrived off Charleston bar in early April 1863, and tested the defenses of the harbor. Spirek (2012) provides a masterful summary of Charleston Harbor as a Civil War Battlefield, with full details. The monitor WEEHAWKEN led a line of battle into the harbor, followed by three monitors, NEW IRONSIDES, and four other monitors. Confederate forces, who had buoyed the shipping channel previously, brought the entire fleet under heavy and accurate fire. Monitors PASSAIC and NAHANT were disabled and forced to withdraw, and NEW IRONSIDES collided with CATSKILL and NANTUCKET, anchored to prevent it from running aground in the shoal waters

(U.S. Naval War Records Office 1902:3, 25; 1921:159), and the ironclad KEOKUK was within 900 yards of Fort Sumter before becoming incapacitated, sinking off Morris island the following morning (U.S. Naval War Records Office 1902:23). Confederate forces enjoyed a brief success, as by July 1863, Federal forces had gained control of Morris Island (U.S. Naval War Records Office 1902:549-550). Morris Island became the basis of the Union attack on Fort Sumter, with shelling contributed by monitors PASSAIC and PATAPSCO.

Sumter was a prime target, and the monitors and ironclads bombarded Fort Sumter and Charleston daily for months while maintaining a tighter blockade on the harbor. Fort Sumter, though visibly damaged, never fell even after more than two years of fire from some of the heaviest artillery of the time. Union attacks on other targets at James Island and Fort Johnson also were inconclusive or failures. After Federal forces captured Savannah in December of 1864, the city began to prepare for evacuation. The fleet continued its pressure on Sumter and the city, but suffered additional losses.

In January of 1865, the monitor PATAPSCO (38CH270) sank in less than a minute after striking a mine about 800 yards east of Fort Sumter (Spirek and Amer 2004:78-82; Spirek 2012:124-132). Only the top of her stack was visible. Continued pressure on Charleston harbor by Federal troops and troops landed by up to 18 additional Federal vessels prompted General Beauregard to evacuate the city in mid-February, finally leaving Fort Sumter to be taken by the Union (U.S. Naval War Records Office 1902:473-521).

Like other cities in the South, Charleston's post-war economy was devastated, as was the architectural fabric of the city itself and the facilities to support and encourage normal trade. Merchant ships began to return to the city immediately, but faced adverse conditions from sunken warships and purposeful obstructions to the channels. It was only when Colonel Quincy A. Gillmore arrived in Charleston in 1871 as an Army engineer that port maintenance and improvements began (Gillmore 1865; Moore 1981:32-33). As part of the effort to rehabilitate the city during Reconstruction, the government charged the engineers of the U.S. Army with clearing hazards to navigation.

Gillmore's plan involved dredging and maintaining a 21-foot channel in Charleston harbor, using jetties to help create the necessary depth, which he expected would be maintained by the powerful ebb tide (Moore 1981:33-35). The earliest phase of the plan required hazards and obstructions to navigation to be removed. Benjamin Maillefert was engaged contractually to remove five vessels (U.S. Army 1873:652-3). In return, Maillefert gained all proceeds from scrapping the wrecks as well as $10,800. The ships involved were the ironclad gunboat PALMETTO STATE, sunk in 1865 in the mouth of Town Creek; the ironclads CHARLESTON and CHICORA, sunk below Drum Island in the Cooper River; and BEATRICE and an unnamed ship at the inner mouth of the Beach Channel on the north side of Drunken Dick Shoal.

Maillefert succeeded in meeting the terms of his contract, and subsequently was contracted to remove the ironclad USS PATAPSCO (38CH270) from east of Fort

Sumter, another unnamed shipwreck near Fort Sumter, WEEHAWKEN (38CH272), and USS HOUSATONIC to areas of greater depth (U. S. Army 1873:652). H.L. HUNLEY is also mentioned in passing: "The torpedo-boat, sunk at the same time and place, could not be found" (U. S. Army 1874:728; National Park Service 1998).

Harbor dredging of Beach Channel to a depth of 15 feet at mean low water, jetty construction and ship removal continued throughout 1874 (U.S. Army 1875:76). In addition, engineers supervised the removal of 125 feet from the outer end of Bowman Jetty, then obstructing navigation in Beach Channel near Fort Moultrie. STONO, PRINCE OF WALES, and JUNO were moved further seaward on Sullivans Island, and KEOKUK, a monitor, was removed from the shipping channel. The engineers also note that harbor improvements were undertaken by "municipal authorities" (U.S. Army 1875:5), and no further removal of shipwrecks is mentioned. By 1876, the engineering report focuses entirely on appropriations, jetty work, and dredging in the section describing Charleston harbor improvements (U.S. Army 1876:82), suggesting that wartime obstructions to navigation into and within the harbor had been cleared.

Gillmore's plan could now be implemented. Between 1878 and 1895, dredging and jetty construction established a shipping channel with a 17.5-foot depth, a depth that would allow Charleston to compete with other eastern harbors (Moore 1981:39; U.S. Army 1879:731-738 for Gillmore's plan and annual reports for its progress through 1896). Charleston's exports, which by 1870 approached $11 million as compared to about $505,000 in imports, had begun to recover as steamboat connections in the region and to New York, Baltimore, Philadelphia and Liverpool were established (figure 36) (Moore 1981:157).

Maritime trade continued to increase, and by 1880, more than 50,000 people lived in Charleston. Cotton, rice and phosphate comprised the principal exports of Charleston (Watts 1986:49), but as at many ports, the continued expansion of the inland railroad systems drained Charleston's industrial base. In the next quarter century, as the proportion of goods exported by rail ballooned, Charleston experienced a severe decline in trade, calculated at less than a quarter of the value of trade in 1885-1894 (Watts 1986:49; Moore 1981:169). Despite the decline, the city invested in its harbor improvements because of a political decision to locate a permanent naval base there.

In 1889, a navy commission recommended that the U.S. build a large naval base at Port Royal, the harbor used by the Union during the Civil War as an operating base for the South Atlantic blockading squadron. A small facility was maintained there after the war, and a wooden dry dock was begun in 1891 but never completed, probably because of an engineering preference for stone dry docks rendered it obsolete. Charleston's mayor and South Carolina's Senator Benjamin Tillman began an effort to bring the Navy Yard to Charleston, an effort rewarded almost immediately when the decision was made to bring the Naval Station to Chicora Park in Charleston (Moore 1981:58-60). The city made it attractive to purchase marshland from Chicora Park to Shipyard Creek, selling 760 acres to the Navy for $1 and the remainder for less than $85,000. The navy took over the property in 1901 and immediately began to build a stone dry dock 583 feet long and

Figure 36. COE Charleston's Corps of Engineers chart from 1918 shows the wetlands that still surrounded the city in 1918 and the improvements to the harbor made under the direction of Colonel Gillmore.

97 feet wide. Completed in 1907, the next major effort was the introduction of a school for machinists mates in 1912 as part of the war effort.

Despite the construction of ten ships during World War I, the Charleston Navy Yard developed very slowly up until 1939 when World War II actions mobilized the resources of the U.S. government, and it became Charleston's largest industry overnight (Watts 1986:49-50). After the war, the federal government assigned the large water transportation facilities developed during World War I and utilized in WWII to the city of Charleston. The city signed them over to the South Carolina State Port Authority, and a prosperous period began, moving Charleston to a position of one of the most important ports in the South Atlantic (Watts 1986:50). An additional boost to the city and its harbor came from a 1948 decision by Secretary of the Navy John L. Sullivan that designated Charleston Navy Yard as a submarine overhaul yard, in addition to its role in surface ship repairs (McNeil 1985:146). By 1956, Charleston was designated as a nuclear shipyard (McNeil 1985:159-169). Problems with completing repairs and overhauls on time in the early 1970s were overcome, and in 1984, Charleston Navy Yard was named best naval shipyard in the country (McNeil 1985:170). Today the U.S. Army Corps of Engineers is responsible for maintaining the channels and the harbor, deepening and dredging them as necessary.

5.4 Past Investigations

The history of Charleston Harbor has been intensively investigated by a number of researchers, including archaeologists Gordon Watts for USACE (1986, 1989, 1995a, 1995b, 1995c) and James Spirek (2012), as well as Christopher Amer (formerly with South Carolina Institute of Archaeology and Anthropology/SCIAA), the Naval Historical Center , salvor E. Lee Spence (1980, 1984) and novelist Clive Cussler. The harbor's central role in the early hours of the Civil War and its focus as a Federal blockade target ensure a number of shipwrecks related to that conflict have been described and studied (Gaines 2008:141-157, and more comprehensively, Spirek and Amer 2004, Spirek 2012). In support of the fieldwork, CCU conducted a brief literature review to provide historic context for any maritime cultural heritage that might be identified during the survey. This report reflects the use of previous USACE reports and the work of Spirek to serve as planning references for the evaluation and possible identification of submerged cultural anomalies. Where pertinent in the discussion and analysis section, relevant data from the literature review will be included to provide context for potentially significant cultural sites.

The impetus for this remote sensing survey is the proposed deepening of the commercial channels in and approaching Charleston harbor and of the area reserved for dredged material (ODMDS). USACE has supervised several archaeological surveys for submerged cultural material in the harbor region in the past 35 years, and current survey areas reflect that work. Survey areas do not overlap with regions previously surveyed by magnetometer and side scan sonar (Watts 1986, 1995a, 1995b, 1995c). Their geometry reflects a concern with defining those parts of the harbor that may be affected by deepening activities that have not previously received formal archaeological inspection for submerged cultural resources.

The Area of Potential Effect (APE) is fully described in Appendix 1, and it incorporates any area of the harbor bottom, channel extension area, or ODMDS disposal that may possible be affected by primary dredging activities or secondary activities such as anchoring or mooring vessels active in deepening and disposal work. The APE includes the specific portions of the harbor bottom used for the navigation channel under consideration for deepening and, in consultation with South Carolina State Underwater Archaeologist James Spirek, a buffer of 75 m beyond each channel edge. The survey area was drawn to avoid duplicating previous surveys, and it does not revisit any sites previously identified.

The results of earlier surveys related to deepening the shipping channels include identification of modern targets reflecting the harbor's present activities. No sites of potentially significant cultural materials were identified in those surveys or subsequent inspection of targets that had characteristics in common with those of known submerged cultural resources other than USS PATAPSCO 38CH270, whose location already was known (Beard 1989; Simmons 1988; Krivor and Tuttle 2000; Watts 1986, 1995a, 1995b, 1995c).

Review of literature

Archival research for the present project was carried out to provide cultural resources information about the type of archaeological and historic sites and artifacts that might be present in the survey APE. The archival research included a review of the South Carolina State Site Files located at the South Carolina Institute of Archaeology and Anthropology (SCIAA), University of South Carolina, historic maps of the project area, numerous primary sources and secondary works related to the prehistoric and historic activities of humans in the Charleston Harbor watershed, and evaluation of the APE in NOAA's Automated Wreck and Obstruction Information System (AWOIS) list (http://www.nauticalcharts.noaa.gov/hsd/awois.html) for navigation hazards that might be culturally significant. Historic navigation charts also were examined, and previous archaeological and historical research on terrestrial sites beyond the project boundaries was also reviewed, especially Watts' compilation of historic maps of the APE and Charleston Harbor area (1995a).

Review of SCIAA and USACE records indicates that a number of previous surveys have occurred in the Charleston Harbor region. In this section, surveys conducted within the proposed project area, surveys in the harbor watershed that document the types of cultural resources that might be detected within the project area, and terrestrial surveys of land adjacent to the survey area are summarized and described in chronological order of publication.

In 1979, Alan Albright of SCIAA's Underwater Research Division conducted a survey to examine the area proposed by the South Carolina State Port Authority for the construction of a marine container terminal on the east bank of the Wando River above Hobcaw Creek. The survey examined the river channel from the southern end of Daniel Island to a point opposite the northern end of the proposed dock for the terminal, primarily on the eastern side of the river (Albright 1980). The survey included remote sensing by magnetometer and side scan sonar, and visual inspection of specific targets and parts of the river bottom.

Site 38CH425 encompasses the entire area that became the Wando Terminal. Remote sensing identified several modern deposits of debris and maritime equipment such as cable, chain, etc. and two anchors dating from the late 18th century and the late 19th or 20th century. The larger and earlier anchor was relocated on the west bank of the river north of the survey area (Poplin and Jateff 2009:53).

Albright's team recovered four prehistoric sherds (Thom's Creek) and one chert core from the Ceramic Late Archaic period, and fragments of 19th century artifacts including glass and pearlware were recorded. No concentrations of artifacts were identified by visual survey or remote sensing, and Albright regarded all cultural materials as redeposited by normal river currents rather than as specific deposits. No artifacts were located on the west side of the survey area, and investigators described the lack of cultural material observed or recovered as puzzling (Albright 1980:35). Terrestrial sites on the east bank include river plantations and shipyards, and similar sites are slightly north of the survey area on the west bank. Even off a bluff in Section II, no historic artifacts were discovered, which Albright suggested may be because they were buried deeply in mud from the eroding bank. No prehistoric sites were seen on the bluff or along the shoreline during terrestrial survey, and Albright recommended no additional work at this site. Further north in the Cooper River, Albright had previously conducted a remote sensing and visual inspection survey at the proposed site of an Amoco facility. Albright (1976) reported that no artifacts were recovered, and only modern debris was identified on the river bottom.

In 1979, Gordon Watts used remote sensing by magnetometer and side scan sonar, followed by visual inspection of anomalies, in an underwater survey of the proposed Mark Clark corridor across the Wando River for the South Carolina Department of Transportation. Watts (1979) identified a number of anomalies as modern debris associated with construction, navigational aids, or anchoring. He also describes three culturally significant anomalies within a 300-m-wide corridor from Daniel Island to the east bank of the Wando River approximately 2.5 km north of the northern terminus of this project's survey area. 38BK426, 38BK427 and 38BK428 are the remains of ships with coherent hull structure and associated artifacts (Watts 1980).

Further examination of these sites by SCIAA archaeologist Lynn Harris suggested that two of the sites were the same vessel and so they are listed as 38BK426/427. The lead-sheathed hull remains of a wooden sailing vessel approximately 85 feet long are in approximately 6 m of water at high tide, some 100 m from shore. Brick fragments, 18th and 19th century ceramics, glass bottles, and cutlery, as well as copper nails and spikes, were associated with the vessel. Watts (1980) supported an NRHP designation for the site, but it has not been acted upon. The location of I-526 was shifted downstream (to the south) to avoid these shipwrecks. A scatter of ballast and the remnants of another vessel are slightly upstream at site 38BK428. Pipe stem fragments, stoneware sherds, and coherent hull structure prompted Watts (1980) to recommend it be evaluated for NRHP status. Both vessels are from the end of the 18th century or the beginning of the 19th century.

In the same area of the Wando River, sport diver Doug Boehme identified a wooden sailing vessel as 38BK1771. Approximately 19.5 m long in about 2 m of water, the vessel lacks any additional survey or description and is listed as potentially eligible for NRHP pending more detailed investigation by archaeologists.

A 1986 underwater remote sensing survey conducted by Gordon Watts in the Charleston Harbor area used magnetometer and side scan sonar data to examine parts of the harbor considered for dredging for cultural resources. Watts identified 84 magnetic and/or acoustic anomalies of which most were classified as modern debris, construction materials, navigational aids, and objects associated with dredging and other harbor activities (Watts 1986:94). Of these, 19 sites were considered to share magnetic and acoustic signature characteristics that may indicate submerged cultural resources with historic and/or archaeological value, and he recommended they be further investigated (Watts 1986:94).

Three additional targets from the 1986 survey were evaluated in a 1988 project by SCIAA. The investigation relied on remote sensing by magnetometer and sidescan sonar, along with visual inspection by diving archaeologists, to identify anomalies recorded in remote sensing data acquired by Gordon Watts previously (Simmons 1988; Watts 1986). The Lower Reach of Town Creek, Custom House Reach, and Hog Island were part of this survey area; with the exception of a large iron anchor shank of the late 19th century, all anomalies were identified as modern debris, including ferrous materials, tires, wire rope, 3-inch diameter metal pipes, and even a cargo of 10-100 kg granite boulders lost when a barge engaged in building the jetties overturned during the August 1893 hurricane (Simmons 1988). The shank was not considered to be culturally significant.

David Beard (1989) described a later project that sought to visually inspect eight additional sites identified in the 1985 Watts survey for SCIAA. Of the seven anomalies that could be relocated, none were considered potentially culturally significant and the targets included materials related to navigation, modern construction, anchor chain, wire rope, and an iron rudder (Beard 1989). Target CHR/1, described by Watts as of high potential to be historically significant as it is located in an area where nearly two dozen ships are known to have sunk and additional activity from Confederate torpedo boats and Davids is documented, could not be located at the time. Beard (1989:8) suggested that it may have been moved by maintenance activities in the channel or that it was associated with nearby tug docks.

Target CHR/1 was in fact inadvertently relocated by a dredge bucket during dredging activities on the Cooper River channel near the intersection of the Town Creek Lower Reach and the Hog Island Reach in February 2000, when the dredging company recovered a propeller and shaft, an encrusted cannon, and a section of hull (Krivor and Tuttle 2000). The recovered materials were taken to the Drum Island Disposal Site and inspected by SCIAA archaeologists, confirming that they represent Civil War shipwreck remains, probably a scuttled Confederate ironclad, and a Parrott gun, probably a 32-pounder (Krivor and Tuttle 2000:4).

As a result of this find, Panamerican Consultants Inc. conducted a refinement survey and recorded the artifacts from CHR/1 at the Disposal Site, examined the original site for further cultural resources, and inspected targets NCR-3, PTR&OR-1, and SYC-1 previously identified by Watts (1986:105-107). It was determined that none of these targets were eligible for listing on the NRHP, and no further archaeological work was recommended for these areas (Krivor and Tuttle 2000:52-53).

As far as this author could discern, six of the original 19 targets recommended by Watts (1986) for further investigation have not been relocated or inspected including FSA/RR targets 3, 4, 5, 7 and 12. As these are in the Fort Sumter Anchorage/Rebellion Reach zone, there are a number of historic shipwrecks recorded in their general vicinity (Watts 1986:96-100).

In1987, Gordon Watts conducted an underwater remote sensing survey in the area proposed for the replacement of the Grace Memorial Bridge. Magnetometer and side scan sonar survey identified 17 anomalies that were visually inspected (Watts 1987a). Eight of these were easily identified as modern debris from sonograms, and inspection of the remaining anomalies by diving archaeologists showed them to be concrete forms, steel beams, and wire rope, along with other concentrations of modern debris. The Cooper River portion of this survey is within the current project survey boundaries.

Also in 1987, Gordon Watts conducted an underwater remote sensing survey of the Highway 700 bridge replacement alignments on the Stono River and Penny's Creek on the western side of the Charleston Harbor watershed. Following the analysis of magnetometer and side scan sonar data, Watts (1987b) reported that no potentially significant cultural resources were identified in that survey.

A remote sensing and visual survey of former marshland near Shipyard Creek that was requested by the Department of the Navy relied primarily on side scan sonar and magnetometer data (Watts 1989). Of the 24 magnetic and/or acoustic anomalies identified, 15 were identified as modern debris, and nine required on-site investigation to determine they also were modern debris.

In 1992, proposed bridge construction near Goose Creek, north and east within the Charleston Harbor watershed but outside project boundaries, included parts of the bottom of Goose Creek (Watts 1992). Intensive remote sensing with magnetometer and side scan sonar of the survey area prompted Watts to comment that the existing bridge created a multi-component disturbance visible in magnetometer records extending from beyond the bridge boundaries, but acoustic inspection by side scan sonar ensured that no culturally significant anomalies were present.

A visual survey along the Cooper River beyond the project area in Charleston Harbor identified a prehistoric component in all sections, but archaeologists note that there was a high likelihood that secondary deposition was responsible for all finds. Ceramic sherds and a very small number of Archaic and Woodland projectile points were identified from such secondary locations (Harris et al: 1993:60).

Historic remains included the Mepkin Abbey Dock structure, a built feature that was intended to make the shoreline more accessible to waterfront activities. Log cribbing filled with sediment hardened the shore and provided a convenient landing space. Ten m wide, the dock extends about 13 m from shore (Harris et al. 1993:50). Six logs approximately 6-8" (14-20 cm) in diameter formed both sides of the cribbing and were fronted by logs fastened to the cribbing with treenails. Little formal study of this type of submerged feature has been undertaken, but these, and the purposeful filling of abandoned ships to harden a shore, are relatively common in the colonial Southeast.

In archaeological surveys conducted underwater along the margins of the northern reaches of the Cooper River (Harris et al. 1993), the location of terrestrial sites was significant in the composition of the assemblages. Small concentrations of artifacts were almost exclusively located along the east bank of the river, and were interpreted as representing secondary distribution (Harris et al. 1993:62). Larger and more varied concentrations of artifacts corresponded to the location of plantations along bluffs rather than inland from marshes and ricefields (Harris et al. 1993:62). Deeper water in those locations would have facilitated the transport of goods and products in larger vessels, and the construction of jetties or docks was also possible. Mercantile traffic allowed residents to engage in convivial activities, and Harris interpreted the high concentration of pipe bowls and stems as indicative of more complex economic and social activities than the sparse distribution of artifacts that seem to have been in secondary deposits (Harris et al. 1993:63).

The Cooper River survey also revised several different types of watercraft previously reported by sport divers. For example, four canoes (38BK52), a barge (38BK62), and the Mepkin Abbey shipwreck (38BK48) had been known for over a decade (Harris et al. 1993:61). Although the canoes had disappeared (possibly in sediment or lost), archaeologists noted several particular features of watercraft in rivers and suggest that rivers offer substantially different environments than shallow or deep open water and coastal sites, where ships settle, usually keel down, into softer substrates and become buried in sediment. Harris (1993:61) suggests that in rivers, particularly those with strong tidal movements or seasonal flooding, watercraft may be subject to tumbling and displacement, particularly if the bottom is hard and does not provide a environment that results in submerged cultural resources embedded in sediment.

Evaluation of the historic Moreland Landing, about 11 miles north of the northern boundary of project area Cooper River 3, was part of an underwater archaeological testing project in 1995 by Mid-Atlantic Technology and Environment (Hall 1995). On former brick kiln properties, six plantations are known to have used three historic wharves that were built of wood with ballast stone and brick as infilling. During the documentation by diving archaeologists, the much-degraded remains of an 18th-century ship were identified under cribbing pilings, suggesting it was wrecked before the wharves were built. Logs notched over other logs and filled with stone and brick deteriorated over time, producing scatters of cobble-type ballast stone as the wood structure collapsed. Similar features might be expected in proximity to waters that are included in the APE.

Significant research and historical documentation of Charleston Harbor, particularly in the areas proposed for dredging to deepen the shipping channel and a submerged cultural resources survey were conducted by Gordon Watts in 1994 for portions of the harbor adjacent to areas surveyed in 1985 as deepening was proposed for those channels (1995a, 1995b). Watts employed a magnetometer, side scan sonar, and visual inspection by diving archaeologists to locate, interpret, and inspect anomalies. Although 32 anomalies were indicated on sonograms and in magnetomer data, 26 could be identified as modern debris associated with construction, navigational aids, anchoring, fishing, dredging, or other activities of the present day harbor (1995a:142). No prehistoric sites, ballast piles, or artifact concentrations were located, but a known historic site, the wreck of the ironclad USS PATAPSCO (38CH270), was revisited (Watts 1995a:135).

USS PATAPSCO lies east of Fort Sumter (38CH75) and produced a multi-component magnetic signature of 3430 nT maximum intensity for a 56 pulse duration; a sonogram image of the site documented a portion of the ship protruding above the bottom, and an extensive bottom scatter of debris (Watts 1995a:135). It is well to the east and south of existing channels, and was not threatened by proposed dredging activities or secondary effects of such dredging, but it should be avoided both for its historical significance and because potentially hazardous ordnance was seen at the site (Watts 1995a:143).

Eight targets were recommended for further investigation through visual inspection as they shared characteristics with known culturally significant sites, but only two of these targets were subsequently investigated (Watts 1995c). One of those targets was seen to be shell hash and scour on the bottom, and the other was identified as a modern pontoon, likely associated with dredging (Watts 1995c: 18). Watts also made recommendations for the management of submerged cultural resources in Charleston Harbor (1995b).

Ralph Wilbanks and Harry Pecorelli conducted an underwater survey using side scan sonar and magnetometer in areas proposed for a marine container terminal under consideration by the South Carolina State Ports Authority in 2006 (Wilbanks and Pecorelli 2006). The two survey areas are in the Cooper River, adjacent to the former Charleston Navy Base, and a total of four anomalies were registered in or near the survey areas. Three were identified as modern debris (pipe and cable), and the fourth anomaly was outside the impact area and not characteristic of potentially significant cultural resources.

In 2007, sports divers located a barge in shallow water, approximately 650 m south of the Bonneau Ferry on the East Branch of the Cooper River, far to the north of this project’s survey area. The barge, approximately 16 feet wide and 46 feet long, was upside down and becoming actively exposed by river currents (Harkins et al. 2007). Built of relatively thick planks, the barge had typical sloped ramp-type ends and also incorporated a 14.5-inch-long iron tow ring.

Underwater remote sensing survey and target identification by R. Wilbanks (2008a, 2008b, 2009; Poplin and Jateff 2009:57) in the area of a proposed marina in the Wando River off the east side of Daniel Island was closely related to the examination of terrestrial and intertidal zone remains of the Simmons Rice Mill 38BK2285 (see below) and a pier/wharf/landing complex 38BK815 (see below), both likely of the early 19th century.

Side scan sonar and magnetometer were deployed, followed by diving archaeological inspection of targets that included moorings constructed of I-beams driven into the river bottom with stud-link chain attached. Buried anchors from WWII-era ships moored in this reach of the Wando River in the 1940s and early 1950s also have been identified by Watts (1980). No culturally significant materials were identified in either of these surveys.

Examples of archaeological sites identified in areas adjacent to the APE

Site 38CH1496. Reported in 2006 by E. Seckinger, this site was located in front of Quarters K and L at the Charleston Navy Base and was identified in a USACE survey of 1993. It is a deeply buried site formerly on the edge of a marsh and tidal river, and is now adjacent to a marshy cove. This small campsite dates to the Late Mississippian/Early Protohistoric period, probably 16th century, and consists of two ceramic sherds, a pig bone, a whiteware sherd, and a piece of brown embossed glass recovered from 40 x 40 cm test units.

Sites 38BK1637, 38BK1638, 38BK1639, 38BK1640. Terrestrial Daniel Island historic and prehistoric sites, on the west side of the island near the mouth of Beresford Creek. These four sites are typical of a number of small 19th and early 20th century historic habitation sites, and earlier Woodland campsites, now much disturbed by agricultural activities (Brockington and Poplin 1994; Zierden et al. 1986). Small amounts of prehistoric Woodland ceramics, mostly worn or plain, and the typical ceramic and bottle glass examples of historic sites from the late 18th century through the early 20th century are present. The area is immediately south of “Calais Tavern” and “Scott’s Ferry” indicated on a map by A.T. Stoney illustrating plantations along the Cooper River in 1842 (Watts 1995:43, 46-47). These sites are near Beresford Creek where it meets Clouter Creek opposite the U.S. Naval piers, approximately 1.5 km northeast of the southern end of the Cooper River 3 survey area of this project (figure 37).

Site 38BK2285. On the east side of Daniel Island, survey in the area of a proposed marina identified the early 19th-century Simmons Rice Mill and pond, including remnants of features on the shoreline (Poplin 2011:32-36), approximately 1 km north of the Wando River 1 and 2 survey areas of this project. Built by 1807, the mill and its associated pond included a dam that collapsed by the mid-19th century. Wood and stone elements of the dam and slough remain visible.

Site 38BK815. Pier/wharf/landing complex built of wood and brick on the east side of Daniel Island, 45 m south of Simmons Rice Mill (38BK2285) and approximately 1.5 km northwest of the northwest edge of survey area Wando River 2 (Poplin and Jateff 2009). A brick floor and foundations are part of the pier complex, and a built landing constructed of local pine timbers and palm logs joined by mortise-and-tenon fastenings was filled with brick. As it does not appear on a 1784 plat of the area, Poplin suggests it is NRHP eligible as a 19th-century structure that is “fairly unique” in its preservation of elements not otherwise seen on Daniel Island, reflecting the movements of people in boats to an area that had no road access until after the 1940s (Poplin and Jateff 2009:52).

Additional plantations, small holder homes, and shipyard sites are further north of the Wando River 1 and 2 survey areas and turn basin. 38BK1627 has been identified as the remnants of an early 18th century house, probably that occupied by the son of Captain Robert Daniell, and areas associated with late 19th and early 20th-century African American tenant farmers (Poplin 2011: 14). “Daniell’s Landing” is north of 38BK1627

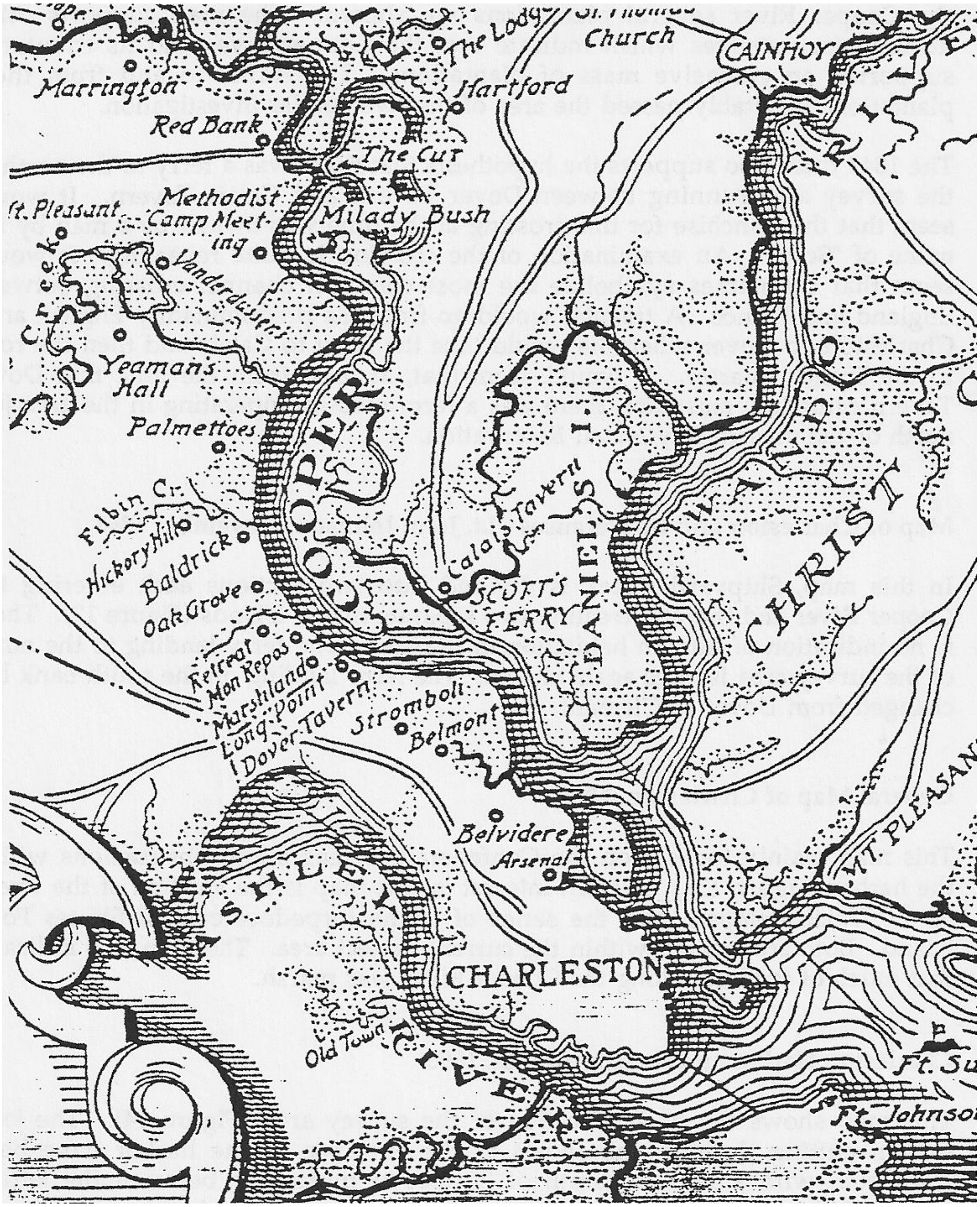


Figure 37. Stoney A.T. Stoney Map showing plantations along the Cooper River as they appeared in the Year 1842 (reproduced in Irving, 1932).

and south of the rice mill 38BK2285, but has no associated features remaining on land or offshore (Poplin 2011: 14-15, 37).

Site 38BK426/427. Wooden-hulled sailing ship remains on the west bank of the Wando River were first identified by Watts (1980). Coherent hull structure sheathed in lead, with bricks mixed with ceramics and glass from the period that included 1780-1820. Watts (1980) considered this site NRHP eligible. Further evaluation by SCIAA in 1994 suggested the two sections of the hull originally defined by Watts as individual sites were part of the same vessel, and concurred that the site warranted protection and further investigation. This site is more than 2.5 km upstream of the Wando River APE in this survey.

Site 38BK428. Wooden-hulled sailing ship remains slightly upstream from 38BK426/7 on the west bank of the Wando River were first identified by Watts (1980). In addition to a ballast scatter, the burned remains of the ship's hull are embedded in the river bottom. Watts also identified pipe stem fragments and stoneware, and suggested it dated to the period 1790 to 1830, making it eligible for NHRP status consideration. Additional work was recommended but has not been conducted.

Site 38BK1771. Remains of a wooden hulled sailing vessel near Sites 38BK426/7 and 38BK428 identified by a sport diver in 1996. No artifacts are associated and it is considered to be potentially eligible for the NRHP, but no additional investigation has been conducted.

Site 38CH425. Albright (1980) assigned a single site number to the entire area of the Wando Terminal underwater survey, which is adjacent to survey areas Wando River 1 and 2 of the present project. Isolated finds of five ceramic sherds including Thom's Creek and plain sherds, chert debitage, glass and ceramics from the 18th to 20th centuries, and two historic anchors were recovered from contexts of secondary deposition. The site is not NRHP eligible.

Site 38CH436. Ralph Wilbanks reported this site to SCIAA in 1979 and identified it as a historic wooden shipwreck of the 19th century, broken into two pieces, in 7.5 m (25 feet) of water. It is indicated on SCIAA's base map as approximately 250 m north of the boat ramp at Remley Point, and approximately 170 m east of the boundary of survey area Wando River 2. Two 19th-century glass bottles were removed from the site. This is referred to as the Wando T-2 wreck on the site file, but no further work is recorded there and eligibility for the NRHP is not mentioned.

Site 38CH1941. J. Weston reported this site to SCIAA in 2002, and a preliminary reconnaissance identified it as the remains of a ship dating after the mid-19th century, possibly of the Civil War era (Harris 2003). Located on a small beach on the north side of Remley Point, the remains extend 13.3 m from the water's edge onto the beach. Metal fastenings and some framing timbers are present, but no further study has been made. The site is approximately 300 m from the southeastern boundary of the Wando River 2 survey area.

Site 38CH257. R. Wilbanks reported this site to SCIAA in 1975. It is in 7.5 m (25 ft) of water approximately 8 m off the jetty seaward of Fort Moultrie (38CH50) on Sullivan's Island. Glass bottles and a 1.7 m (5 ft) anchor were reported, but no additional work has been conducted here. This site is approximately 250 m north east of the boundary of the Lower Harbor 1 survey area.

Site 38CH281. Reported by R. Wilbanks in 1976, the location of this late 19th century aggregation of bottles and stoneware in 3-9 m of water is questionable, but indicated to generally be in the area of 10 m offshore of the northwest tip of Sullivan's Island, at a point that corresponds to 32^{o} 45'50.31 N/79^{o}51'55.71 W. This site is approximately 250 m north east of the boundary of the Lower Harbor 1 survey area.

Site 38CH282. Reported by R. Wilbanks in 1975, this is reported as the old dock for Fort Moultrie (38CH50), described as old pilings surround by rocks and debris, containing historic bottles and iron debris mixed with sand and silt. It is immediately offshore of Fort Moultrie on Sullivan's Island. This site is approximately 250 m north east of the boundary of the Lower Harbor 1 survey area.

Site 38CH1269. Recorded by D. Beard in 1991 after it was reported by a citizen, this site is described as "Bob's Thing." It is a timber feature that consists of three timbers 24'3" long fastened to crosspieces 6'3" long by wooden dowels and iron drift pins. Age and function of the feature are unknown, but it was eroding out of the beach off the Fort Moultrie jetty and Station 12. Covered at high tide, it resembles a portion of cribbing or a trestle. No further work was conducted. The site is immediately landward of 38CH282, and more than 300 m from the boundary of survey area Lower Harbor 1.

Site 38CH880. Located immediately off the beach on the southwest corner of Sullivan's Island, this site incorporates the remains of blockade runners CSS STONO, MINHO, and PRINCE ALBERT, lost in the years 1861, 1862 and 1863 (Spirek 2012). Salvaged by H. Tower in 1988, artifacts included bullets, rifles, swords, percussion caps, fasteners, glass lenses, bottles, copper and lead sheathing, and ceramics of the mid-19th century. The three ships were subject to demolition by Army engineers after the war, and their remains are now in 5.7 m (20 feet) of water, approximately 350 m north east of the boundary of survey area Lower Harbor 1.

Site 38CH270. Remains of the USS PATAPSCO were demolished by Army Engineers after the war, and much of the superstructure was removed from the original location of sinking by subsequent salvage efforts. The current position was identified by underwater side scan sonar survey conducted by Spirek and Amer (2004:144-148), and further examined by Spirek (2012). The site is approximately 650 m south of the Lower Harbor 1 boundary area.

Implications of Historic Review and Previous Archaeological Work

After a review of historic maps and literature, and previous archaeological work in the Area of Possible Effect, it is possible to identify the types of cultural resources that may be present in the survey area. It is also clear that many of these resources may be obscured by sediment deposition, in secondary contexts, and buried so deeply that they cannot be identified by standard archaeological testing procedures (See Spirek 2012 for a discussion of efforts to locate known shipwrecks from the Civil War era beneath more than 6 m of sediment).

Wooden ships, barges, and boats; ironclads and iron-hulled ships; lead or copper alloy (Muntz) sheathing for wood hulls, wood cribbing and stone or brick infilling for landings and wharf structures, iron anchors, stone ballast piles, historic ceramics, glass sherds and bottles, and prehistoric ceramics and debitage are all reported in areas adjacent to the project area. Known shipwreck sites, mostly from the Civil War, but some from the period immediately after the Revolutionary War, are beyond the boundaries of the survey but offer examples of the types of sites that may exist within survey areas, especially where they approach the shoreline.

Terrestrial habitation and work sites, such as those on Daniel Island (38BK2285, 38BK1637-1640) and the pre-contact period prehistoric campsite 38CH1496, may contribute artifacts to the survey area through shoreline erosion, but it is unlikely that they would be represented as intact and coherent sites on the river bottoms of the project area.

5.5 Field and Analytical Methods

Field methods are presented in section 2 of this report, and copies of all raw data are included in the materials deposited with USACE. This section specifically details the analytical methods used to evaluate anomalies identified through the use of side scan sonar and magnetometer remote sensing equipment.

Following post-processing of magnetometer data, contour plots of each anomaly with an amplitude greater than 5 nT were created within ArcGIS and overlaid on charts of the survey areas. Where multiple measurements indicate a single source for magnetic anomalies, these were combined into a single reference number reflecting the greatest amplitude registered. The final reference numbers consisting of a survey area code and target number are used in this report; raw data includes anomaly designations identified by survey area code, Julian date, and a sequential number indicating the order of anomalies registered on that date.

All data are presented in digital materials with this report. Each designated magnetic anomaly was correlated with side scan sonar processed through the Klein SonarPro 12.1 program. Date, time, and location data were matched for all sites. Magnetic anomalies were investigated and analyzed according to spatial extent, shape (dipole, monopole, multi-component), duration, and intensity (distortion of the magnetic background as measured in nT). Side scan sonar signatures were analyzed by evaluating their strength of return, differentiation from background, relief above the bottom, shape, size, and spatial extent (total area of disturbance). No sub-bottom data related to cultural resources was collected.

Each target site was assessed within the context of past archaeological research into the composition of shipwreck sites, their appearance, and characteristics that may be reflected in remote sensing. Targets directly related to navigational aids such as channel markers were excluded. Although the magnetometer is the most commonly used instrument to identify historic ships in North America, there are no entirely satisfactory formulas that equate particular magnetic signatures with shipwrecks. The wide variety of watercraft that may be encountered, from wood-fastened and constructed small craft to ironclad ships of war loaded with guns, constrain the ability of archaeological research to predict which anomalies are likely to reflect submerged cultural remains.

In general, ships built of wood with metal fastenings and propelled by sails often produce long duration and low intensity signatures. The duration and intensity typically also reflects the depth, sediment cover, and dispersion of the wreck, and may be supplemented by some very localized and intense anomalies that reflect concentrations of, for example, metal weapons or rigging. Watts (1986) details past experience and research related to this question, pointing out that the discovery of an 85-foot-long vessel dating to the period of the American Revolutionary War produced only a low intensity (20 nT) anomaly that was confirmed as a shipwreck only after divers visited the site. The 48-foot-long wood-built Mepkin Abbey shipwreck from the Cooper River north of Charleston produced no reliably detectable signal (Watts 1986:13; Wilbanks 1981).

After 1850, more iron began to be used as internal structures, to protect ships of war (ironclads), and eventually to replace wood as the primary hull material along with the introduction of steam propulsion. The effect of this on magnetic detection is to increase the intensity and duration of magnetic signatures. Watts (1986:13) notes that the remains of monitors WEEHAWKEN (38CH272; Spirek and Amer 2004:153-156), PATAPSCO (38CH270), and KEOKUK (38CH271; Spirek and Amer 2004:149-152) in Charleston Harbor produced dipolar or multi-component effects in excess of 1000 nT (comparable to a buried pipeline or cable).

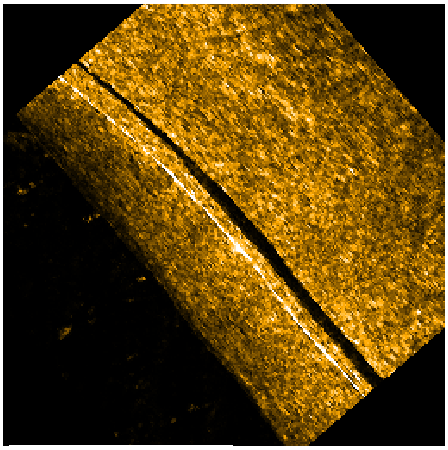
The very common harbor locations of modern vessels, cables, pipelines, and debris, along with major commercial structures such as terminals, mooring sites, channel markers, bridges, container ships, groins, and wharves can produce almost identical signatures, however. Another difficulty is that shipwreck sites tend to "collect" debris when material moving by physiographic means normal to the ocean (tides, currents) is trapped within the more complex structure of a shipwreck as compared to a smooth harbor bottom. Ground truthing by diving archaeologists often is required to ascertain the composition and characteristics of many sites, even after examining both side scan sonar and magnetic data.

Examination of side scan sonar records can, however, remove many modern targets from the catalog of culturally significant anomalies. Tires, pipes, pipelines, cables, anchors, buoy sinks and chains, navigational aids, crab pots, and other marine debris all produce relatively hard returns and are identifiable through sonograms that correspond with the time and physical location of magnetic anomalies. Examples of these types of anomalies are included to provide a baseline for future work in the region (figure 38).

As Watts (1986:15) noted, the long and complex use of Charleston Harbor makes it difficult to eliminate any target signatures without careful analysis. Traffic in the harbor reflected its position as a major colonial harbor, a key port in the Revolutionary War, a dominant port for the nascent United States, and the location of a major part of the U.S. government's blockading fleet and navy during the Civil War. In a 1995 report to USACE, Watts (1995:52) comments further, suggesting that extensive dredging in the region since the later 1800s, the use of traditional navigation channels throughout the next century, and the regular removal of obstructions to navigation makes the potential for discovering significant submerged cultural resources marginal.

Over the past three decades, remote sensing and positioning equipment has become more and more refined, providing more accurate and detailed data and images to be used in reconnaissance surveys for cultural resources. At the same time, the intensity of commercial use in these areas, and patterns of maintenance, dredging, and the establishment of navigational aids create conditions that may be of concern in protecting cultural resources. Krivor and Tuttle (2000:51) address this question specifically and point out that survey results from approaches to the New York Harbor and from the Mobile, Matagorda and Galveston Bays produce a large number of magnetic anomalies that are predominantly modern debris such as dredge pipe (Tuttle and James 1996) or discarded steel cable (Irion 1986; Mistovich and Knight 1983; Pearson and Hudson 1990;

Rogers et al. 1990). Historic ships certainly exist in all these areas, but they are extremely difficult to identify when such a large volume of modern debris and materials is present. Charleston Harbor is no exception, and the heavy volume of extremely fine-grained sediments further obscures potentially significant targets such as CHR/1, remains of a Civil War shipwreck inadvertently relocated by a bucket dredge (Watts 1986, Krivor and Tuttle 2000).



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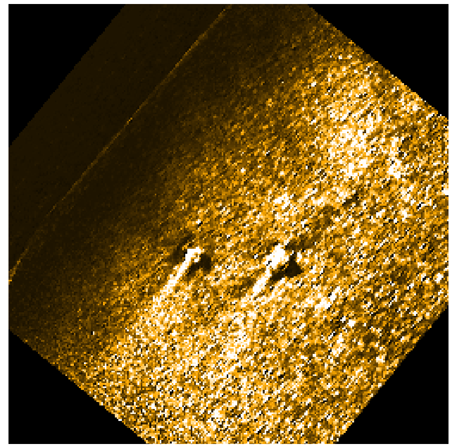
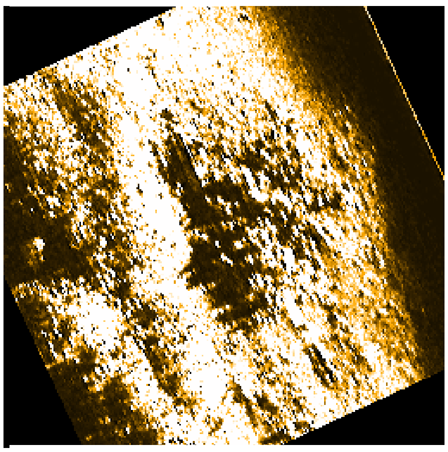
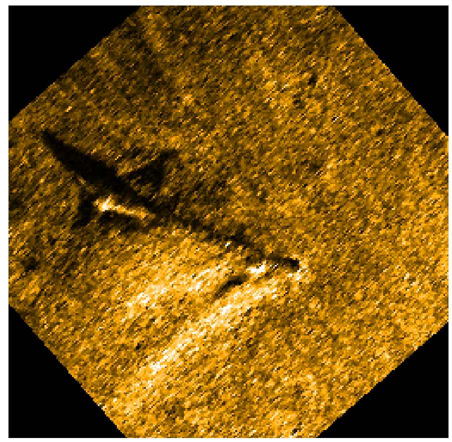


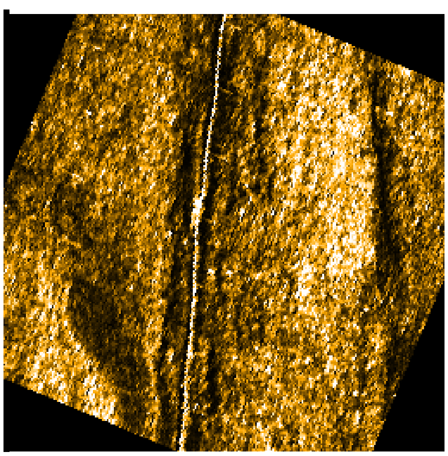
crab pot: LH4-010 278-101



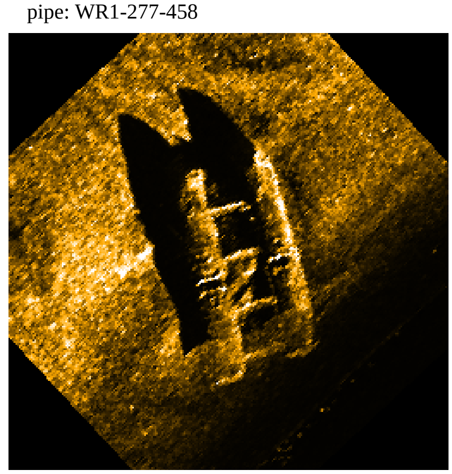
rocks: MB1-285-1098



pipe: WR1-277-458



pipeline: WR1-278-814



pontoon: WR1-278-15

Figure 38. Moderns Examples of sonograms illustrating modern crab pots, pipes, cable, pipeline, rocks from the end of a groin, and a pontoon.

5.6 Analysis and Results

In this section, sites are described and analyzed for cultural significance. Sites in each survey area are presented in individual tables which summarize position and magnetic and sonar target characteristics. The identification of sites as cables, pipelines, buoy sinkers, chain, channel markers, crab pots, and pilings is based on an analysis of the characterization and shape of magnetic anomalies and the review of side scan sonar data at high resolution. Where they may be identified as likely sources of contemporaneous magnetic anomalies, targets are examined and identified on the basis of their shape, the presence of "hard" returns in acoustic data, and dimensions. Some anomalies reflect a dispersed pattern of objects on the harbor bottom, most of which are small and unidentifiable; the dispersed pattern is referred to as a scatter. Single point sources are included in the overall analysis as target sites, but do not require further inspection as they are unlikely to be associated with potentially significant cultural resources. Channel markers and other navigational aids, terminals, and shore features such as groins are not included, but may be referred to as the source of materials identified on the harbor bottom.

Lower Harbor 1 (LH1)

LH1 was surveyed on 8 and 10 October 2012. Much of the survey on 10 October was in rough waters, resulting in a number of anomalies registered for turbulence and noise and subsequently removed (figure 39). A total of 18 individual sites were identified for this survey section and are described below, including recommendations. Table 3 provides specific details of each target. Sonograms show modern features of an industrial harbor such as concrete blocks on the bottom, buoy sinkers, and crab traps. Ship traffic, jetties, piers, sewage and other pipelines, and movement of large vessels (container ships) through the adjacent channel create significant potential for masking magnetic signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged.

Two anomalies in this region would benefit from further inspection by diving archaeologists. Anomaly LH1-001 is measurable over a distance of approximately 95 m (312 ft), and although nothing is visible on the harbor bottom in sonograms of the area, the size of the anomaly suggests a large disturbance that may be buried cultural resources of potential historic or archaeological significance. Sonogram images suggest that anomaly LH1-009 (figure 39, 40) may include culturally significant material, and further inspection is highly recommended for this location as it occurs within an area of repeated Civil War engagements and loss of vessels.

Table 3. Characteristics of Lower Harbor 1 (LH1) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
LH1-001	513.68	2339852.4	345011.1	0:00:21	14.85	11.32	Dipolar	buried pipes	Further inspection recommended
LH1-002	23.62	2341012.5	344317.6	0:00:05	12.86	10.11	Dipolar	isolated debris	No further work
LH1-003	52.07	2341437.0	344285.8	0:00:02	4.47	2.01	Dipolar	none	No further work
LH1-004	62.05	2342060.8	343732.2	0:00:08	8.25	5.22	Dipolar	pipe, buoy sink, debris	No further work
LH1-005	42.11	2342491.2	343434.9	0:00:04	8.47	5.49	Negative monopolar	debris	No further work
LH1-006	10.64	2342901.6	343290.1	0:00:01	7.96	4.46	Positive monopolar	cable	No further work
LH1-007	61.91	2343353.5	342720.2	0:00:12	13.36	10.38	Negative monopolar	debris	No further work
LH1-008	140.80	2344436.1	342098.8	0:00:11	13.56	10.69	Dipolar	posts, debris	No further work
LH1-009	76.59	2344643.2	341704.5	0:00:08	15.79	12.64	Dipolar	50 x 17 m debris scatter	**Visual inspection**
LH1-010	29.38	2345313.4	341417.0	0:00:05	14.10	10.99	Dipolar	none	No further work
LH1-011	11.41	2345953.7	340769.1	0:00:03	15.33	12.07	Positive monopolar	debris	No further work
LH1-012	19.23	2346997.8	340031.0	0:00:04	14.81	11.55	Dipolar	debris	No further work
LH1-013	15.33	2347453.8	339934.1	0:00:03	12.72	9.74	Negative monopolar	debris	No further work
LH1-014	6.42	2348540.2	339262.0	0:00:01	17.11	13.60	Positive monopolar	debris	No further work
LH1-015	11.24	2349543.7	338305.2	0:00:01	18.32	15.97	Negative monopolar	isolated debris	No further work
LH1-016	6.71	2350138.1	337649.6	0:00:01	15.88	13.48	Positive monopolar	isolated debris	No further work
LH1-017	7.12	2350390.2	337375.8	0:00:01	20.97	18.58	Positive monopolar	debris	No further work

Table 3 continued

LH1-018	299.43	2351601.7	335966.6	0:00:03	10.19	4.81	Dipolar	scattered rock	No further work

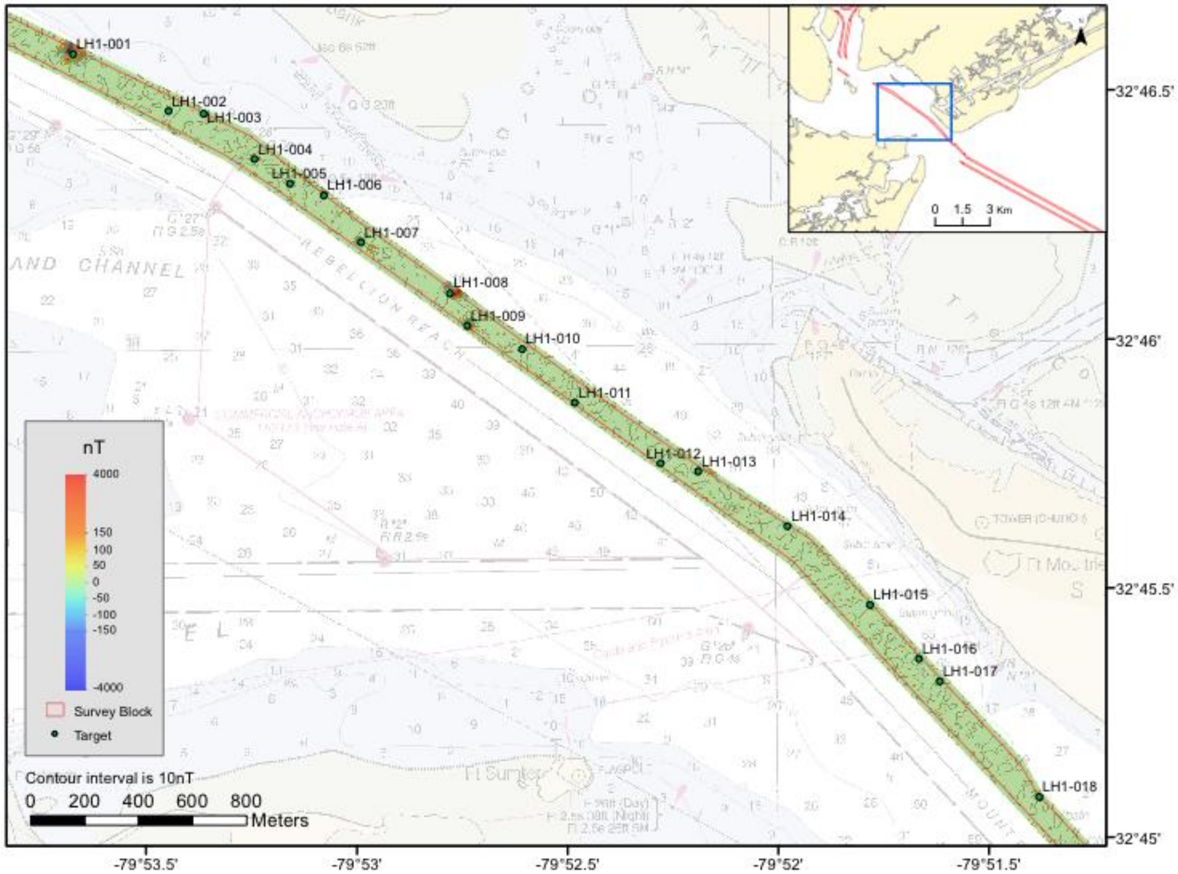
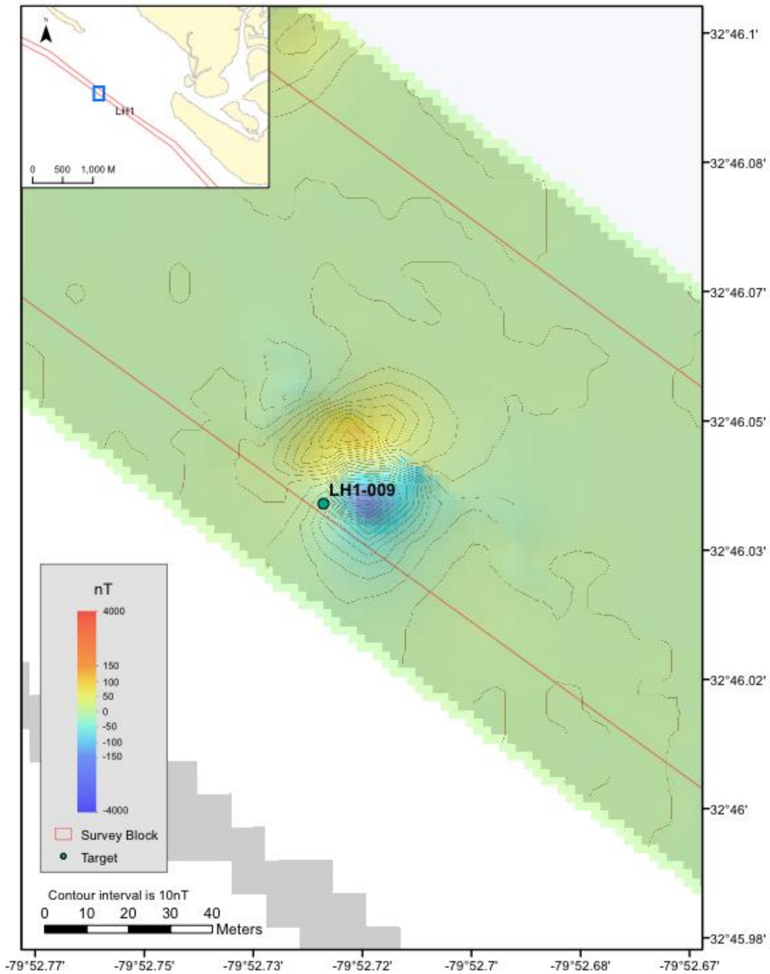


Figure 39. Magnetic anomaly color contour map of LH1.



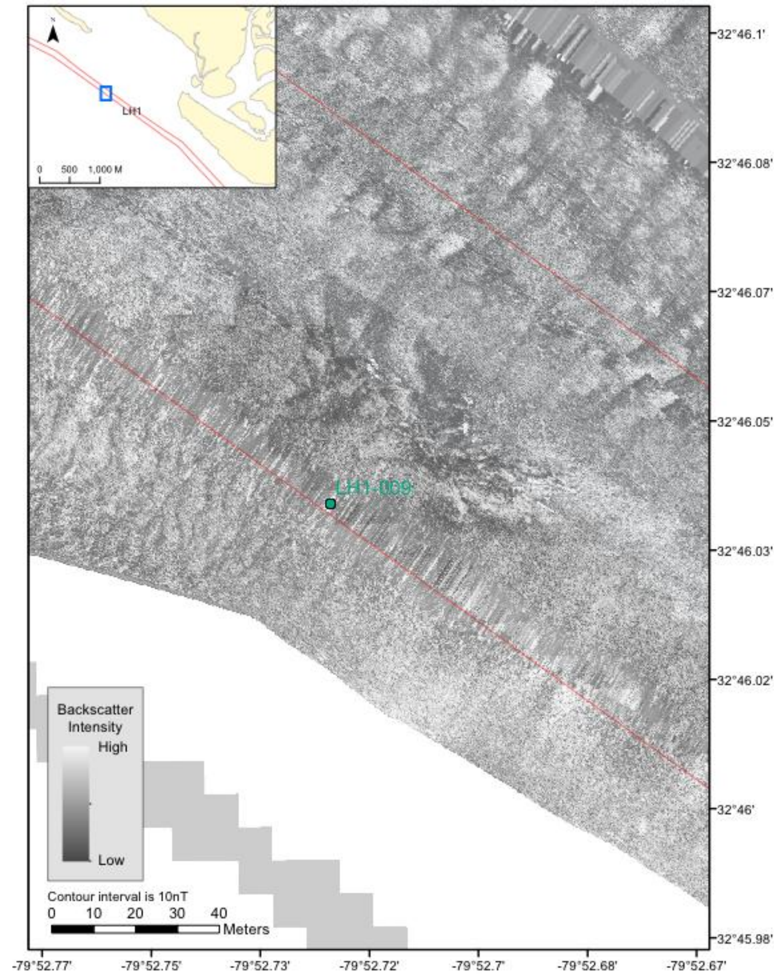


Figure 40. Magnetic (L) and side scan sonar (R) signatures of target LH1-009 in the lower harbor area. Visual inspection of this target is recommended.

LH1-001 is a dipolar magnetic anomaly of 513.68 nT and 21 seconds duration near the northern end of the survey area. It is detectable over a distance of approximately 95 m (312 ft). A sonogram of the harbor bottom shows small dispersed objects unlikely to generate a signal of this amplitude (figure 41). The anomaly was recorded on three survey lines and is a significant magnetic distortion. Because this is a part of the harbor known to be the site of Civil War naval engagements and the demolition or disposal of shipwrecks from that era, it is a high priority to further investigate this anomaly if it is in an area that will be impacted by primary or secondary dredging activities.

LH1-002 is a dipolar magnetic anomaly of 23.62 nT and 5 seconds duration that coincides with a sonogram image of an isolated piece of small debris providing a hard return on the sea bottom. The debris is less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-003 is a dipolar magnetic anomaly of 52.07 nT and 2 seconds duration that sonogram records do not link with a specific identified feature. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-004 is a dipolar magnetic anomaly of 52.05 nT and 8 seconds duration that sonogram records do not link with a specific identified feature. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-005 is a negative monopolar magnetic anomaly of 42.11 nT and 4 seconds duration that coincides with a sonogram image of an isolated piece of small debris providing a hard return on the sea bottom. The debris is less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-006 is a positive monopolar magnetic anomaly of 10.64 nT and 1 second duration that coincides with a sonogram image of an isolated piece of cable providing a hard return on the sea bottom. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-007 is a negative monopolar magnetic anomaly of 42.11 nT and 4 seconds duration that coincides with a sonogram image of an isolated piece of small debris providing a hard return on the sea bottom. The debris is less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-008 (figure 42) is a dipolar magnetic anomaly of 140.80 nT and 11 seconds duration that coincides with what appears to be an upright post or piling at least 1.2 m tall on the sea bottom in sonogram records. In addition, sonogram records indicate small debris less than 1 m in any dimension in this location. No additional evidence of submerged cultural material was found in the anomaly area.

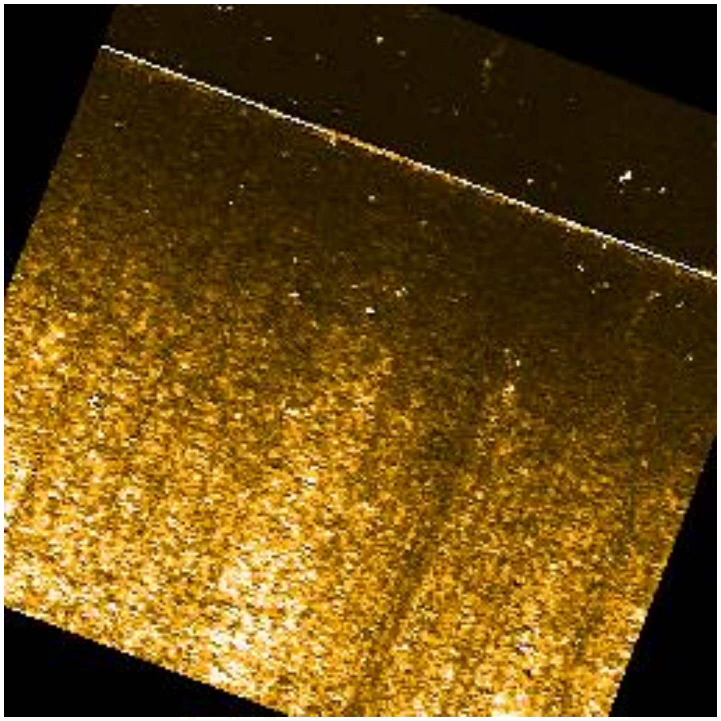
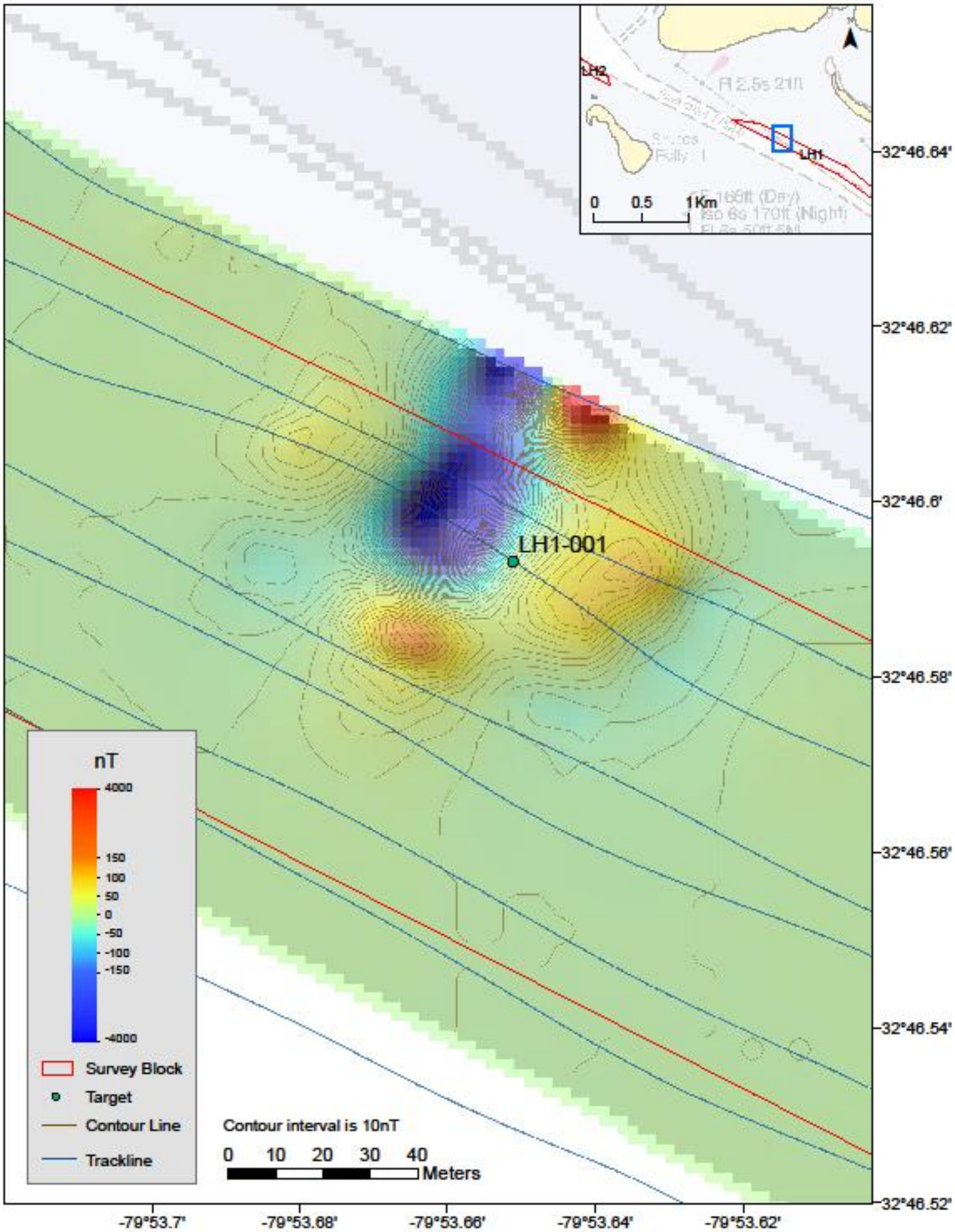


Figure 41. Anomaly LH1-001 sonogram showing buried pipes (top). Anomaly LH1-001 magnetic contour map (next page).



LH1-001
LH1
LH2
nT
4000
150
100
50
0
-50
-100
-150
-4000
Survey Block
Target
Contour Line
Trackline
Contour interval is 10nT
0 10 20 30 40
Meters
0 0.5 1 Km
32°46.64'
32°46.62'
32°46.6'
32°46.58'
32°46.56'
32°46.54'
32°46.52'
-79°53.7'
-79°53.68'
-79°53.66'
-79°53.64'
-79°53.62'

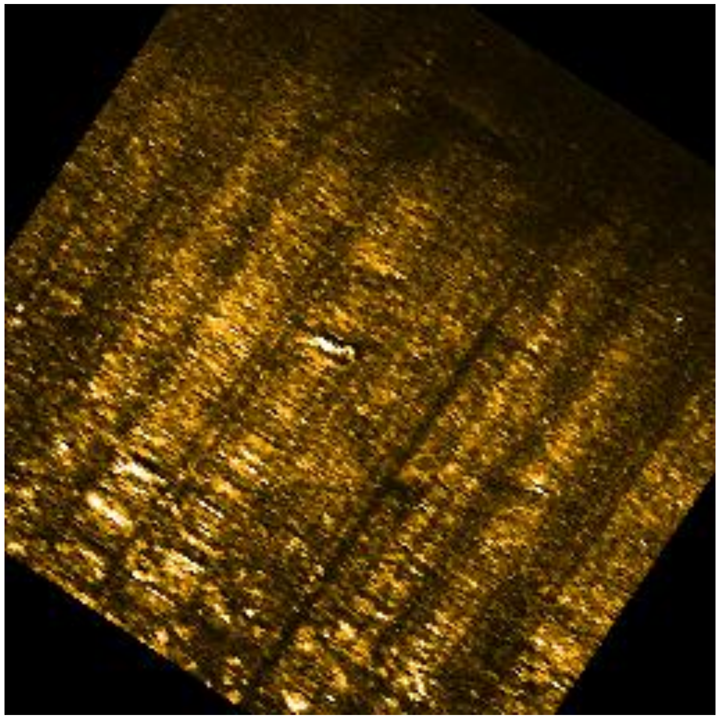
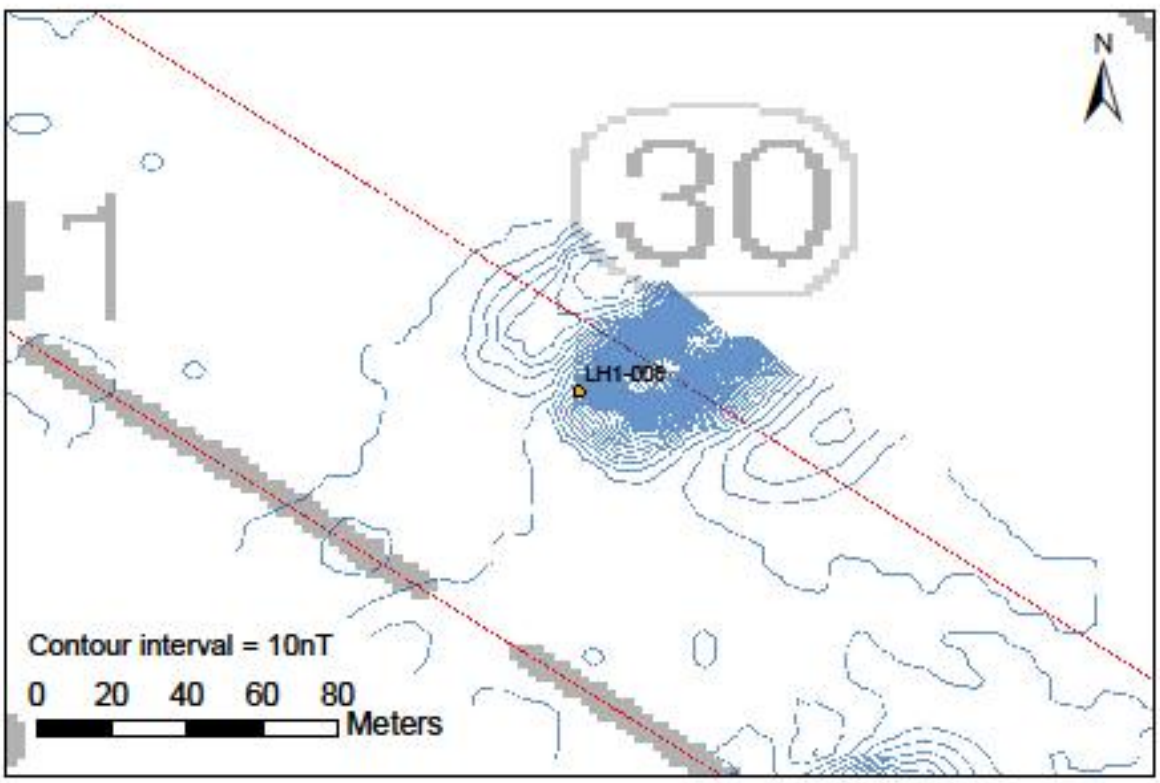


Figure 42. Anomaly LH1-008 sonogram showing posts and debris (top). Anomaly LH1-008 magnetic contour map (bottom).



LH1-009 is a dipolar magnetic anomaly of 76.59 nT and 8 seconds duration that coincides with a 50 m long, 17 m wide, and .6 to 1.0 m high mound on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area. **Further inspection is strongly recommended** as there are few areas in the survey that show any accumulation of sediment, and sonogram images show this site traps sediment and also includes multiple sources of origin for materials on the site, including wood and metal. The site is located in a part of the harbor that saw naval engagements in the Revolutionary War and the Civil War.

LH1-010 is a dipolar magnetic anomaly of 29.38 nT and 5 seconds duration that coincides with no specific identified feature in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-011 is a positive monopolar magnetic anomaly of 11.41 nT and 3 seconds duration that coincides with a piece of small debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-012 is a dipolar magnetic anomaly of 19.23 nT and 4 seconds duration that coincides with a piece of small debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-013 is a negative monopolar magnetic anomaly of 15.33 nT and 3 seconds duration that coincides with a piece of small debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-014 is a positive monopolar magnetic anomaly of 6.42 nT and 1 second duration that coincides with a piece of debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-015 is a negative monopolar magnetic anomaly of 11.41 nT and 3 seconds duration that coincides with a piece of isolated debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-016 is a positive monopolar magnetic anomaly of 6.71 nT and 1 second duration that coincides with a piece of isolated debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-017 is a positive monopolar magnetic anomaly of 7.12 nT and 1 second duration that coincides with a piece of debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH1-018 (figure 43) is a dipolar magnetic anomaly of 6.42 nT and 1 second duration that coincides with an area of scattered rock on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

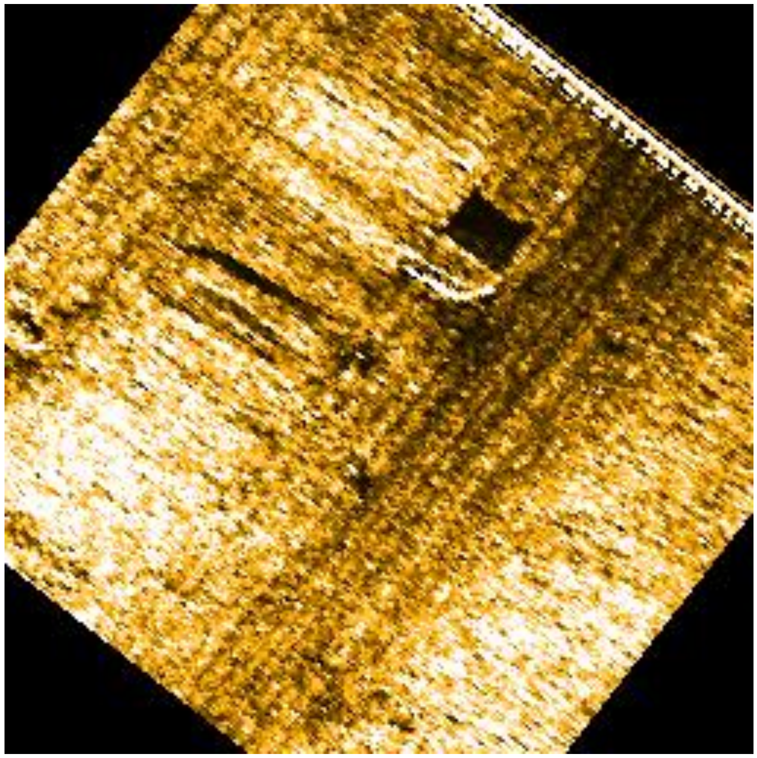
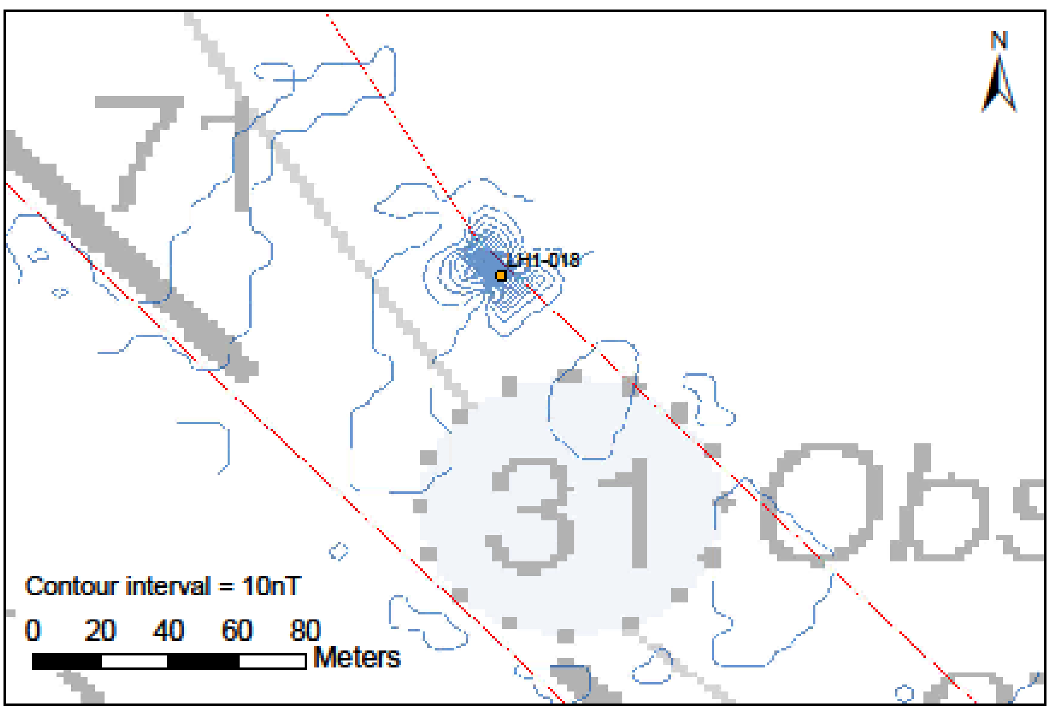


Figure 43. Anomaly LH1-018 sonogram showing scattered rock (top). Anomaly LH1-018 magnetic contour map (bottom).



Lower Harbor 2 (LH2)

LH2 Two individual anomalies were identified for this survey section and are described below, including recommendations. Table 4 and figure 44 provide specific details of each target. This small, wedge-shaped survey area is adjacent to pipelines and erosion control measures. There are no indications of historic or culturally significant materials in this survey area.

Table 4. Characteristics of Lower Harbor 2 (LH2) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
LH2-001	1362.73	2332066.8	348246.9	0:00:12	12.97	9.99	Dipolar	pipes	No further work
LH2-002	242.12	2333257.9	347204.2	0:00:02	12.22	9.27	Dipolar	channel marker	No further work

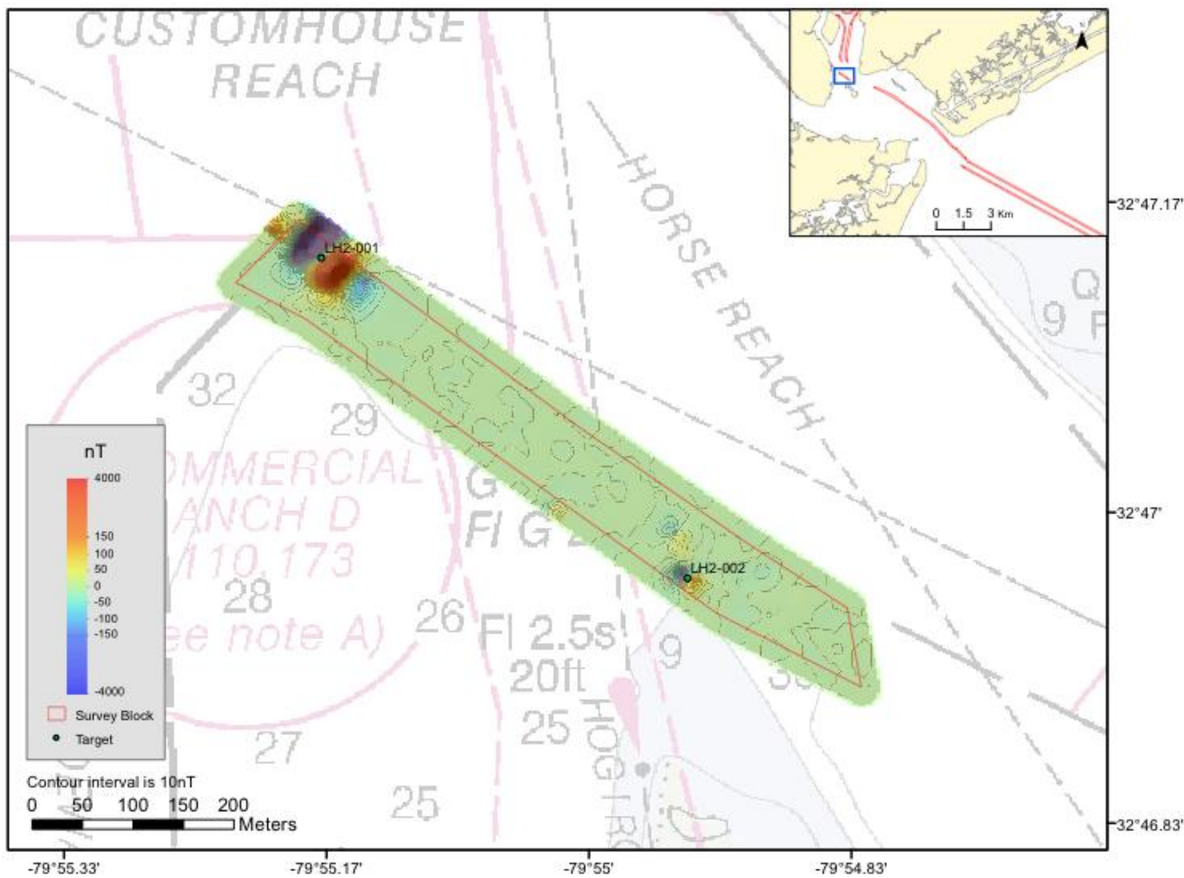


Figure 44. Magnetic anomaly color contour map of LH2.

LH2-001 is a dipolar magnetic anomaly of 1362.73 nT and 12 seconds duration. This magnetic anomaly identifies the location of buried pipelines. No further work is recommended. No additional evidence of submerged cultural material was found in the anomaly area.

LH2-002 is positive monopolar magnetic anomaly of 242.12 nT and 2 seconds duration that coincides with a channel marker. No additional evidence of submerged cultural material was found in the anomaly area.

Lower Harbor 4 (LH4)

A total of 16 individual sites were identified for this survey section and each is described below, including recommendations. Table 5 and figure 45 provide specific details of each target. Sonograms show modern features of an industrial harbor such as concrete blocks on the bottom, buoy sinkers, and crab traps. Ship traffic, jetties, piers, sewage and other pipelines, docks, moving vessels and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged. In addition, the submerged remains of the demolished Grace Memorial Bridge and the existing Ravenel bridge create significant magnetic disturbance for more than 500 m on either side of the bridge.

Table 5. Characteristics of Lower Harbor 4 (LH4) magnetic anomalies.

Anomaly	**Amplitude (nT)**	**x coords**	**y cords**	**Duration**	**Depth (m)**	**Altitude (m)**	**Shape**	Identification	**Recommendation**
LH4-001	484.96	2332002.2	358244.4	00:00:06	3.32	1.57	Dipolar	pipe, 4 m	No further work
LH4-002	15.45	2332234.4	358079.4	00:00:05	7.41	5.43	Dipolar	debris	No further work
LH4-003	328.62	2332764.9	356706.0	00:00:05	11.95	8.92	Dipolar	pipes/poles	No further work
LH4-004	11.62	2332799.8	355724.1	00:00:03	11.36	8.46	Negative monopolar	debris	No further work
LH4-005	7.04	2332879.3	355470.2	00:00:01	10.84	9.22	Positive monopolar	buoy sink	No further work
LH4-006	488.52	2332818.5	355113.0	00:00:11	10.63	9.09	Dipolar	40 x 22 x 1 m bottom deposit	Check with DNR
LH4-007	377.68	2332407.0	353325.9	00:00:10	9.77	6.90	Dipolar	long cable (70+m)	No further work
LH4-008	10.45	2332380.2	352656.2	00:00:02	9.99	8.20	Negative monopolar	isolated debris	No further work
LH4-009	39.56	2332221.5	352552.6	00:00:02	8.70	4.83	Dipolar	wire/cable	No further work
LH4-010	19.34	2332137.6	352053.3	00:00:03	9.55	5.60	Dipolar	crab pots (6+)	No further work
LH4-011	6.45	2332317.7	351880.6	00:00:01	12.98	11.08	Negative monopolar	small scattered debris	No further work
LH4-012	171.72	2332241.8	351203.0	00:00:15	15.38	12.51	Dipolar	buoy sink and float	No further work
LH4-013	46.65	2331948.3	351058.1	00:00:07	13.32	10.34	Negative monopolar	buoy sink, debris	No further work
LH4-014	17.30	2332062.4	351022.9	00:00:02	12.34	9.23	Positive monopolar	debris	No further work

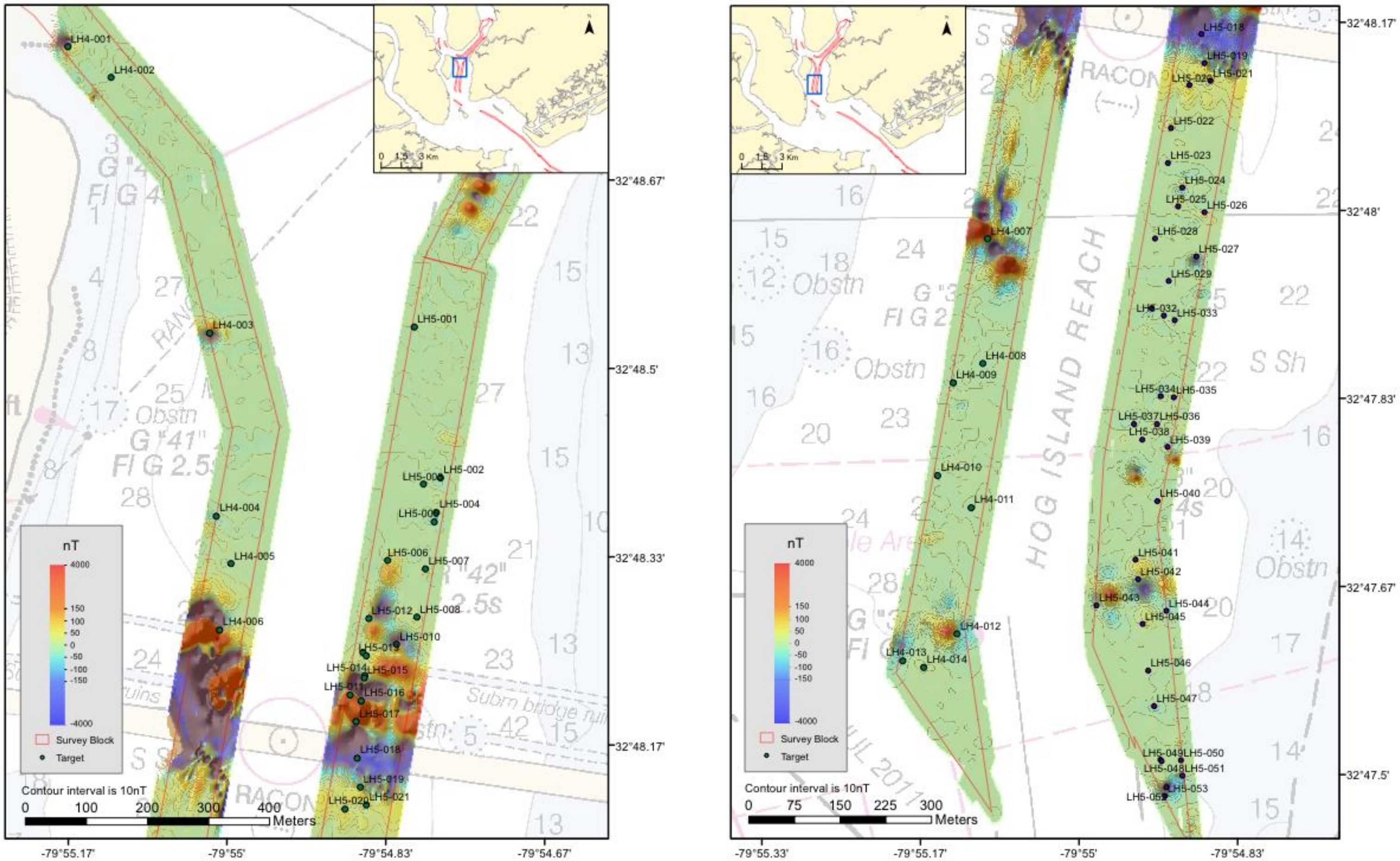


Figure 45. Magnetic anomaly color contour maps of LH4 and LH5.

LH4-001 is a dipolar magnetic anomaly of 484.96 nT and 6 seconds duration that coincides with a c. 4 m long length of pipe on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-002 is a dipolar magnetic anomaly of 15.45 nT and 5 seconds duration that coincides with a piece of isolated debris on the sea bottom in sonogram records. It is less than .8 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-003 is a dipolar magnetic anomaly of 328.62 nT and 5 seconds duration that coincides with an aggregation of pipes or poles visible in sonogram records on the harbor bottom. An 'A-frame' measuring 8 x 14 m is visible in the aggregation and may be part of a net spreader. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-004 is a negative monopolar magnetic anomaly of 11.62 nT and 3 seconds duration that coincides with a piece of isolated debris less than 1 m in any dimension on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-005 is a positive monopolar magnetic anomaly of 7.04 nT and 1 second duration that coincides with a 0.5 m buoy sink on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-006 (figure 46) is a dipolar magnetic anomaly of 488.52 nT and 11 seconds duration that coincides with a 40 x 22 x 1 m mound on the sea bottom in sonogram records. A diamond pattern and rings visible on portions and edges of the surface suggest that this is likely a commercial fishing net. No additional evidence of submerged cultural material was found in the anomaly area. The size of the deposit and its potential to trap further debris and affect local habitat and vessel traffic suggest its presence should be reported to the Department of Natural Resources.

LH4-007 is a dipolar magnetic anomaly of 377.68 nT and 10 seconds duration that coincides with cable running parallel to the vessel track for over 70 m on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-008 is a negative monopolar magnetic anomaly of 10.45 nT and 2 seconds duration that coincides with a 0.5 m long isolated object providing a hard return in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

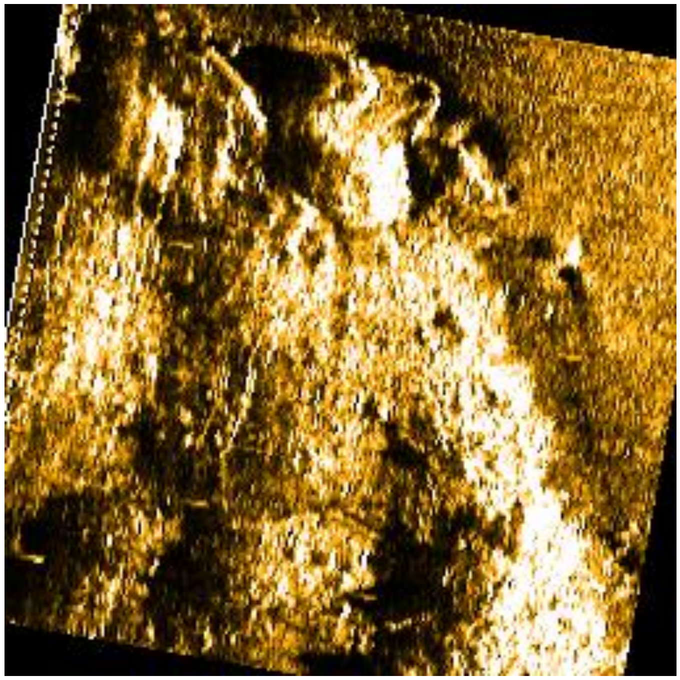
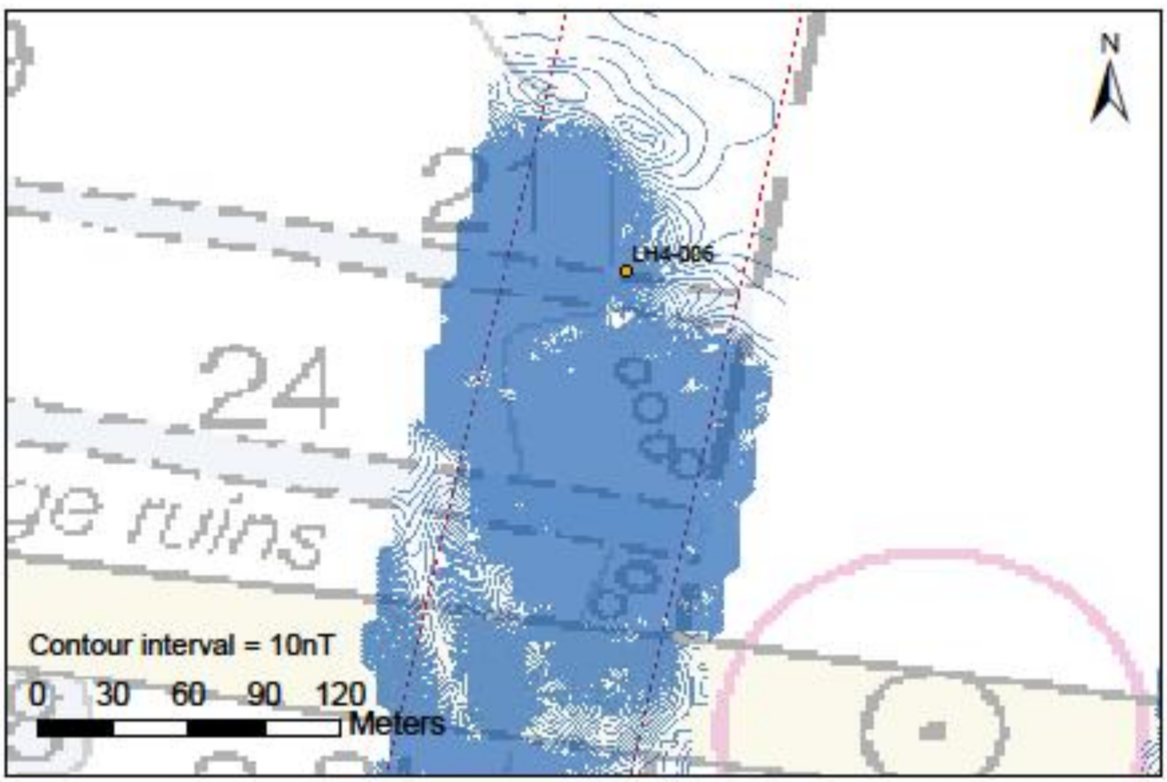


Figure 46. Anomaly LH4-006 sonogram showing bottom deposit (top). Anomaly LH4-006 magnetic contour map (bottom).



LH4-009 is a dipolar magnetic anomaly of 39.56 nT and 2 seconds duration that coincides with wire or cable on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-010 is a dipolar magnetic anomaly of 19.34 nT and 3 seconds duration that coincides with six crab pots. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-011 (figure 47) is a negative monopolar magnetic anomaly of 6.45 nT and 1 second duration that coincides with a small scatter of debris on the sea bottom in sonogram records. All materials are less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-012 is a dipolar magnetic anomaly of 171.72 nT and 15 seconds duration that coincides with a buoy sink, chain and float on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-013 is a negative monopolar magnetic anomaly of 46.65 nT and 7 seconds duration that coincides with a buoy sink and small scatter of debris on the sea bottom in sonogram records. All materials are less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH4-014 is a positive monopolar magnetic anomaly of 17.30 nT and 2 seconds duration that coincides with a piece of isolated debris on the sea bottom in sonogram records that measures less than 1 m in all dimensions. No additional evidence of submerged cultural material was found in the anomaly area

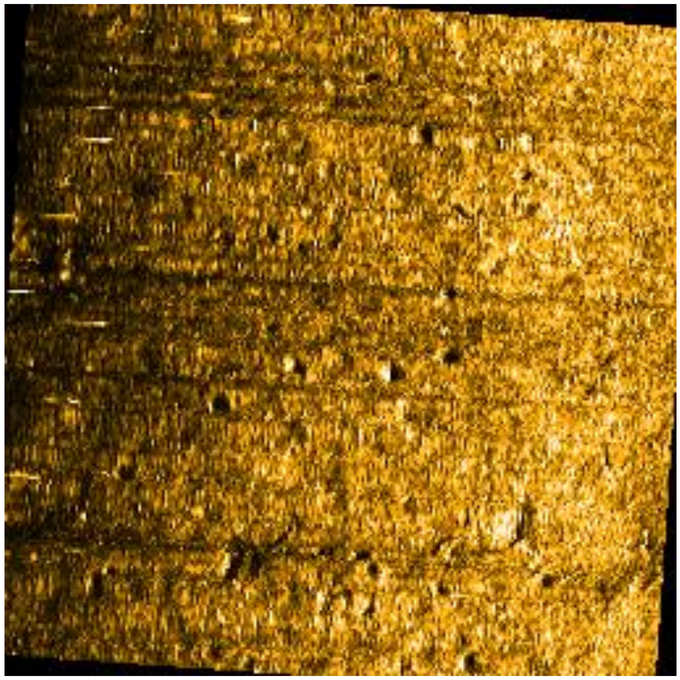
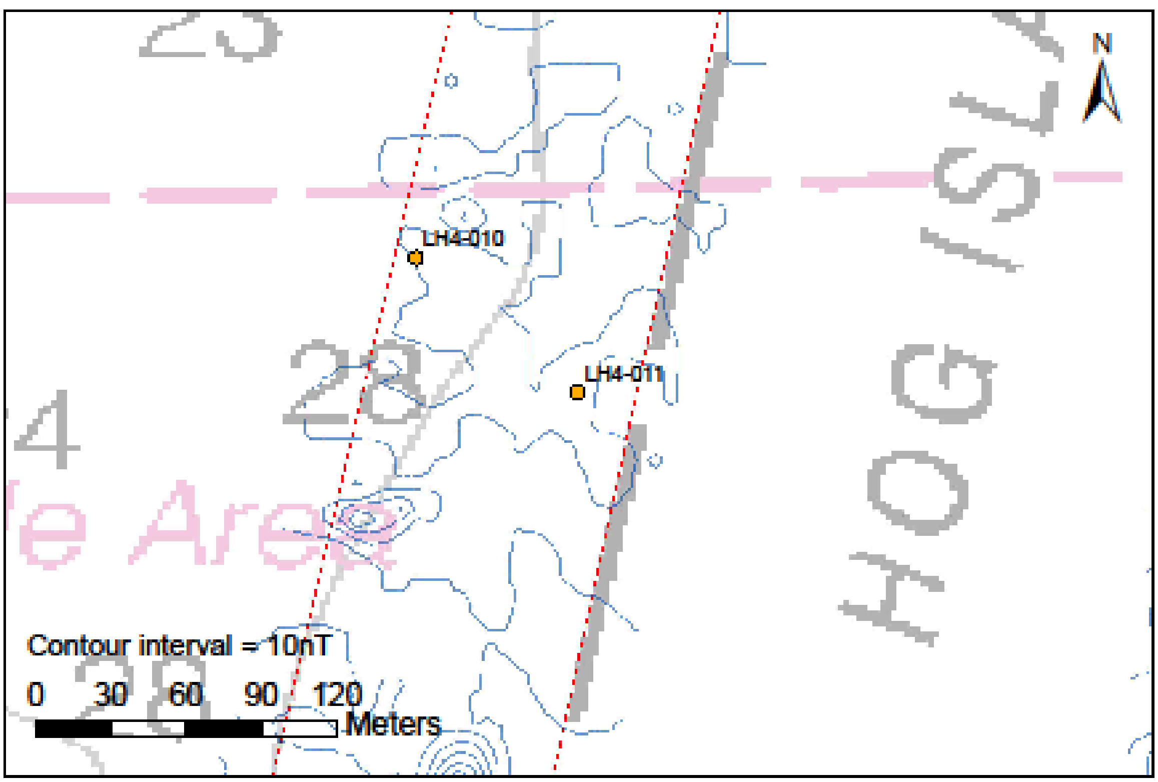


Figure 47. Anomaly LH4-011 sonogram showing small scattered debris (top). Anomaly LH4-011 magnetic contour map (bottom).



Lower Harbor 5 (LH5)

Sonograms show modern features of an industrial harbor such as concrete blocks on the bottom, buoy sinkers, and crab traps. Ship traffic, jetties, piers, sewage and other pipelines, docks, moving vessels and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged. In addition, the submerged remains of the destroyed Grace Memorial bridge and the existing Ravenel bridge create significant magnetic disturbance for more than 500 m on either side of the bridge.

A total of 53 individual sites were identified for this survey section and each is described below, including recommendations. Table 6 and figure 45 provide specific details of each target. LH5-013 (figure 48) is a group of timbers that appear to be fastened together; it is located in an area of debris related to bridge construction and dismantling, but it is possible that the timbers could represent historic or archaeologically significant materials. Further examination is highly recommended.

Table 6. Characteristics of Lower Harbor 5 (LH5) magnetic anomalies.

Anomaly	Amplitude (nT)	x cords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
LH5-001	16.29	2333864.5	356739.4	0:00:05	15.93	12.07	Dipolar	isolated debris	No further work
LH5-002	19.43	2334005.2	355929.5	0:00:05	11.04	7.45	Negative monopolar	isolated debris	No further work
LH5-003	7.20	2333913.4	355895.8	0:00:01	11.88	8.90	Positive monopolar	Logs	No further work
LH5-004	52.04	2333982.6	355743.8	0:00:09	10.87	7.33	Dipolar	Debris	No further work
LH5-005	43.71	2333970.8	355692.7	0:00:07	10.94	7.24	Negative monopolar	Debris	No further work
LH5-006	115.16	2333721.0	355486.3	0:00:24	13.45	10.47	Positive monopolar	Pipe	No further work
LH5-007	13.45	2333924.3	355441.2	0:00:03	10.59	7.01	Positive monopolar	cable/pipe frag.	No further work
LH5-008	21.07	2333877.8	355182.3	0:00:01	10.17	6.75	Positive monopolar	crab pots; scattered debris	No further work
LH5-009	30.54	2333587.9	354993.7	0:00:02	13.60	10.06	Positive monopolar	bridge debris	No further work
LH5-010	425.73	2333768.8	355035.7	0:00:07	10.97	7.99	Dipolar	bridge debris	No further work
LH5-011	2520.91	2333519.7	354763.8	0:00:13	19.02	15.35	Dipolar	tires, modern debris	No further work
LH5-012	5.78	2333619.8	355176.0	0:00:01	13.87	10.21	Positive monopolar	debris; tire	No further work
LH5-013	17.31	2333606.5	354975.8	0:00:02	13.25	10.22	Positive monopolar	possible timbers 17.5 x 7 m	**Visual inspection**
LH5-014	18.50	2333598.4	354870.2	0:00:01	13.26	10.12	Negative monopolar	isolated block	No further work
LH5-015	22.25	2333595.5	354855.6	0:00:01	13.17	10.06	Negative monopolar	tires; isolated debris	No further work
LH5-016	4113.16	2333578.4	354731.7	0:00:20	20.03	17.00	Dipolar	submerged bridge remains + cables	No further work

Table 6 continued

LH5-017	3822.16	2333551.9	354622.3	0:00:23	13.70	10.80	Dipolar	submerged bridge remains + cables	No further work
LH5-018	731.71	2333557.0	354425.8	0:00:30	12.12	9.14	Negative monopolar	bridge debris	No further work
LH5-019	82.46	2333574.0	354269.6	0:00:11	11.78	8.80	Dipolar	bridge debris	No further work
LH5-020	57.68	2333492.3	354152.3	0:00:05	11.20	8.34	Positive monopolar	barricade/piling segment	No further work
LH5-021	54.28	2333605.7	354175.3	0:00:06	11.31	8.41	Positive monopolar	barricade/piling segment	No further work
LH5-022	33.15	2333393.3	353922.0	0:00:06	13.68	9.78	Positive monopolar	concrete pipe	No further work
LH5-023	5.85	2333376.9	353732.7	0:00:01	12.75	8.85	Negative monopolar	wire	No further work
LH5-024	56.66	2333455.0	353602.5	0:00:07	10.44	6.97	Dipolar	scattered debris	No further work
LH5-025	25.36	2333431.5	353500.4	0:00:05	10.22	6.63	Positive monopolar	isolated debris	No further work
LH5-026	33.88	2333573.2	353469.1	0:00:05	9.81	6.19	Dipolar	isolated block	No further work
LH5-027	161.54	2333529.6	353232.2	0:00:09	9.41	5.94	Dipolar	cable	No further work
LH5-028	7.07	2333307.4	353328.1	0:00:02	12.34	8.40	Positive monopolar	isolated debris	No further work
LH5-029	7.58	2333380.4	353099.6	0:00:01	9.74	6.32	Negative monopolar	isolated debris	No further work
LH5-030	5.61	2333289.8	352953.1	0:00:01	10.18	7.15	Negative monopolar	crab pot	No further work
LH5-031	36.96	2333278.0	352902.1	0:00:04	10.23	7.20	Dipolar	none	No further work
LH5-032	5.39	2333354.7	352913.8	0:00:01	9.83	6.52	Negative monopolar	debris (2 pcs)	No further work
LH5-033	26.43	2333413.4	352889.0	0:00:05	9.64	6.61	Dipolar	debris	No further work
LH5-034	35.40	2333337.8	352480.7	0:00:08	9.80	6.85	Dipolar	scattered debris	No further work
LH5-035	23.41	2333408.5	352474.1	0:00:04	9.07	5.60	Positive monopolar	isolated modern debris	No further work
LH5-036	31.20	2333317.8	352331.3	0:00:05	9.56	6.58	Dipolar	isolated debris	No further work

Table 6 Continued

LH5-037	10.89	2333194.9	352330.0	0:00:02	10.15	7.20	Negative monopolar	cable fragments	No further work
LH5-038	6.65	2333238.8	352246.8	0:00:01	9.83	6.41	Positive monopolar	isolated debris	No further work
LH5-039	40.92	2333374.4	352208.2	0:00:03	9.18	5.76	Dipolar	none	No further work
LH5-040	13.22	2333319.1	351916.5	0:00:04	8.57	4.99	Dipolar	cable	No further work
LH5-041	44.01	2333202.5	351602.4	0:00:08	9.75	6.33	Positive monopolar	isolated	No further work
LH5-042	162.88	2333215.9	351497.0	0:00:13	9.75	6.22	Dipolar	modern debris	No further work
LH5-043	55.42	2332993.1	351356.4	0:00:13	14.43	11.32	Negative monopolar	post	No further work
LH5-044	25.58	2333368.3	351327.6	0:00:03	8.26	4.75	Negative monopolar	debris	No further work
LH5-045	22.65	2333240.0	351257.2	0:00:02	9.71	6.17	Positive monopolar	fragment of cable or pipe	No further work
LH5-046	6.46	2333270.3	351006.4	0:00:01	9.51	5.76	Positive monopolar	crab pot	No further work
LH5-047	34.80	2333303.0	350813.9	0:00:05	8.99	6.04	Negative monopolar	isolated debris	No further work
LH5-048	6.97	2333336.8	350526.9	0:00:02	8.16	4.57	Positive monopolar	crab pot	No further work
LH5-049	6.12	2333343.0	350519.7	0:00:01	8.19	4.94	Positive monopolar	tire	No further work
LH5-050	10.21	2333447.4	350524.4	0:00:01	7.35	4.04	Positive monopolar	debris	No further work
LH5-051	100.26	2333454.4	350440.8	0:00:05	7.35	3.92	Dipolar	isolated debris	No further work
LH5-052	223.76	2333369.1	350378.0	0:00:02	8.04	4.54	Negative monopolar	isolated debris	No further work
LH5-053	151.32	2333360.3	350330.6	0:00:14	8.33	5.19	Negative monopolar	isolated debris	No further work

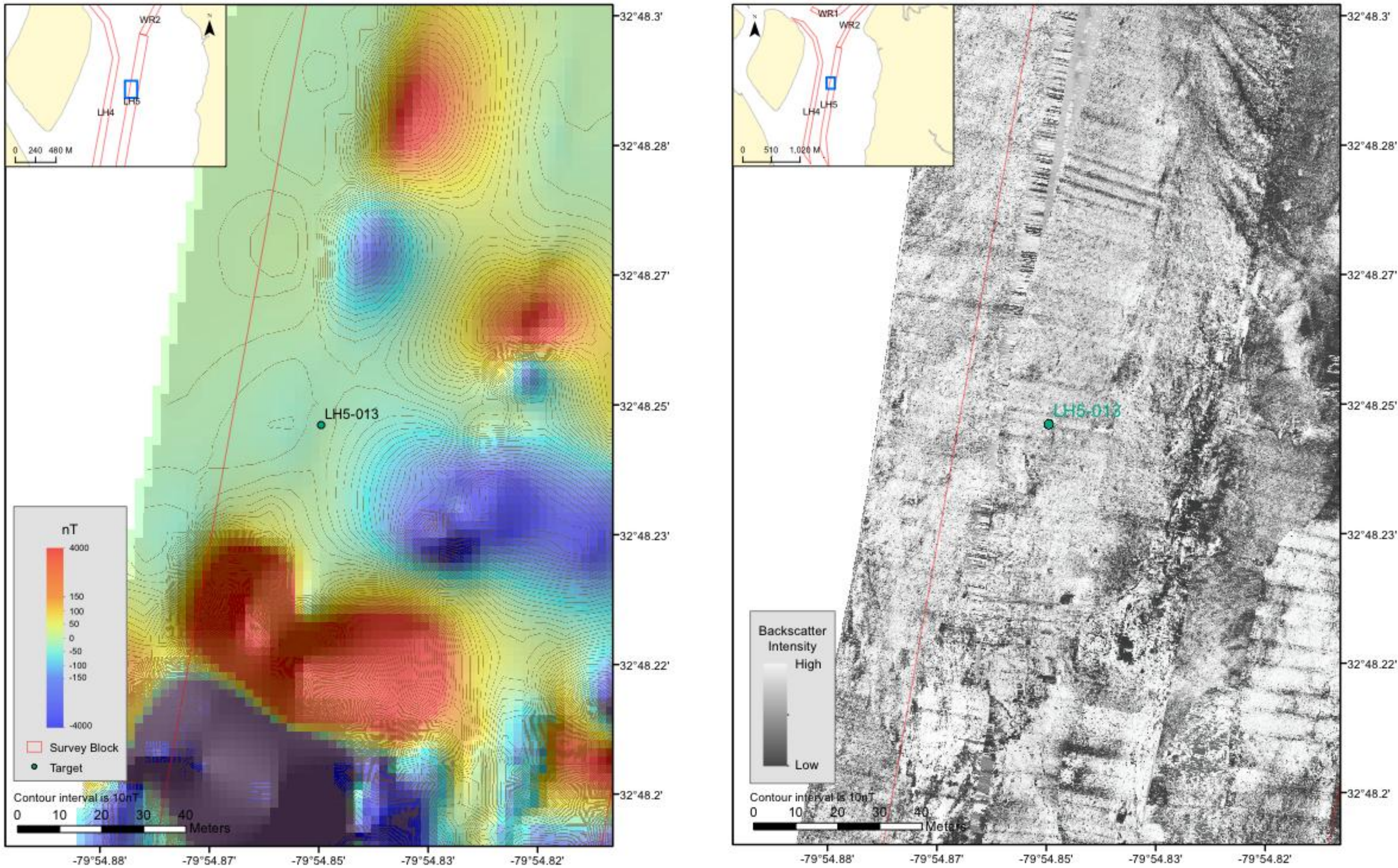


Figure 48. Magnetic (L) and side scan sonar (R) signatures of target LH5-013 in the lower harbor area. Visual inspection of this target is recommended.

LH5-001 is a dipolar magnetic anomaly of 16.29 nT and 5 seconds duration that coincides with a piece of isolated debris less than 1 m in any dimension on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-002 is a negative magnetic anomaly of 19.43 nT and 5 seconds duration that coincides with a piece of isolated debris less than 1 m in any dimension on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-003 is a positive monopolar magnetic anomaly of 7.2 nT and 1 second duration that coincides with two logs 4 and 8.7 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-004 is a dipolar magnetic anomaly of 52.04 nT and 9 seconds duration that coincides with a large piece of what is likely bridge debris measuring 9.3 m long and 4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-005 is a negative monopolar magnetic anomaly of 43.71 nT and 7 seconds duration that coincides with a large piece of what is likely bridge debris measuring 5.3 m long and 4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-006 is a positive monopolar magnetic anomaly of 115.16 nT and 24 seconds duration that coincides with a pipe section that is 5.6 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-007 is a positive monopolar magnetic anomaly of 13.45 nT and 7 seconds duration that coincides with a length of cable or pipe approximately 2 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-008 is a positive monopolar magnetic anomaly of 21.07 nT and 1 second duration that coincides with a scatter of small debris and a crab pot on the harbor bottom in sonogram records. No item is larger than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-009 is a positive monopolar magnetic anomaly of 30.54 nT and 2 seconds duration that coincides with an area of what is likely bridge debris in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-010 is a dipolar magnetic anomaly 425.73 nT and 7 seconds duration that coincides with an area of what is large aggregations of bridge debris in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area. Although these massive pieces of debris could mask more subtle signatures of historic shipwrecks, the recent history of construction, destruction, and additional bridge building suggests this is not an area where such cultural remains might be preserved.

LH5-011 (figure 49) is a dipolar magnetic anomaly of 2520.91 nT and 13 seconds duration that coincides with bridge debris, tires, and hard return modern debris on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-012 is a positive monopolar magnetic anomaly of 5.78 nT and 1 second duration that coincides with a piece of isolated debris and a tire in sonogram records of the harbor bottom. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-013 is a positive monopolar magnetic anomaly of 17.31 nT and 2 seconds duration that coincides with a 17 m long and 7 m high aggregation of what appear to be timbers fastened together on the sea bottom in sonogram records (figure 48). The size, orientation, and appearance of the timbers in the sonogram record likely represents a feature associated with a previous bridge construction or a navigational aid, but the possibility exists that it may also represent part of a ship's hull. The area immediately around this feature suggests additional material may be present under a shallow sediment layer. **Additional inspection is strongly recommended for this site.**

LH5-014 is a negative monopolar magnetic anomaly of 18.50 nT and 1 second duration that coincides with a piece of isolated debris measuring 2.3 x 1.6 x 1.1 m on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-015 is a negative monopolar magnetic anomaly of 22.25 nT and 1 second duration that coincides with two tires and fragments of isolated debris measuring less than 1 m in any dimension and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-016 is a dipolar magnetic anomaly of 4113.16 nT and 20 seconds duration that represents submerged bridge remains and trapped cables and wires in their vicinity on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-017 is a dipolar magnetic anomaly of 3822.16 nT and 23 seconds duration that represents submerged bridge remains and trapped cables and wires in their vicinity on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

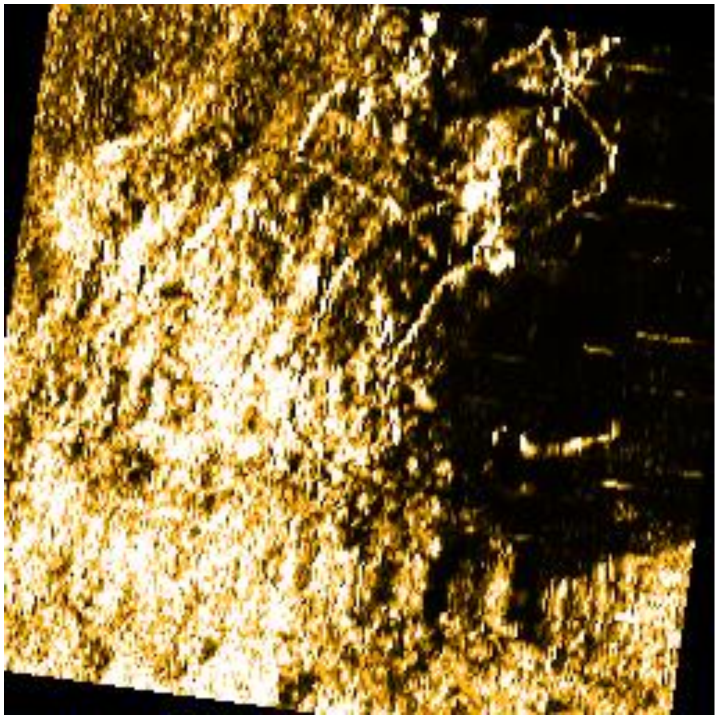
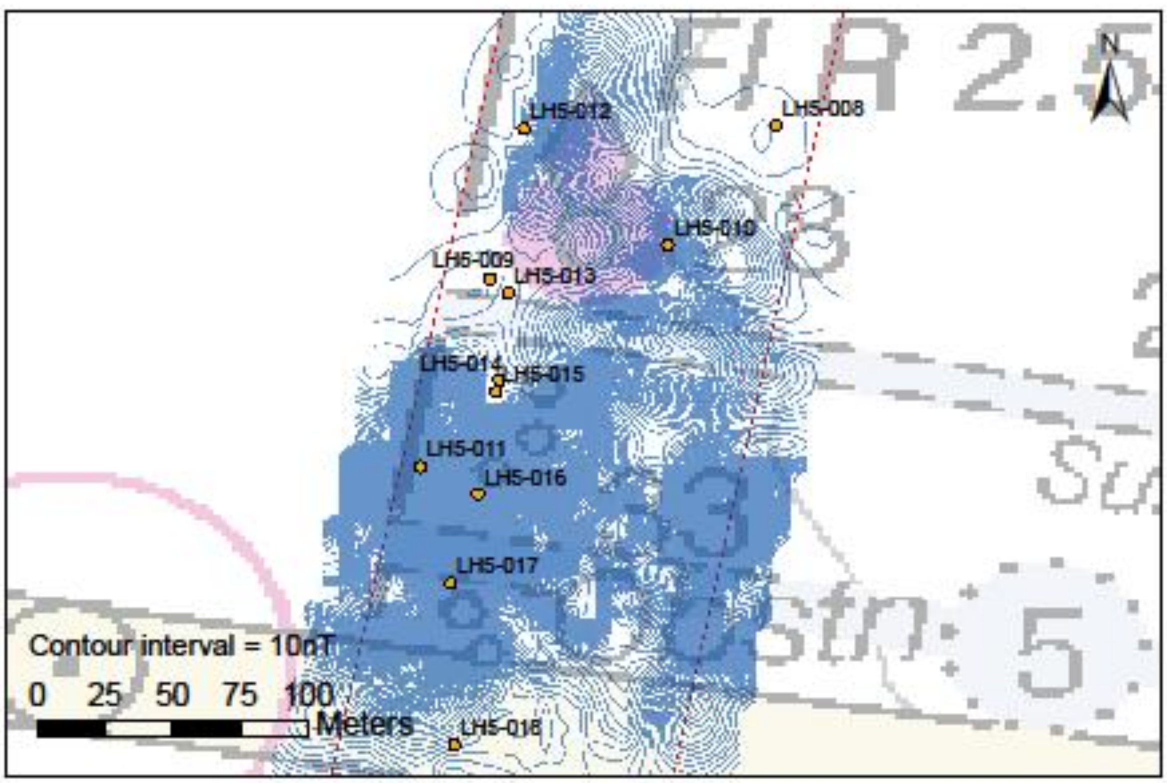


Figure 49. Anomaly LH5-011 sonogram showing tires and other modern debris (top). Anomaly LH5-011 magnetic contour map (bottom).



LH5-018 is a negative magnetic anomaly of 731.71 nT and 30 seconds duration that coincides with submerged bridge remains of 10.3 m length and 2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-019 is a dipolar magnetic anomaly of 82.46 nT and 11seconds duration that represents submerged bridge remains on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-020 is a positive monopolar magnetic anomaly of 57.68 nT and 5 seconds duration that represents a coherent fragment of a barricade or set of large wooden pilings measuring 11 m in length and at least 2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-021 is a positive monopolar magnetic anomaly of 54.28 nT and 6 seconds duration that represents a coherent fragment of a barricade or set of large wooden pilings measuring 10 m in length and at least 2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-022 is a positive monopolar magnetic anomaly of 33.15 nT and 6 seconds duration that coincides with a 2.2 x 1 x 0.5 m concrete pipe fragment on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-023 is a negative monopolar magnetic anomaly of 5.85 nT and 1 second duration that coincides with a piece of isolated wire approximately 4.3 m long and 0.1m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-024 (figure 50) is a dipolar magnetic anomaly of 56.66 nT and 7 seconds duration that coincides with a scatter of debris less than 1 m in any dimension visible on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-025 is a positive monopolar magnetic anomaly of 25.36 nT and 51 second duration that coincides with an isolated piece of debris 1.3 m long and 0.4m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-026 is a dipolar magnetic anomaly of 33.88 nT and 5 seconds duration that coincides with an isolated block 1 m sq and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

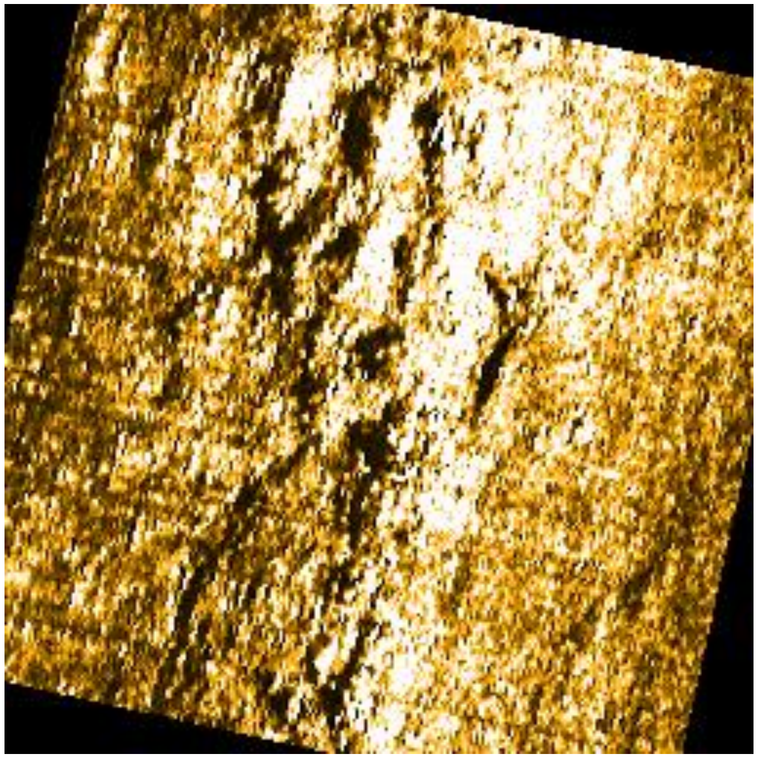
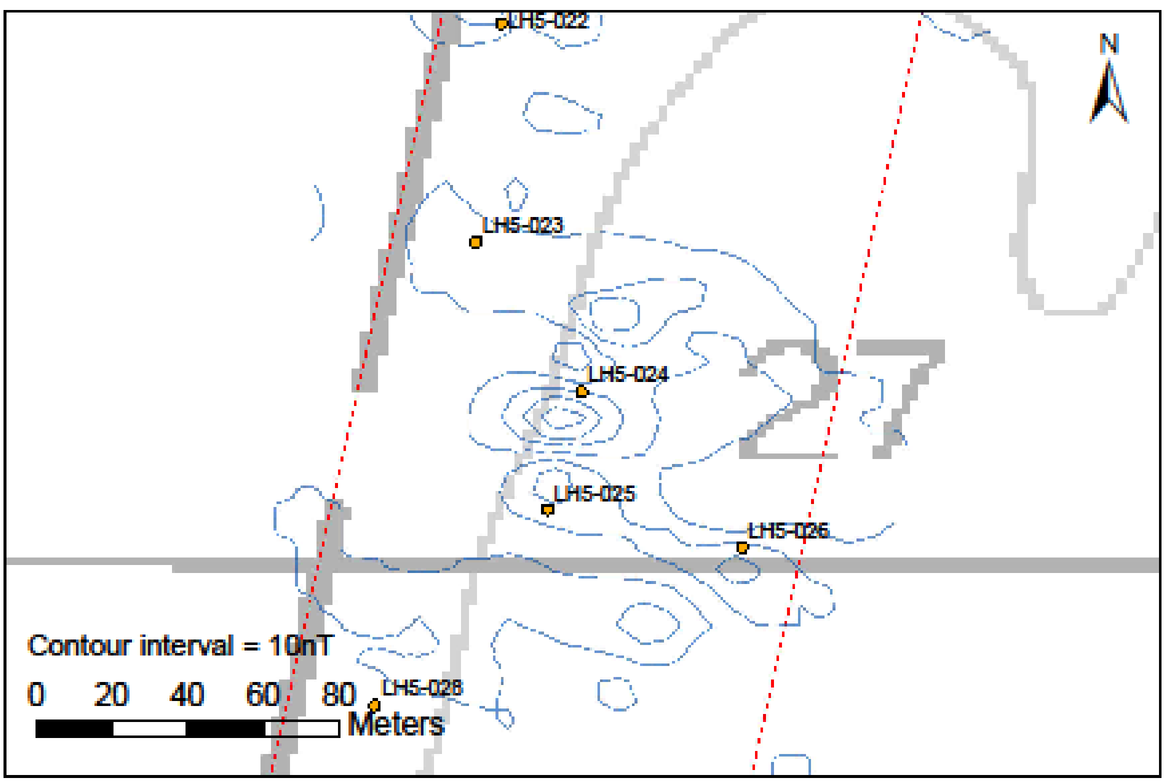


Figure 50. Anomaly LH5-024 sonogram showing scattered debris(top). Anomaly LH5-024 magnetic contour map (bottom).



LH5-027 is a dipolar magnetic anomaly of 161.54 nT and 9 seconds duration that coincides with a 40 m length of cable 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-028 is a positive monopolar magnetic anomaly of 7.07 nT and 2 seconds duration that coincides with an isolated piece of debris 1.2 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-029 is a negative monopolar magnetic anomaly of 7.58 nT and 1 second duration that coincides with an isolated piece of debris 2.7 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-030 is a negative monopolar magnetic anomaly of 5.61 nT and 1 second duration that coincides with a crab pot 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-031 is a dipolar magnetic anomaly of 36.96 nT and 4 seconds duration that coincides with no specific identified feature in accompanying sonogram records although it is in the general area of bridge-linked debris. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-032 is a negative monopolar magnetic anomaly of 5.39 nT and 1 second duration that coincides with two pieces of debris approximately 2.2 m long and .3 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-033 is a dipolar magnetic anomaly of 26.43 nT and 5 seconds duration that coincides with a piece of debris 5.2 m long and 0.4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-034 (figure 51) is a dipolar magnetic anomaly of 35.4 nT and 8 seconds duration that coincides with a scatter of debris 2.6 to 1 m long and 0.3 to 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-035 is a positive monopolar magnetic anomaly of 23.41 nT and 4 seconds duration that coincides with several pieces of dispersed debris providing a hard return and measuring less than 0.5 m in any dimension and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

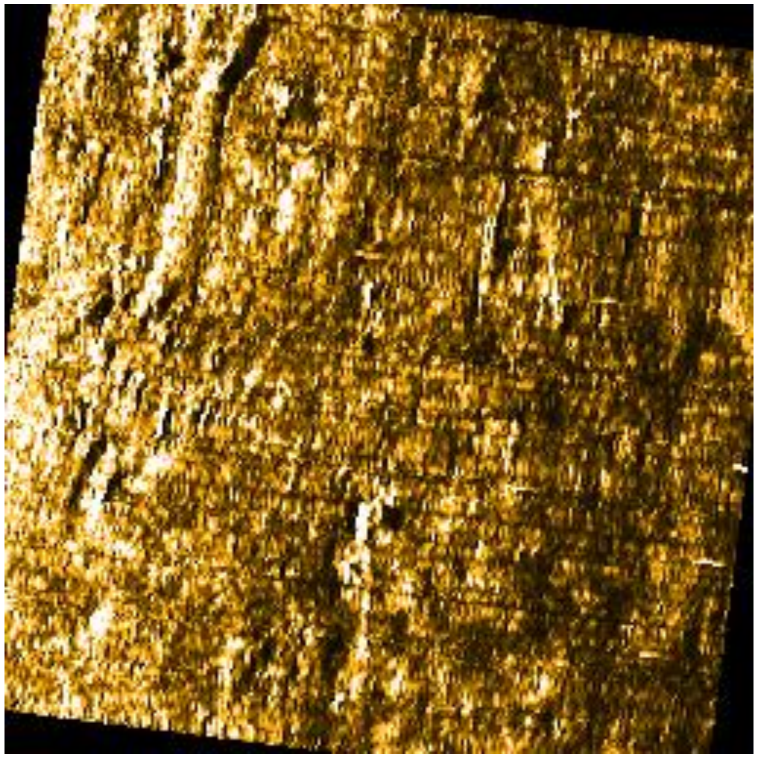
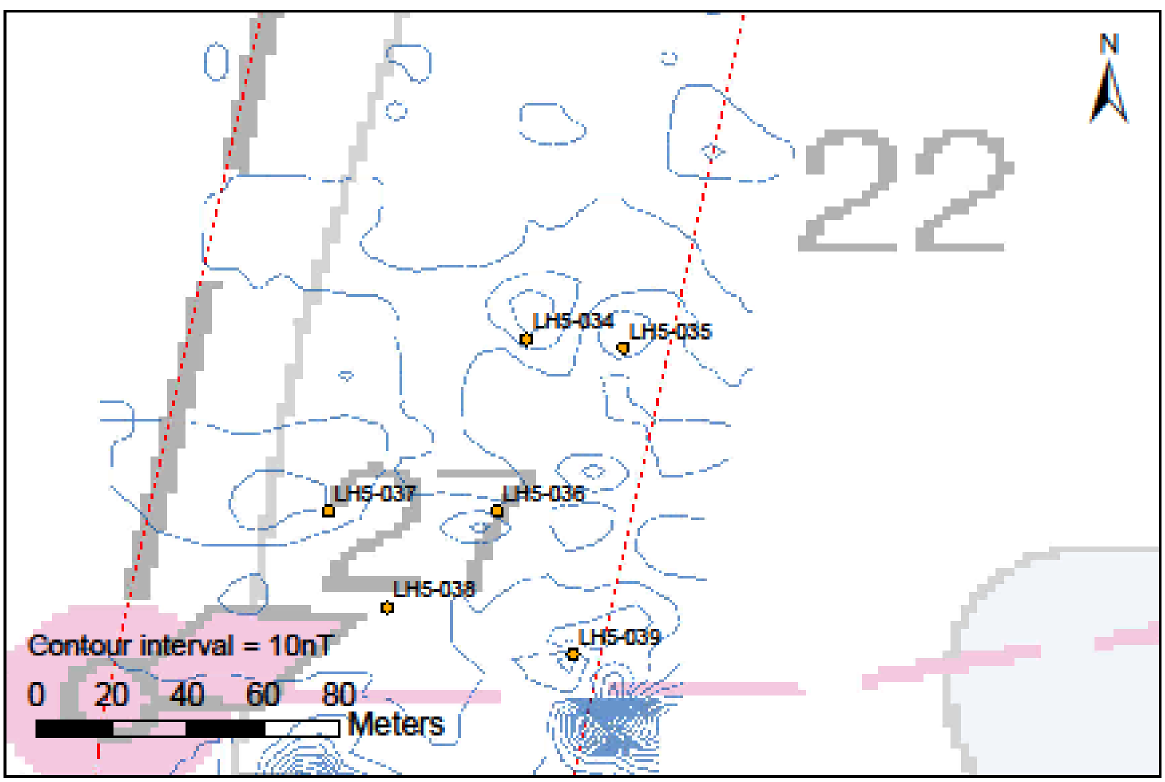


Figure 51. Anomaly LH5-034 sonogram showing scattered debris (top). Anomaly LH5-034 magnetic contour map (bottom).



LH5-036 is a dipolar magnetic anomaly of 31.20 nT and 5 seconds duration that coincides with a piece of debris 1.4 m long and 0.5 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-037 is a negative monopolar magnetic anomaly of 10.89 nT and 2 seconds duration that coincides with a piece of cable 2.4 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-038 is a positive monopolar magnetic anomaly of 6.65 nT and 1 second duration that coincides with a piece of debris 1.8 m long and 0.6 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-039 is a dipolar magnetic anomaly of 40.92 nT and 3 seconds duration that coincides with a tire 0.8 m in diameter in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-040 is a positive monopolar magnetic anomaly of 13.22 nT and 4 second duration that coincides with a piece of cable 2 m long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-041 is a positive monopolar magnetic anomaly of 44.01 nT and 8 seconds duration that coincides with a piece of debris 1.2 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-042 (figure 52) is a dipolar magnetic anomaly of 162.88 nT and 13 seconds duration that coincides with a scatter of modern debris over a 20 m area on the harbor bottom in sonogram records. All objects are smaller than 1 m in any dimension and 0.3-0.1 m above the bottom. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-043 is a negative monopolar magnetic anomaly of 55.42 nT and 13 seconds duration that coincides with what appears to be an upright post or piling at least 1.6 m tall on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-044 is a negative monopolar magnetic anomaly of 25.58 nT and 3 seconds duration that coincides with a piece of debris 1.5 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

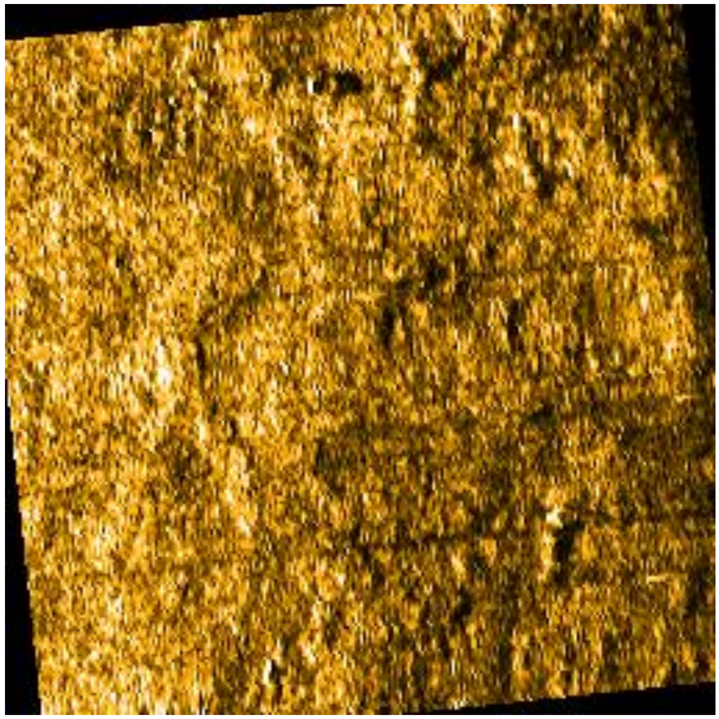
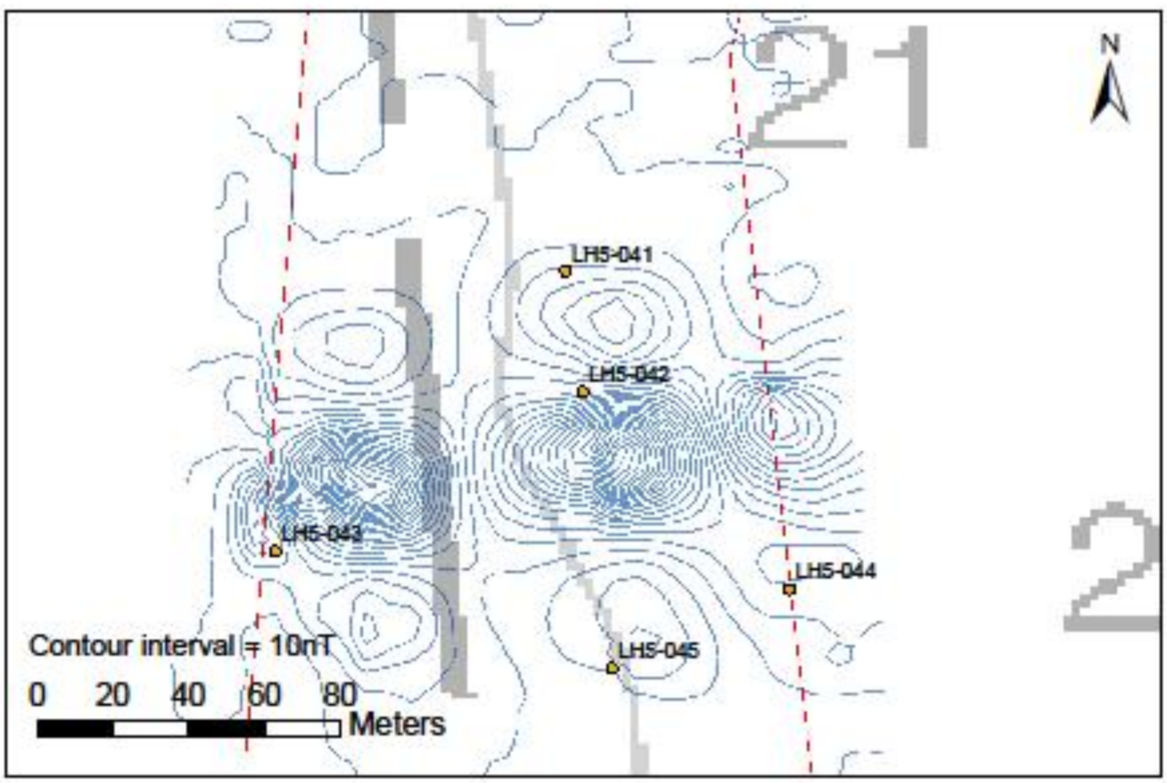


Figure 52. Anomaly LH5-042 sonogram showing modern debris (top). Anomaly LH5-042 magnetic contour map (bottom).



LH5-045 is a positive monopolar magnetic anomaly of 22.65 nT and 2 seconds duration that coincides with a piece of pipe or cable 3.1 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-046 is a positive monopolar magnetic anomaly of 6.46 nT and 1 second duration that coincides with a crab pot 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-047 is a negative monopolar magnetic anomaly of 34.80 nT and 5 seconds duration that coincides with two pieces of isolated debris less than 0.8 long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-048 is a positive monopolar magnetic anomaly of 6.97 nT and 2 seconds duration that coincides with a crab pot 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-049 is a positive monopolar magnetic anomaly of 6.12 nT and 1 second duration that coincides with a tire on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-050 is a positive monopolar magnetic anomaly of 10.21 nT and 1 second duration that coincides with isolated debris 1.6 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-051 is a dipolar magnetic anomaly of 100.26 nT and 5 seconds duration that coincides with an isolated block 2.7 m long and 3.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-052 is a negative monopolar magnetic anomaly of 223.76 nT and 2 seconds duration that coincides with an isolated block 3.5 m long and 0.6 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

LH5-053 is a negative monopolar magnetic anomaly of 151.32 nT and 14 seconds duration that coincides with isolated debris 0.9 m long and 0.5 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

Wando River 1 (WR1)

WR1 A total of 57 individual sites was identified for this survey section and each is described below, including recommendations. Table 7 and figure 53 provide specific details of each target. Ship traffic, jetties, piers, sewage and other pipelines, docks, and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged, and dredging was occurring in the area during the recovery of remote sensing data. This survey area is on the northwest boundary of 38CH425, the Wando Terminal area originally surveyed by Albright, and it is south of archaeological sites recently documented on the east side of Daniel Island such as 38CH815. Its northern edge is parallel to an area of marshes, a dike, and built-up land at the southern end of Daniel Island for which no habitation is recorded from historic or prehistoric times.

Table 7. Characteristics of Wando River 1 (WR1) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
WR1-001	171.52	2340295.1	368221.2	0:00:03	4.09	2.27	Dipolar	crab pot	No further work
WR1-002	47.98	2340265.9	368082.6	0:00:05	5.87	3.69	Negative monopolar	crab pot	No further work
WR1-003	22.28	2340416.5	368076.9	0:00:02	4.62	3.19	Negative monopolar	buried pipes	No further work
WR1-004	127.63	2340377.6	367974.6	0:00:04	5.88	4.42	Dipolar	crab pot	No further work
WR1-005	59.03	2340586.0	368020.5	0:00:03	6.55	5.12	Dipolar	isolated debris	No further work
WR1-006	23.69	2340158.3	367804.9	0:00:05	7.17	5.30	Positive monopolar	isolated debris	No further work
WR1-007	97.27	2340203.1	367634.4	0:00:12	7.25	5.43	Dipolar	crab pot; debris	No further work
WR1-008	99.44	2340147.8	367637.4	0:00:03	7.62	5.76	Dipolar	none	No further work
WR1-009	13.06	2340024.8	367647.0	0:00:03	8.11	5.52	Positive monopolar	crab pot	No further work
WR1-010	32.51	2339537.3	367569.1	0:00:05	9.97	8.35	Dipolar	crab pots (2)	No further work
WR1-011	14.41	2339693.5	367610.8	0:00:02	8.88	7.01	Positive monopolar	isolated debris	No further work
WR1-012	15.89	2338791.8	367488.3	0:00:02	11.84	10.03	Positive monopolar	debris; pipe	No further work
WR1-013	49.13	2339118.1	367419.0	0:00:05	12.39	10.77	Dipolar	cable/pipe	No further work
WR1-014	1051.90	2339498.8	367153.9	0:00:11	10.30	8.52	Dipolar	cables; debris	No further work
WR1-015	29.68	2339844.7	366972.0	0:00:04	9.86	7.99	Negative monopolar	modern debris and scour	No further work
WR1-016	33.96	2338864.2	367325.4	0:00:06	12.36	10.38	Negative monopolar	isolated debris	No further work
WR1-017	38.35	2338715.3	367178.2	0:00:04	11.05	9.35	Dipolar	cable	No further work
WR1-018	50.24	2338845.8	367034.1	0:00:08	11.18	9.15	Dipolar	cable/pipeline	No further work
WR1-019	92.73	2339506.4	366724.6	0:00:14	9.97	7.02	Dipolar	cable	No further work
WR1-020	11.94	2339685.8	366606.5	0:00:01	10.40	8.65	Negative monopolar	isolated debris	No further work

Table 7 continued

WR1-021	8.29	2338583.3	366882.1	0:00:01	8.37	6.70	Negative monopolar	crab pot	No further work
WR1-022	2214.67	2338536.8	366630.6	0:00:19	7.32	5.34	Dipolar	pipeline/cable	No further work
WR1-023	513.12	2338787.1	366487.7	0:00:15	10.62	8.80	Dipolar	cable	No further work
WR1-024	3084.91	2338485.2	366000.6	0:00:12	5.63	3.82	Dipolar	pipeline/cable	No further work
WR1-025	54.75	2338961.6	366260.4	0:00:08	11.88	10.29	Negative monopolar	channel marker	No further work
WR1-026	140.20	2339332.8	366304.4	0:00:17	15.11	12.35	Dipolar	debris	No further work
WR1-027	980.36	2338737.4	365966.9	0:00:10	9.34	7.55	Dipolar	none [cable]	No further work
WR1-028	3071.75	2338495.0	365938.9	0:00:19	6.68	4.82	Dipolar	pipeline/cable	No further work
WR1-029	25.52	2338353.8	365930.1	0:00:01	3.31	1.92	Negative monopolar	crab pot	No further work
WR1-030	854.26	2338396.5	365672.2	0:00:04	5.12	3.42	Dipolar	“submerged piles”	No further work
WR1-031	1100.94	2338292.0	365387.3	0:00:09	5.00	3.30	Positive monopolar	”submerged piles”	No further work
WR1-032	90.91	2338459.9	365491.0	0:00:05	6.68	4.93	Dipolar	small hard return debris	No further work
WR1-033	15.20	2338616.6	365489.0	0:00:01	8.52	6.85	Negative monopolar	pipe	No further work
WR1-034	1373.77	2338379.2	365279.1	0:00:05	6.45	4.74	Dipolar	”submerged piles”	No further work
WR1-035	21.68	2338282.7	364819.6	0:00:06	7.82	6.15	Dipolar	crab pot	No further work
WR1-036	13.91	2338334.5	364576.4	0:00:03	8.42	6.55	Dipolar	crab pot	No further work
WR1-037	116.00	2338330.5	364372.6	0:00:16	7.92	6.10	Dipolar	crab pot; debris	No further work
WR1-038	6.24	2338780.1	364268.3	0:00:01	10.50	7.96	Positive monopolar	crab pot	No further work
WR1-039	198.78	2338485.9	363915.9	0:00:07	10.43	7.40	Dipolar	pipe/cable	No further work
WR1-040	111.17	2338718.4	364009.3	0:00:07	11.38	8.76	Dipolar	debris	No further work
WR1-041	35.75	2338321.8	363459.3	0:00:03	11.38	8.84	Positive monopolar	debris	No further work
WR1-042	7.38	2337266.9	362425.7	0:00:01	9.88	6.90	Negative monopolar	debris	No further work

Table 7 continued

WR1-043	83.32	2336816.3	362038.9	0:00:10	9.68	6.98	Negative monopolar	debris	No further work
WR1-044	83.27	2336985.4	362022.5	0:00:07	9.91	7.29	Dipolar	debris, u-shaped	No further work
WR1-045	58.70	2336779.3	361765.6	0:00:05	9.99	7.29	Dipolar	crab pot	No further work
WR1-046	74.16	2336416.5	361499.8	0:00:03	9.90	6.78	Dipolar	pipe	No further work
WR1-047	0.94	2336014.7	361226.3	0:00:03	8.84	6.03	Positive monopolar	pipe	No further work
WR1-048	52.78	2336007.6	360949.8	0:00:08	9.31	6.80	Negative monopolar	channel marker	No further work
WR1-049	164.14	2335679.0	360647.9	0:00:05	9.53	6.91	Dipolar	modern piling	No further work
WR1-050	103.98	2335224.1	360381.2	0:00:08	9.88	6.85	Dipolar	pontoon	No further work
WR1-051	117.15	2335433.3	360350.6	0:00:04	9.75	6.97	Dipolar	debris	No further work
WR1-052	10.80	2334980.6	360163.9	0:00:02	9.72	6.66	Negative monopolar	debris	No further work
WR1-053	12.89	2334908.3	360028.6	0:00:02	10.04	7.01	Positive monopolar	debris	No further work
WR1-054	141.88	2334382.0	359535.5	0:00:09	10.14	7.11	Negative monopolar	debris	No further work
WR1-055	13.41	2333961.0	359250.9	0:00:01	11.01	8.26	Positive monopolar	wire/cable	No further work
WR1-056	50.43	2333400.2	359121.3	0:00:05	8.29	5.34	Dipolar	debris	No further work
WR1-057	490.50	2332968.0	359022.2	0:00:10	12.31	8.97	Dipolar	wire/cable	No further work
WR1-058	28.99	2339451.2	367579.1	0:00:05	10.40	8.73	Dipolar	modern debris	No further work

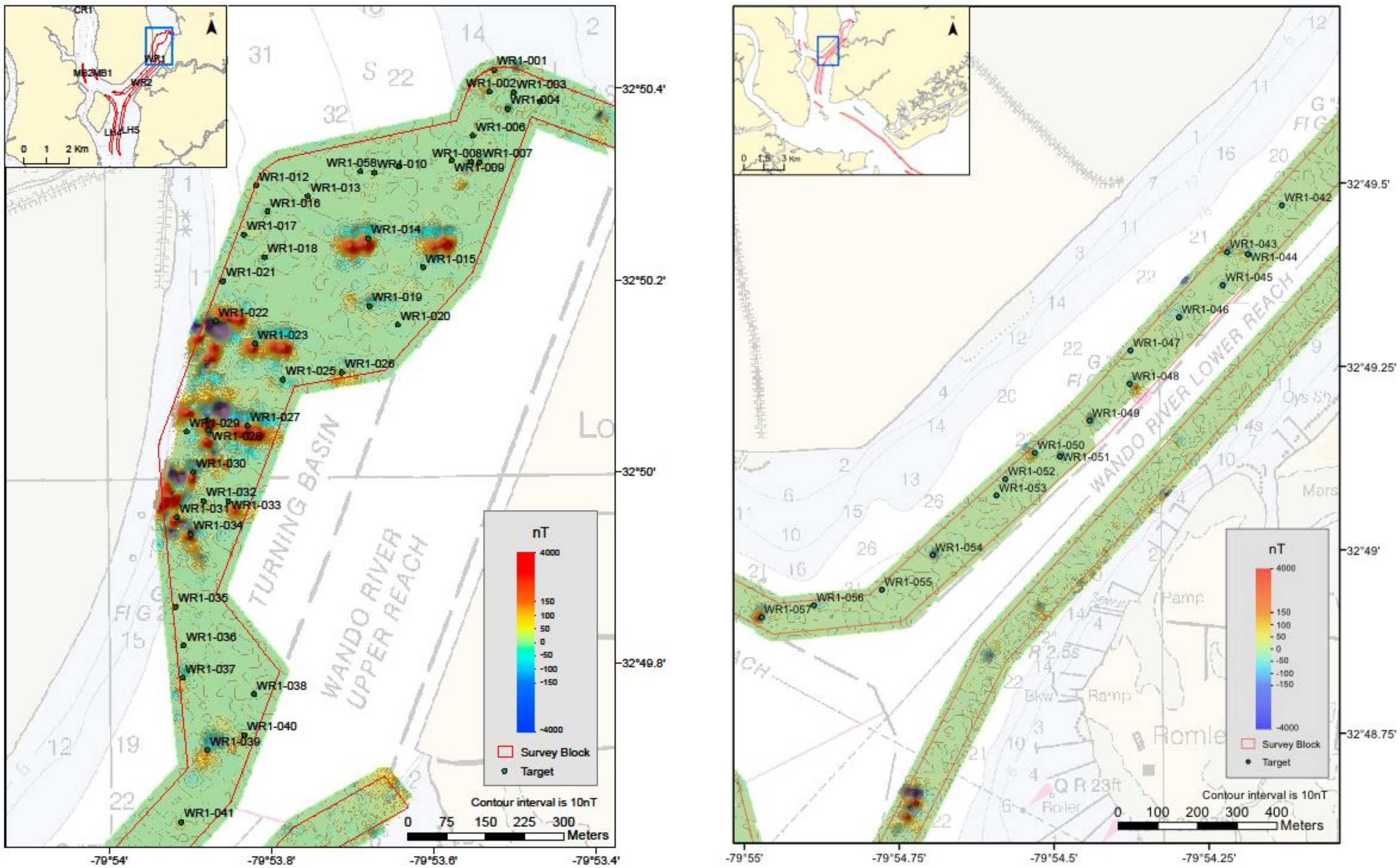


Figure 53. Magnetic anomaly color contour map of WR1.

WR1-001 is a dipolar magnetic anomaly of 171.52 nT and 3 seconds duration that coincides with a crab pot 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-002 is a negative monopolar magnetic anomaly of 47.98 nT and 5 seconds duration that coincides with a crab pot 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-003 is a negative monopolar magnetic anomaly of 22.28 nT and 2 seconds duration that coincides with slightly buried pipes in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-004 is a dipolar magnetic anomaly of 127.63 nT and 4 seconds duration that coincides with a crab pot 0.3m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-005 is a dipolar magnetic anomaly of 59.03 nT and 3 seconds duration that coincides with isolated debris less than 1 m in all dimensions above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-006 is a positive monopolar magnetic anomaly of 23.69 nT and 5 seconds duration that coincides with isolated debris 1.5 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-007 is a dipolar magnetic anomaly of 97.27 nT and 12 seconds duration that coincides with a crab pot and small debris above the harbor bottom in sonogram records. All items are less than 1 m in all dimensions. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-008 is a dipolar magnetic anomaly of 99.44 nT and 3 seconds duration that coincides with no specific identified feature in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-009 is a positive monopolar magnetic anomaly of 13.06 nT and 3 seconds duration that coincides with a crab pot 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-010 is a dipolar magnetic anomaly of 32.51 nT and 5 seconds duration that coincides with two crab pots 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-011 is a positive monopolar magnetic anomaly of 14.41 nT and 2 seconds duration that coincides with isolated debris 1.2 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-012 is a positive monopolar magnetic anomaly of 15.89 nT and 2 seconds duration that coincides with debris and a pipe above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-013 is a dipolar magnetic anomaly of 49.13 nT and 5 seconds duration that coincides with a cable/pipe above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-014 is a dipolar magnetic anomaly of 1051.90 nT and 11 seconds duration that coincides with cables and debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-015 is a negative monopolar magnetic anomaly of 29.68 nT and 4 seconds duration that coincides with a scoured area approximately 1.8 m long around modern debris in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-016 is a negative monopolar magnetic anomaly of 33.96 nT and 6 seconds duration that coincides with isolated debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-017 is a dipolar magnetic anomaly of 38.35 nT and 4 seconds duration that coincides with a cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-018 is a dipolar magnetic anomaly of 50.24 nT and 8 seconds duration that coincides with a cable/pipeline above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-019 is a dipolar magnetic anomaly of 92.73 nT and 14 seconds duration that coincides with a cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-020 is a negative monopolar magnetic anomaly of 11.94 nT and 1 second duration that coincides with isolated debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-021 is a negative monopolar magnetic anomaly of 8.29 nT and 1 second duration that coincides with a crab pot above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-022 is a dipolar magnetic anomaly of 2214.67 nT and 19 seconds duration that coincides with a pipeline/cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-023 is a dipolar magnetic anomaly of 513.12 nT and 15 seconds duration that coincides with a cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-024 is a dipolar magnetic anomaly of 3084.91 nT and 12 seconds duration that coincides with a pipeline/cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-025 is a negative monopolar magnetic anomaly of 54.75 nT and 8 seconds duration that coincides with a channel marker. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-026 is a dipolar magnetic anomaly of 140.20 nT and 17 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-027 is a dipolar magnetic anomaly of 980.36 nT and 10 seconds duration that coincides with a cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-028 is a dipolar magnetic anomaly of 3071.75 nT and 19 seconds duration that coincides with a pipeline/cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-029 is a negative monopolar magnetic anomaly of 25.52 nT and 1 second duration that coincides with a crab pot above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-030 (figure 54) is a dipolar magnetic anomaly of 854.26 nT and 4 seconds duration that coincides with an area designated as submerged piles on nautical charts. Nothing is visible on the bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area. Less than 1 km upstream, previous underwater surveys by Wilbanks (2008a, 2008b, 2009) identified similar targets as the ends of I-beams driven into the bottom, some with stud-link chains for mooring.

WR1-031 (figure 54) is a positive monopolar magnetic anomaly of 1100.94 nT and 9 seconds duration that coincides with an area designated as submerged piles on nautical charts. Nothing is visible on the bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area. Less than 1 km upstream, previous underwater surveys by Wilbanks (2008a, 2008b, 2009) identified similar targets as the ends of I-beams driven into the bottom, some with stud-link chains for mooring.

WR1-032 (figure 54) is a dipolar magnetic anomaly of 90.91 nT and 5 seconds duration that coincides with small hard return debris less than 0.25 in any dimension in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-033 is a negative monopolar magnetic anomaly of 15.20 nT and 1 second duration that coincides with a pipe above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-034 (figure 54) is a dipolar magnetic anomaly of 1373.77 nT and 5 seconds duration that coincides with an area designated as submerged piles on nautical charts. Nothing is visible on the bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area. Less than 1 km upstream, previous underwater surveys by Wilbanks (2008a, 2008b, 2009) identified similar targets as the ends of I-beams driven into the bottom, some with stud-link chains for mooring.

WR1-035 is a dipolar magnetic anomaly of 21.68 nT and 6 seconds duration that coincides with a crab pot above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-036 is a dipolar magnetic anomaly of 13.91 nT and 3 seconds duration that coincides with a crab pot above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-037 is a dipolar magnetic anomaly of 116.00 nT and 16 seconds duration that coincides with a crab pot and debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

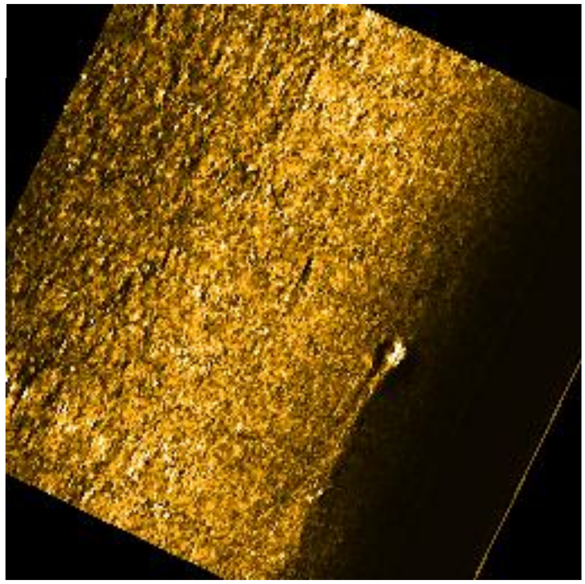
WR1-038 is a positive monopolar magnetic anomaly of 6.24 nT and 1 second duration that coincides with a crab pot above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-039 is a dipolar magnetic anomaly of 198.78 nT and 7 seconds duration that coincides with a pipe/cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

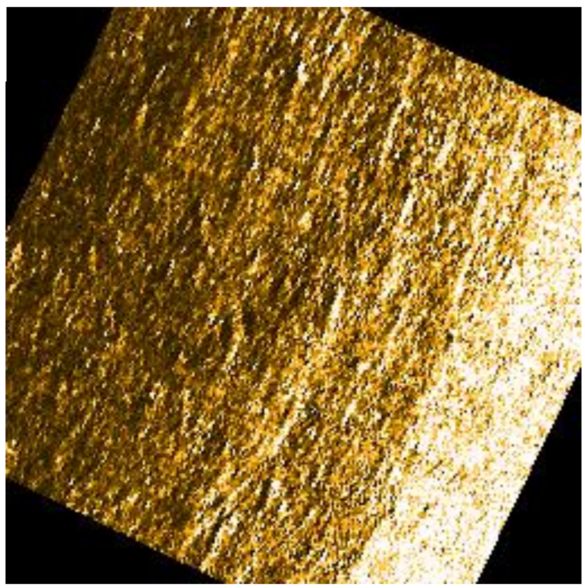
WR1-040 is a dipolar magnetic anomaly of 111.17 nT and 7 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-041 is a positive monopolar magnetic anomaly of 35.75 nT and 3 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

a)



b)



c)

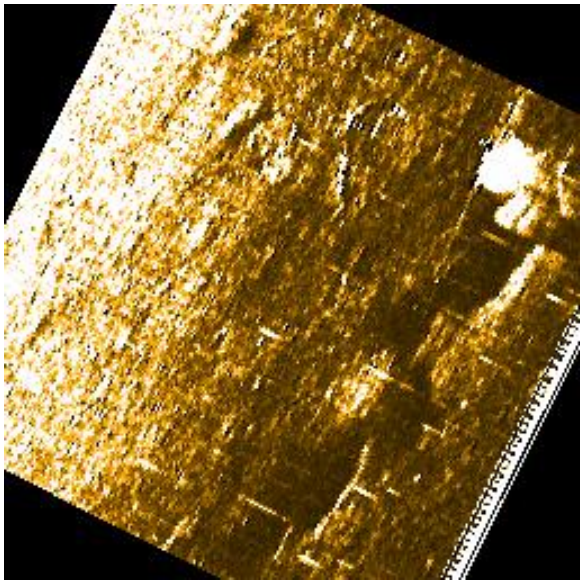
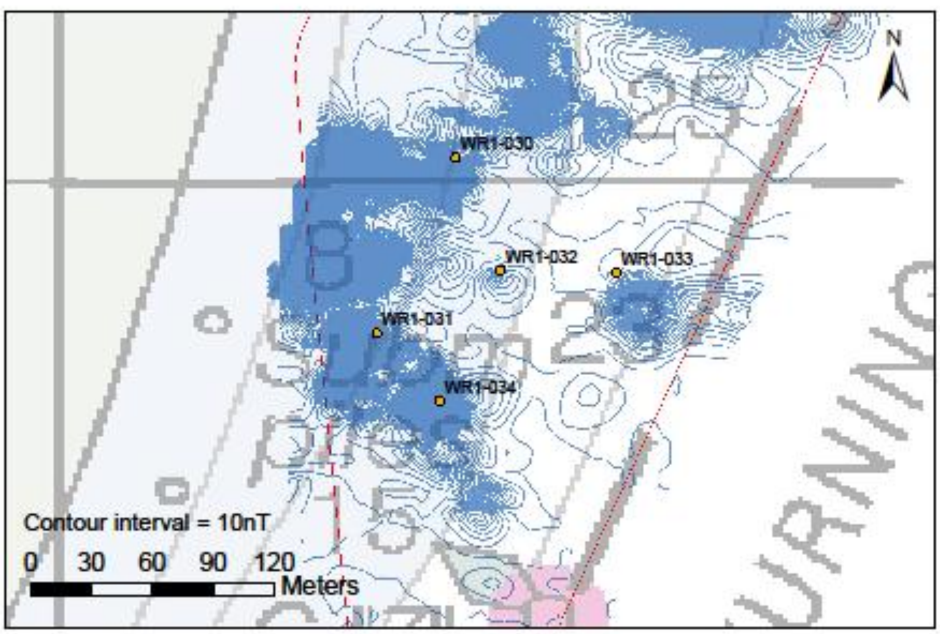


Figure 54. This area is marked as "submerged piles" on naval charts; previous underwater surveys just north of this survey area located targets like WR1-031 pictured above (top a) and identified them as the top of an I-beam, often with a stud-link chain attached, likely to have been used as a mooring dolphin after World War II (Wilbanks 2009).
Anomaly WR1-032 sonogram showing small hard return debris (top b). Anomaly WR1-034 sonogram showing “submerged piles” (top c). Anomalies WR1-030, WR1-031, WR1-032 and WR1-034 magnetic contour map (bottom).



WR1-042 is a positive monopolar magnetic anomaly of 35.75 nT and 1 second duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-043 is a positive monopolar magnetic anomaly of 83.32 nT and 10 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-044 is a dipolar magnetic anomaly of 83.27 nT and 7 seconds duration that coincides with u-shaped debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-045 is a dipolar magnetic anomaly of 58.70 nT and 5 seconds duration that coincides with a crab pot above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-046 is a dipolar magnetic anomaly of 74.16 nT and 3 seconds duration that coincides with a pipe above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-047 is a positive monopolar magnetic anomaly of 0.94 nT and 3 seconds duration that coincides with a pipe above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-048 is a negative monopolar magnetic anomaly of 52.78 nT and 8 seconds duration that coincides with a channel marker. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-049 is a dipolar magnetic anomaly of 164.14 nT and 5 seconds duration that coincides with a modern piling above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-050 is a dipolar magnetic anomaly of 103.98 nT and 8 seconds duration that coincides with a pontoon above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-051 is a dipolar magnetic anomaly of 117.15 nT and 4 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-052 is a negative monopolar magnetic anomaly of 10.80 nT and 2 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-053 is a positive monopolar magnetic anomaly of 12.89 nT and 2 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-054 is a negative monopolar magnetic anomaly of 141.88 nT and 9 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-055 is a positive monopolar magnetic anomaly of 13.41 nT and 1 second duration that coincides with a wire/cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-056 is a dipolar magnetic anomaly of 50.43 nT and 5 seconds duration that coincides with debris above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-057 is a dipolar magnetic anomaly of 490.50 nT and 10 seconds duration that coincides with a wire/cable above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR1-058 is a dipolar magnetic anomaly of 28.99 nT and 5 seconds duration that coincides with a piece of modern debris 2.7 m long and 1.3 m above the harbor bottom. No additional evidence of submerged cultural material was found in the anomaly area.

Wando River 2 (WR2)

WR2 Remote sensing data was generated from this survey area on 3 and 11 October 2012. A total of 24 individual sites were identified for this survey section and each is described below, including recommendations. Table 8 and figure 55 provide specific details of each target. Ship traffic, jetties, piers, sewage and other pipelines, docks, moving vessels, and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged, and dredging was occurring in the area during the recovery of remote sensing data. There are no indications of historic or culturally significant materials in this survey area.

This survey area shares its northern boundary with the southeast edge of 38CH425, the Wando Terminal site surveyed by Albright (1980). It is parallel to a stretch north of the boat ramp at Remley Point that includes reports of a 19th-century shipwreck (38CH436) that was in 25' of water in 1975 and a 19th-century shipwreck partially on shore (38CH1941) about 200 m northeast of that site. Both sites are at least 50 m from the edge of the survey boundary; no data recovered can be correlated with their last known positions.

Table 8. Characteristics of Wando River 2 (WR2) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
WR2-001	16.26	2338904.3	362988.9	0:00:01	7.08	5.68	Positive monopolar	isolated modern debris	No further work
WR2-002	36.34	2338503.5	362555.3	0:00:04	9.47	8.01	Dipolar	modern debris	No further work
WR2-003	64.87	2336396.8	360462.7	0:00:09	13.06	10.24	Dipolar	channel marker	No further work
WR2-004	32.82	2335881.8	359776.9	0:00:08	8.98	6.52	Positive monopolar	none identified	No further work
WR2-005	44.82	2335791.8	359564.9	0:00:03	7.52	6.12	Positive monopolar	isolated object	No further work
WR2-006	20.82	2335770.3	359564.7	0:00:03	7.94	5.43	Positive monopolar	isolated object	No further work
WR2-007	7.54	2335693.5	359567.5	0:00:01	8.70	6.24	Negative monopolar	log	No further work
WR2-008	18.47	2335758.4	359535.4	0:00:01	7.59	6.16	Positive monopolar	scatter of small debris	No further work
WR2-009	20.68	2335551.6	359329.5	0:00:02	8.02	5.49	Negative monopolar	debris	No further work
WR2-010	33.66	2335309.9	359239.6	0:00:03	9.47	6.24	Positive monopolar	wire or cable	No further work
WR2-011	7.15	2335329.9	359087.0	0:00:01	8.25	5.67	Negative monopolar	isolated object, hard return	No further work
WR2-012	79.89	2335263.1	359017.2	0:00:07	8.34	6.91	Dipolar	sediment-covered machine	No further work
WR2-013	22.39	2335229.7	358980.5	0:00:03	8.45	5.78	Dipolar	pipe	No further work
WR2-014	5.49	2335059.8	358774.9	0:00:01	8.54	7.08	Positive monopolar	crab pot	No further work
WR2-015	51.98	2334730.7	358222.1	0:00:02	8.56	5.75	Dipolar	pipe (6 m)	No further work
WR2-016	8.36	2334646.4	358061.1	0:00:01	8.63	7.28	Positive monopolar	slightly buried debris	No further work
WR2-017	9.90	2334595.2	357962.3	0:00:01	8.60	7.25	Negative monopolar	pipes	No further work

Table 8 continued

WR2-018	12.78	2334559.1	357885.5	0:00:01	8.36	7.02	Negative monopolar	block/debris	No further work
WR2-019	18.27	2334423.5	357636.7	0:00:02	8.09	6.75	Positive monopolar	6 m L pipe	No further work
WR2-020	1703.29	2334237.3	357525.6	0:00:05	11.23	8.34	Dipolar	pipe cluster	No further work
WR2-021	797.77	2334267.5	357573.2	0:00:07	11.31	8.41	Negative monopolar	pipe cluster under pipeline/cable	No further work
WR2-022	7.46	2334288.0	357373.3	0:00:01	10.13	7.32	Negative monopolar	crab pot	No further work
WR2-023	470.99	2334146.8	357360.9	0:00:06	12.62	9.67	Positive monopolar	pipe	No further work
WR2-024	14.19	2334164.2	357171.9	0:00:01	12.01	10.70	Negative monopolar	tire or modern rigging eye	No further work

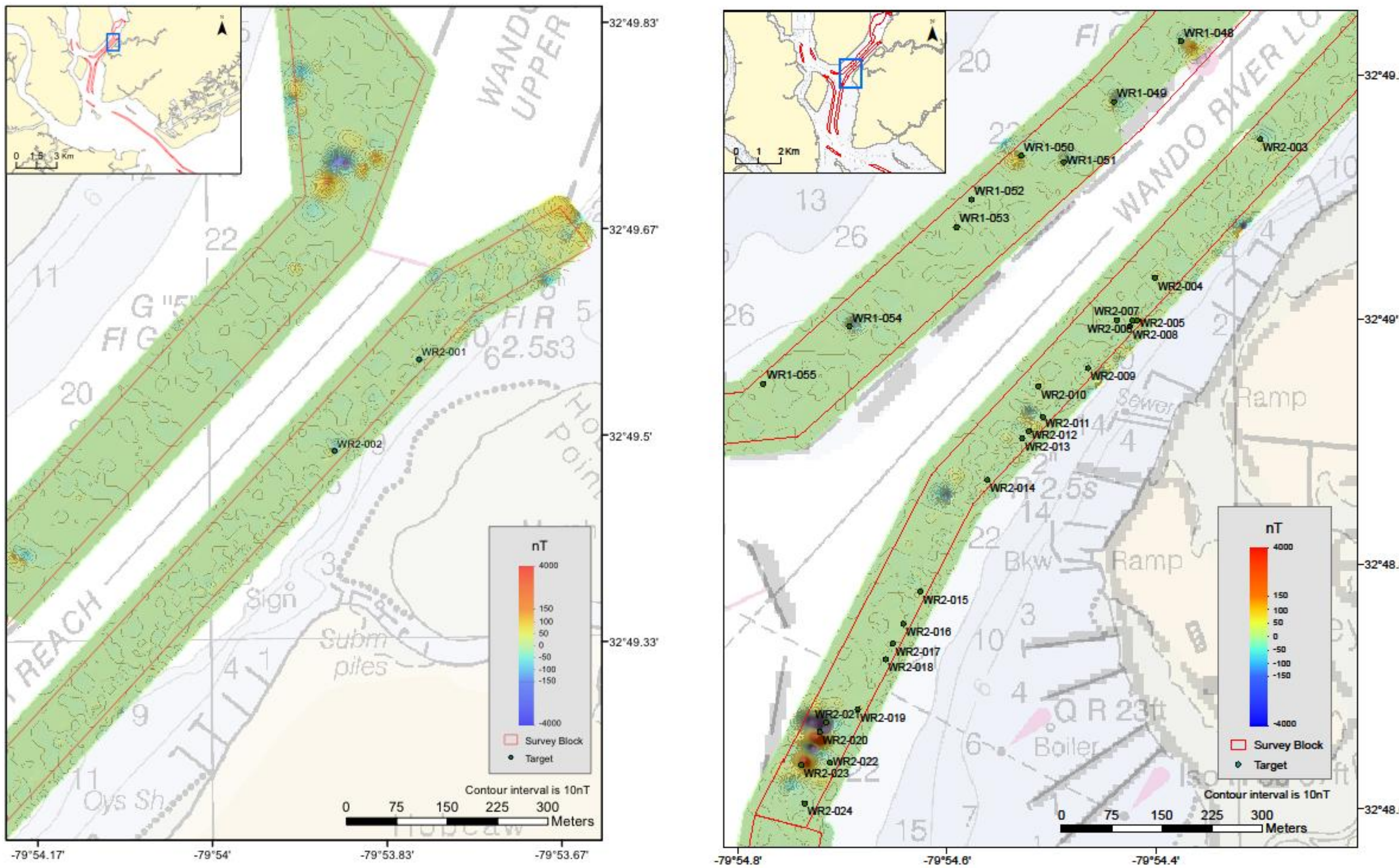


Figure 55. Magnetic anomaly color contour map of WR2.

WR2-001 is a positive monopolar magnetic anomaly of 16.26 nT and 1 second duration that coincides with isolated modern debris less than 0.5 m in any dimension in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-002 is a dipolar magnetic anomaly of 36.34 nT and 4 seconds duration that coincides with isolated modern debris providing a hard return and resembling part of a curved metal drum wall, for example, in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-003 is a dipolar magnetic anomaly of 64.87 nT and 9 seconds duration that coincides with a channel marker. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-004 (figure 56) is a positive monopolar magnetic anomaly of 32.82 nT and 8 seconds duration that coincides with a no specific feature on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-005 is a positive monopolar magnetic anomaly of 44.82 nT and 3 seconds duration that coincides with an isolated block-shaped object 1.5 m sq visible 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-006 is a positive monopolar magnetic anomaly of 20.82 nT and 3 seconds duration that coincides with an isolated block-shaped object 2.5 m sq visible 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-007 is a negative monopolar magnetic anomaly of 7.54 nT and 1 second duration that coincides with an isolated log or branch 7 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-008 (figure 57) is a positive monopolar magnetic anomaly of 18.47 nT and 1 second duration that coincides with a scatter of small debris providing hard returns in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-009 is a negative monopolar magnetic anomaly of 20.68 nT and 2 seconds duration that coincides with several small pieces of debris less than 1 m in all dimensions 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-010 (figure 58) is a positive monopolar magnetic anomaly of 33.66 nT and 3 seconds duration that coincides with a length of wire rope or cable approximately 3.6 m long in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

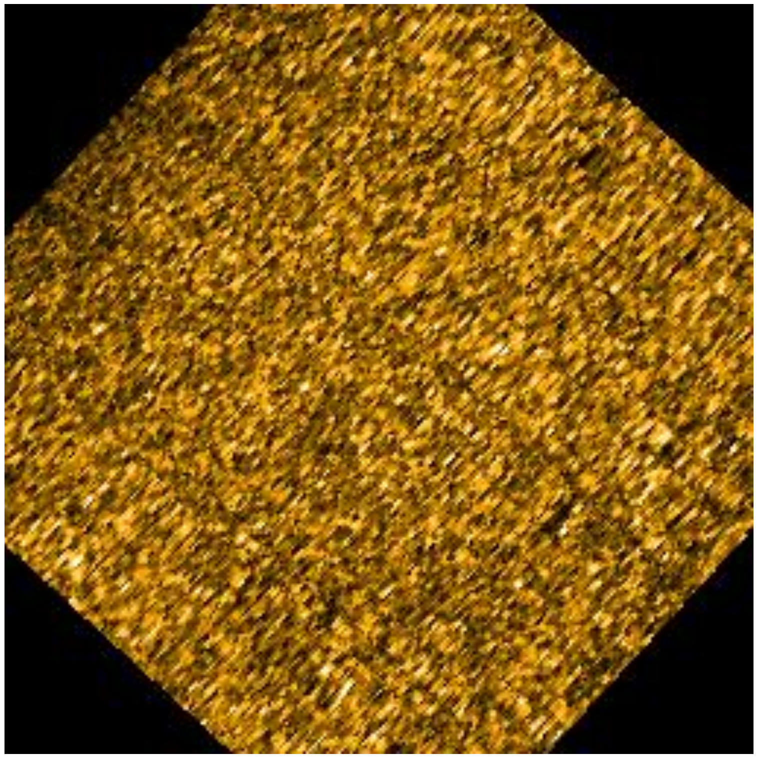
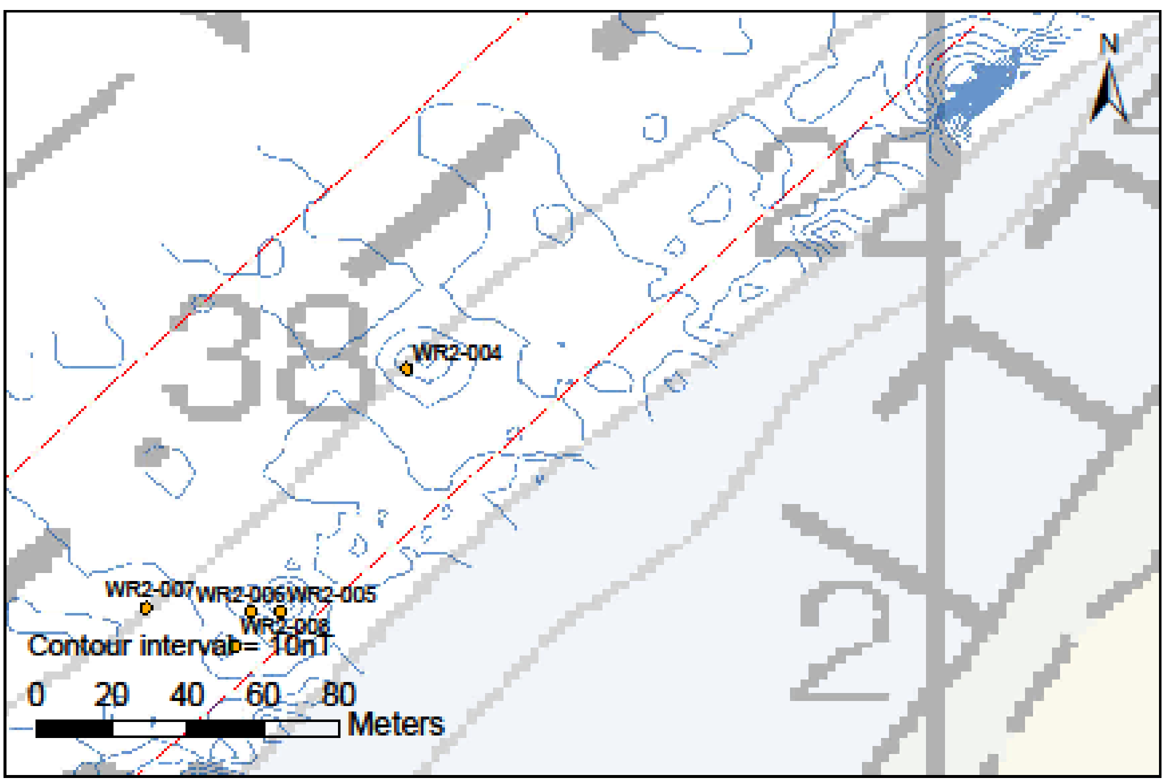


Figure 56. Anomaly WR2-004 sonogram showing no features (top). Anomaly WR2-004 magnetic contour map.



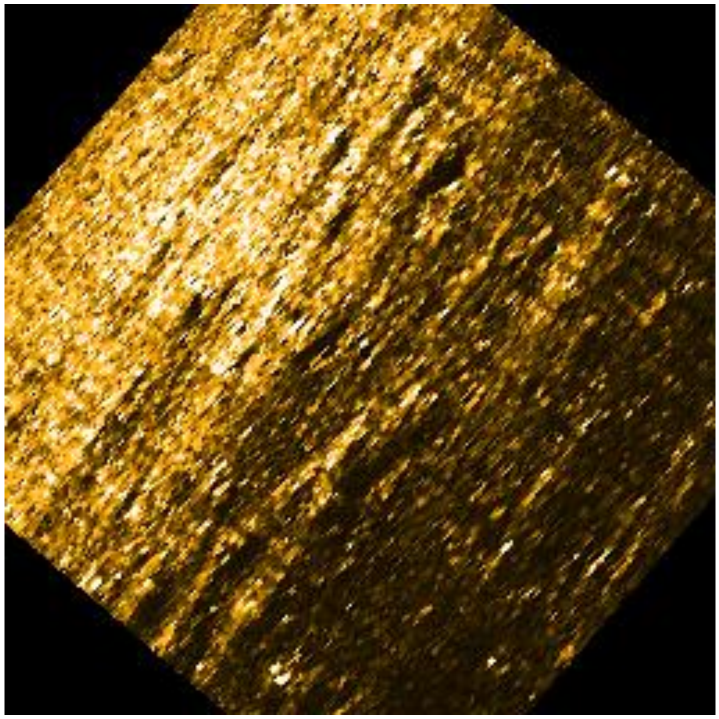
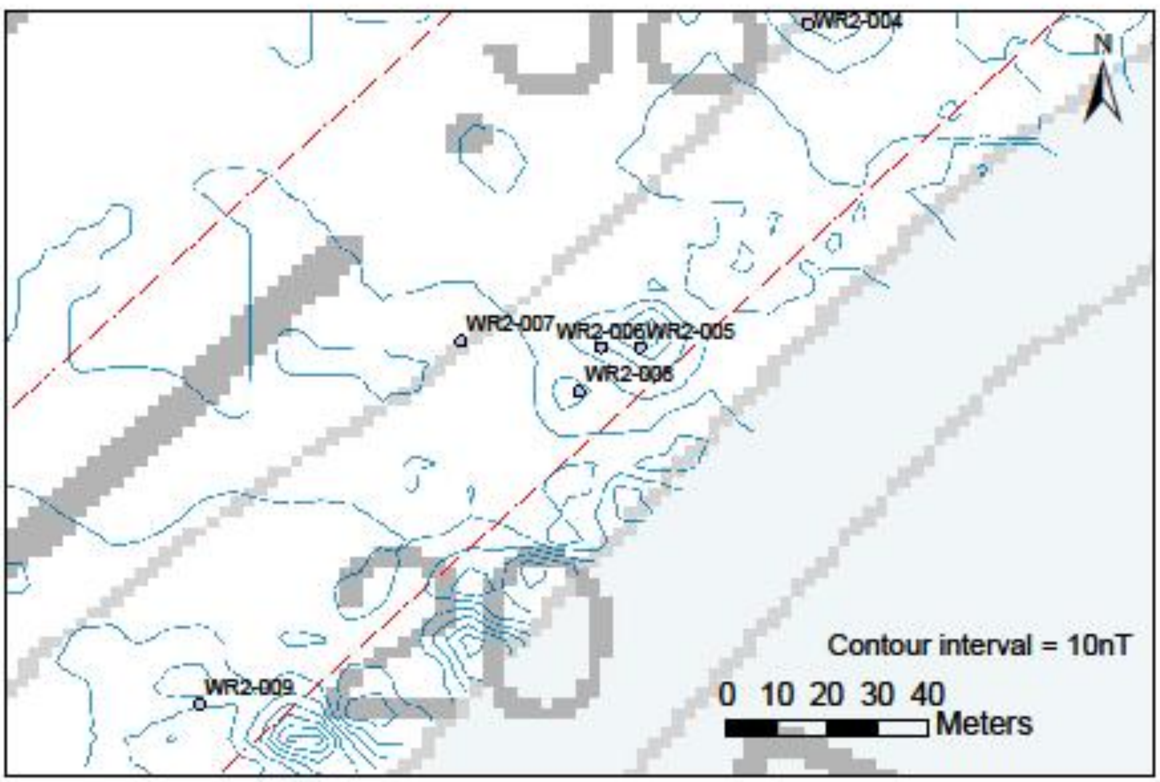


Figure 57. Anomaly WR2-008 sonogram showing scattered small debris (top). Anomaly WR2-008 magnetic contour map (bottom).



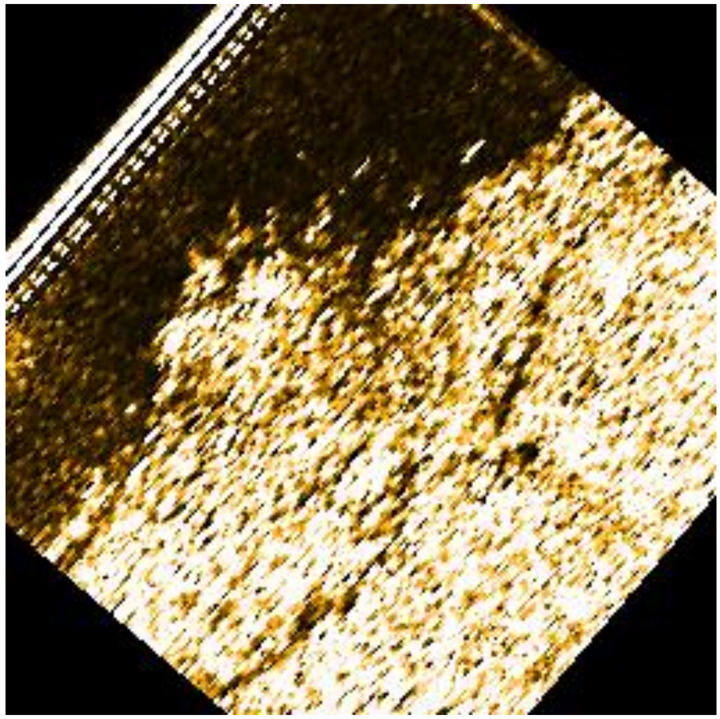
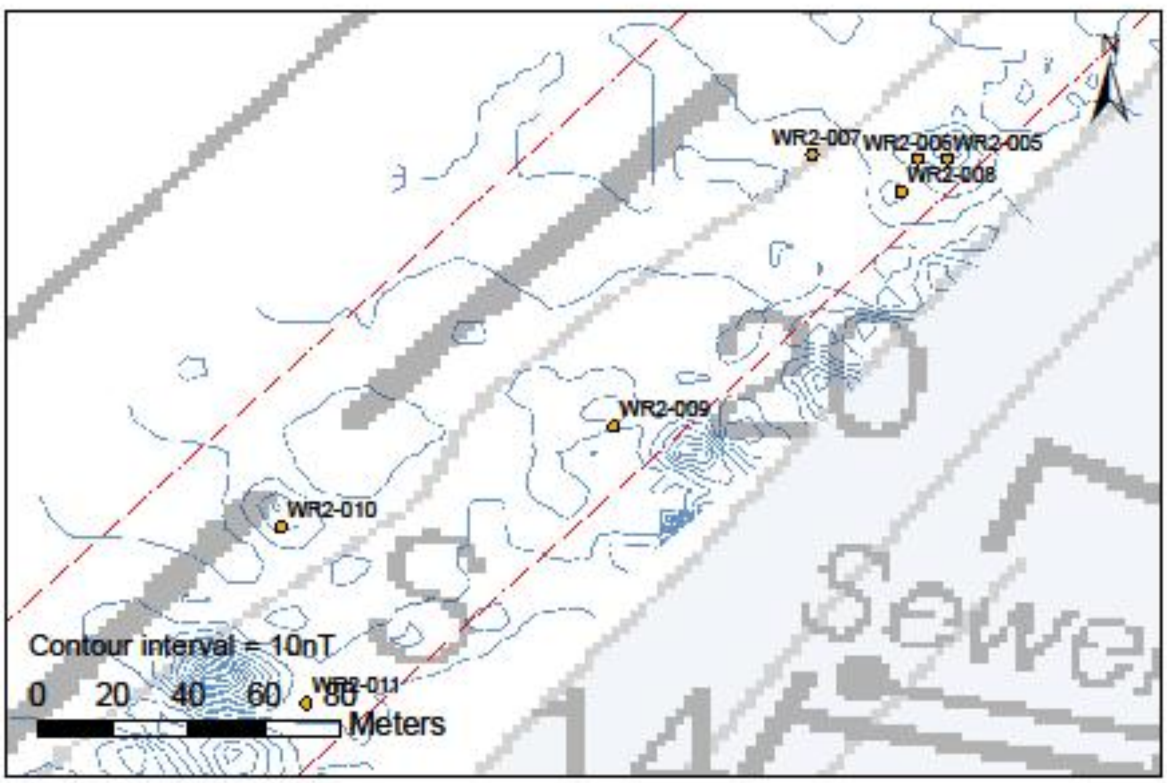
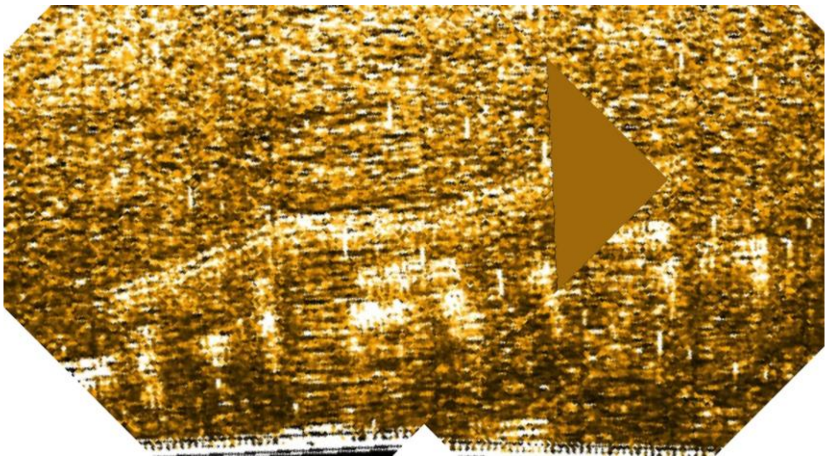


Figure 58. Anomaly WR2-010 sonogram showing a wire or cable (top). Anomaly WR2-010 magnetic contour map (bottom).



WR2-011 is a negative monopolar magnetic anomaly of 7.15 nT and 1 second duration that coincides with an isolated piece of hard-return debris less than 0.5 m long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-012 is a dipolar magnetic anomaly of 79.89 nT and 7 seconds duration that coincides with sediment-covered modern machine element that resembles a winch. It appears to be about 15 m long and is covered by sediment on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.



WR2-012 resembles a winch with its symmetrical components aligned along a central axis.

WR2-013 is a dipolar magnetic anomaly of 22.39 nT and 3 seconds duration that coincides with an isolated pipe approximately 2.4 m long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-014 is a positive monopolar magnetic anomaly of 5.49 nT and 1 second duration that coincides with an isolated crab pot 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-015 is a dipolar magnetic anomaly of 51.98 nT and 2 seconds duration that coincides with an isolated pipe approximately 6 m long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-016 is a positive monopolar magnetic anomaly of 8.36 nT and 1 second duration that coincides with an isolated pipe approximately 2.4 m long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-017 is a negative monopolar magnetic anomaly of 9.9 nT and 1 second duration that coincides with pipes (continuing beyond the margin of sonogram records) approximately 2 m long and 0.1 m above the harbor bottom. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-018 is a negative monopolar magnetic anomaly of 12.78 nT and 2 seconds duration that coincides with an isolated piece of debris less than 1 m long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-019 is a positive monopolar magnetic anomaly of 18.27 nT and 2 seconds duration that coincides with a 6 m long pipe 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-020 is a negative monopolar magnetic anomaly of 1703.29 nT and 5 seconds duration that coincides with a cluster of pipes approximately 8 m long and up to 0.8 m above the harbor bottom. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-021 is a negative monopolar magnetic anomaly of 797.77 nT and 7 seconds duration that coincides with pipes approximately 8 m long and in a tangle 11.3 m wide under a pipeline or cable 0.8 m above the harbor bottom. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-022 is a positive monopolar magnetic anomaly of 7.46 nT and 1 second duration that coincides with an isolated crab pot 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-023 is a negative monopolar magnetic anomaly of 470.99 nT and 6 seconds duration that coincides with a pipe or cable approximately 8 m long and 0.2 m above the harbor bottom. No additional evidence of submerged cultural material was found in the anomaly area.

WR2-024 is a positive monopolar magnetic anomaly of 14.19 nT and 1 second duration that coincides with an isolated tire or modern rigging eye about 1 m in diameter and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

Myers Bend 1 (MB1)

MB1 Remote sensing data was generated from this survey area on 4 and 11 October 2012. The major concentrations of magnetic anomalies are associated with a rock spill from a groin on shore. A total of 5 individual anomalies were identified for this survey section and each is described below, including recommendations. Table 9 and figure 59 provide specific details of each target. There are no indications of historic or culturally significant materials in this survey area. Sonograms show modern features of an industrial harbor such as concrete blocks on the bottom, buoy sinkers, and crab traps. Ship traffic, jetties, piers, sewage and other pipelines, docks, and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged, and dredging was occurring in the area during the recovery of remote sensing data.

Table 9. Characteristics of Myers Bend 1 (MB1) magnetic anomalies.

Anomaly	Amplitude (nT)	x cords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
MB1-001	112.71	2329485.6	362427.7	0:00:08	8.91	6.88	Dipolar	debris	No further work
MB1-002	25.82	2329585.1	362308.6	0:00:02	6.69	5.10	Negative monopolar	2m L pipe	No further work
MB1-003	889.94	2329746.5	362146.6	0:00:01	3.40	2.01	Positive monopolar	scattered rocks	No further work
MB1-004	103.98	2329997.9	361607.1	0:00:01	4.57	3.31	Dipolar	debris	No further work
MB1-005	72.96	2330028.2	361352.7	0:00:03	6.23	4.61	Dipolar	debris	No further work

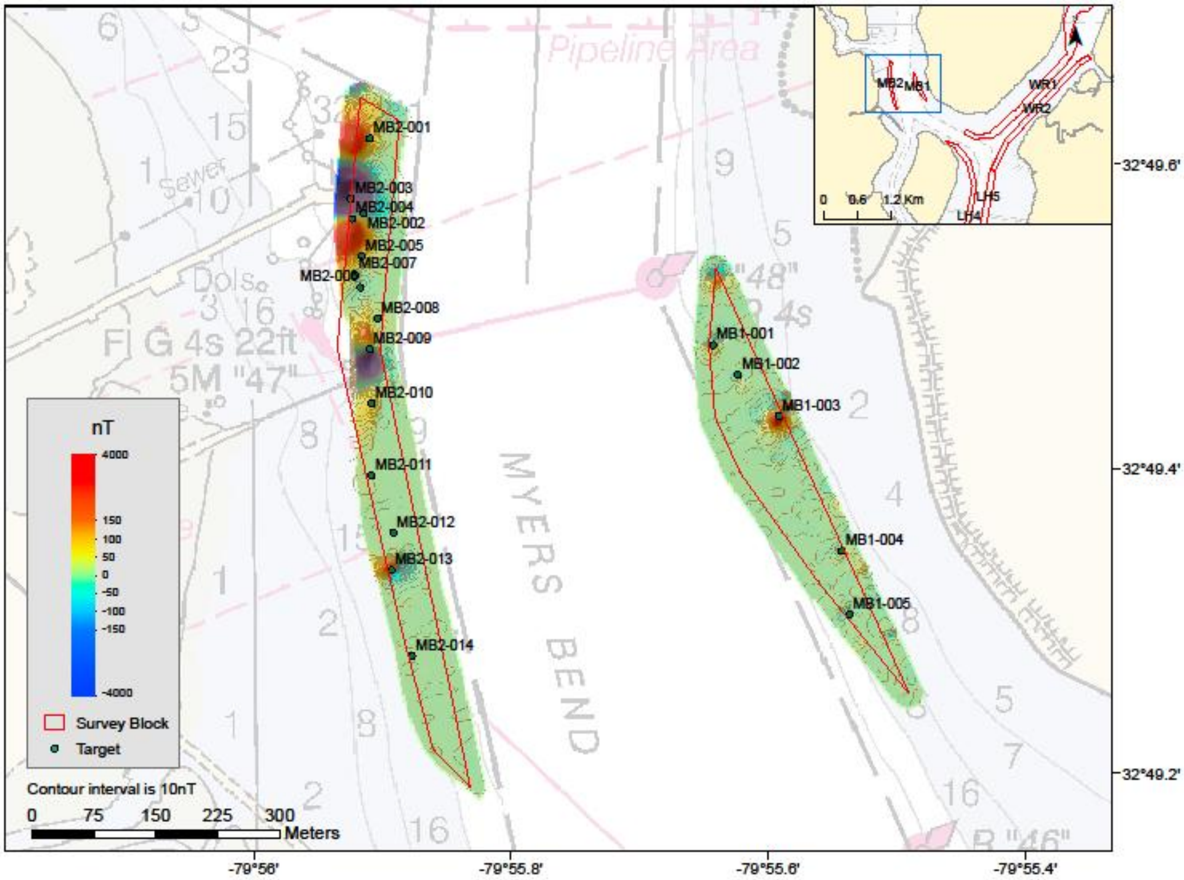


Figure 59. Magnetic anomaly color contour maps of MB1 and MB2.

MB1-001 is a dipolar magnetic anomaly of 112.71 nT and 8 seconds duration that coincides with a piece of debris less than 1 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

MB1-002 is a negative monopolar magnetic anomaly of 25.82 nT and 2 seconds duration that coincides with an isolated piece of pipe 2 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

MB1-003 (figure 60) is a positive monopolar magnetic anomaly of 889.94 nT and 1 second duration that coincides with an area of scattered rocks on the harbor bottom in sonogram records located at the base of a rock-built groin. No additional evidence of submerged cultural material was found in the anomaly area.

MB1-004 is a dipolar magnetic anomaly of 103.98 nT and 1 second duration that coincides with a piece of debris 0.3 m above the harbor bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

MB1-005 is a dipolar magnetic anomaly of 72.96 nT and 3 seconds duration that coincides with a small piece of debris less than 1 m long and 0.2 m above the harbor bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

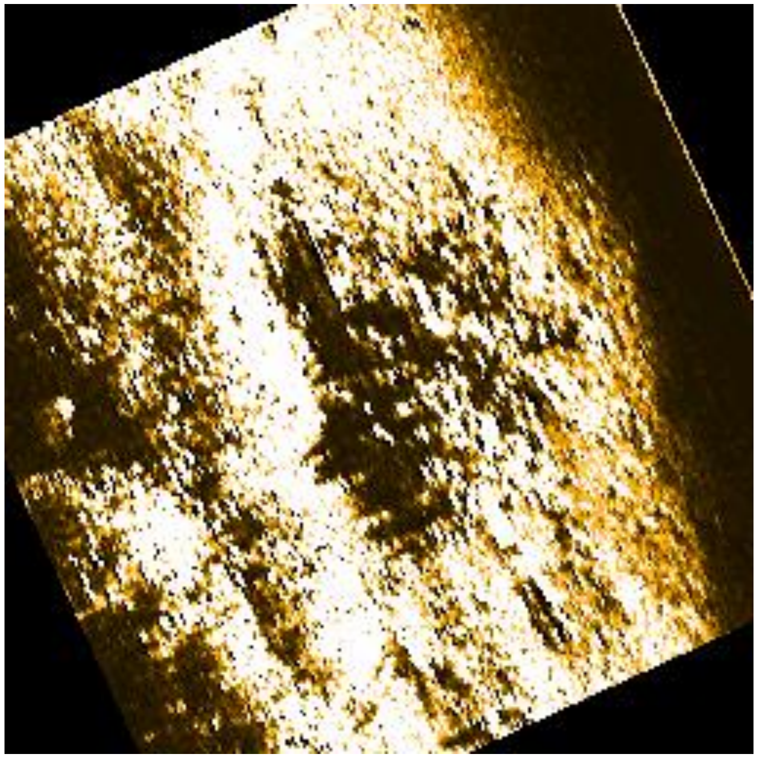
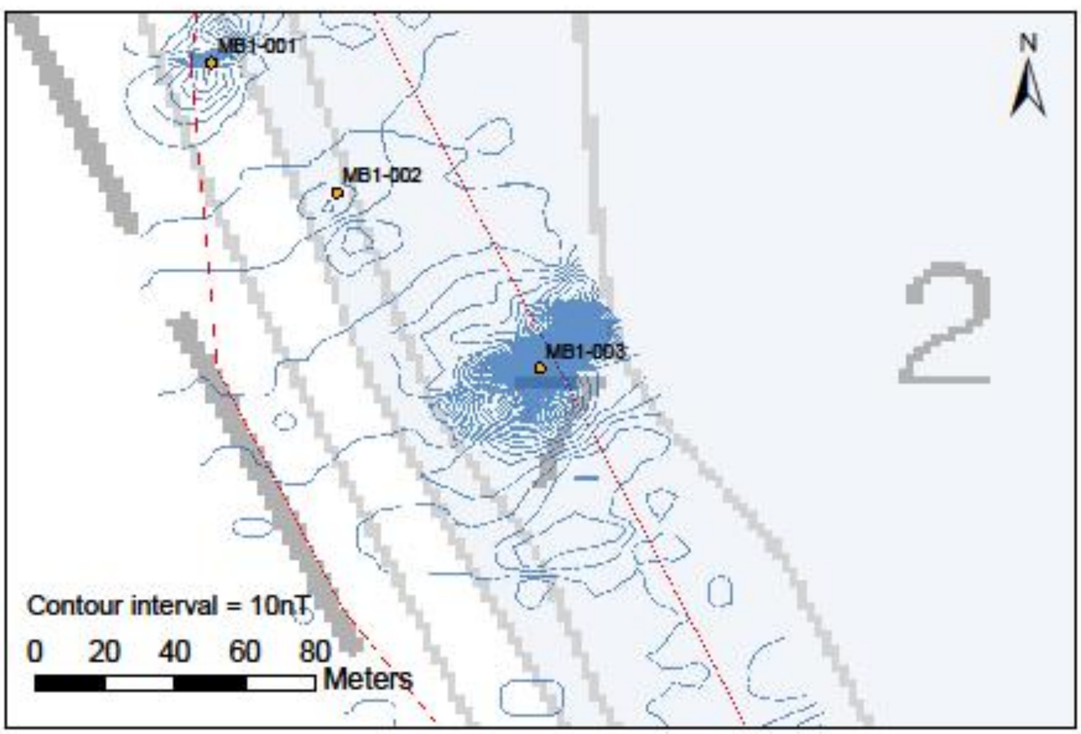


Figure 60. Anomaly MB1-003 sonogram showing rocks (top). Anomaly MB1-003 magnetic contour map (bottom).



Myers Bend 2 (MB2)

MB2 was examined on 4 October 2012. Rock groins and iron piers on the western side severely impacted magnetometer data acquisition and rock is visible at the base of the groins. Several pipelines running through the area also affect magnetometer data. Sonograms show modern features of an industrial harbor such as rocks on the harbor bottom near a dike, concrete blocks on the bottom, buoy sinkers, and crab traps. Ship traffic, jetties, piers, sewage and other pipelines, docks, and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged, and dredging was occurring in the area during the recovery of remote sensing data.

MB2 is on the edge of a deeper channel at its eastern boundary, and its western boundary is along the seaward edge of a modern pier with mooring dolphins that generated most of the magnetic distortion in this area.

A total of 14 individual anomalies were identified for this survey section and each is described below, including recommendations. Table 10 and figure 61 provide specific details of each target. No potentially historic or prehistoric cultural material was noted in reviewing these anomalies.

Table 10. Characteristics of Myers Bend 2 (MB2) magnetic anomalies.

Anomaly	Amplitude (nT)	x cords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
MB2-001	104.68	2328119.2	363250.3	0:00:01	13.96	12.37	Positive monopolar	modern pier structure	No further work
MB2-002	462.53	2328094.7	362951.7	0:00:01	13.78	12.24	Dipolar	modern pier structure; isolated debris	No further work
MB2-003	1222.91	2328044.9	363009.4	0:00:04	13.17	10.86	Negative monopolar	modern pier structure foundations	No further work
MB2-004	947.45	2328048.8	362929.4	0:00:20	13.47	11.41	Dipolar	modern pier structure foundations	No further work
MB2-005	116.59	2328087.2	362780.7	0:00:08	14.03	12.53	Positive monopolar	modern pier structure; crab pot	No further work
MB2-006	52.86	2328082.4	362656.9	0:00:02	13.39	11.81	Negative monopolar	crab pots	No further work
MB2-007	52.86	2328060.3	362707.6	0:00:02	13.76	11.86	Positive monopolar	isolated modern debris	No further work
MB2-008	31.57	2328151.2	362533.9	0:00:01	13.56	11.77	Positive monopolar	modern pier structure	No further work
MB2-009	617.36	2328118.7	362409.9	0:00:18	11.69	10.02	Dipolar	modern object, possibly an anchor	No further work
MB2-010	100.95	2328127.1	362195.3	0:00:01	8.61	7.07	Positive monopolar	modern pier structure; rock scatter from dike	No further work
MB2-011	16.26	2328127.0	361907.9	0:00:01	7.46	5.51	Positive monopolar	crab pot; sm isolated debris fragments or	No further work

								rocks	

Table 10 continued

MB2-012	8.80	2328212.3	361679.5	0:00:01	9.08	7.66	Positive monopolar	crab pots (3)	No further work
MB2-013	411.77	2328204.6	361530.3	0:00:08	7.42	5.36	Dipolar	none	No further work
MB2-014	15.30	2328288.0	361189.2	0:00:04	6.32	4.22	Positive monopolar	crab pot	No further work

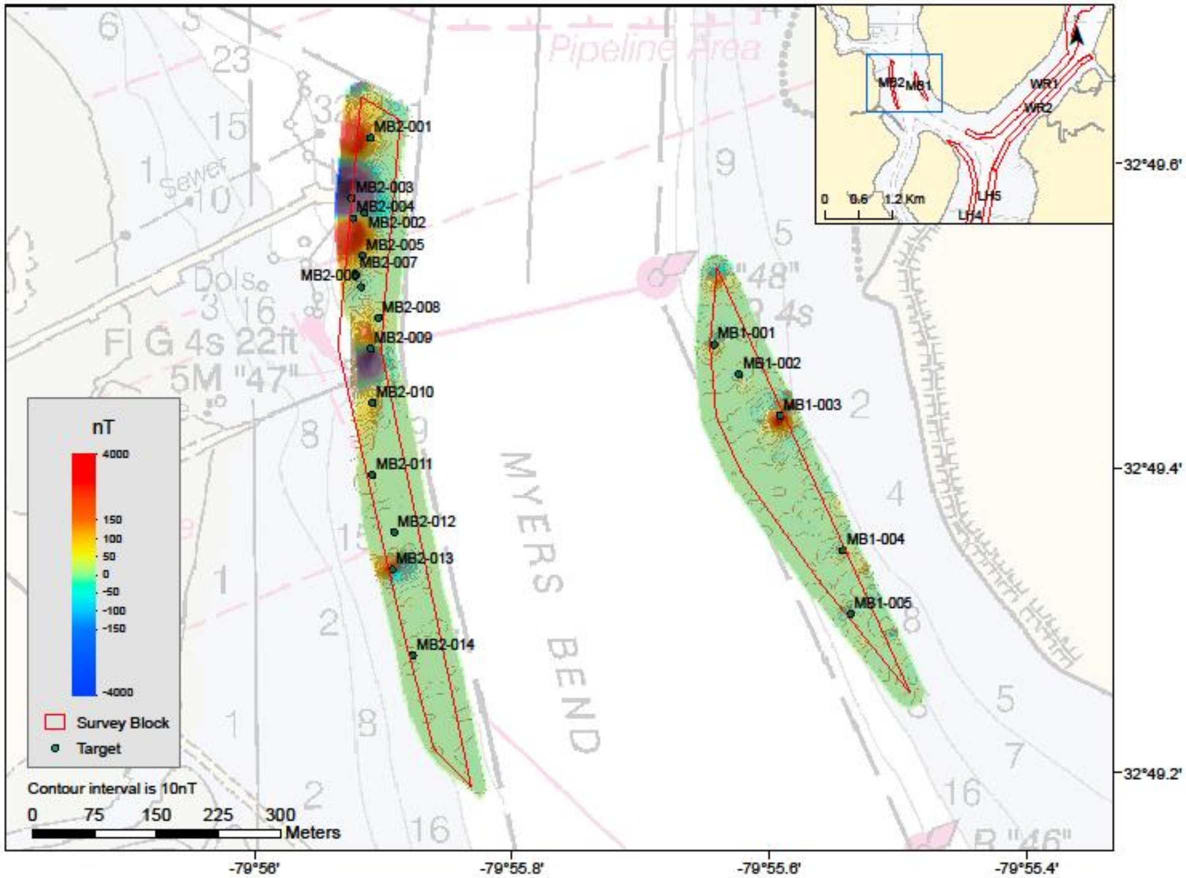


Figure 61. Magnetic anomaly color contour maps of MB1 and MB2.

MB2-001 is a positive monopolar magnetic anomaly of 104.68 nT and 1 second duration that coincides with the foundation of a modern pier structure with mooring dolphins in sonogram records. Small pieces of debris also are visible, all less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-002 is a dipolar magnetic anomaly of 462.53 nT and 1 second duration that coincides with a line of piles forming part of a modern pier structure parallel to the shoreline and at least 0.4 m above the harbor bottom in sonogram records. Small pieces of debris also are visible, all less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-003 (figure 62) is a negative monopolar magnetic anomaly of 1222.91 nT and 4 seconds duration that is located immediately adjacent to a modern steel and concrete pier with mooring dolphins and is unlikely to represent historic cultural materials. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-004 is a dipolar magnetic anomaly of 947.45 nT and 20 second duration that that is located immediately adjacent to a modern steel and concrete pier with mooring dolphins and is unlikely to represent historic cultural materials. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-005 is a positive magnetic anomaly 116.59 nT and 8 seconds duration that coincides with a line of mooring dolphins that are part of a modern steel and concrete pier structure and a crab pot in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-006 (figure 63) is a positive monopolar magnetic anomaly of 52.86 nT and 2 seconds duration that coincides with a line of crab pots at least 0.4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-007 is a positive monopolar magnetic anomaly of 52.86 nT and 2 seconds duration that coincides with isolated modern debris no more than 0.4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-008 is a dipolar magnetic anomaly of 31.57 nT and 1 second duration that coincides with a modern pier structure very close to the survey boundary. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-009 is a dipolar magnetic anomaly of 617.36 nT and 18 seconds duration that coincides with a modern object, possibly an anchor, that provides a hard return and measures approximately 5 m in length and is 0.7 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

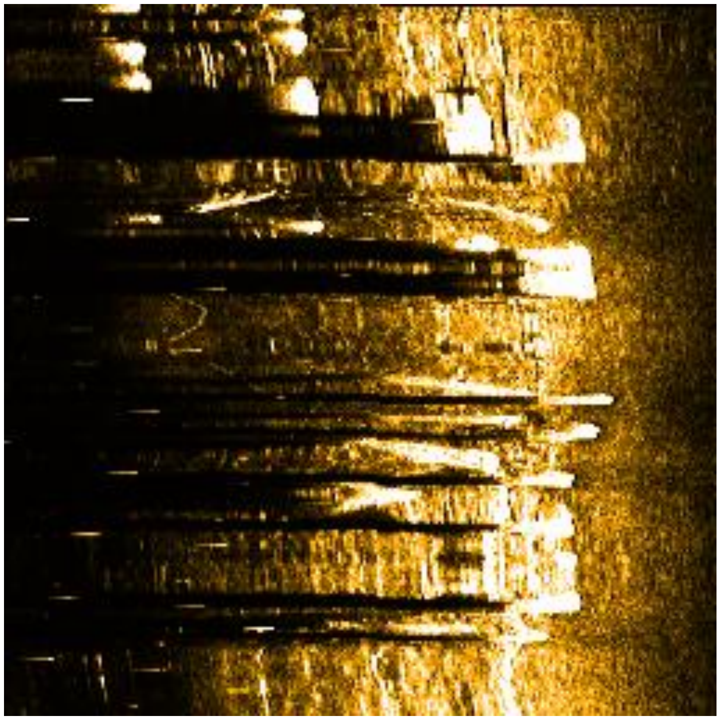
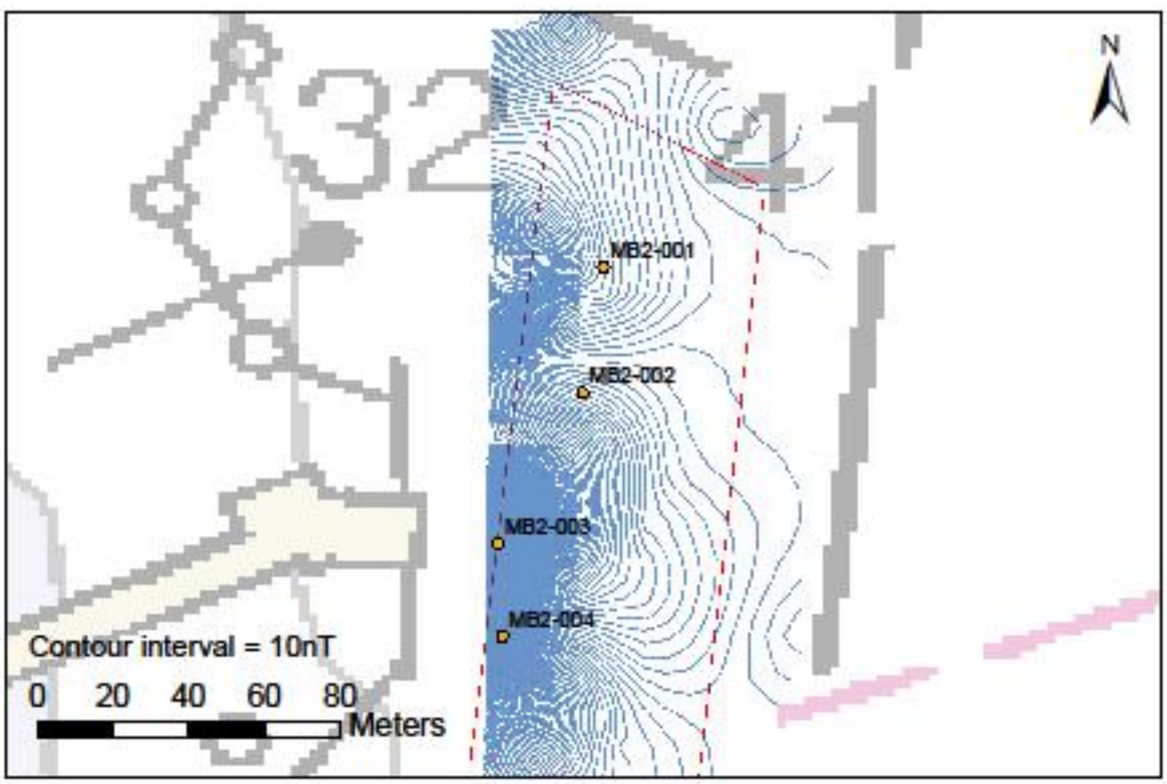


Figure 62. Anomaly MB2-003 sonogram showing modern pier structure foundations (top). Anomaly MB2-003 magnetic contour map (bottom).



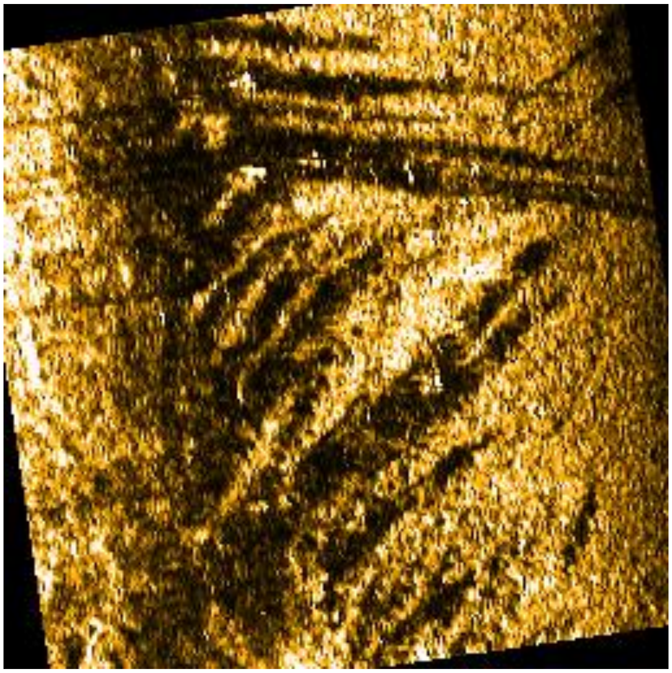
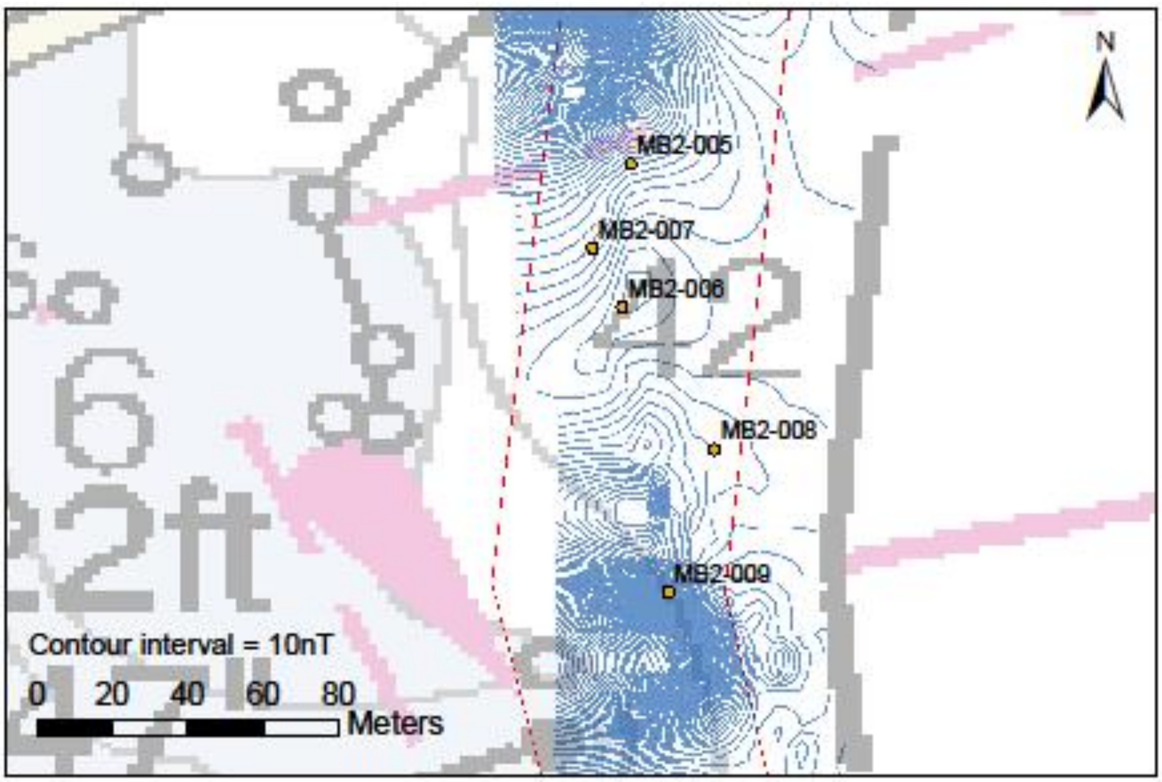


Figure 63. Anomaly MB2-006 sonogram showing crab pots (top). Anomaly MB2-006 magnetic contour map (bottom).



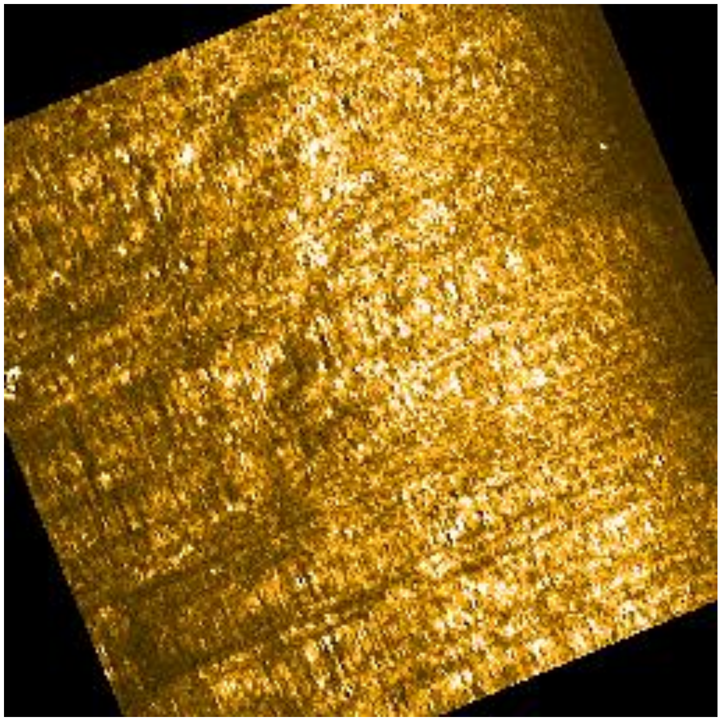
MB2-010 is a positive monopolar magnetic anomaly of 100.95 nT and 1 second duration that coincides with a modern pier structure and scatter rock at least 0.4m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

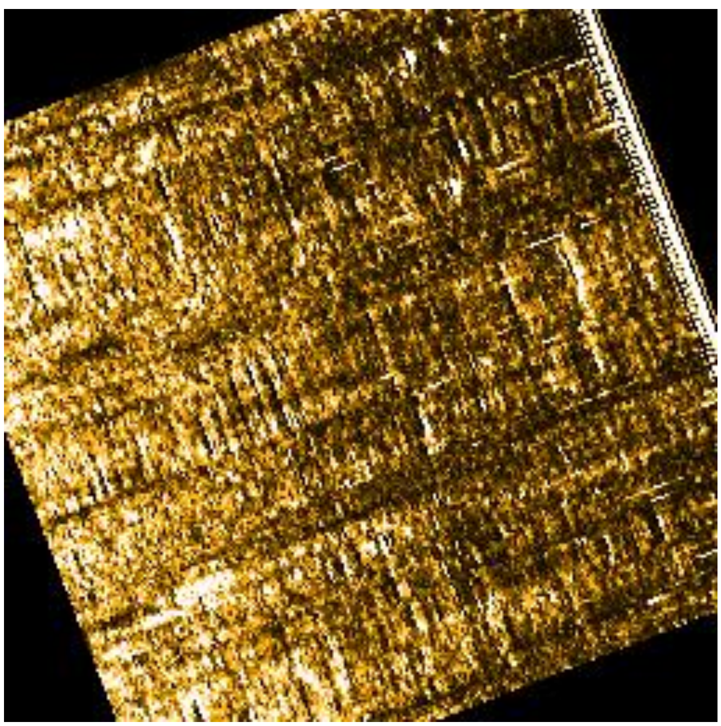
MB2-011 is a positive monopolar magnetic anomaly of 16.26 nT and 1 second duration that coincides with a crab pot and an isolated piece of debris less than 0.5 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-012 is a positive monopolar magnetic anomaly of 8.80 nT and 1 second duration that coincides 3 crab pots less than 0.6 m above the bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-013 (figure 64) is a dipolar magnetic anomaly of 411.77 nT and 8 seconds duration that coincides with no specific feature in sonogram records, but is identified with an area of pipelines crossing the channel. No additional evidence of submerged cultural material was found in the anomaly area.

MB2-014 is a positive monopolar magnetic anomaly of 15.3 nT and 4 seconds duration that coincides with a crab pot at least 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.





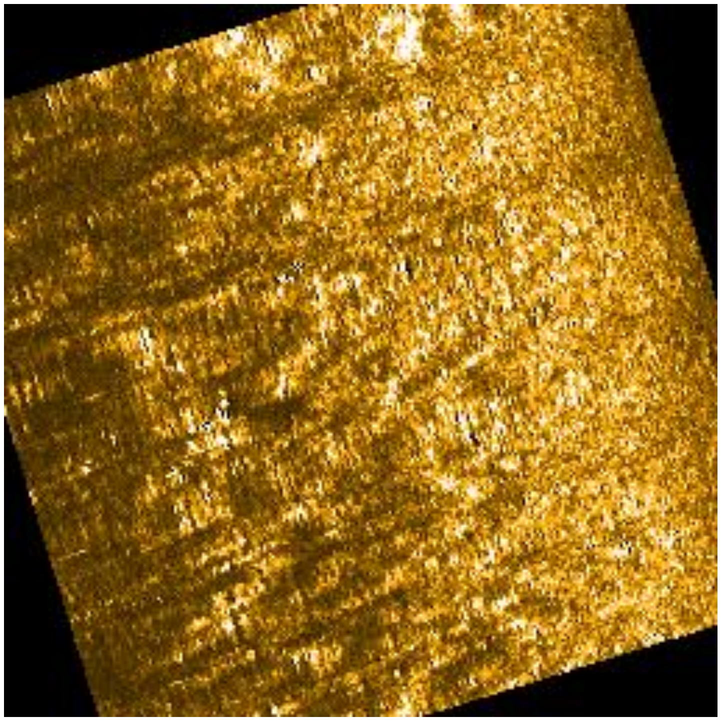
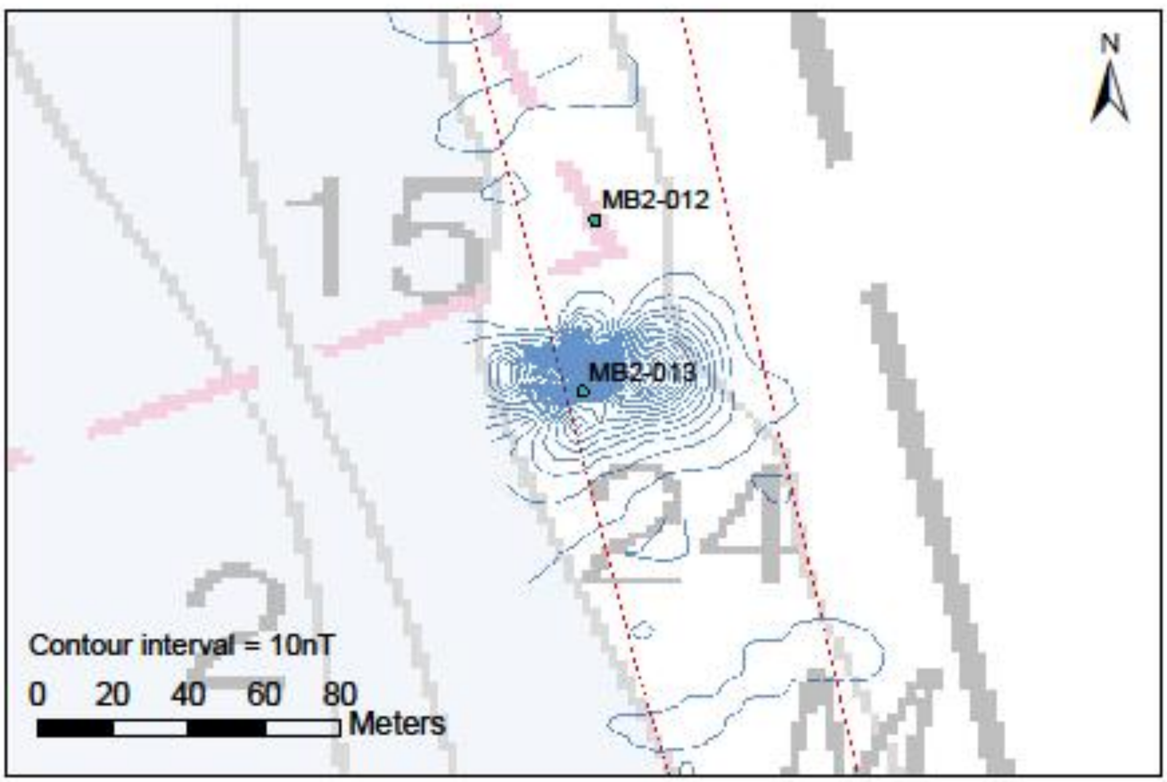


Figure 64. Anomaly MB2-013 sonograms showing no features (top). Anomaly MB2-013 magnetic contour map (bottom).



Cooper River 1 (CR1)

CR1 Remote sensing data was generated from this survey area on 9 October 2012. A total of 7 individual anomalies were identified for this survey section and each is described below, including recommendations. Table 11 and figure 65 provide specific details of each target. Ship traffic, docks, and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged and is scarred by anchoring activities. No potentially historic or prehistoric cultural material was noted in reviewing these anomalies. All cultural material in the Cooper River 1 survey area proved to be modern debris or cables and pilings representative of harbor activity.

Table 11. Characteristics of Cooper River 1 (CR1) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
CR1-001	1038.13	2327887.22	372030.84	0:00:18	12.97	9.35	Dipolar	pipeline	No further work
CR1-002	47.75	2328120.93	372000.52	0:00:04	8.54	5.64	Positive monopolar	isolated debris	No further work
CR1-003	31.91	2328026.34	371941.32	0:00:01	9.91	6.57	Positive monopolar	isolated debris	No further work
CR1-004	582.51	2328005.67	371861.07	0:00:10	14.06	10.52	Negative monopolar	isolated block	No further work
CR1-005	617.16	2328036.87	371814.09	0:00:17	13.99	10.29	Dipolar	isolated block	No further work
CR1-006	1746.96	2328172.92	371724.54	0:00:10	9.64	6.17	Dipolar	pipeline	No further work
CR1-007	65.93	2328339.04	371697.15	0:00:05	8.49	5.51	Dipolar	cable	No further work

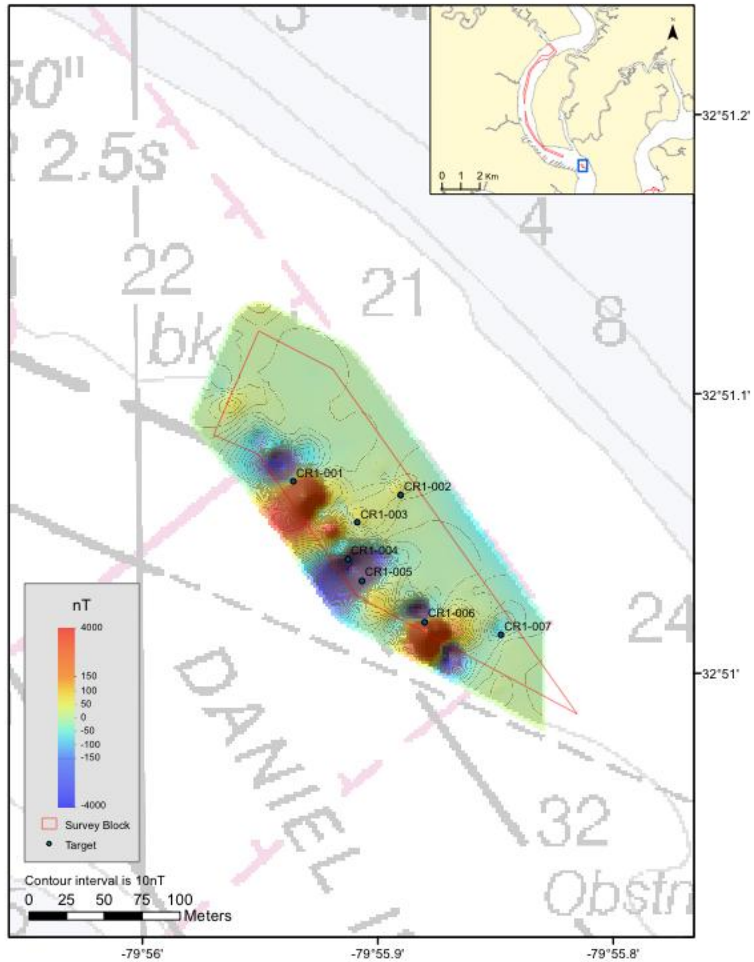


Figure 65. Magnetic anomaly color contour map of CR1.

CR1-001 is a dipolar magnetic anomaly of 1038.13 nT and 18 seconds duration that coincides with a pipeline 0.4m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR1-002 is a positive monopolar magnetic anomaly of 47.75 nT and 4 seconds duration that coincides with an isolated rectangular block approximately 0.8 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR1-003 is a positive monopolar magnetic anomaly of 31.91 nT and 1 second duration that coincides with an isolated piece of debris 1 m long and 0.4m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR1-004 is a negative monopolar magnetic anomaly of 582.51 nT and 10seconds duration that coincides with an isolated block-shaped object 1.3 m long and 0.4m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR1-005 is a dipolar magnetic anomaly of 617.16 nT and 17 seconds duration that coincides with an isolated block-shaped object approximately 1.2 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR1-006 is a dipolar magnetic anomaly of 1746.96 nT and 10 seconds duration that coincides with a pipeline 0.4m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR1-007 is a dipolar magnetic anomaly of 65.93 nT and 5 seconds duration that coincides with a length of cable visible in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

Cooper River 2 (CR2)

CR2 Remote sensing data was generated from this survey area on 9 October 2012. A total of 76 individual anomalies were identified for this survey section, and each is described below, including recommendations. Table 12 and figures 66-67 provide specific details of each target. Ship traffic, docks, and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged and is scarred by anchoring activities. No potentially historic or prehistoric cultural material was noted in reviewing these anomalies. All cultural material in the CR2 survey area proved to be modern debris or cables and debris representative of harbor activity.

Table 12. Characteristics of Cooper River 2 (CR2) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
CR2-001	150.70	2318149.70	380539.95	00:00:02	5.90	2.15	Negative monopolar	scatter of small debris over 8 m area	No further work
CR2-002	21.80	2318172.57	380401.92	00:00:02	6.02	2.23	Positive monopolar	isolated debris	No further work
CR2-003	62.73	2318326.39	379759.48	00:00:07	26.41	20.51	Dipolar	isolated block, with chain	No further work
CR2-004	231.23	2318336.07	379712.28	00:00:01	6.36	1.39	Dipolar	isolated block	No further work
CR2-005	25.16	2318352.70	379585.11	00:00:03	6.76	3.26	Dipolar	crab pot	No further work
CR2-006	49.77	2318397.39	379414.56	00:00:03	7.28	3.78	Dipolar	isolated block	No further work
CR2-007	43.42	2318421.80	379123.74	00:00:05	8.63	5.68	Dipolar	debris, buoy/sink	No further work
CR2-008	14.23	2318969.59	378387.03	00:00:01	6.00	2.47	Negative monopolar	tires, 2	No further work
CR2-009	11.80	2318813.38	378349.08	00:00:01	8.75	5.80	Positive monopolar	debris, crab pot	No further work
CR2-010	61.78	2318811.99	378181.70	00:00:09	11.72	8.14	Dipolar	scattered small debris	No further work
CR2-011	190.63	2319126.24	378075.71	00:00:02	5.95	2.41	Dipolar	pipe	No further work
CR2-012	120.15	2319204.20	377956.43	00:00:04	6.07	2.60	Dipolar	pipe	No further work
CR2-013	191.91	2319300.95	377800.96	00:00:05	5.80	2.49	Dipolar	isolated block	No further work
CR2-014	20.41	2319082.34	377860.61	00:00:03	8.71	5.81	Positive monopolar	small scatter of debris	No further work
CR2-015	55.54	2319329.67	377692.10	00:00:02	6.15	2.68	Dipolar	tire	No further work
CR2-016	25.94	2319185.56	377672.46	00:00:05	8.93	6.15	Dipolar	scattered debris	No further work
CR2-017	109.22	2319361.29	377601.46	00:00:05	6.52	3.05	Dipolar	rectangular block	No further work
CR2-018	81.20	2319307.31	377473.57	00:00:02	9.08	6.22	Dipolar	debris	No further work
CR2-019	25.40	2319467.58	377413.34	00:00:03	6.32	2.89	Dipolar	debris	No further work
CR2-020	26.68	2319400.95	377321.71	00:00:02	9.66	6.63	Positive monopolar	pipe/cable	No further work
CR2-021	4364.48	2319607.94	377196.45	00:00:19	6.57	3.10	Dipolar	buried pipeline	No further work

Table 12 continued

CR2-022	374.11	2319441.71	377238.44	00:00:09	9.62	6.67	Dipolar	debris; exposed pipe	No further work
CR2-023	93.93	2319660.83	377127.86	00:00:04	6.72	3.30	Positive monopolar	various hard return small debris	No further work
CR2-024	26.91	2319520.04	377082.78	00:00:01	10.59	7.61	Positive monopolar	debris; crab pot	No further work
CR2-025	69.07	2319723.44	377008.42	00:00:03	7.16	3.77	Positive monopolar	debris	No further work
CR2-026	12.36	2319601.37	376934.43	00:00:03	10.71	7.76	Positive monopolar	crab pot	No further work
CR2-027	32.35	2320084.98	376477.24	00:00:04	7.56	4.14	Dipolar	various debris incl. cable	No further work
CR2-028	29.63	2320128.41	376434.02	00:00:05	7.59	4.12	Positive monopolar	various debris; crab pot	No further work
CR2-029	29.50	2320147.01	376416.01	00:00:04	7.67	4.20	Positive monopolar	various debris, tires	No further work
CR2-030	42.05	2320181.11	376383.61	00:00:07	7.48	4.01	Dipolar	isolated block; tires	No further work
CR2-031	149.21	2320295.82	376275.62	00:00:03	7.30	3.83	Dipolar	cable/wire 20m+	No further work
CR2-032	62.39	2320392.02	376174.72	00:00:03	7.02	3.68	Dipolar	isolated debris	No further work
CR2-033	23.82	2320420.02	376138.62	00:00:04	6.88	3.57	Dipolar	tires, 3	No further work
CR2-034	110.67	2320479.17	376059.18	00:00:04	7.17	3.70	Dipolar	pipe; debris	No further work
CR2-035	825.72	2320674.77	375846.49	00:00:05	6.89	3.42	Dipolar	exposed cable	No further work
CR2-036	347.21	2320462.77	375858.90	00:00:08	12.68	9.74	Dipolar	pipe	No further work
CR2-037	49.00	2320696.44	375828.52	00:00:02	6.97	3.55	Positive monopolar	tire	No further work
CR2-038	32.84	2320642.76	375671.53	00:00:04	12.65	9.78	Dipolar	crab pot; debris	No further work
CR2-039	105.26	2320724.37	375799.69	00:00:03	6.75	3.44	Dipolar	pipe or cable	No further work
CR2-040	54.15	2320808.33	375695.03	00:00:05	7.37	3.95	Dipolar	pipe	No further work
CR2-041	43.94	2320882.94	375604.83	00:00:06	7.12	3.70	Dipolar	small debris	No further work
CR2-042	298.56	2320969.87	375511.11	00:00:04	6.27	2.77	Dipolar	debris; metal poles/framework	No further work

Table 12 continued

CR2-043	585.66	2321004.01	375475.08	00:00:01	5.91	2.65	Dipolar	pipe; debris	No further work
CR2-044	179.04	2321084.80	375381.30	00:00:11	7.50	4.03	Dipolar	pipe	No further work
CR2-045	39.33	2320983.70	375358.44	00:00:07	10.58	7.55	Dipolar	small debris; crab pot	No further work
CR2-046	814.68	2321165.47	375298.43	00:00:04	7.37	4.03	Dipolar	cable/wire; scattered debris in area	No further work
CR2-047	61.08	2321079.94	375253.91	00:00:05	10.72	7.78	Dipolar	scattered debris; pipes	No further work
CR2-048	112.02	2321151.34	375178.23	00:00:08	11.08	8.13	Dipolar	debris	No further work
CR2-049	111.76	2321302.01	375157.92	00:00:03	7.56	4.22	Dipolar	tires, 6	No further work
CR2-050	88.15	2321342.33	375118.31	00:00:03	7.99	4.48	Dipolar	tires, 4	No further work
CR2-051	34.19	2321425.85	375057.30	00:00:03	7.81	4.28	Dipolar	cable	No further work
CR2-052	20.17	2321522.95	374869.09	00:00:05	10.21	7.26	Dipolar	debris, crab pot	No further work
CR2-053	25.23	2321634.04	374815.65	00:00:05	8.97	5.99	Dipolar	debris	No further work
CR2-054	78.34	2321763.66	374751.47	00:00:05	10.29	7.54	Dipolar	cable; under sediment	No further work
CR2-055	123.27	2321736.44	374711.17	00:00:10	12.88	9.49	Dipolar	buoy/sink	No further work
CR2-056	24.91	2321806.83	374733.72	00:00:05	10.42	7.47	Negative monopolar	pipe	No further work
CR2-057	34.52	2321782.75	374686.17	00:00:12	12.74	9.27	Negative monopolar	debris; pipe	No further work
CR2-058	7.52	2321914.78	374687.51	00:00:01	9.83	7.13	Positive monopolar	crab pot	No further work
CR2-059	6.45	2321890.70	374639.97	00:00:01	12.65	9.03	Positive monopolar	debris	No further work
CR2-060	148.06	2322098.75	374714.85	00:00:03	5.38	2.07	Dipolar	pipe	No further work
CR2-061	69.09	2322277.50	374651.17	00:00:02	4.89	1.71	Dipolar	cable or wire	No further work
CR2-062	82.00	2322192.15	374588.46	00:00:03	7.70	4.89	Dipolar	bundle of timbers or barricade	No further work
CR2-063	29.85	2322623.05	374490.96	00:00:05	5.34	2.16	Dipolar	isoated debris	No further work
CR2-064	8.53	2322605.59	374396.19	00:00:02	8.78	5.99	Positive monopolar	crab pot	No further work

Table 12 continued

CR2-065	120.91	2322860.40	374402.42	00:00:04	5.03	1.89	Dipolar	isoated debris	No further work
CR2-066	14.52	2322878.86	374398.97	00:00:01	4.99	1.81	Positive monopolar	2 crab pots	No further work
CR2-067	177.24	2322940.57	374370.49	00:00:01	4.97	1.75	Dipolar	rock scatter over 20m	No further work
CR2-068	12.75	2323446.39	374153.70	00:00:02	5.54	2.40	Negative monopolar	tire?	No further work
CR2-069	135.86	2323591.25	374100.61	00:00:03	5.75	2.72	Dipolar	cable or wire	No further work
CR2-070	10.55	2323773.08	374036.97	00:00:01	5.75	2.80	Negative monopolar	small debris	No further work
CR2-071	24.05	2324004.63	373915.63	00:00:06	6.34	3.27	Dipolar	modern debris	No further work
CR2-072	48.15	2324112.51	373876.71	00:00:02	5.80	2.69	Dipolar	5m anchor/sink (modern)	No further work
CR2-073	48.32	2324164.89	373859.06	00:00:01	5.78	2.63	Positive monopolar	isoated debris	No further work
CR2-074	44.38	2324272.81	373816.50	00:00:01	5.77	2.79	Dipolar	small debris	No further work
CR2-075	19.83	2324457.89	373734.71	00:00:07	5.82	2.71	Negative monopolar	pipe/wood frag	No further work
CR2-076	34.89	2324623.52	373754.59	00:00:01	5.17	2.14	Negative monopolar	cable/wire fragment	No further work

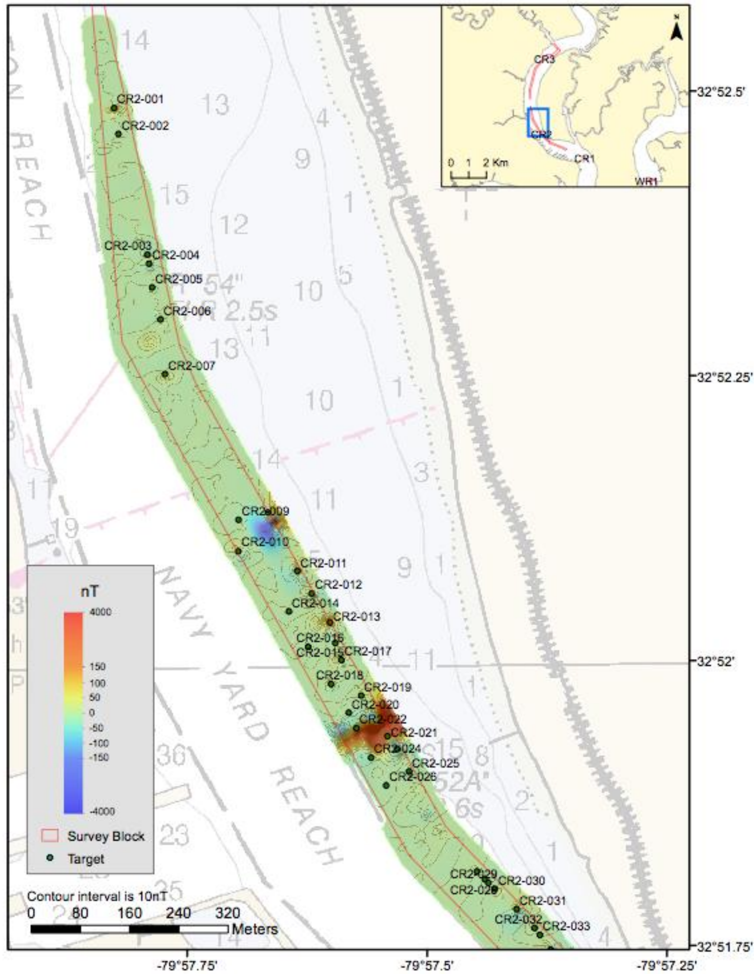


Figure 66. Magnetic anomaly color contour map of CR2.

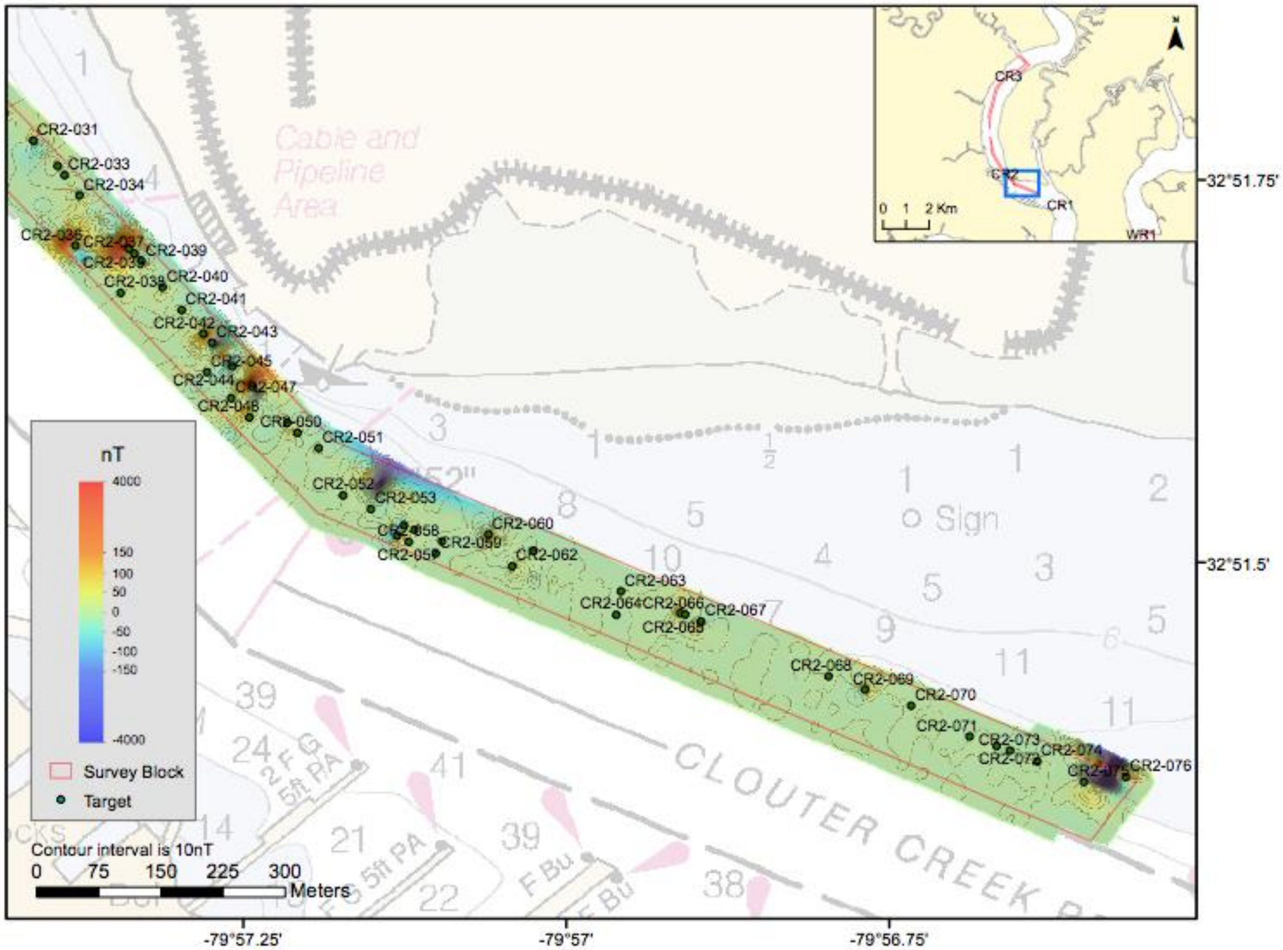


Figure 67. Magnetic anomaly color contour map of CR2 continued.

CR2-001 is a negative monopolar magnetic anomaly of 150.7 nT and 2 seconds duration that coincides with a scatter of small hard return debris in an area approximately 8 m^2 in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-002 is a positive monopolar magnetic anomaly of 21.8 nT and 2 seconds duration that coincides with isolated debris of dimensions less than 1 m in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-003 is a dipolar magnetic anomaly of 62.73 nT and 7 seconds duration that coincides with an isolated block and chain identified feature in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-004 is a dipolar magnetic anomaly of 231.23 nT and 1 second duration that coincides with an isolated block 1.5 m long and 0.4 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-005 is a dipolar magnetic anomaly of 25.16 nT and 3 seconds duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-006 is a dipolar magnetic anomaly of 49.77 nT and 3 seconds duration that coincides with an isolated block 1.8 m long and 0.4 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-007 is a dipolar magnetic anomaly of 43.42 nT and 5 seconds duration that coincides with debris providing a hard return and a buoy/sink in accompanying sonogram records. The debris is less than 0.6 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-008 is a negative monopolar magnetic anomaly of 14.23 nT and 1 second duration that coincides with two tires in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-009 is a positive monopolar magnetic anomaly of 11.8 nT and 1 second duration that coincides with a crab pot and a 4.3 m long piece of what is probably wood 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-010 (figure 68) is a dipolar magnetic anomaly of 61.78 nT and 9 seconds duration that coincides with a scatter of small debris in accompanying sonogram records. The debris is less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-011 is a dipolar magnetic anomaly of 190.63 nT and 2 seconds duration that coincides with a pipe approximately 2.2 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-012 is a dipolar magnetic anomaly of 120.15 nT and 4 seconds duration that coincides with a pipe approximately 3.4 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-013 is a dipolar magnetic anomaly of 191.91 nT and 5 seconds duration that coincides with an isolated block approximately 2 m long and 1.4 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-014 is a positive monopolar magnetic anomaly of 20.41 nT and 3 seconds duration that coincides with a crab pot in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-015 is a dipolar magnetic anomaly of 55.54 nT and 2 seconds duration that coincides with a tire in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-016 is a dipolar magnetic anomaly of 25.94 nT and 5 seconds duration that coincides with a crab pot in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-017 is a dipolar magnetic anomaly of 109.22 nT and 5 seconds duration that coincides with a rectangular block approximately 2.1 m long and 2.8 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-018 is a dipolar magnetic anomaly of 81.20 nT and 2 seconds duration that coincides with debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

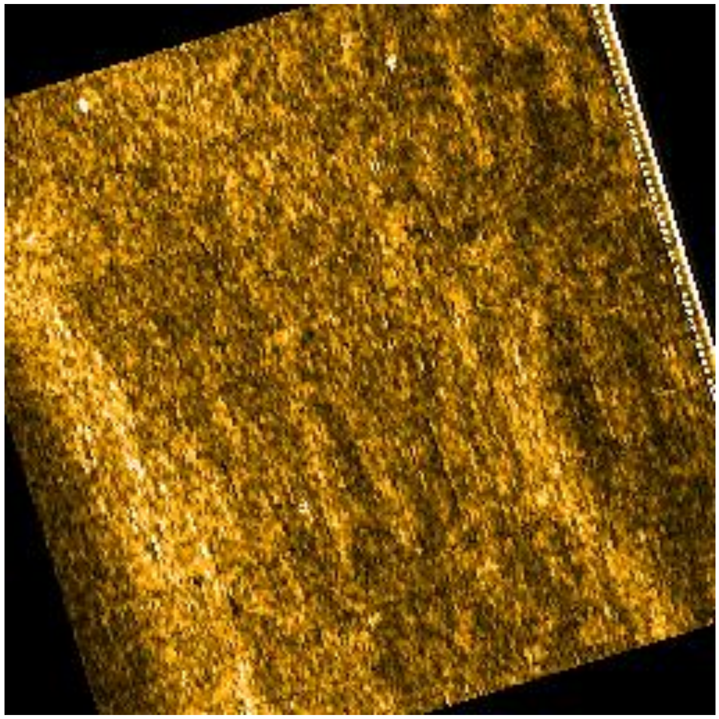
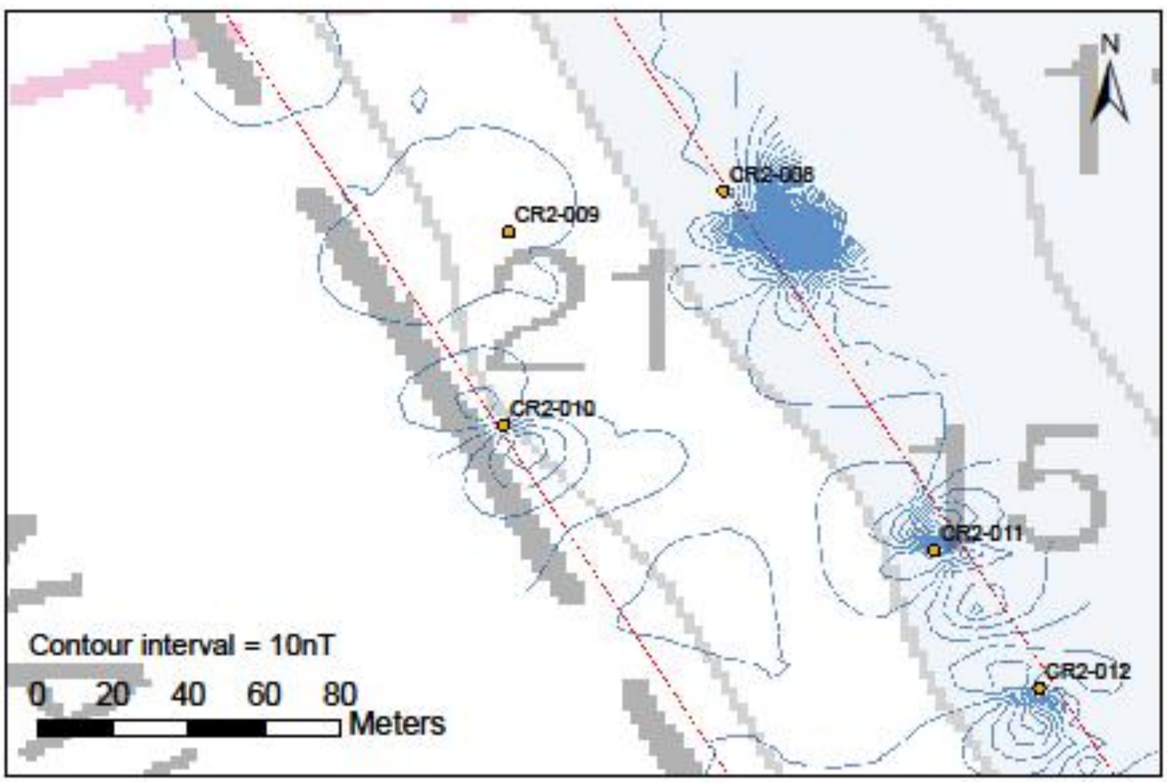


Figure 68. Anomaly CR2-010 sonogram showing scattered small debris (top). Anomaly CR2-010 magnetic contour map (bottom).



CR2-019 is a dipolar magnetic anomaly of 25.40 nT and 3 seconds duration that coincides with debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-020 is a positive monopolar magnetic anomaly of 26.68 nT and 2 seconds duration that coincides with a pipe or cable fragment 12 m long and 0.3 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-021 is a dipolar magnetic anomaly of 4364.48 nT and 19 seconds duration that coincides with a buried pipeline on navigation charts in this area. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-022 is a dipolar magnetic anomaly of 374.11 nT and 9 seconds duration that coincides with small debris and what appears to be a section of exposed buried pipe approximately 3.4 m long on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-023 (figure 69) is a positive monopolar magnetic anomaly of 93.93 nT and 4 seconds duration that coincides with debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-024 is a positive monopolar magnetic anomaly of 26.91 nT and 1 second duration that coincides with small debris providing a hard return on the harbor bottom and a crab pot in accompanying sonogram records. All debris is less than 0.8 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-025 is a positive monopolar magnetic anomaly of 69.07 nT and 3 seconds duration that coincides with a crab pot and other isolated debris fragments providing a hard return on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-026 is a positive monopolar magnetic anomaly of 12.36 nT and 3 seconds duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-027 is a dipolar magnetic anomaly of 32.35 nT and 4 seconds duration that coincides with various debris including a cable approximately 6.8 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

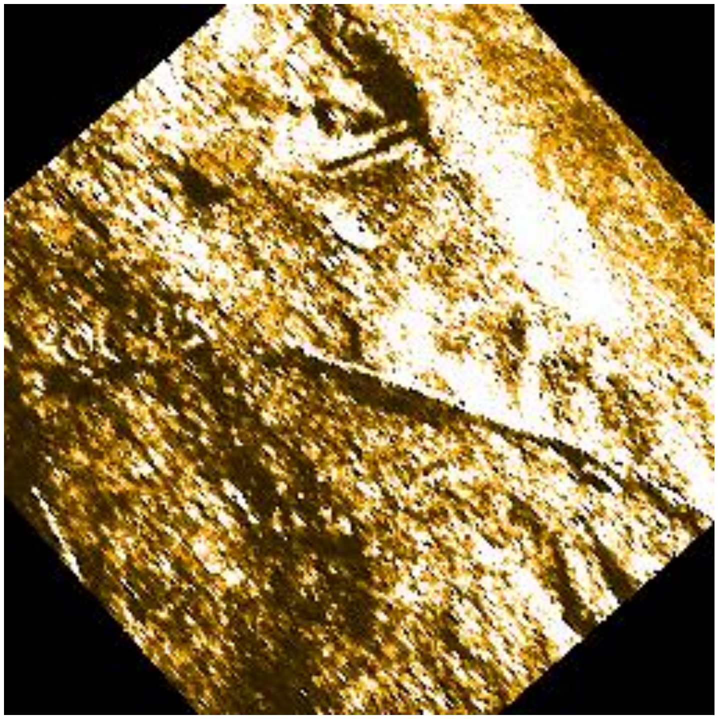
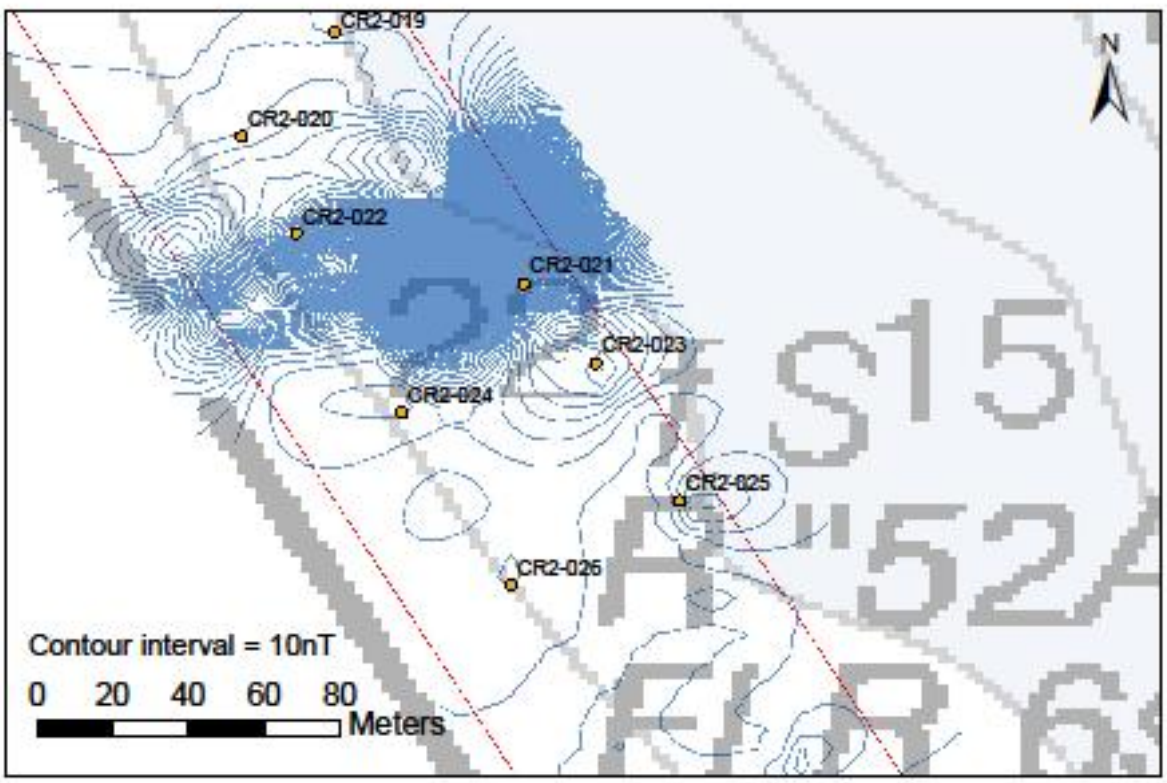


Figure 69. Anomaly CR2-023 sonogram showing various hard return small debris (top). Anomaly CR2-023 magnetic contour map (bottom).



CR2-028 is a positive monopolar magnetic anomaly of 29.63 nT and 5 seconds duration that coincides with a crab pot and other debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-029 is a positive monopolar magnetic anomaly of 29.50 nT and 4 seconds duration that coincides with tires and other debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-030 is a dipolar magnetic anomaly of 42.05 nT and 7 seconds duration that coincides with an isolated block approximately 1.1 m long and 0.2 m above the harbor bottom and tires in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-031 is a dipolar magnetic anomaly of 149.21 nT and 3 seconds duration that coincides with a cable approximately 20 m long on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-032 is a dipolar magnetic anomaly of 62.39 nT and 3 seconds duration that coincides with isolated debris approximately 1 m long and 0.2 m high providing a hard return on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-033 is a dipolar magnetic anomaly of 23.82 nT and 4 seconds duration that coincides with three tires in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-034 is a dipolar magnetic anomaly of 110.67 nT and 4 seconds duration that coincides with a pipe approximately 16 m long and debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-035 is a dipolar magnetic anomaly of 825.72 nT and 5 seconds duration that coincides with approximately 15 m of exposed cable in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-036 is a dipolar magnetic anomaly of 347.21 nT and 8 seconds duration that coincides with a pipe approximately 15.8 m long and in an area of scour 0.3 m lower than the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-037 is a positive monopolar magnetic anomaly of 49.00 nT and 2 seconds duration that coincides with a tire in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-038 is a dipolar magnetic anomaly of 32.84 nT and 4 seconds duration that coincides with a crab pot and a 10.2 m long piece of probably wood debris 0.3 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-039 is a dipolar magnetic anomaly of 105.26 nT and 3 seconds duration that coincides with a pipe or cable approximately 9.7 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-040 is a dipolar magnetic anomaly of 54.15 nT and 5 seconds duration that coincides with a pipe approximately 10.8 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-041 is a dipolar magnetic anomaly of 43.94 nT and 6 seconds duration that coincides with small debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 2 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-042 is a dipolar magnetic anomaly of 298.56 nT and 4 seconds duration that coincides with accumulated modern debris providing a hard return above the harbor bottom and metal poles or framework approximately 11.3 m long and 0.9 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-043 is a dipolar magnetic anomaly of 585.66 nT and 1 second duration that coincides with debris and a pipe approximately 9 m long and 0.3 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-044 is a dipolar magnetic anomaly of 179.04 nT and 11 seconds duration that coincides with a pipe approximately 5.6 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-045 is a dipolar magnetic anomaly of 39.33 nT and 7 seconds duration that coincides with a crab pot and debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-046 (figure 70) is a dipolar magnetic anomaly of 814.68 nT and 4 seconds duration that coincides with a cable/wire of at least 20 m length and scattered debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-047 (figure 70) is a dipolar magnetic anomaly of 61.08 nT and 5 seconds duration that coincides with two pipes approximately 10 and 11.4 m long and 0.4 m above the harbor bottom, as well as scattered debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-048 is a dipolar magnetic anomaly of 112.02 nT and 8 seconds duration that coincides with a large isolated debris fragment approximately 18.9 m long and 1.9 m above the harbor bottom. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-049 is a dipolar magnetic anomaly of 111.76 nT and 3 seconds duration that coincides with six tires in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-050 is a dipolar magnetic anomaly of 88.15 nT and 3 seconds duration that coincides with four tires in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-051 is a dipolar magnetic anomaly of 34.19 nT and 3 seconds duration that coincides with a cable of at least 15 m length in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-052 is a dipolar magnetic anomaly of 20.17 nT and 5 seconds duration that coincides with a crab pot and debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-053 is a dipolar magnetic anomaly of 25.23 nT and 5 seconds duration that coincides with isolated debris 0.8 m long and 0.6 m above the harbor bottom, providing a hard return visible in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-054 is a dipolar magnetic anomaly of 78.34 nT and 5 seconds duration that coincides with a cable visible for approximately 15 m before disappearing into sediment in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

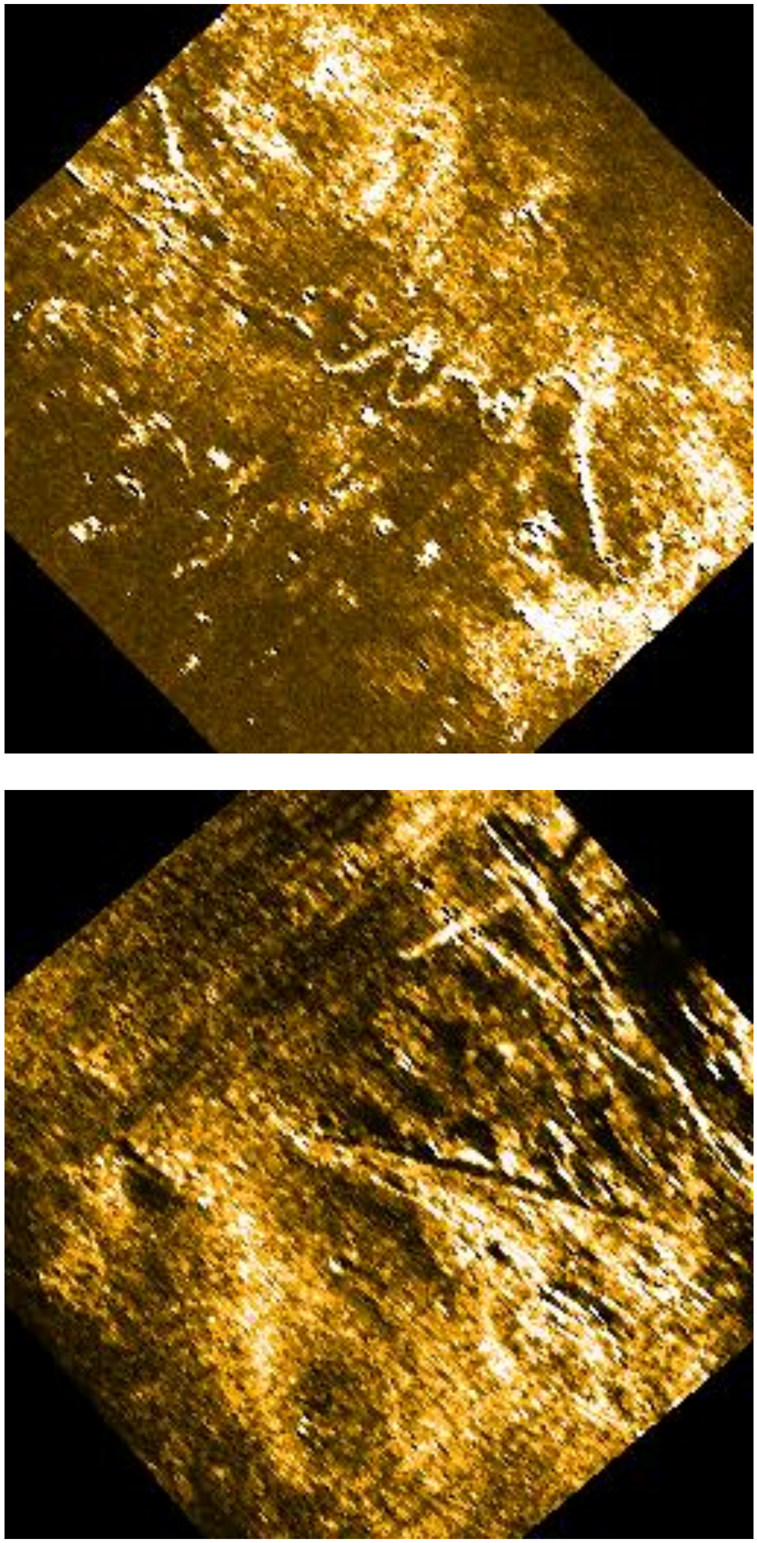
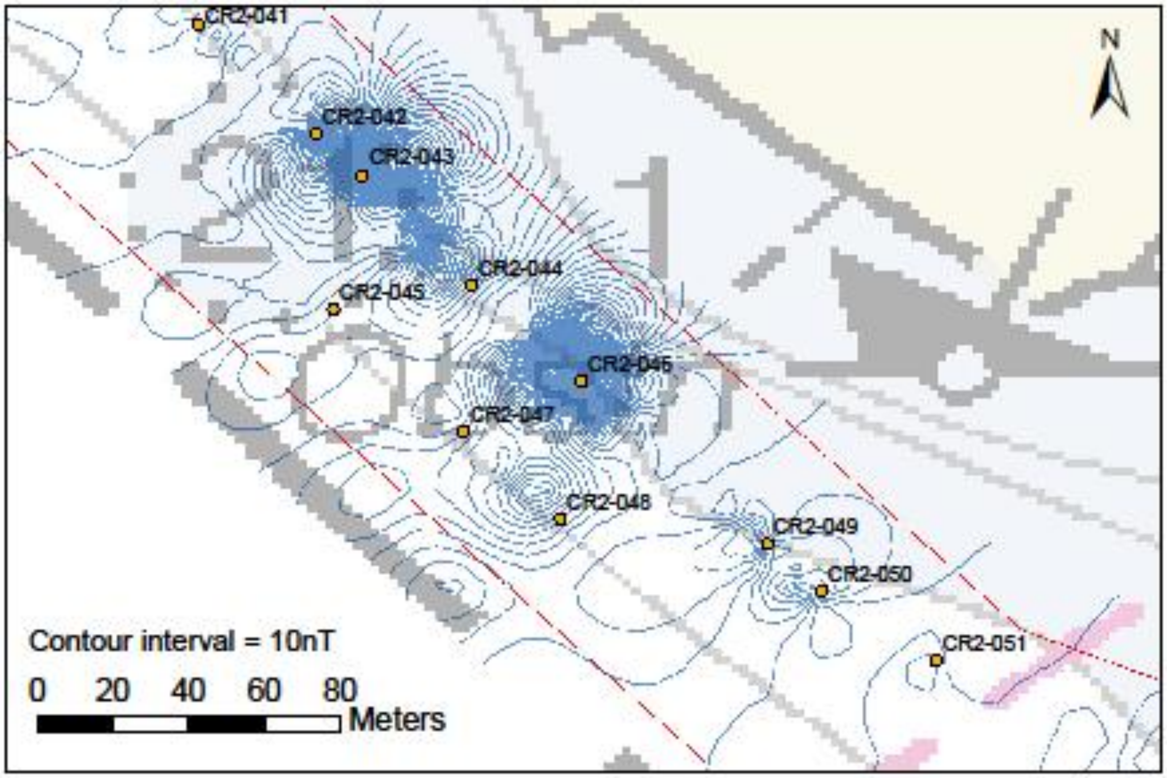


Figure 70. Anomaly CR2-046 sonogram showing a cable or wire and scattered debris and anomaly CR2-047 sonogram showing a pipe and other scattered debris (top). Anomalies CR2-046 and CR2-047 magnetic contour map (next page).


CR2-041
CR2-042
CR2-043
CR2-044
CR2-045
CR2-046
CR2-047
CR2-048
CR2-049
CR2-050
CR2-051
N
Contour interval = 10nT
0 20 40 60 80
Meters

CR2-055 is a dipolar magnetic anomaly of 123.27 nT and 10 seconds duration that coincides with a buoy/sink in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-056 is a negative monopolar magnetic anomaly of 24.91 nT and 5 seconds duration that coincides with a pipe approximately 6.2 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-057 is a negative monopolar magnetic anomaly of 34.52 nT and 12 seconds duration that coincides with debris and a pipe 2.8 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-058 is a positive monopolar magnetic anomaly of 7.52 nT and 1 second duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-059 is a positive monopolar magnetic anomaly of 6.45 nT and 1 second duration that coincides with debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 0.7 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-060 is a dipolar magnetic anomaly of 148.06 nT and 3 seconds duration that coincides with a pipe approximately 10.7 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-061 is a dipolar magnetic anomaly of 69.09 nT and 2 seconds duration that coincides with a cable or wire fragment approximately 9 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-062 (figure 71) is a dipolar magnetic anomaly of 82.00 nT and 3 seconds duration that coincides with a bundle of timbers or traffic barricade approximately 10 m long and 0.5 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-063 is a dipolar magnetic anomaly of 29.85 nT and 5 seconds duration that coincides with isolated debris approximately 1.9 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-064 is a positive monopolar magnetic anomaly of 8.53 nT and 2 seconds duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

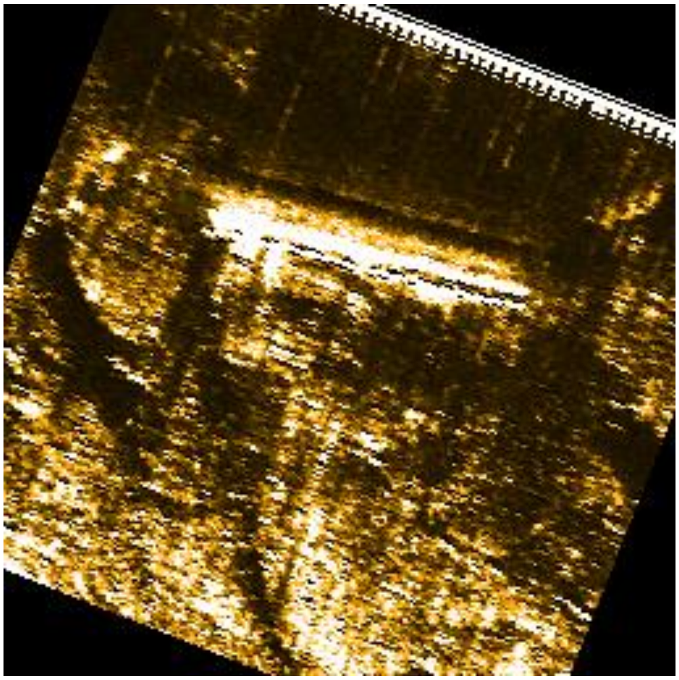
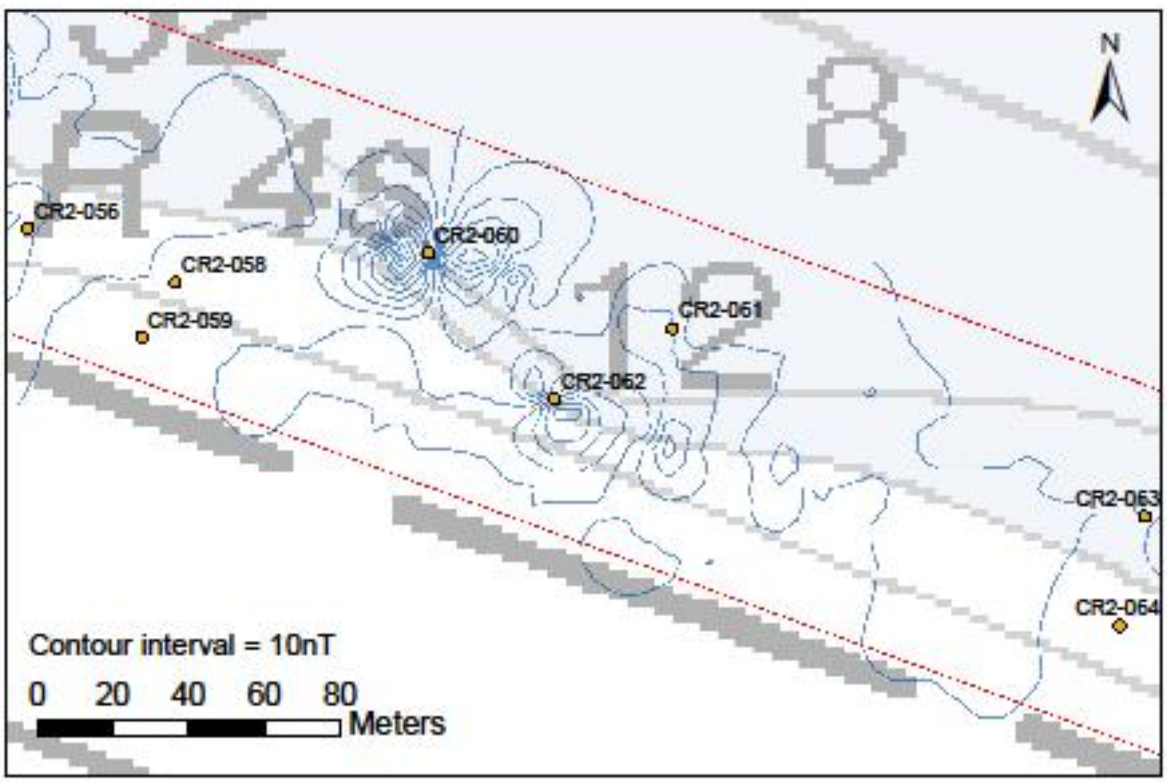


Figure 71. Anomaly CR2-062 sonogram showing a bundle of timbers or a barricade (top). Anomaly CR2-062 magnetic contour map (bottom).



CR2-065 is a dipolar magnetic anomaly of 120.91 nT and 4 seconds duration that coincides with isolated debris approximately 1.3 m long and 0.3 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-066 is a positive monopolar magnetic anomaly of 14.52 nT and 1 second duration that coincides with two crab pots in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-067 (figure 72) is a dipolar magnetic anomaly of 177.24 nT and 1 second duration that coincides with a scatter of rocks that appears to be riprap in an area approximately 20 m^2 in accompanying sonogram records. It is a dispersed scatter and does not share characteristic features of ballast piles. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-068 is a negative monopolar magnetic anomaly of 12.75 nT and 2 seconds duration that coincides with a tire in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-069 is a dipolar magnetic anomaly of 135.86 nT and 3 seconds duration that coincides with a cable or wire fragment approximately 0.9 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-070 is a negative monopolar magnetic anomaly of 10.55 nT and 1 second duration that coincides with small debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-071 is a dipolar magnetic anomaly of 24.05 nT and 6 seconds duration that coincides with isolated debris approximately 2 m long and 0.1 m above the harbor bottom providing a hard return in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-072 is a dipolar magnetic anomaly of 48.15 nT and 2 seconds duration that coincides with a modern anchor or sinker approximately 5 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-073 is a positive monopolar magnetic anomaly of 48.32 nT and 1 second duration that coincides with isolated debris 3.3 m long and 1.6 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

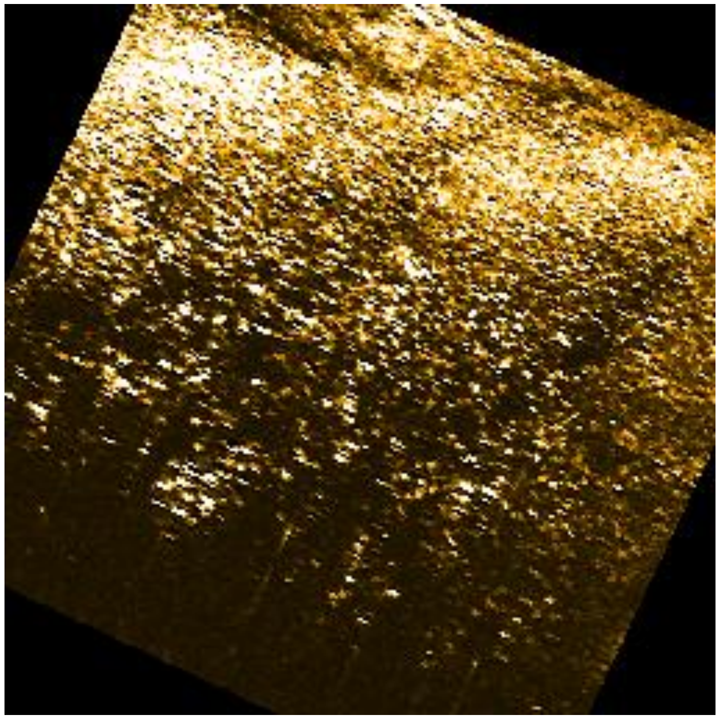
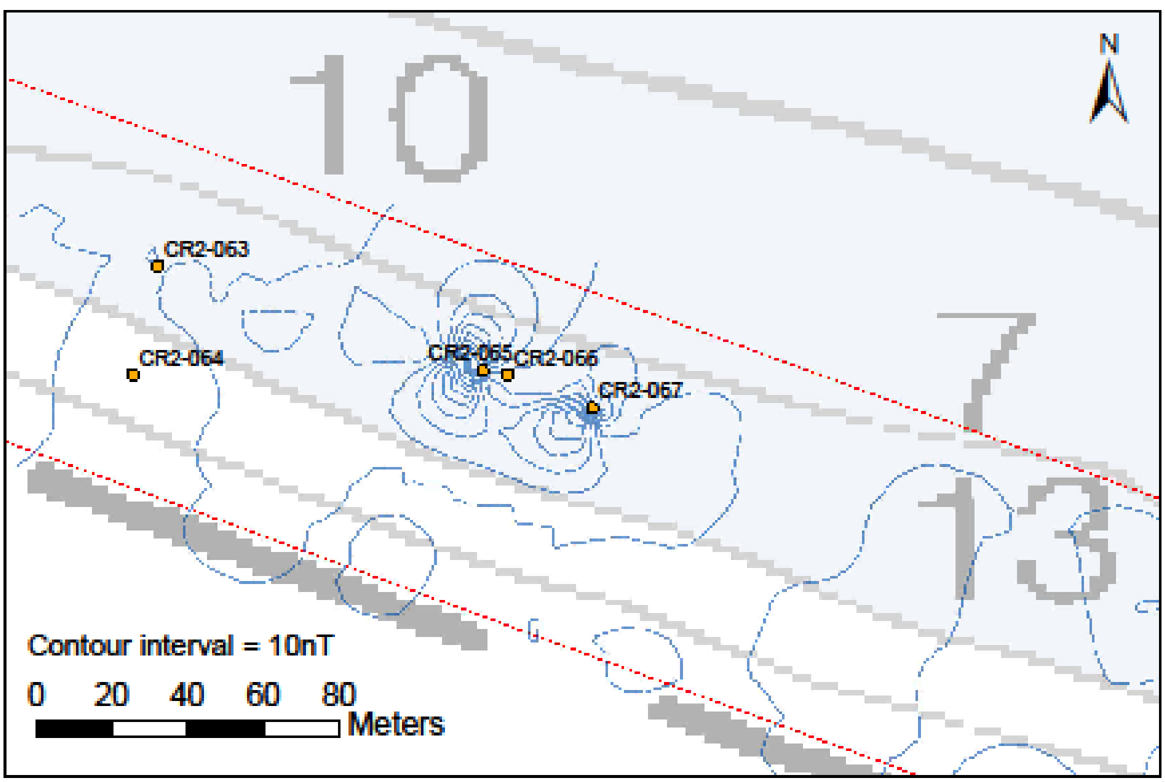


Figure 72. Anomaly CR2-067 sonogram showing a scatter of rocks (top). Anomaly CR2-067 magnetic contour map (bottom).



CR2-074 is a dipolar magnetic anomaly of 44.38 nT and 1 second duration that coincides with small debris providing a hard return on the harbor bottom in accompanying sonogram records. All debris is less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-075 is a negative monopolar magnetic anomaly of 19.83 nT and 7 seconds duration that coincides with what appears to be a piece of wood or pipe 7.1 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR2-076 is a negative monopolar magnetic anomaly of 34.89 nT and 1 second duration that coincides with a cable or wire fragment 2.6 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

Cooper River 3 (CR3)

CR3 Remote sensing data was generated from this survey area on 9 October 2012. A total of 76 individual anomalies were identified for this survey section and each is described below, including recommendations. Table 13 and figures 73-74 provide specific details of each anomaly. Ship traffic, docks, and docked vessels created an extensive magnetic disturbance capable of masking the more subtle signatures of earlier shipwrecks. Sonogram records show that much of the survey area has been extensively dredged and is scarred by anchoring activities. No potentially historic or prehistoric cultural material was noted in reviewing these anomalies. All cultural material in the Cooper River 3 survey area proved to be modern debris such as cables, dredge pipes, buried lines, and crab pots representative of harbor activity.

Table 13. Characteristics of Cooper River 3 (CR3) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
CR3-001	36.43	2322197.61	393092.90	0:00:09	11.45	8.14	Negative monopolar	isolated debris (pipe)	No further work
CR3-002	33.21	2322330.30	393021.48	0:00:03	8.72	5.46	Dipolar	isolated debris	No further work
CR3-003	28.37	2323052.28	392042.85	0:00:01	10.00	6.70	Negative monopolar	crab pots (3)	No further work
CR3-004	109.57	2323378.27	391977.05	0:00:05	9.03	5.77	Negative monopolar	isolated debris	No further work
CR3-005	7.28	2323170.07	391927.63	0:00:01	8.75	5.45	Positive monopolar	tire	No further work
CR3-006	33.39	2323281.26	391859.63	0:00:03	7.85	4.63	Dipolar	debris scatter, crab pot	No further work
CR3-007	13.77	2323306.10	391830.78	0:00:01	8.01	4.70	Positive monopolar	crab pot	No further work
CR3-008	45.46	2323239.89	391702.76	0:00:05	6.64	3.42	Dipolar	isolated debris, crab pot, tire	No further work
CR3-009	32.56	2323001.00	391653.03	0:00:06	6.76	3.14	Dipolar	isolated debris, crab pot, tire	No further work
CR3-010	25.35	2323066.37	391562.74	0:00:02	6.01	2.75	Dipolar	tires; log	No further work
CR3-011	27.22	2322700.37	391639.06	0:00:06	9.67	6.45	Dipolar	crab pots	No further work
CR3-012	54.41	2323079.24	391504.66	0:00:03	5.19	2.65	Dipolar	debris scatter, tires	No further work
CR3-013	24.96	2322612.93	391485.36	0:00:04	8.95	5.13	Dipolar	tire, isolated debris	No further work
CR3-014	200.84	2322885.83	391509.96	0:00:09	6.49	3.55	Dipolar	cable A (north end)	No further work
CR3-015	811.84	2322667.06	391293.08	0:00:02	5.87	2.70	Dipolar	cable A (south end)	No further work
CR3-016	497.00	2322521.76	391095.13	0:00:02	4.88	1.41	Positive monopolar	tires, isolated debris	No further work
CR3-017	38.91	2322433.65	391006.92	0:00:01	4.90	1.65	Positive monopolar	isolated debris	No further work
CR3-018	20.40	2322497.46	391069.42	0:00:02	4.84	1.45	Negative monopolar	debris scatter, tires	No further work
CR3-019	247.25	2322583.13	391095.76	0:00:06	4.55	2.13	Dipolar	cable B (north end)	No further work
CR3-020	390.62	2322434.16	390955.99	0:00:04	4.51	2.01	Dipolar	cable B (south end)	No further work
CR3-021	55.07	2322276.47	391372.79	0:00:08	13.34	9.95	Dipolar	crab pots (4)	No further work

Table 13 continued

CR3-022	170.61	2322430.39	391327.05	0:00:06	8.09	4.42	Dipolar	debris scatter	No further work
CR3-023	812.10	2322214.09	391168.41	0:00:04	8.68	5.02	Dipolar	pipe, tires, debris	No further work
CR3-024	389.19	2322413.72	391155.89	0:00:02	6.68	3.18	Dipolar	tires; isolated debris	No further work
CR3-025	949.17	2322059.91	390937.63	0:00:03	6.35	3.21	Dipolar	2 pipes	No further work
CR3-026	52.19	2321909.87	390903.36	0:00:03	6.46	2.60	Positive monopolar	2 pipes	No further work
CR3-027	588.34	2322327.16	390914.88	0:00:01	5.36	1.89	Dipolar	crab pots (2), tires, isolated pipe	No further work
CR3-028	92.41	2322125.50	390825.51	0:00:03	5.97	2.83	Negative monopolar	pipe, crab pots, debris scatter	No further work
CR3-029	81.14	2322255.02	390764.98	0:00:02	4.52	2.18	Dipolar	rock scatter (not ballast)	No further work
CR3-030	104.34	2322056.29	390690.19	0:00:02	5.83	2.30	Dipolar	debris, tires, log and crab pot	No further work
CR3-031	14.98	2321998.49	390638.67	0:00:01	5.71	2.05	Negative monopolar	tire	No further work
CR3-032	85.50	2322051.18	390588.27	0:00:06	5.26	2.75	Dipolar	cable	No further work
CR3-033	15.55	2321424.62	390934.82	0:00:02	9.84	6.50	Positive monopolar	crab pot	No further work
CR3-034	101.71	2321718.30	390726.78	0:00:04	6.34	2.95	Positive monopolar	tires (4)	No further work
CR3-035	114.87	2321864.72	390513.61	0:00:05	6.04	3.42	Dipolar	crab pot, pipes (2)	No further work
CR3-036	61.09	2321607.78	390729.30	0:00:02	6.38	3.04	Dipolar	tires (2), crab pot	No further work
CR3-037	40.92	2321463.95	390687.82	0:00:03	6.63	3.33	Dipolar	isolated debris	No further work
CR3-038	110.27	2321520.63	390546.50	0:00:04	6.31	3.00	Negative monopolar	tires, crab pots	No further work
CR3-039	439.31	2321202.07	390787.04	0:00:03	6.49	2.96	Dipolar	debris scatter	No further work
CR3-040	20.63	2320965.84	390777.37	0:00:03	7.53	4.42	Positive monopolar	crab pot	No further work
CR3-041	135.27	2320958.32	390609.93	0:00:03	6.59	3.36	Dipolar	pipes, isolated debris	No further work
CR3-042	181.11	2321088.76	390458.44	0:00:04	6.62	3.19	Dipolar	pipe	No further work
CR3-043	48.97	2320805.39	390557.45	0:00:01	6.55	3.52	Negative monopolar	clustered debris (tire, pole, debris)	No further work
CR3-044	6.26	2320910.62	390471.20	0:00:01	6.60	3.45	Negative monopolar	debris scatter, probably wood	No further work

Table 13 continued

CR3-045	83.14	2320788.34	390422.66	0:00:09	6.55	3.49	Dipolar	crab pots, isolated debris	No further work
CR3-046	133.57	2320868.61	390376.17	0:00:04	6.65	3.18	Dipolar	pipes, crab pots	No further work
CR3-047	13.91	2320615.19	390548.25	0:00:04	7.11	3.63	Positive monopolar	crab pots (3)	No further work
CR3-048	57.09	2320573.99	390373.20	0:00:02	6.87	3.40	Dipolar	isolated debris, tire	No further work
CR3-049	129.75	2320658.58	390203.05	0:00:03	6.80	4.34	Dipolar	buoy sink with float	No further work
CR3-050	278.41	2320511.90	390139.72	0:00:04	6.81	4.47	Dipolar	pipes (2), cable and tires	No further work
CR3-051	23.28	2320281.44	390166.50	0:00:04	7.22	4.20	Dipolar	crab pots (2)	No further work
CR3-052	73.04	2320152.50	390168.83	0:00:07	10.10	6.24	Negative monopolar	isolated debris (pipe)	No further work
CR3-053	10.29	2320237.09	389998.69	0:00:01	7.29	5.03	Negative monopolar	2 pc debris	No further work
CR3-054	11.51	2320037.87	389971.21	0:00:01	8.22	5.04	Positive monopolar	crab pot	No further work
CR3-055	78.16	2319964.43	389948.64	0:00:05	9.37	5.84	Dipolar	isolated debris	No further work
CR3-056	62.54	2320093.77	389906.28	0:00:06	7.35	3.77	Dipolar	isolated debris	No further work
CR3-057	57.25	2319924.18	389679.00	0:00:03	7.41	3.80	Dipolar	debris or rock crab pot; small debris	No further work
CR3-058	53.89	2319623.10	389403.09	0:00:06	7.48	4.36	Dipolar	isolated debris	No further work
CR3-059	28.86	2319519.96	389281.99	0:00:03	7.74	4.68	Dipolar	isolated debris	No further work
CR3-060	27.66	2319177.95	389107.54	0:00:03	10.96	7.29	Positive monopolar	crab pot	No further work
CR3-061	11.18	2318860.32	388340.31	0:00:01	7.74	4.68	Positive monopolar	crab pots (2)	No further work
CR3-062	39.26	2318580.92	388042.80	0:00:05	14.88	11.13	Negative monopolar	buoy sink/float	No further work
CR3-063	269.70	2318744.97	387906.19	0:00:04	6.75	3.69	Dipolar	pipe	No further work
CR3-064	363.93	2318286.34	386810.10	0:00:33	14.16	10.30	Positive monopolar	bridge affiliated anomalies	No further work
CR3-065	6127.10	2318503.09	386623.08	0:00:03	5.93	1.96	Dipolar	bridge, crab pots, debris	No further work
CR3-066	1933.88	2318233.03	386616.73	0:00:23	12.79	9.09	Dipolar	crab pots (8); riprap	No further work

Table 13 continued

CR3-067	1968.80	2318203.94	386456.36	0:00:24	14.05	11.11	Dipolar	bridge affiliated, riprap	No further work
CR3-068	729.23	2318417.58	386272.95	0:00:01	5.33	1.51	Positive monopolar	bridge affiliated anomalies	No further work
CR3-069	523.58	2318225.75	385812.60	0:00:04	5.10	2.15	Dipolar	bridge affiliated anomalies; pipe	No further work
CR3-070	57.88	2317978.59	385664.59	0:00:15	15.58	11.72	Dipolar	isolated debris	No further work
CR3-071	96.19	2317986.69	385162.58	0:00:02	7.41	3.80	Dipolar	debris scatter	No further work
CR3-072	147.30	2318140.42	385138.66	0:00:03	5.80	2.14	Dipolar	isolated debris	No further work
CR3-073	13.39	2318063.24	384875.93	0:00:02	6.37	2.62	Positive monopolar	crab pots (2)	No further work
CR3-074	69.05	2317823.72	383963.95	0:00:04	6.69	3.15	Dipolar	isolated debris	No further work
CR3-075	102.00	2317893.70	383720.89	0:00:02	6.52	2.86	Dipolar	isolated debris, crab pots	No further work
CR3-076	53.00	2317857.87	383313.04	0:00:04	6.52	2.74	Dipolar	rock scatter, crab pot	No further work

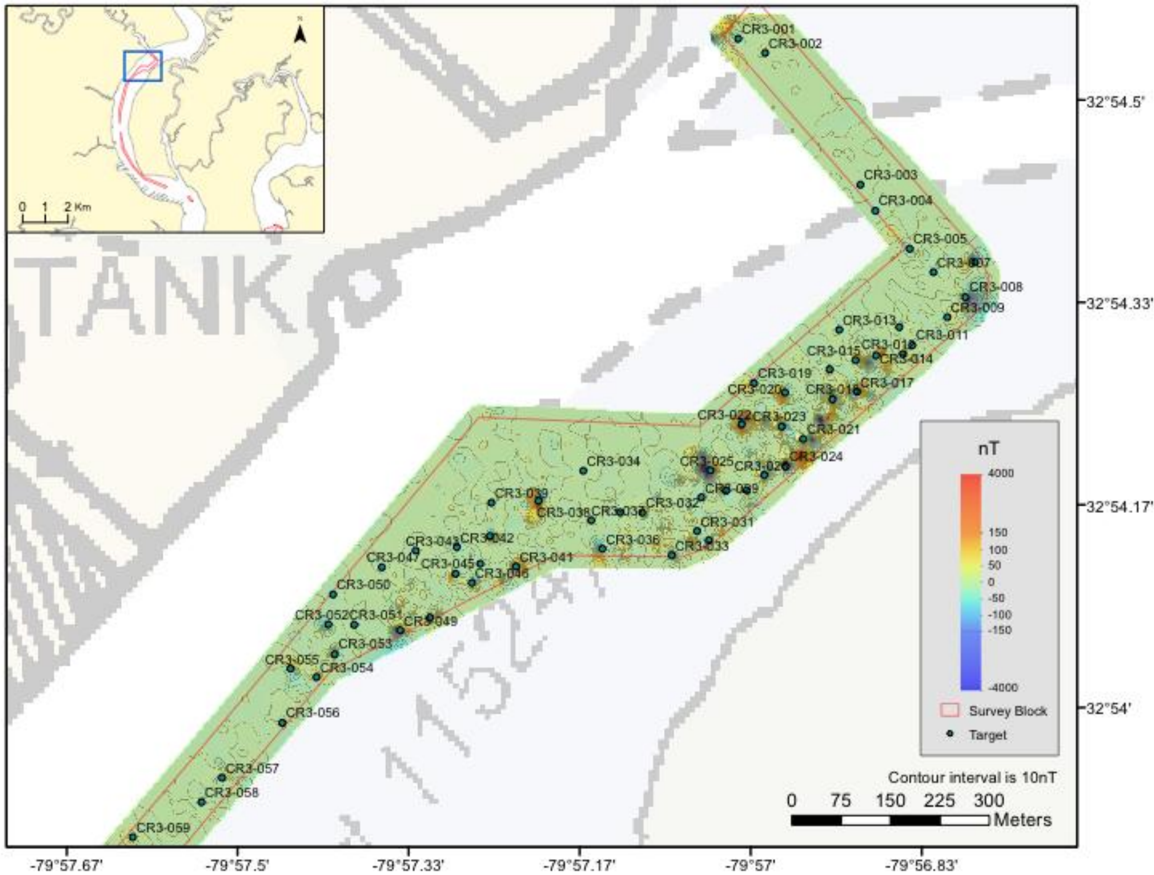


Figure 73. Magnetic anomaly color contour map of CR3.

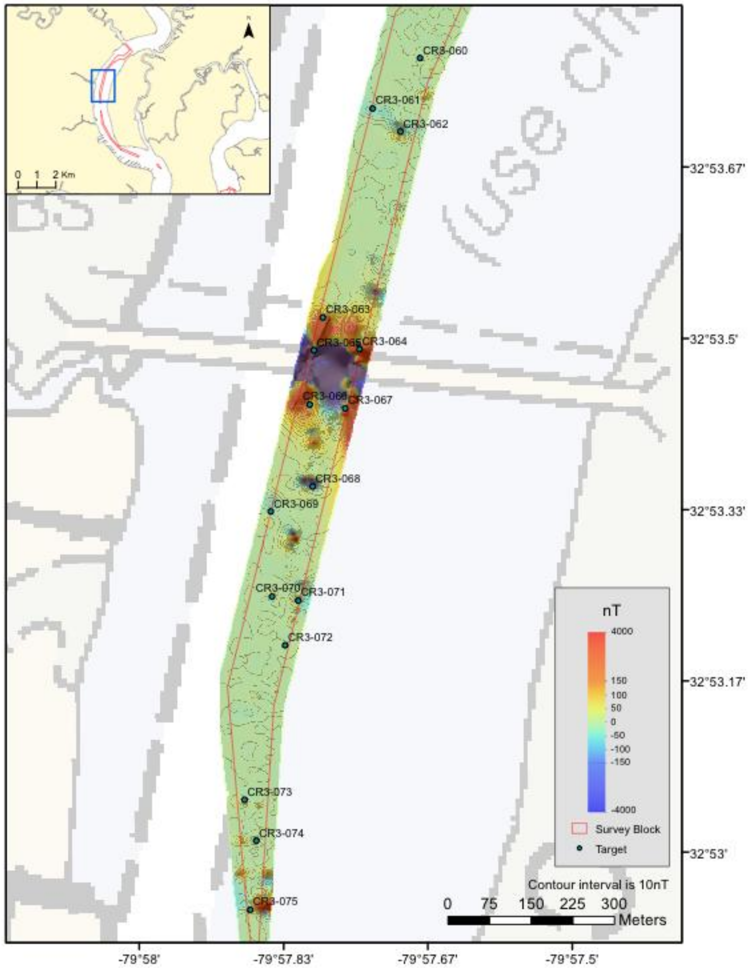


Figure 74. Magnetic anomaly color contour map of CR3 continued.

CR3-001 is a negative monopolar magnetic anomaly of 36.43 nT and 9 seconds duration that coincides with isolated debris, probably a pipe, approximately 5 m long and 0.8 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-002 is a dipolar magnetic anomaly of 33.21 nT and 3 seconds duration that coincides with isolated debris approximately 1.3 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-003 is a positive monopolar magnetic anomaly of 6.64 nT and 1 second duration that coincides with three crab pots in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-004 is a negative monopolar magnetic anomaly of 9.93 nT and 1 second duration that coincides with an isolated block approximately 7.9 m long and 1.4 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-005 is a negative monopolar magnetic anomaly of 28.37 nT and 1 second duration that coincides with a tire in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-006 (figure 75) is a negative monopolar magnetic anomaly of 109.57 nT and 5 seconds duration that coincides with a crab pot and isolated debris of less than 2 m in any dimension in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-007 is a positive monopolar magnetic anomaly of 7.28 nT and 1 second duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-008 is a dipolar magnetic anomaly of 45.46 nT and 5 seconds duration that coincides with crab pots, tires, and isolated debris less than 1 m in any dimension in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-009 is a dipolar magnetic anomaly of 32.56 nT and 6 seconds duration that coincides with a crab pot, tire and probable log in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-010 is a dipolar magnetic anomaly of 25.35 nT and 2 seconds duration that coincides with tires and a probable log 15 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

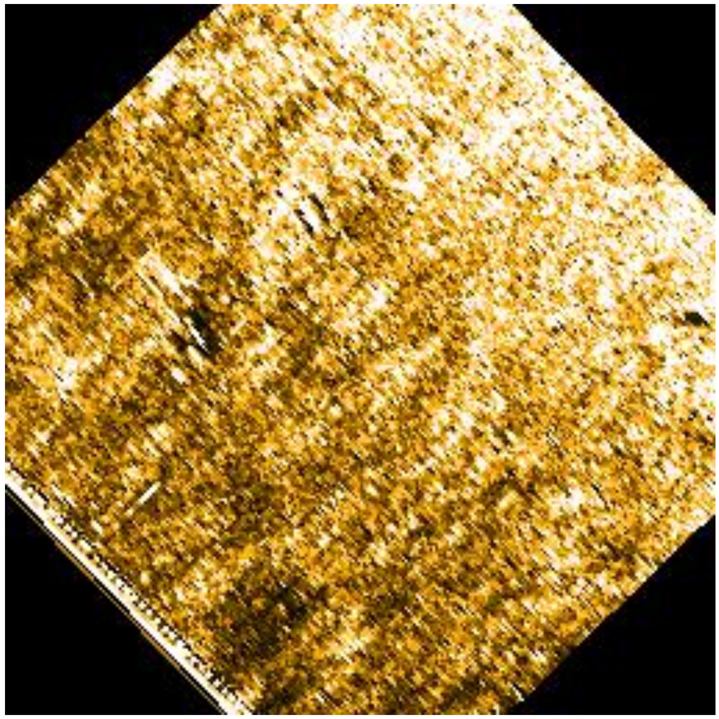
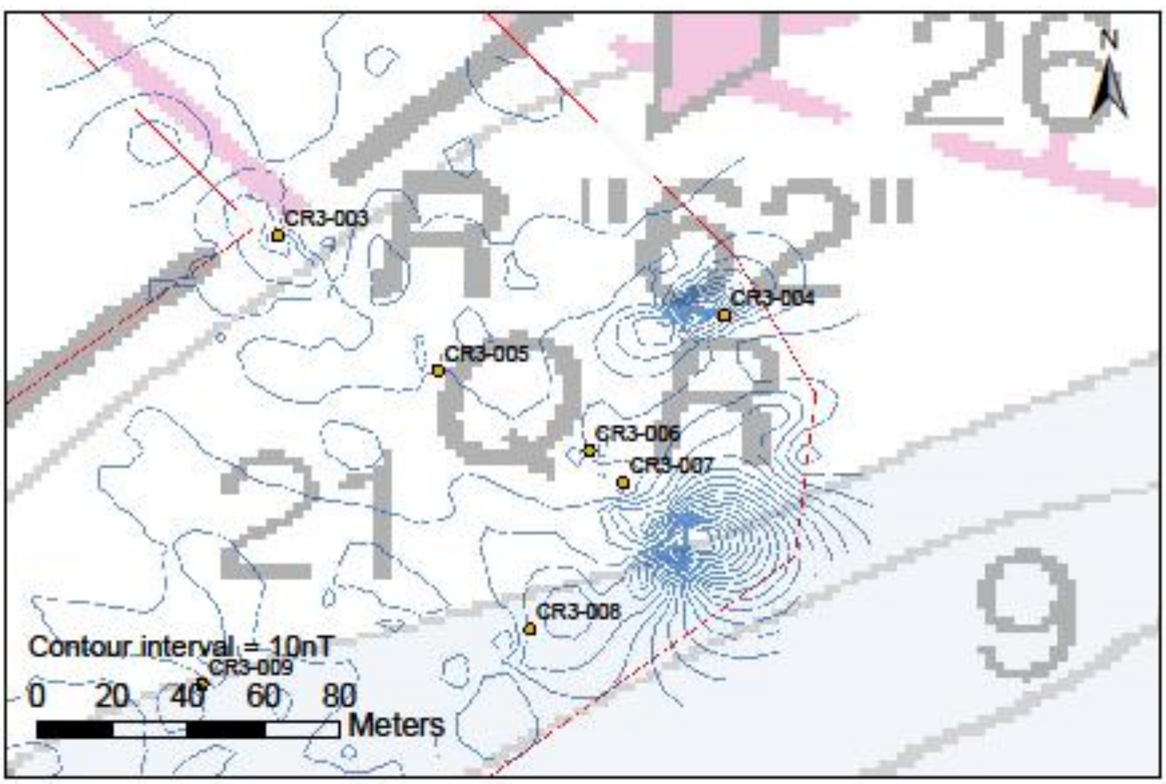


Figure 75. Anomaly CR3-006 sonogram showing a debris scatter and a crab pot (top). Anomaly CR3-006 magnetic contour map (bottom).



CR3-011 is a dipolar magnetic anomaly of 27.22 nT and 6 seconds duration that coincides with crab pots on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-012 (figure 76) is a dipolar magnetic anomaly of 54.41 nT and 3 seconds duration that coincides with an area that includes tires, a scatter of small rocks and a crab pot on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-013 is a dipolar magnetic anomaly of 24.96 nT and 4 seconds duration that coincides with a tire and isolated debris of less than 1 m in any dimension on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-014 is a dipolar magnetic anomaly of 200.84 nT and 9 seconds duration that coincides with the north end of an exposed cable (cable A) in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-015 is a dipolar magnetic anomaly of 811.84 nT and 2 seconds duration that coincides with the south end of an exposed cable (cable A) in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-016 is a positive monopolar magnetic anomaly of 497.00 nT and 2 seconds duration that coincides with tires and an isolated block approximately 10 m long and 0.3 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-017 is a positive monopolar magnetic anomaly of 38.91 nT and 1 second duration that coincides with an isolated debris feature approximately 11.5 m long and 1.5 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-018 is a negative monopolar magnetic anomaly of 20.40 nT and 2 seconds duration that coincides with a debris scatter and tires on the harbor bottom in sonogram records. Debris measures less than 0.8 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-019 is a dipolar magnetic anomaly of 247.25 nT and 6 seconds duration that coincides with the north end of exposed cable B on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

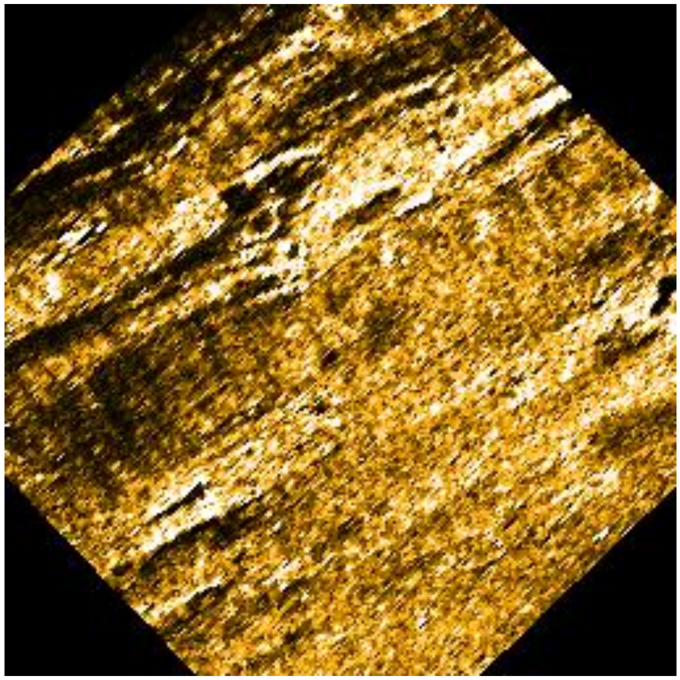
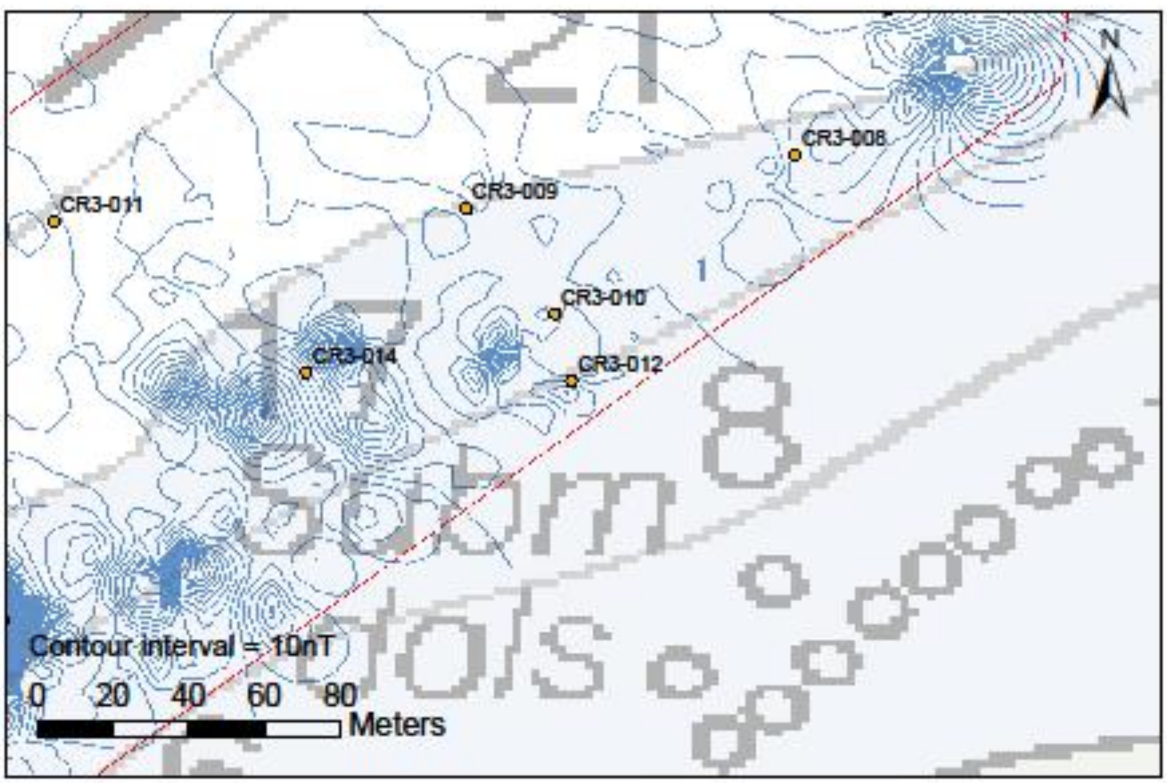


Figure 76. Anomaly CR3-012 sonogram showing a debris scatter and tires (top). Anomaly CR3-012 magnetic contour map (bottom).



CR3-020 is a dipolar magnetic anomaly of 390.62 nT and 4 seconds duration that coincides with the south end of exposed cable B in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-021 is a dipolar magnetic anomaly of 55.07 nT and 8 seconds duration that coincides with four crab pots on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-022 is a dipolar magnetic anomaly of 170.61 nT and 6 seconds duration that coincides with a debris scatter in accompanying sonogram records. All debris is less than 0.8 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-023 is a dipolar magnetic anomaly of 812.10 nT and 4 seconds duration that coincides with tires, small debris, and a pipe approximately 7.1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-024 is a dipolar magnetic anomaly of 389.19 nT and 3 seconds duration that coincides with a debris scatter, tires, and what appears to be a metal eye 4.8 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-025 is a dipolar magnetic anomaly of 949.17 nT and 3 seconds duration that coincides with two pipes approximately 4.3 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-026 is a positive monopolar magnetic anomaly of 52.19 nT and 3 seconds duration that coincides with 2 pipes approximately 2.5 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-027 is a dipolar magnetic anomaly of 588.34 nT and 1 second duration that coincides with two crab pots, tires, scattered rocks, and a pipe approximately 3 m long and 0.3 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-028 (figure 77) is a negative monopolar magnetic anomaly of 92.41 nT and 3 seconds duration that coincides with crab pots, a pole or pipe, and debris up to 2.4 m long and 0.6 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-029 (figure 77) is a dipolar magnetic anomaly of 81.14 nT and 2 seconds duration that coincides with a rock scatter and isolated debris approximately 2 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-030 is a dipolar magnetic anomaly of 104.34 nT and 2 seconds duration that coincides with tires, crab pots, and debris including a log approximately 11.6 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-031 is a negative monopolar magnetic anomaly of 14.98 nT and 1 second duration that coincides with a tire above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-032 is a dipolar magnetic anomaly of 85.50 nT and 4 seconds duration that coincides with a cable visible on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

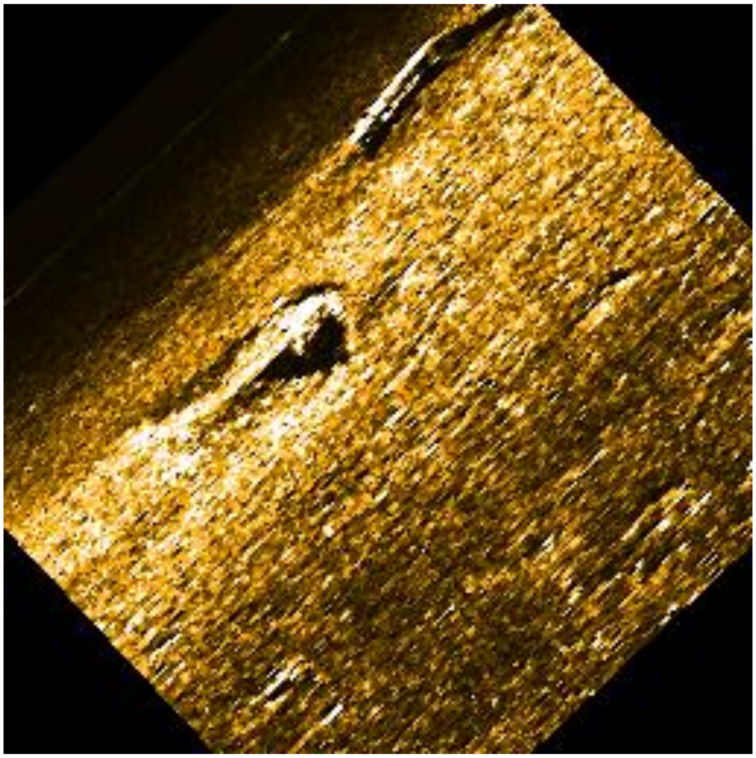
CR3-033 is a positive monopolar magnetic anomaly of 15.55 nT and 2 seconds duration that coincides with a crab pot on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-034 is a positive monopolar magnetic anomaly of 101.71 nT and 4 seconds duration that coincides with four tires on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-035 is a dipolar magnetic anomaly of 114.87 nT and 5 seconds duration that coincides with a crab pot and two pipes approximately 3.2 m and 3.6 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-036 is a negative monopolar magnetic anomaly of 110.27 nT and 4 seconds duration that coincides with a pipe above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-037 is a dipolar magnetic anomaly of 40.92 nT and 3 seconds duration that coincides with isolated debris less than 0.5 m in any dimension on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.



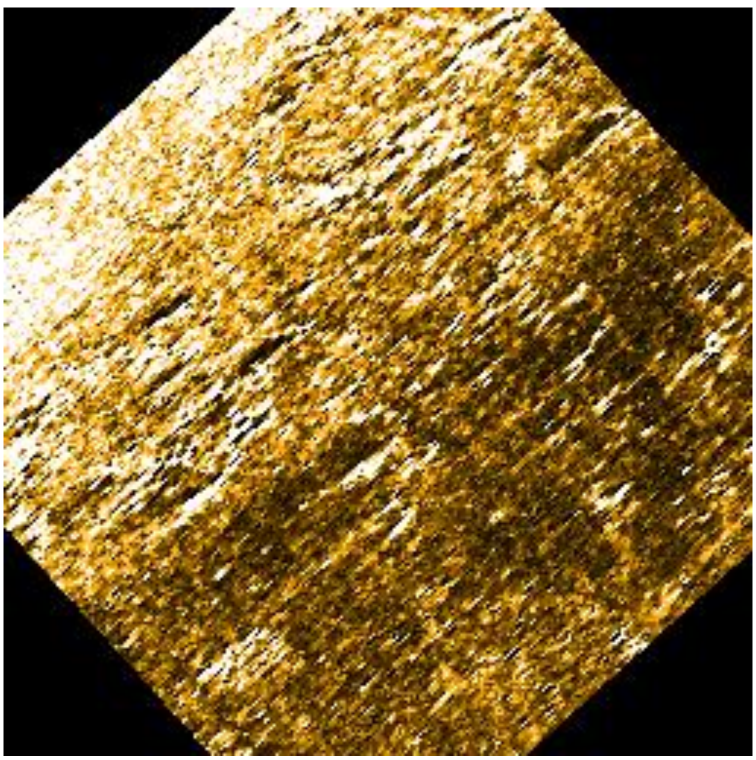
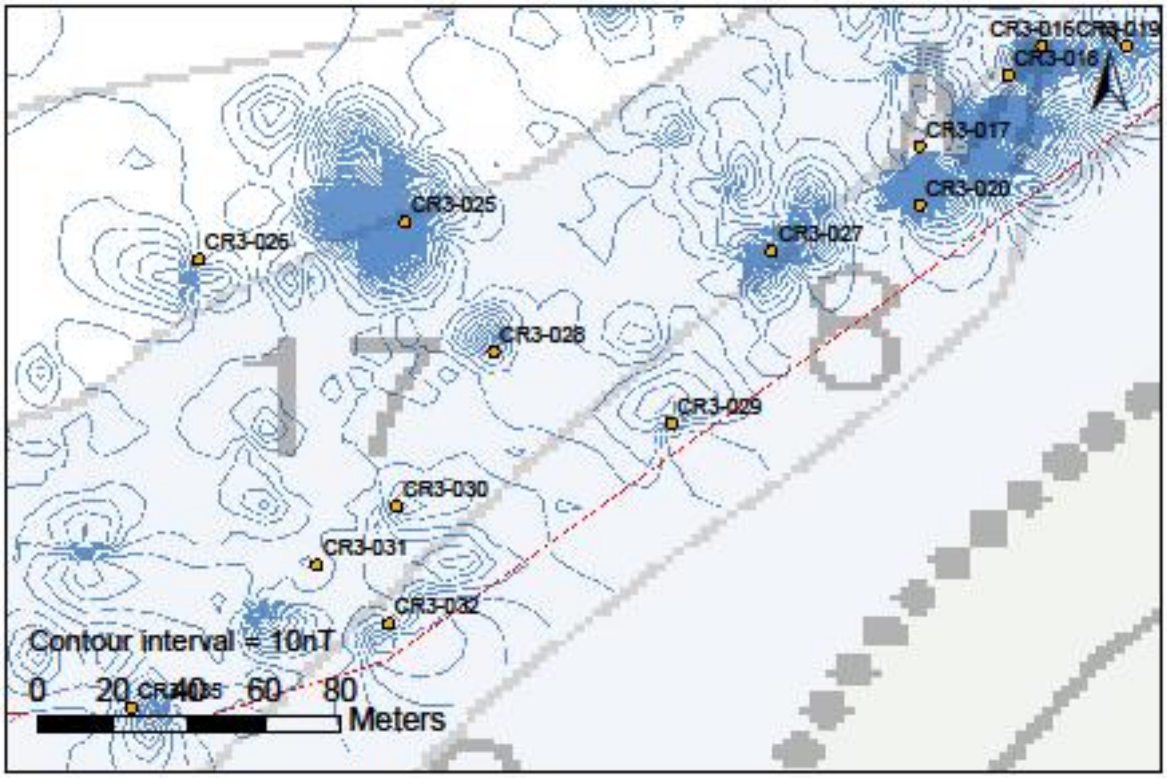


Figure 77. Anomaly CR3-028 sonogram showing a pipe, crab pots and a scatter of debris and anomaly CR3-029 sonogram showing a scatter of rocks (top). Anomalies CR3-028 and CR3-029 magnetic contour map (next page).


CR3-016
CR3-019
CR3-018
CR3-017
CR3-020
CR3-025
CR3-026
CR3-027
CR3-028
CR3-029
CR3-030
CR3-031
CR3-032
CR3-035
17
8
Contour interval = 10nT
0 20 40 60 80
Meters

CR3-038 is a negative monopolar magnetic anomaly of 110.27 nT and 4 seconds duration that coincides with tires and crab pots on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-039 (figure 78) is a dipolar magnetic anomaly of 439.31 nT and 3 seconds duration that coincides with a debris scatter and isolated debris features less than 2 m in any dimension and providing a hard return in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-040 is a positive monopolar magnetic anomaly of 20.63 nT and 3 seconds duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-041 is a dipolar magnetic anomaly of 135.27 nT and 3 seconds duration that coincides with isolated debris and pipes 2.3 m long and 0.3 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

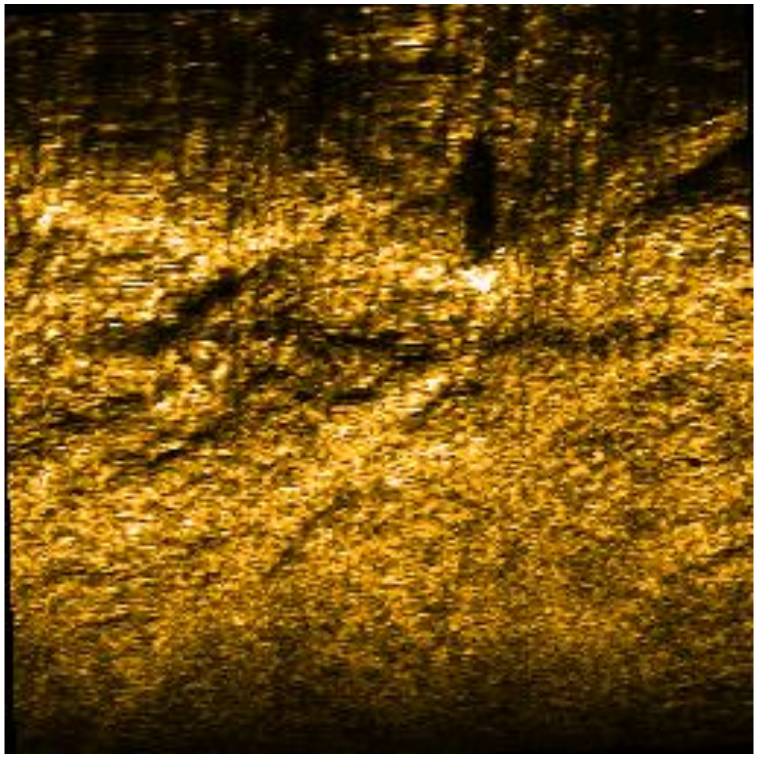
CR3-042 is a dipolar magnetic anomaly of 181.11 nT and 4 seconds duration that coincides with a 4.2 m long pipe 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-043 is a negative monopolar magnetic anomaly of 48.97 nT and 1 second duration that coincides with a cluster of debris including tires, poles approximately 1.8 m ong and 0.3 m above the surface, and debris up to 2 m long and 0.1 m above the harbor bottom feature in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-044 is a negative monopolar magnetic anomaly of 6.26 nT and 1 second duration that coincides with scattered debris (sticks/wood) above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-045 is a dipolar magnetic anomaly of 83.14 nT and 9 seconds duration that coincides with crab pots and isolated hard return debris less than 2 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-046 is a dipolar magnetic anomaly of 133.57 nT and 4 seconds duration that coincides with crab pots and two pipes approximately 2.5-2.7 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.



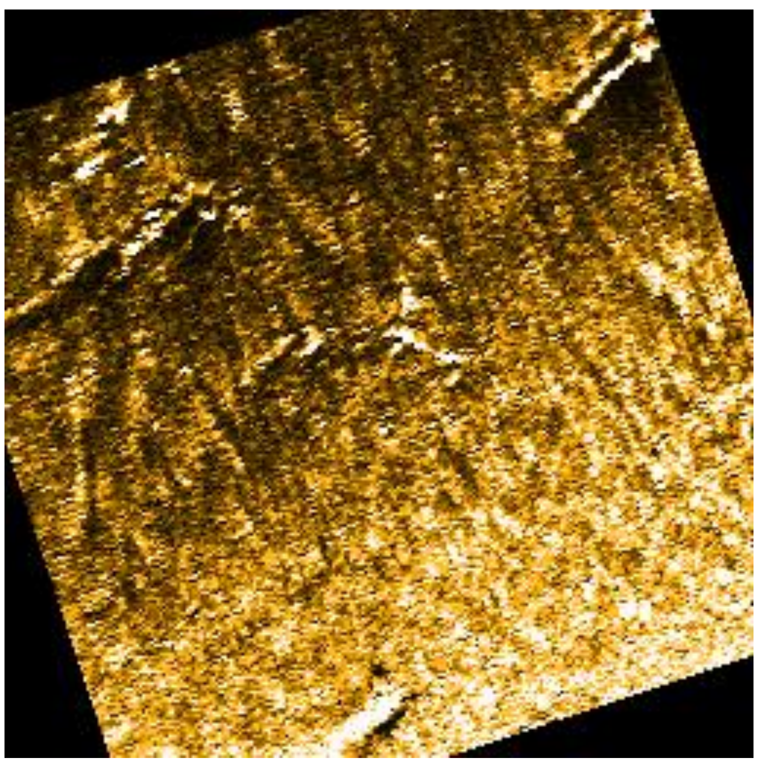
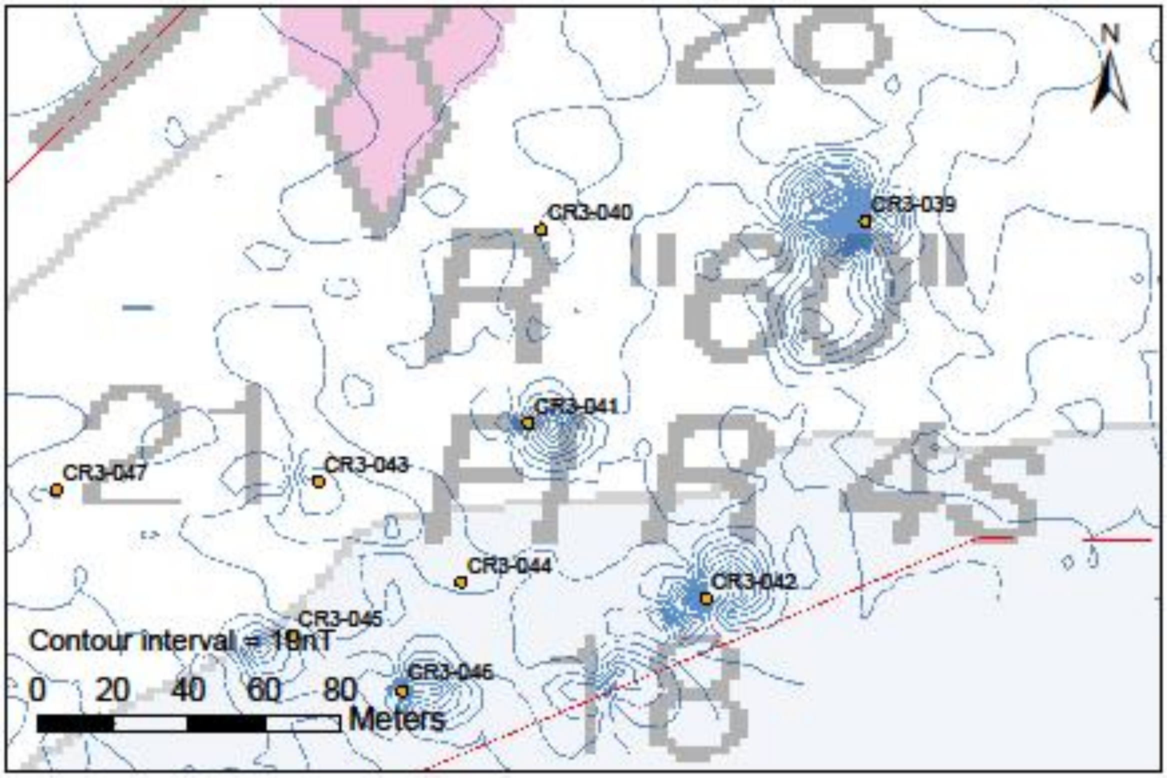


Figure 78. Anomaly CR3-039 sonogram showing a scatter of debris and anomaly CR3-044 sonogram showing a scatter of debris (top). Anomalies CR3-039 and CR3-044 magnetic contour map (next page).


N
CR3-039
CR3-040
CR3-041
CR3-042
CR3-043
CR3-044
CR3-045
CR3-046
CR3-047
Contour interval = 10nT
0 20 40 60 80
Meters

CR3-047 is a positive monopolar magnetic anomaly of 13.91 nT and 1 second duration that coincides with three crab pots in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-048 is a dipolar magnetic anomaly of 57.09 nT and 2 seconds duration that coincides with a tire and isolated debris less than 1 m in any dimension on the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-049 is a dipolar magnetic anomaly of 129.75 nT and 3 seconds duration that coincides with a buoy sink and float on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-050 is a dipolar magnetic anomaly of 278.41 nT and 4 seconds duration that coincides with two pipes approximately 2.5 m long and 0.2 m above the harbor bottom, a fragment of cable, and tires in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-051 is a dipolar magnetic anomaly of 23.28 nT and 4 seconds duration that coincides with two crab pots in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-052 is a negative monopolar magnetic anomaly of 73.04 nT and 7 seconds duration that coincides with an isolated feature, probably a pipe, 3 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-053 is a negative monopolar magnetic anomaly of 10.29 nT and 1 second duration that coincides with two pieces of debris 1.8 m long and 0.5 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-054 is a positive monopolar magnetic anomaly of 11.51 nT and 1 second duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-055 is a dipolar magnetic anomaly of 78.16 nT and 5 seconds duration that coincides with isolated debris approximately 2 m long and 0.8 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-056 is a dipolar magnetic anomaly of 62.54 nT and 6 seconds duration that coincides with isolated debris approximately 1.3 m long and 0.1 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-057 is a dipolar magnetic anomaly of 57.25 nT and 3 seconds duration that coincides with a small hard return debris less than 0.5 m in any dimension and a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-058 is a dipolar magnetic anomaly of 53.89 nT and 6 seconds duration that coincides with isolated debris less than 0.8 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-059 is a dipolar magnetic anomaly of 28.86 nT and 3 seconds duration that coincides with isolated debris approximately 3.5 m long and 0.2 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-060 is a positive monopolar magnetic anomaly of 27.66 nT and 3 seconds duration that coincides with a crab pot on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-061 is a positive monopolar magnetic anomaly of 11.18 nT and 1 second duration that coincides with two crab pots on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-062 is a negative monopolar magnetic anomaly of 39.26 nT and 5 seconds duration that coincides with a buoy sink and float for a channel marker in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-063 is a positive monopolar magnetic anomaly of 269.70 nT and 4 seconds duration that coincides with a pipe approximately 11 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-064 is a positive monopolar magnetic anomaly of 363.93 nT and 33 seconds duration that coincides with bridge and associated features affiliated with it in the area. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-065 is a dipolar magnetic anomaly of 6127.10 nT and 3 seconds duration that coincides with a bridge, crab pots, and modern metal debris up to 20 m long and 1.7 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-066 (figure 79) is a dipolar magnetic anomaly of 1933.88 nT and 23 seconds duration that coincides with crab pots, pilings and scattered rocks and debris visible on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-067 (figure 79) is a dipolar magnetic anomaly of 1968.80 nT and 24 seconds duration that coincides with a bridge and affiliated debris, including a riprap, on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-068 is a positive monopolar magnetic anomaly of 729.23 nT and 1 second duration that coincides with a bridge above the survey area. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-069 is a dipolar magnetic anomaly of 523.58 nT and 4 seconds duration that coincides with a bridge and debris, including a pipe approximately 8.9 m long and 0.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-070 is a dipolar magnetic anomaly of 57.88 nT and 15 seconds duration that coincides with two pieces of isolated debris approximately 6.7 m long and 1.9 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-071 (figure 80) is a dipolar magnetic anomaly of 96.19 nT and 2 seconds duration that coincides with a scatter of debris less than 0.5 m in any dimension with a hard return in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

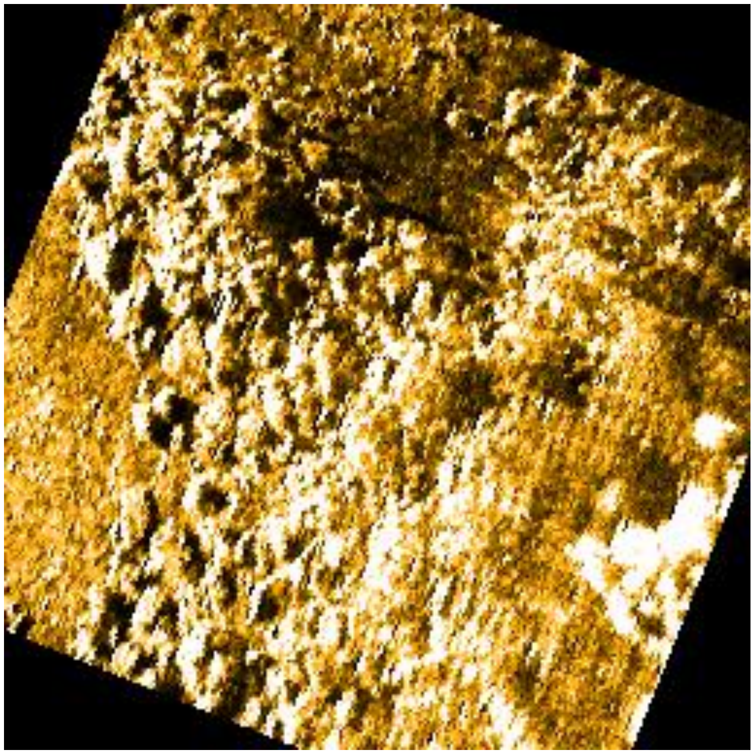
CR3-072 is a dipolar magnetic anomaly of 147.30 nT and 3 seconds duration that coincides with isolated debris approximately 4.7 m long and 0.8 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-073 is a positive monopolar magnetic anomaly of 13.39 nT and 2 seconds duration that coincides with two crab pots in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-074 is a dipolar magnetic anomaly of 69.05 nT and 4 seconds duration that coincides with isolated debris less than 0.8 m in any dimension with a hard return in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-075 is a dipolar magnetic anomaly of 102.00 nT and 2 seconds duration that coincides with crab pots, a tire, and an isolated block approximately 1.3 m long and 2.7 m above the harbor bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

CR3-076 (figure 81) is a dipolar magnetic anomaly of 53.00 nT and 4 seconds duration that coincides with a rock scatter and crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.



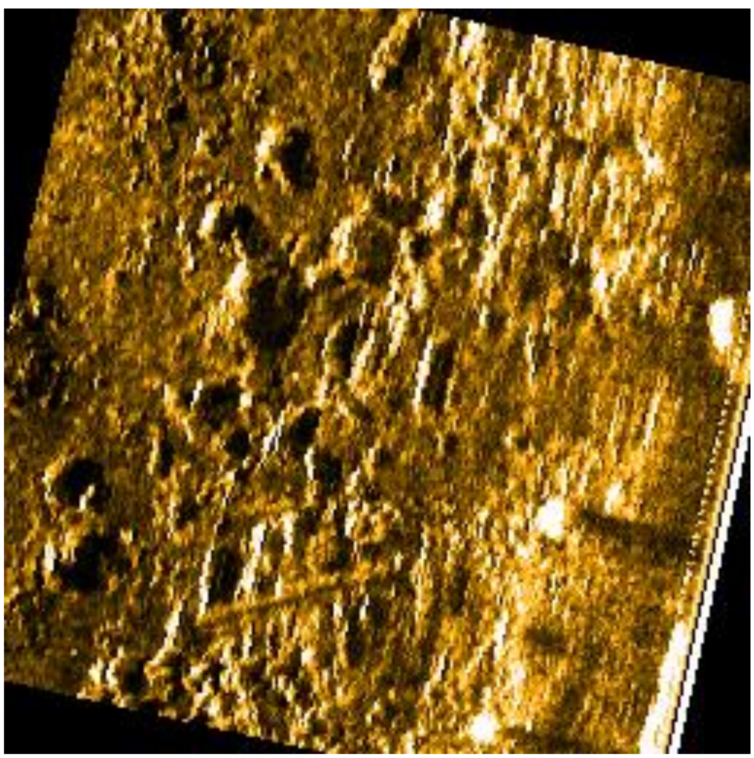
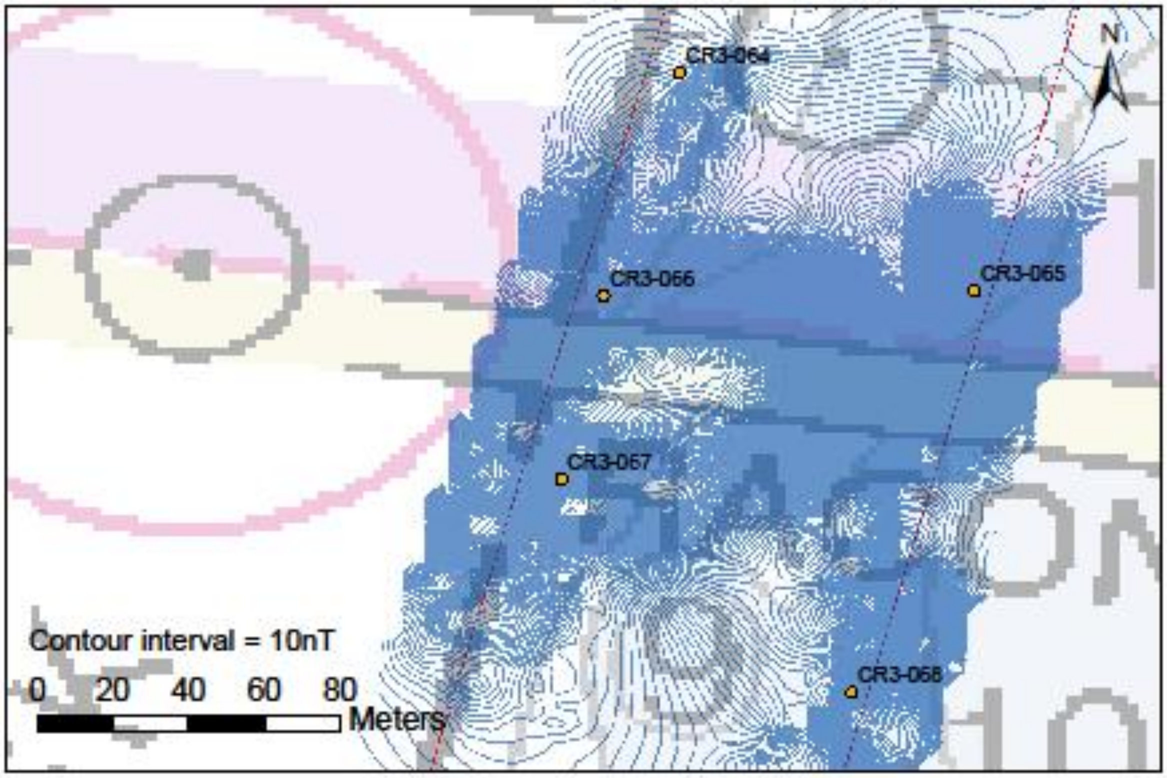


Figure 79. Anomaly CR3-066 sonogram showing crab pots and riprap and anomaly CR3-067 sonogram showing bridge affiliated riprap (top). Anomalies CR3-066 and CR3-067 magnetic contour map (next page).


CR3-064
CR3-066
CR3-065
CR3-067
CR3-068
N
Contour interval = 10nT
0 20 40 60 80
Meters

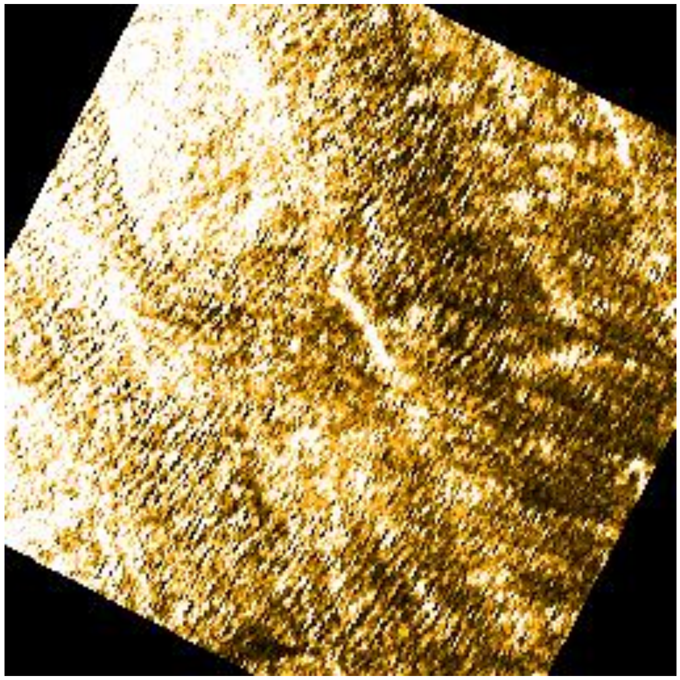
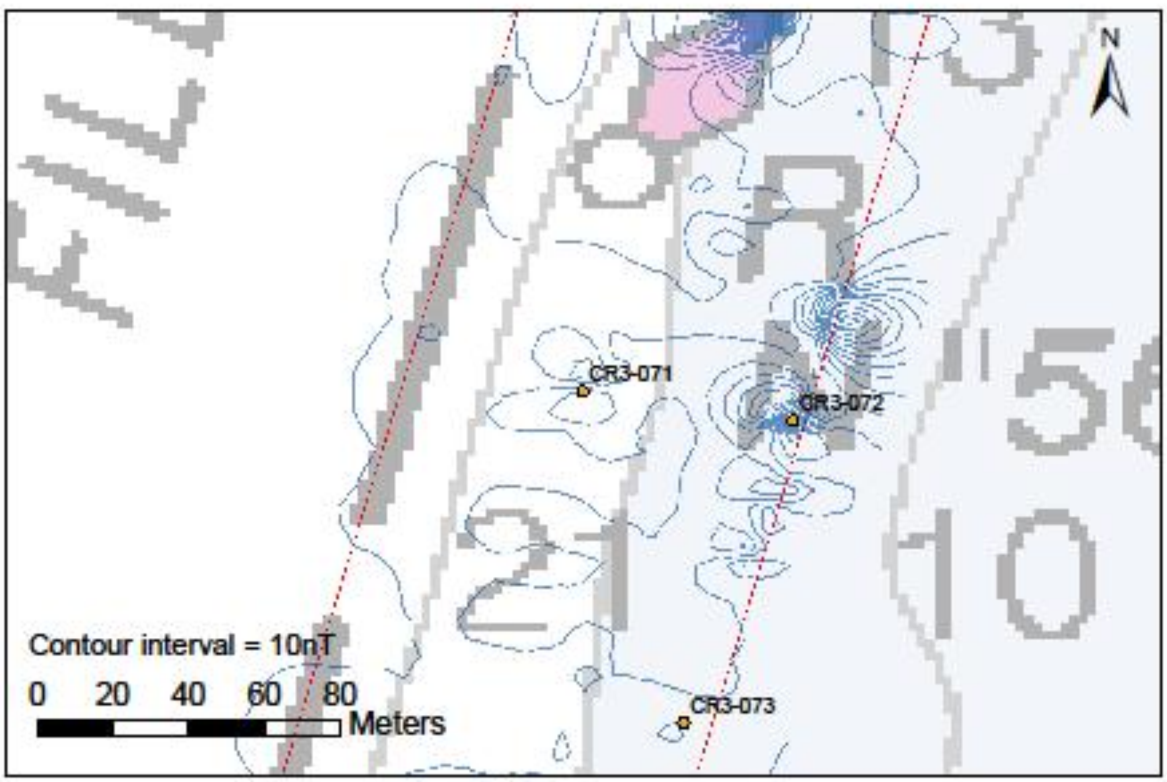


Figure 80. Anomaly CR3-071 sonogram showing a scatter of debris (top). Anomaly CR3-071 magnetic contour map (bottom).



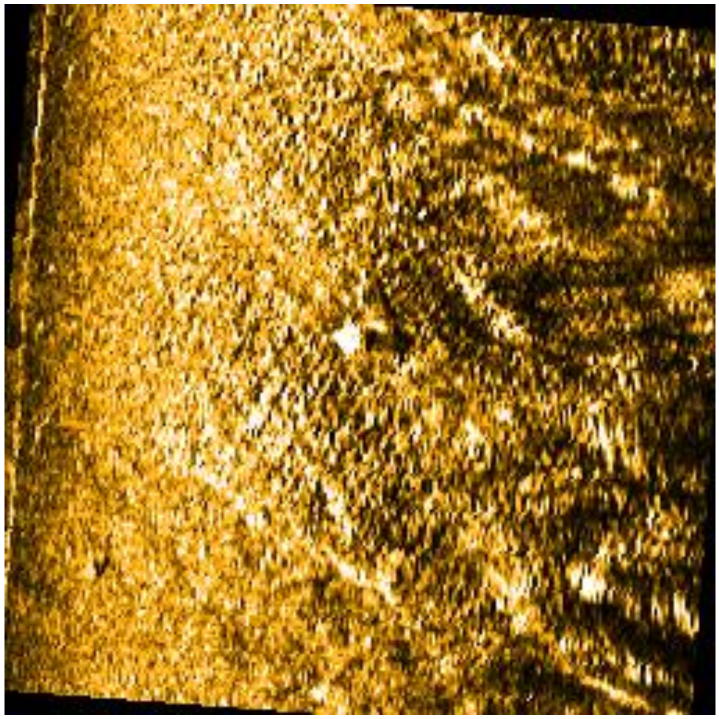
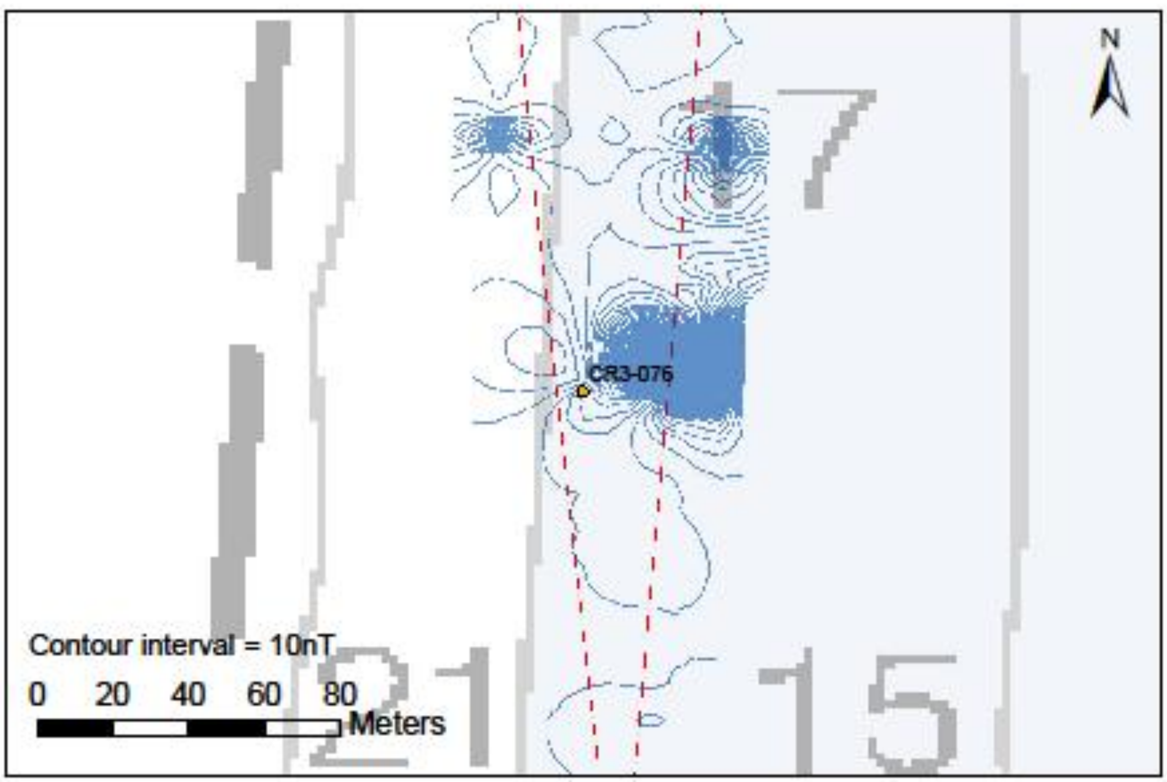


Figure 81. Anomaly CR3-076 sonogram showing a scatter of rocks and a crab pot (top). Anomaly CR3-076 magnetic contour map (bottom).



Entrance Channel 1 (EC1)

EC1 Remote sensing data was generated from this survey area on 12 and 15 October, and 6, 7, and 8 November 2012. A total of 23 individual sites was identified for this survey section and are described below, including recommendations. Table 14 and figures 82-88 provide specific details of each target. No potentially historic or prehistoric cultural material was noted in reviewing these anomalies. All cultural material in the Entrance Channel 1 survey area proved to be modern debris or cables representative of harbor activity. Upright posts or piles occur throughout the Entrance Channel and ODMDS areas, and are likely to represent locations for research by the Department of Natural Resources.

Table 14. Characteristics of Entrance Channel 1 (EC1) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
EC1-001	45.48	2354305.8	333347.9	0:00:03	7.77	3.30	Positive monopolar	dispersed debris	No further work
EC1-002	30.75	2356894.0	331226.6	0:00:02	50.24	46.38	Dipolar	dispersed debris	No further work
EC1-003	17.10	2388157.1	314194.1	0:00:04	13.40	9.30	Negative monopolar	cable/pipe	No further work
EC1-004	38.18	2358530.7	330339.0	0:00:07	6.10	2.15	Dipolar	isolated debris	No further work
EC1-005	127.39	2362647.2	328009.9	0:00:03	9.53	5.11	Positive monopolar	pipe	No further work
EC1-006	45.44	2362902.9	327976.4	0:00:10	9.27	5.66	Negative monopolar	dispersed debris	No further work
EC1-007	18.21	2364506.8	327023.3	0:00:02	9.76	5.22	Positive monopolar	isolated debris	No further work
EC1-008	16.70	2364800.0	326939.4	0:00:03	9.33	5.63	Positive monopolar	isolated debris	No further work
EC1-009	7.69	2364903.1	326798.6	0:00:01	13.99	9.88	Positive monopolar	dispersed debris	No further work
EC1-010	36.32	2365078.3	326800.7	0:00:07	9.38	5.57	Dipolar	isolated debris	No further work
EC1-011	8.08	2368230.0	325006.9	0:00:01	10.94	7.41	Positive monopolar	tire	No further work
EC1-012	26.72	2369411.3	324453.0	0:00:03	9.87	6.01	Positive monopolar	isolated debris	No further work
EC1-013	7.63	2370450.0	323741.1	0:00:02	11.16	5.57	Positive monopolar	none	No further work
EC1-014	7.86	2382482.5	317348.9	0:00:01	11.79	6.49	Positive monopolar	post	No further work

Table 14 continued

EC1-015	12.70	2386448.2	315057.4	0:00:03	10.41	4.99	Negative monopolar	isolated debris	No further work
EC1-016	8.15	2387477.0	314455.0	0:00:02	12.15	6.61	Positive monopolar	isolated debris	No further work
EC1-017	13.86	2387642.8	314482.5	0:00:04	13.69	9.52	Dipolar	scattered debris	No further work
EC1-018	29.45	2394082.7	310981.4	0:00:07	14.81	10.51	Dipolar	post	No further work
EC1-019	10.86	2397105.4	309178.0	0:00:01	13.80	11.41	Positive monopolar	isolated debris	No further work
EC1-020	10.17	2397523.1	308994.0	0:00:01	13.90	11.32	Positive monopolar	post	No further work
EC1-021	31.38	2397316.1	309064.2	0:00:01	14.13	11.70	Negative monopolar	pipes	No further work
EC1-022	10.68	2406480.2	304249.8	0:00:03	13.67	11.41	Positive monopolar	scattered debris	No further work
EC1-023	6.81	2407736.7	303465.4	0:00:01	12.75	10.08	Positive monopolar	pipe	No further work

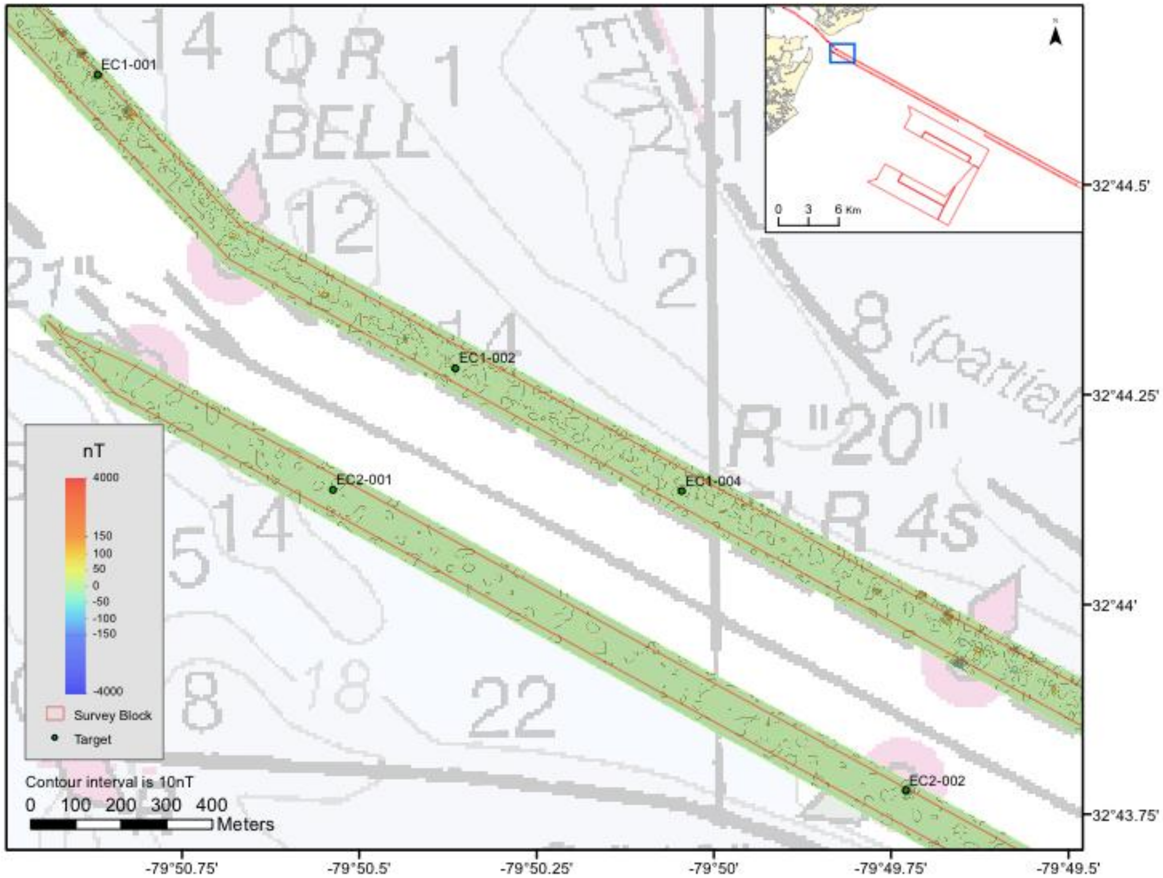


Figure 82. Magnetic anomaly color contour maps of EC1 and EC2.

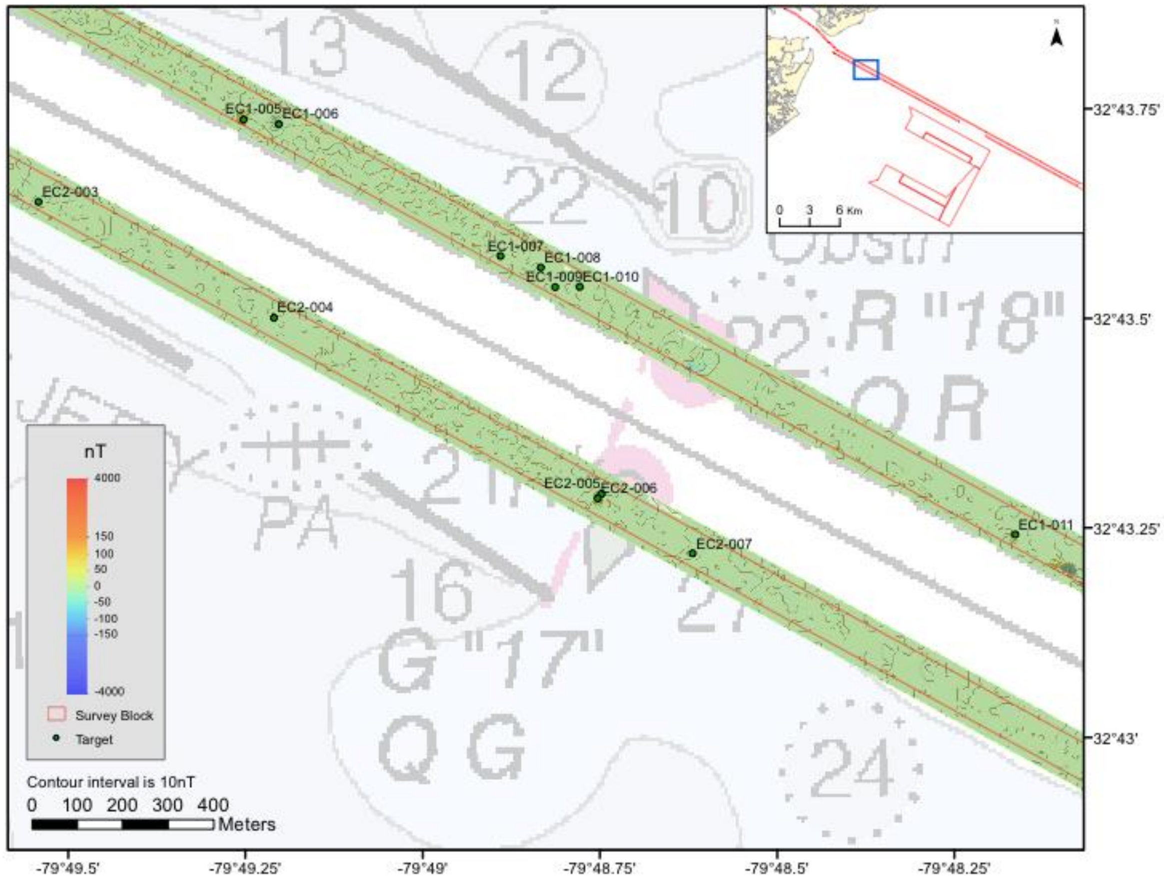


Figure 83. Magnetic anomaly color contour maps of EC1 and EC2 continued.

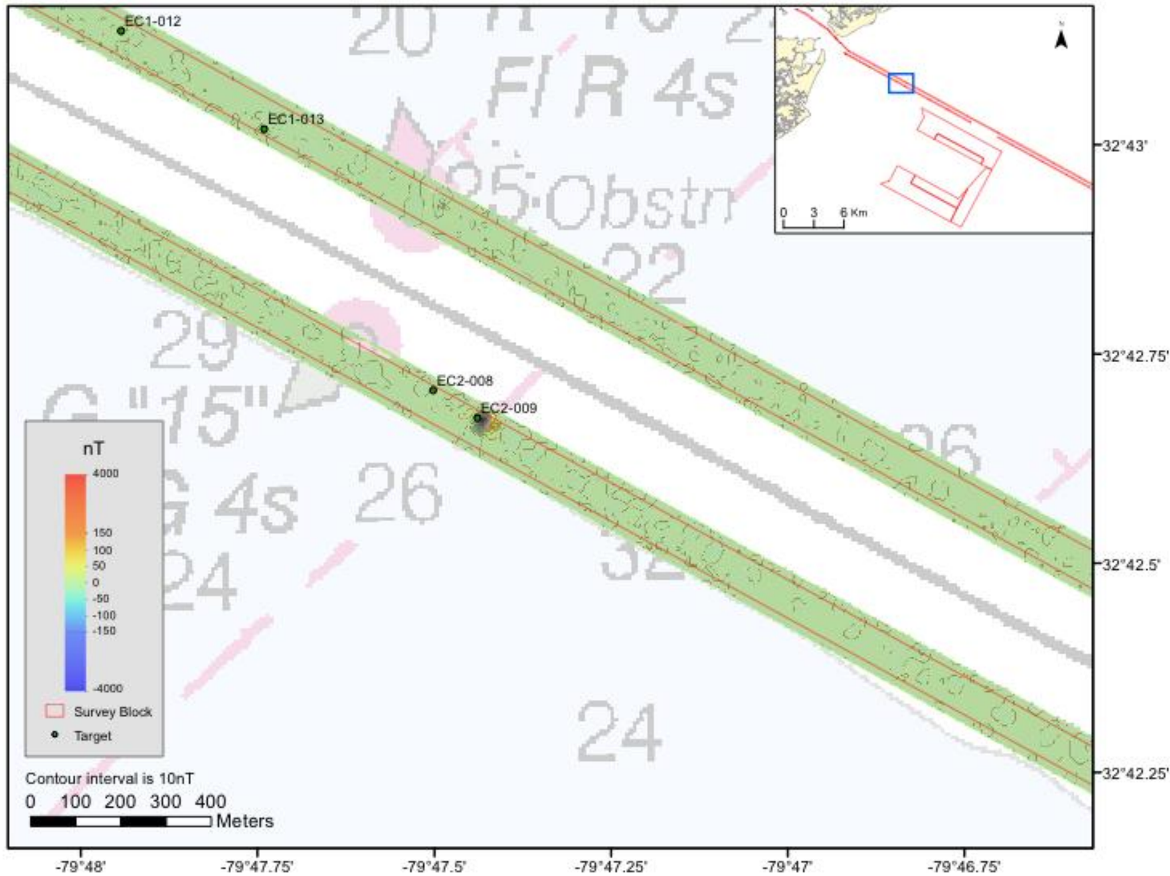


Figure 84. Magnetic anomaly color contour maps of EC1 and EC2 continued.

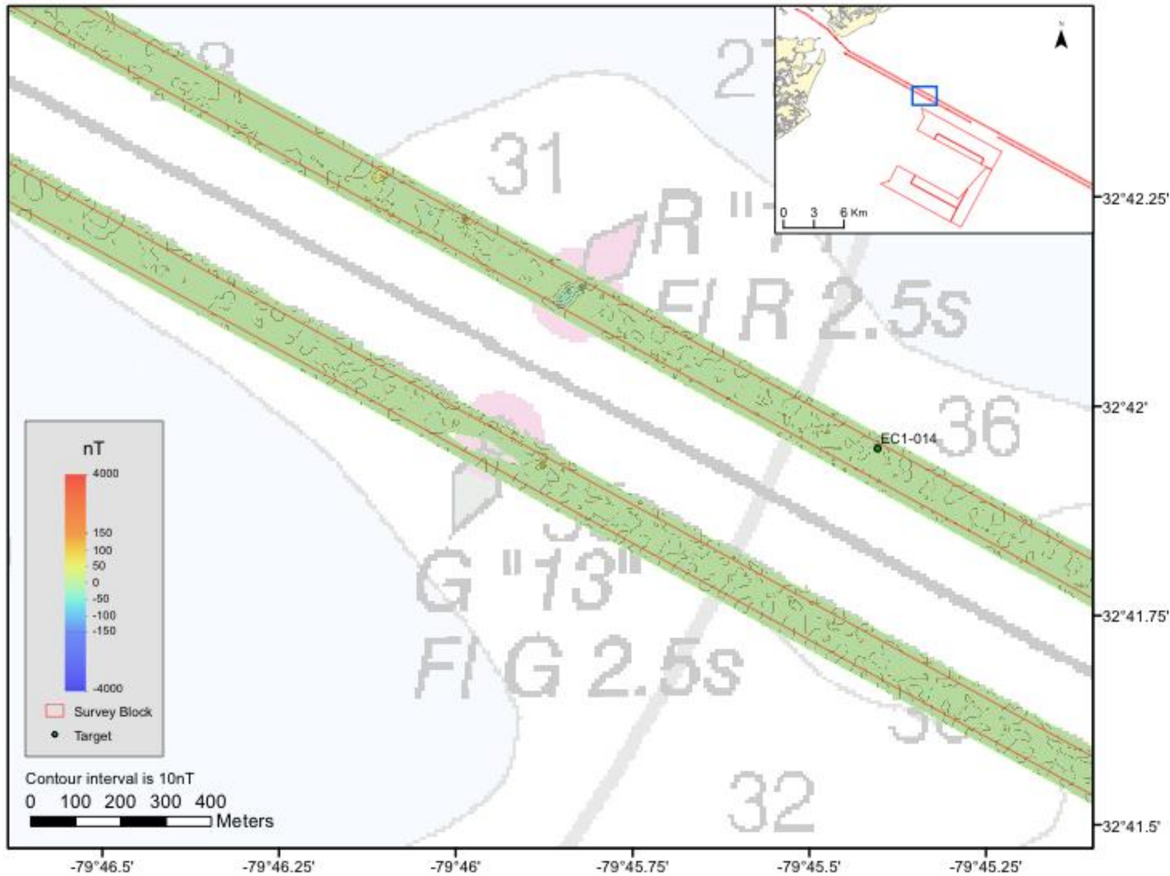


Figure 85. Magnetic anomaly color contour maps of EC1 and EC2 continued.

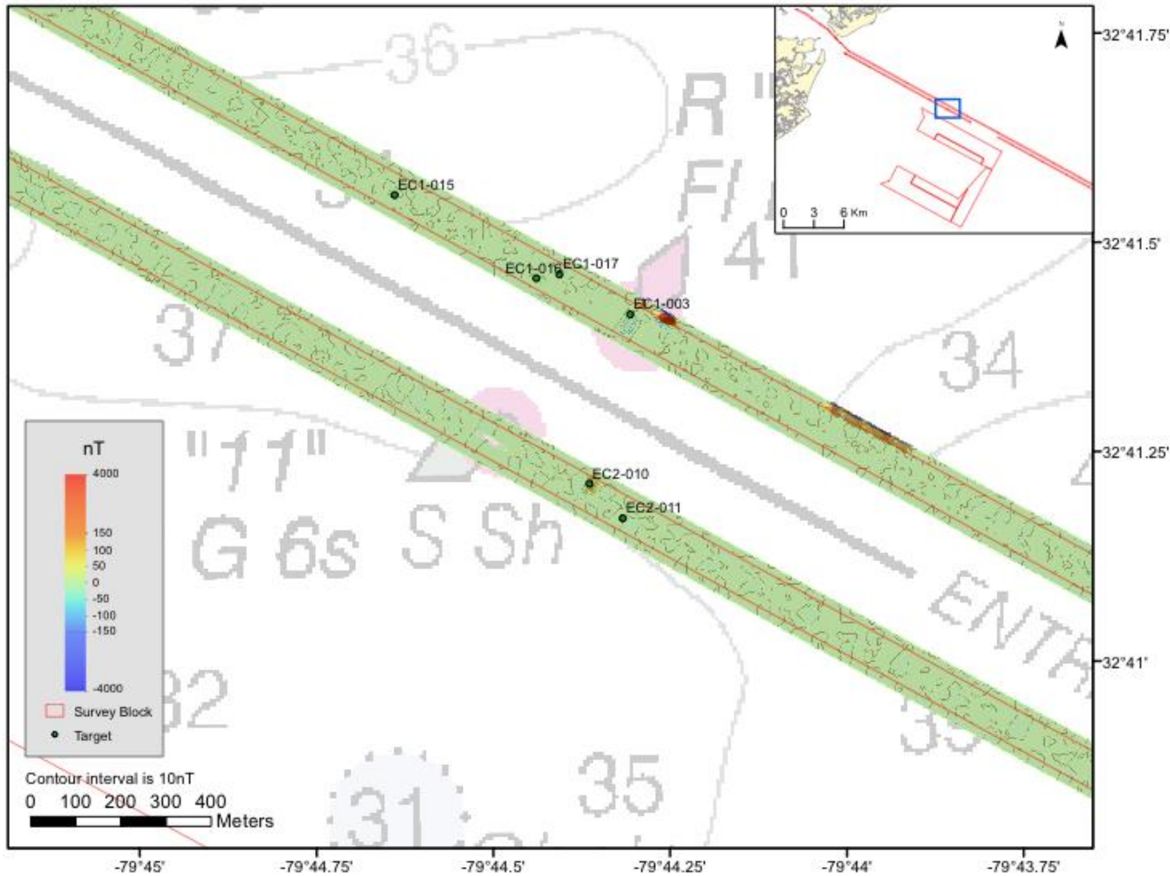


Figure 86. Magnetic anomaly color contour maps of EC1 and EC2 continued.

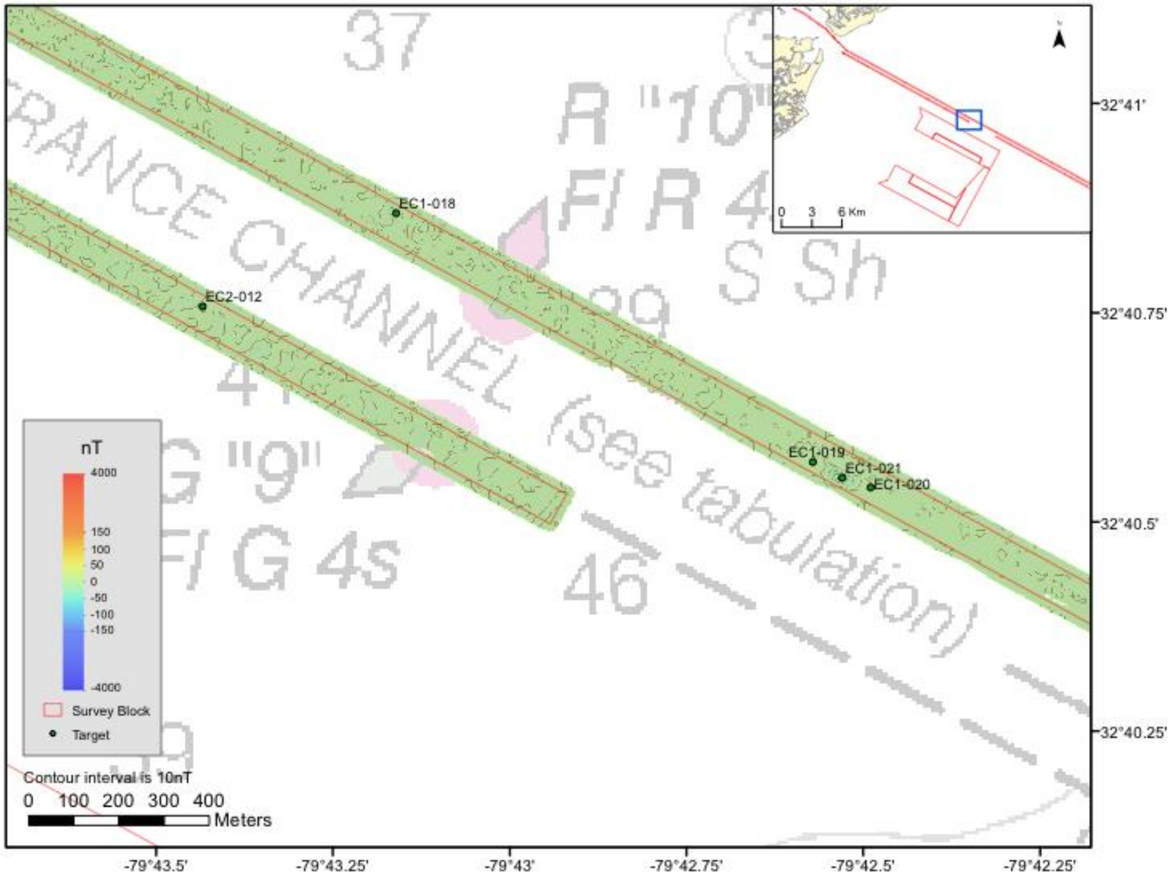


Figure 87. Magnetic anomaly color contour maps of EC1 and EC2 continued.

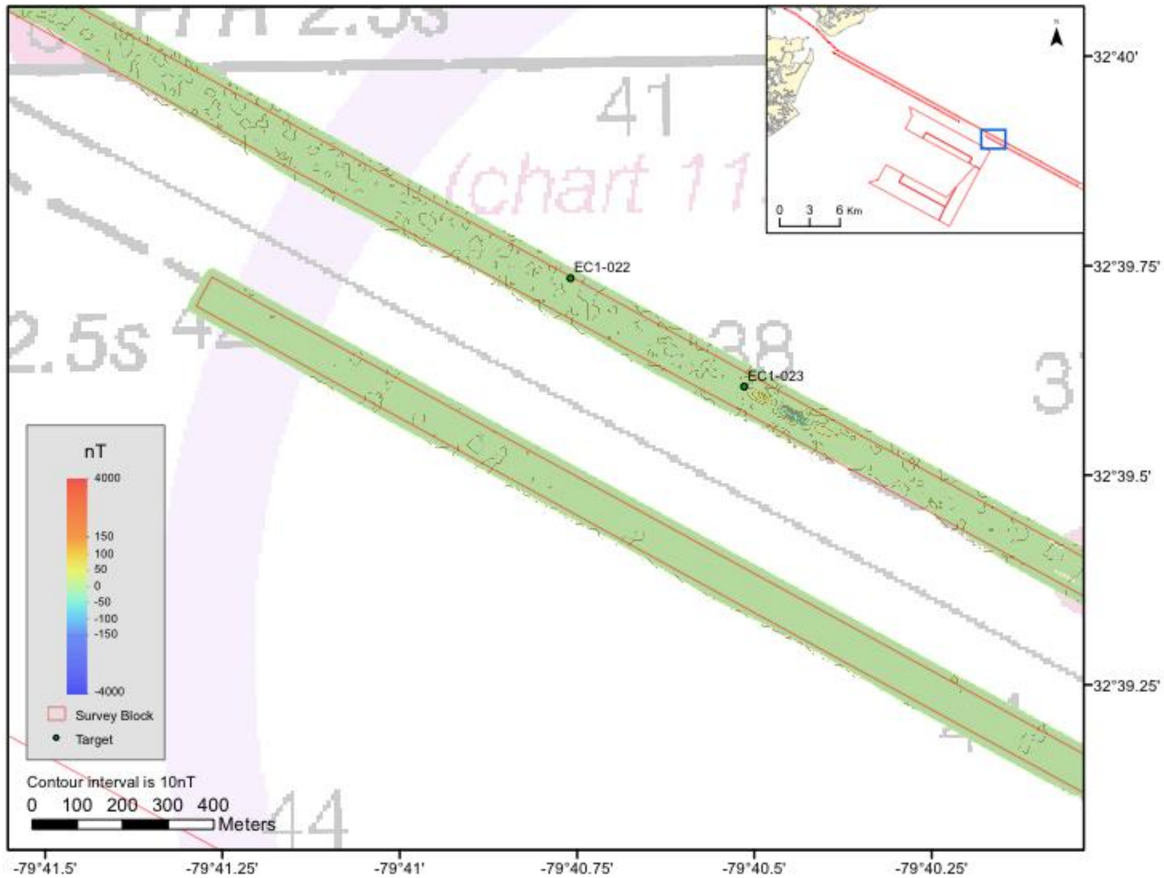


Figure 88. Magnetic anomaly color contour maps of EC1 and EC2 continued.

EC1-001 (figure 89) is a positive monopolar magnetic anomaly of 45.48 nT and 3 seconds duration that coincides with an area of dispersed hard return small debris on the sea bottom. All materials are less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-002 (figure 90) is a dipolar magnetic anomaly of 30.75 nT and 2 seconds duration that coincides with an area of dispersed hard return small debris on the sea bottom. All materials are less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-003 is a negative monopolar magnetic anomaly of 17.10 nT 4 seconds duration that coincides with what appears to be a channel marker. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-004 is a dipolar magnetic anomaly of 38.18 nT 7 seconds duration that sonogram records indicate coincides with an isolated piece of debris approximately 0.8 m long on the sea bottom. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-005 is a positive monopolar magnetic anomaly of 127.39 nT and 3 seconds duration that coincides with a piece of pipe approximately 7 m L and 0.1 m above the sea bottom. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-006 (figure 91) is a negative monopolar magnetic anomaly of 45.44 nT and 10 seconds duration that coincides with an area of dispersed hard return small debris on the sea bottom. All materials are less than 0.5 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-007 is a positive monopolar magnetic anomaly of 18.21 nT and 2 seconds duration that coincides with a piece of small debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-008 (figure 92) is a positive monopolar magnetic anomaly of 16.70 nT 3 seconds duration that coincides with isolated hard return debris less than 0.7 m in any dimension in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-009 (figure 92) is a positive monopolar magnetic anomaly of 7.69 nT and 1 second duration that coincides with pieces of small debris on the sea bottom. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

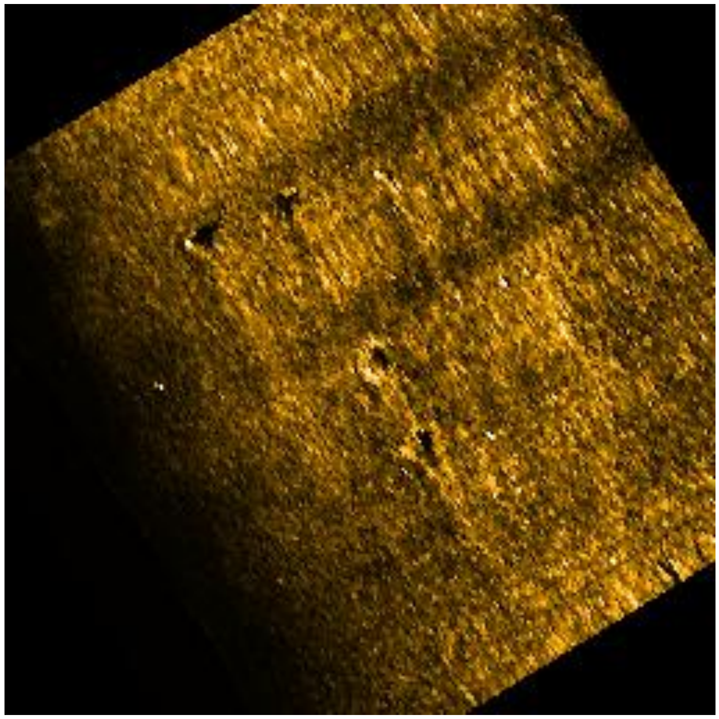
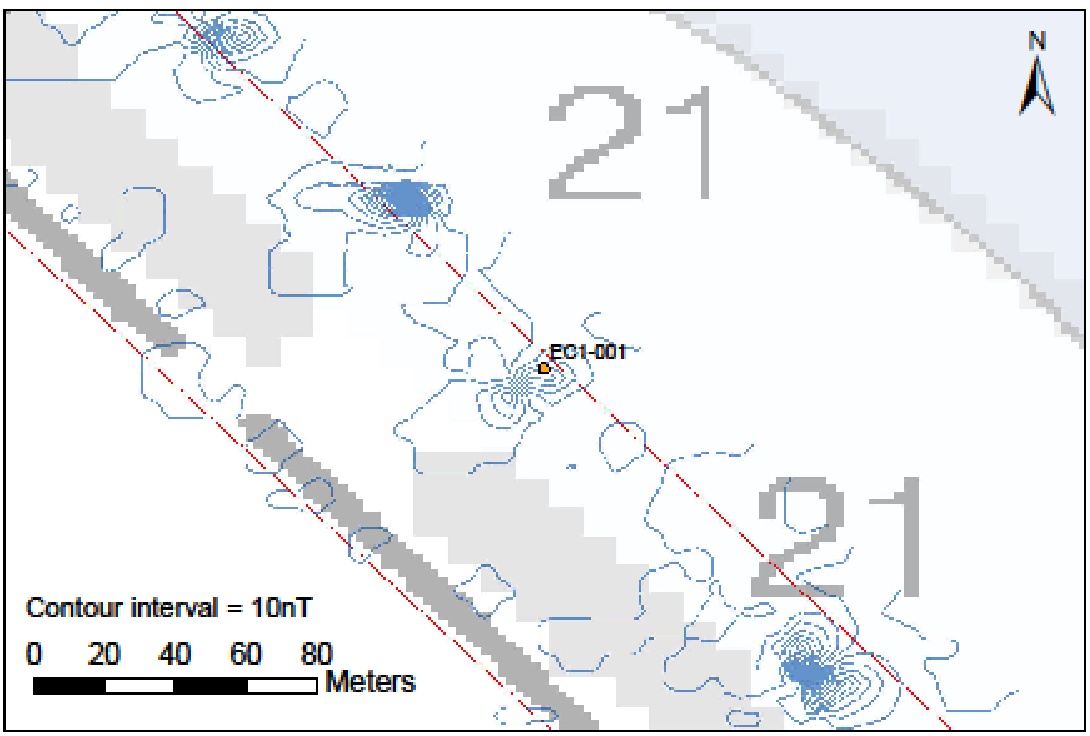


Figure 89. Anomaly EC1-001 sonogram showing dispersed debris (top). Anomaly EC1-001 magnetic contour map (bottom).



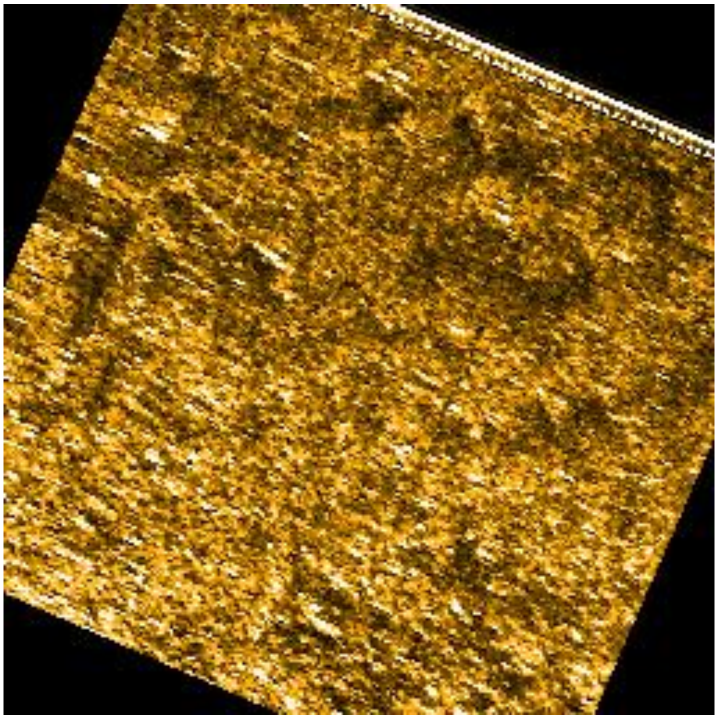
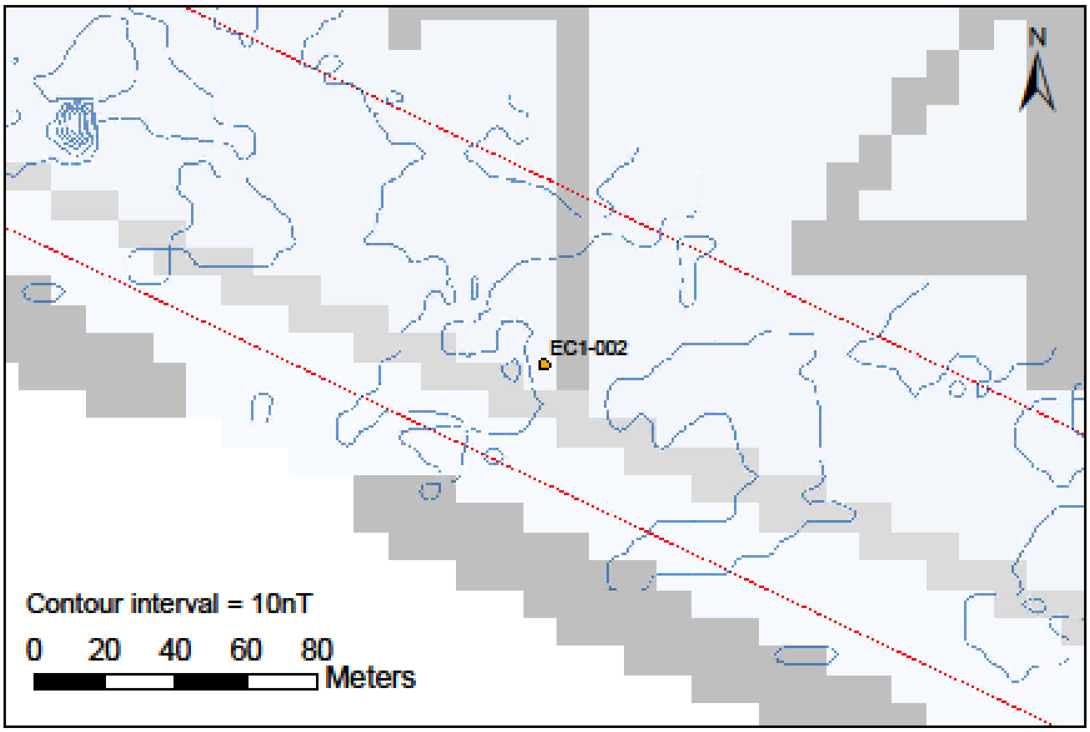


Figure 90. Anomaly EC1-002 sonogram showing dispersed debris (top). Anomaly EC1-002 magnetic contour map (bottom).



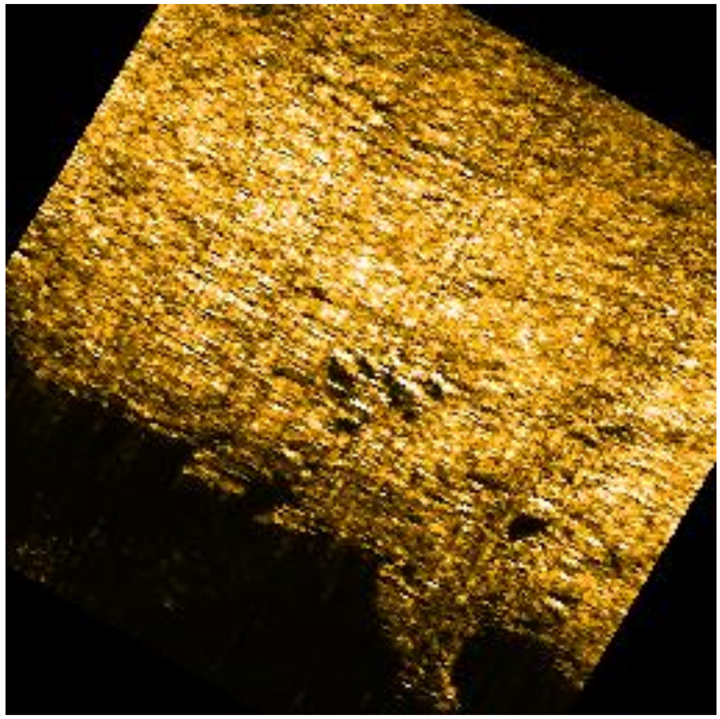
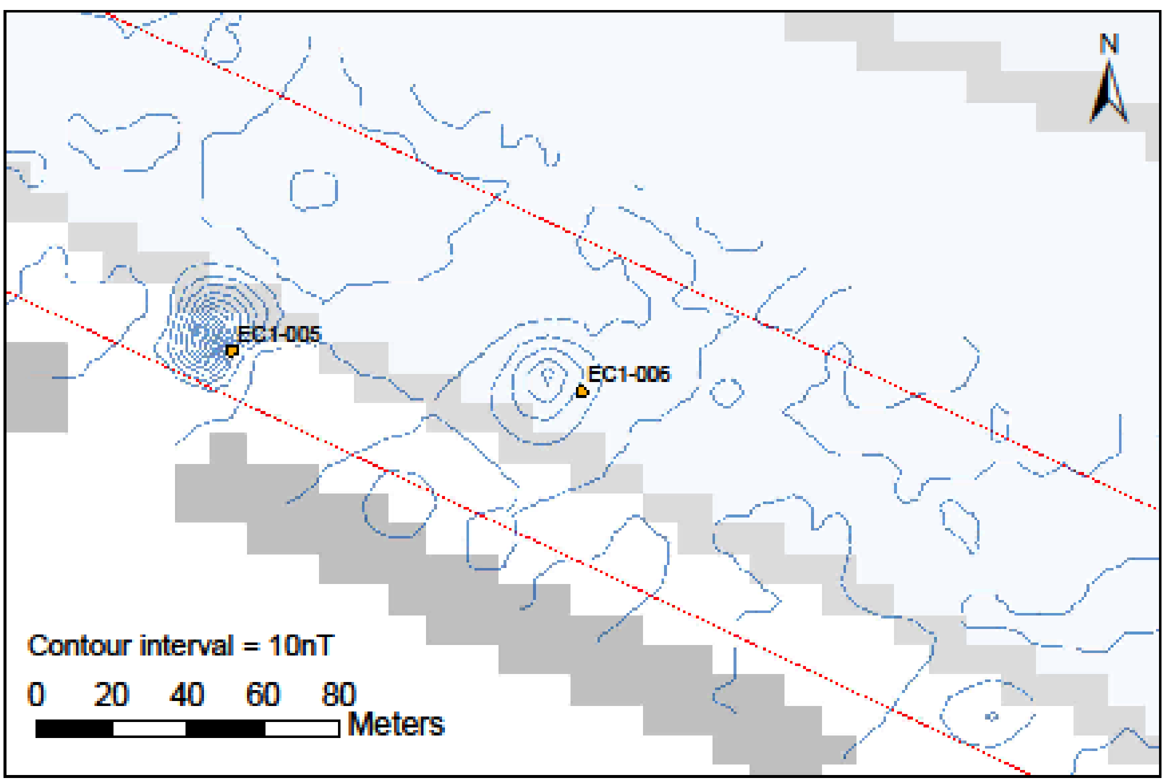
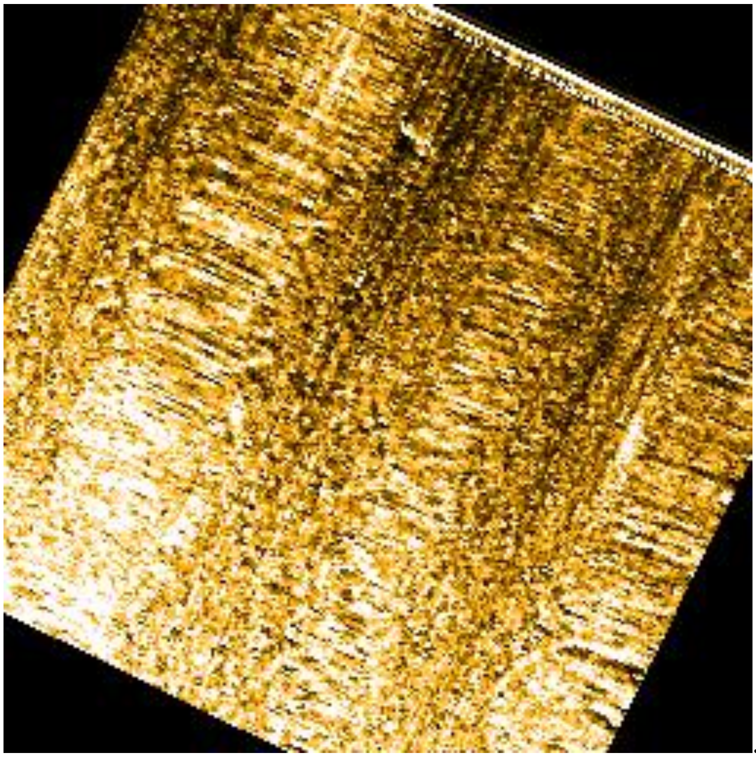


Figure 91. Anomaly EC1-006 sonogram showing dispersed debris (top). Anomaly EC1-006 magnetic contour map (bottom).





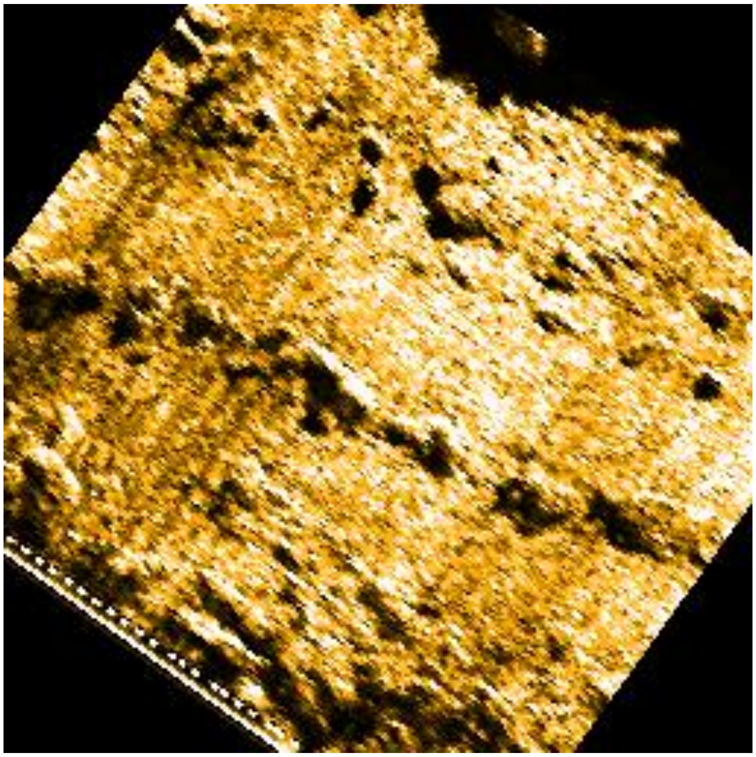
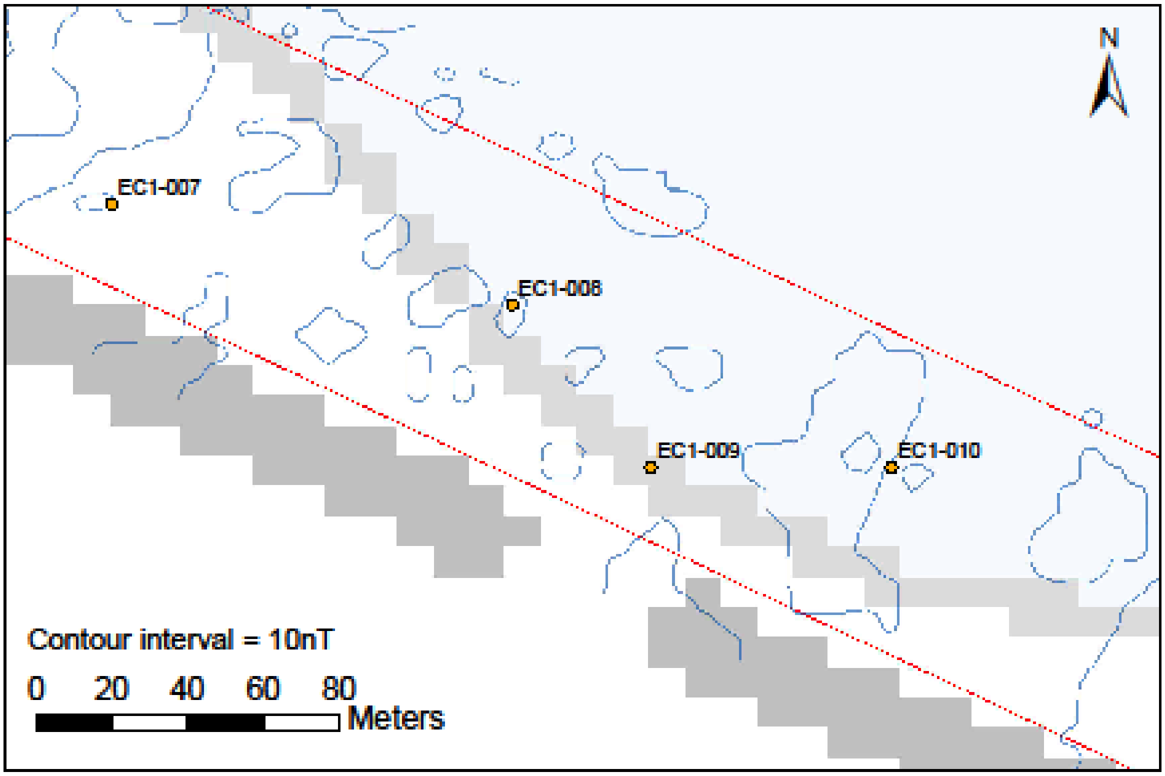


Figure 92. Anomaly EC1-008 sonogram showing isolated debris and anomaly EC1-009 sonogram showing dispersed debris (top). Anomalies EC1-008 and EC1-009 magnetic contour map (next page).


N
EC1-007
EC1-008
EC1-009
EC1-010
Contour interval = 10nT
0 20 40 60 80
Meters

EC1-010 is a dipolar magnetic anomaly of 36.32 nT and 7 seconds duration that coincides with a piece of small debris on the sea bottom. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-011 is a positive monopolar magnetic anomaly of 8.08 nT and 1 second duration that coincides with what appears to be a tire approximately 1.4 m in diameter and 0.2 m high on the sea bottom. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-012 is a positive monopolar magnetic anomaly of 26.72 nT 3 seconds duration with a narrow diameter pipe or rod approximately 3.2 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-013 is a positive monopolar magnetic anomaly of 7.63 nT and 2 seconds duration with no specific identified feature in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-014 is a positive monopolar magnetic anomaly of 7.86 nT and 1 seconds duration that coincides with what appears to be an upright post at least 1.2 m tall on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-015 is a negative monopolar magnetic anomaly of 12.70 nT and 3 seconds duration that coincides with a piece of small debris on the sea bottom in sonogram records. It measures less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-016 is a positive monopolar magnetic anomaly of 8.15 nT and 2 seconds duration that coincides with a piece of small debris on the sea bottom in sonogram records. It measures less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-017 (figure 93) is a dipolar magnetic anomaly of 13.86 nT and 4 seconds duration that coincides with an area of dispersed hard return small debris on the sea bottom. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-018 is a positive monopolar magnetic anomaly of 29.45 nT and 7 seconds duration that coincides with what appears to be an upright post at least 1.2 m tall on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

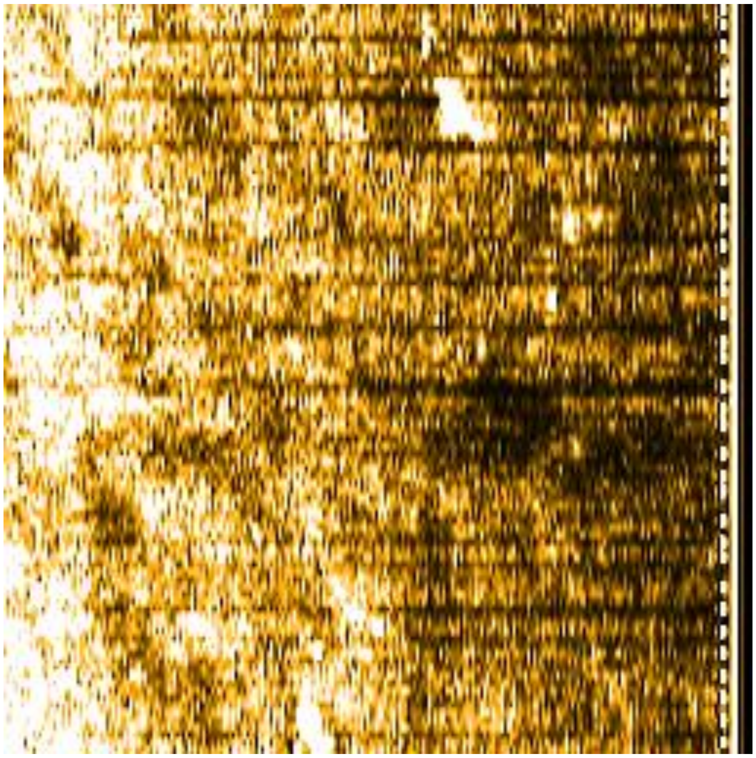
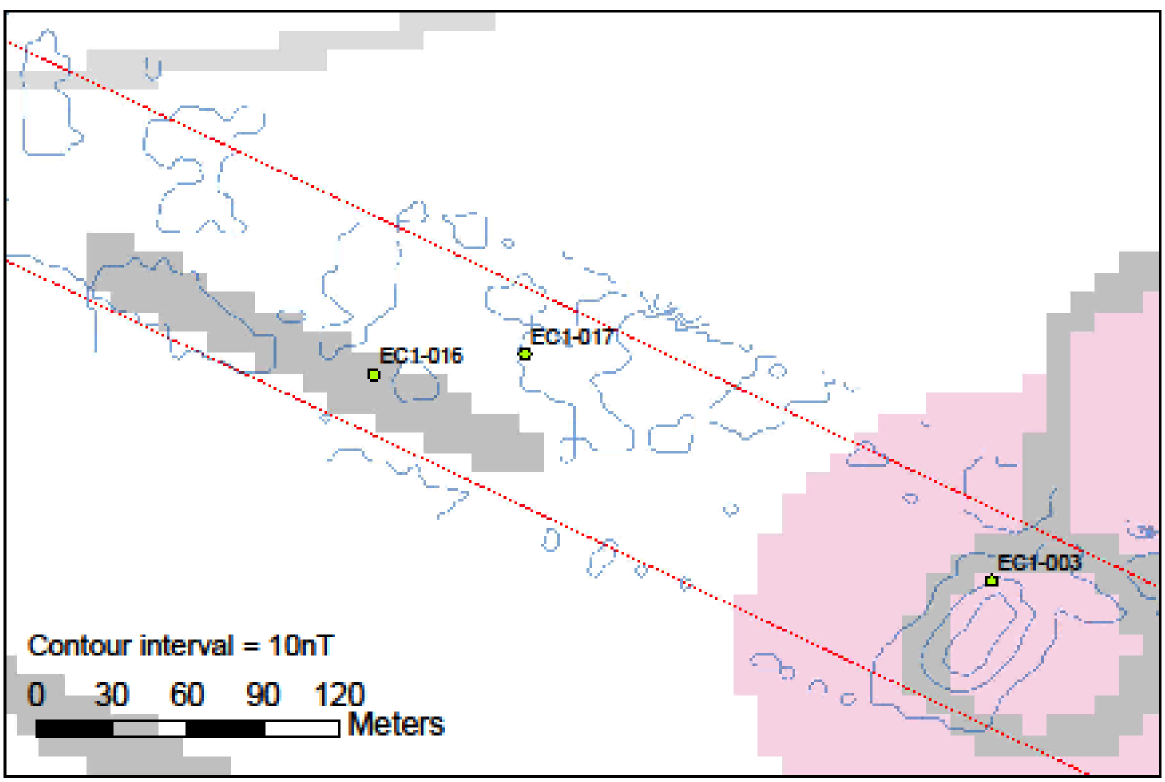


Figure 93. Anomaly EC1-017 sonogram showing scattered debris (top). Anomaly EC1-017 magnetic contour map (bottom).



EC1-019 is a positive monopolar magnetic anomaly of 10.86 nT and 1 second duration that coincides with a piece of debris 3.8 m long and 0.1 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-020 is a positive monopolar magnetic anomaly of 10.17 nT and 1 second duration that coincides with what appears to be an upright post at least 1.2 m tall on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-021 is a negative monopolar magnetic anomaly of 31.38 nT and 1 second duration that coincides with a pair of pipes 14.8 m long spaced 3.4 m apart and about 0.4 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-022 (figure 94) is a positive monopolar magnetic anomaly of 10.68 nT and 3 seconds duration that coincides with pieces of small debris on the sea bottom in sonogram records. All materials are less than 1 m in any dimension. No additional evidence of submerged cultural material was found in the anomaly area.

EC1-023 is a positive monopolar magnetic anomaly of 6.81 nT and 1 second duration that appears to be a pipe or similar object 7.8 m long, 1 m wide, and at least 0.1 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

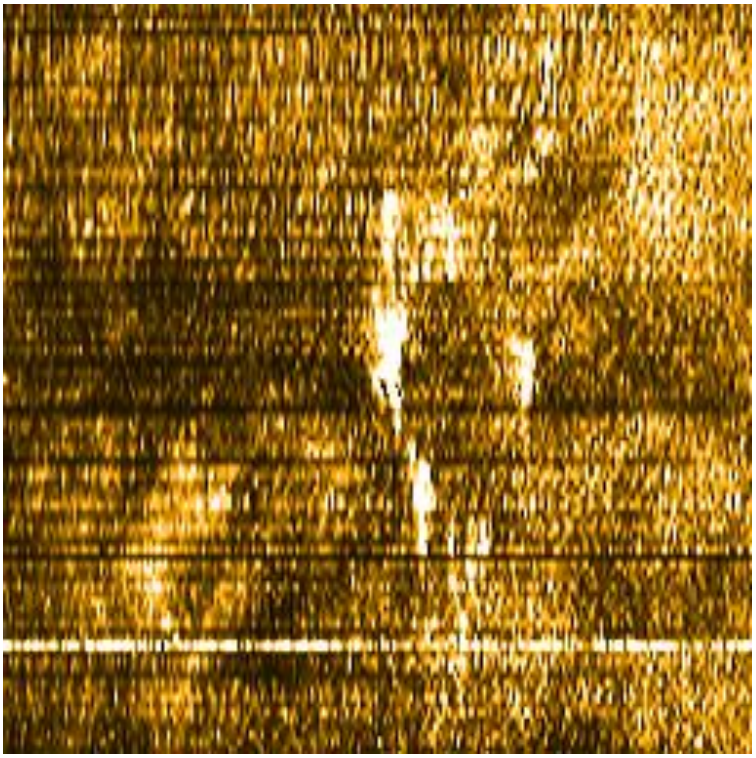
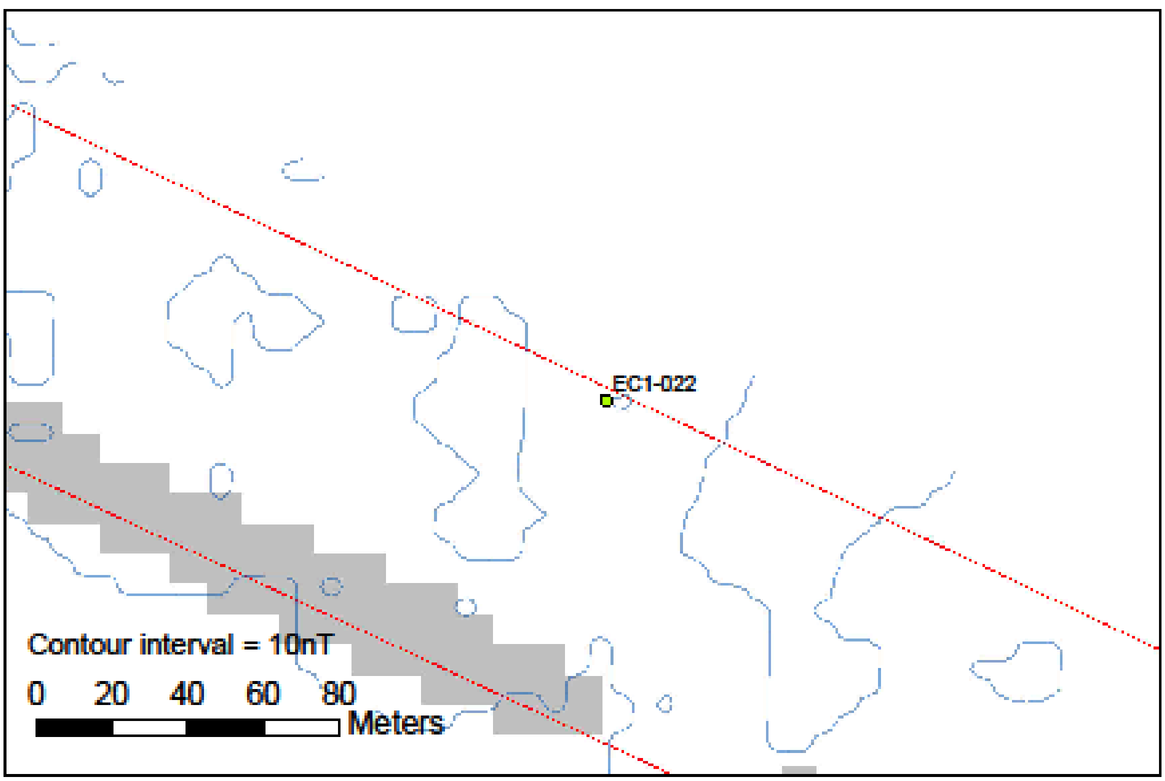


Figure 94. Anomaly EC1-022 sonogram showing scattered debris (top). Anomaly EC1-022 magnetic contour map (bottom).



Entrance Channel 2 (EC2)

EC2 Remote sensing data was generated from this survey area on 15 October, and 5, 6, and 7 November 2012. A total of 12 individual sites were identified for this survey section and are described below, including recommendations. Table 12 and figures 82-88 provide specific details of each target. No potentially historic or prehistoric cultural material was noted in reviewing these anomalies.

Table 15. Characteristics of Entrance Channel 2 (EC2) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
EC2-001	8.25	2356006.0	330347.0	00:00:01	11.02	6.55	Positive monopolar	crab pot	No further work
EC2-002	59.08	2360148.1	328177.9	00:00:09	16.43	12.04	Negative monopolar	buoy chain	No further work
EC2-003	10.23	2361165.5	327414.5	00:00:04	10.40	6.46	Negative monopolar	buoy sink	No further work
EC2-004	17.16	2362866.6	326575.2	00:00:02	10.28	6.05	Positive monopolar	isolated debris	No further work
EC2-005	22.93	2365237.0	325303.5	00:00:05	9.60	5.57	Negative monopolar	channel marker	No further work
EC2-006	150.94	2365209.7	325270.4	00:00:03	9.59	4.61	Dipolar	channel marker	No further work
EC2-007	19.72	2365897.1	324870.8	00:00:04	9.98	6.32	Negative monopolar	channel marker	No further work
EC2-008	10.77	2371674.7	321848.8	00:00:02	12.01	7.79	Positive monopolar	isolated debris	No further work
EC2-009	327.68	2371993.9	321648.8	00:00:14	11.31	6.89	Dipolar	lg debris	No further work
EC2-010	89.15	2387861.3	312967.9	00:00:06	14.30	9.64	Dipolar	isolated debris	No further work
EC2-011	24.18	2388104.3	312716.2	00:00:04	12.86	8.25	Dipolar	pipe	No further work
EC2-012	13.29	2392678.7	310305.5	00:00:03	14.49	9.71	Positive monopolar	buoy sink	No further work

EC2-001 is a positive monopolar magnetic anomaly of 8.25 nT and 1 second duration that coincides with a crab pot 1 m long and 0.3 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-002 is a negative monopolar magnetic anomaly of 59.08 nT and 9 seconds duration that coincides with buoy chain on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-003 is a negative monopolar magnetic anomaly of 10.23 nT and 4 seconds duration that coincides with a buoy sink less than 0.5 m in any dimension on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-004 is a positive monopolar magnetic anomaly of 17.16 nT and 2 seconds duration that coincides with isolated debris less than 0.4 m in any dimension in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-005 is a negative monopolar magnetic anomaly of 22.93 nT and 5 seconds duration that coincides with 2 buoy sinks less than 0.5 m in any dimension on the sea bottom in sonogram records. They are part of the channel marker nearby. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-006 is a dipolar magnetic anomaly of 150.94 nT and 3 seconds duration that coincides with a 4-m length of rod or cable isolated 0.1 m above the sea bottom in sonogram records. It is part of the channel marker nearby. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-007 is a negative monopolar magnetic anomaly of 19.72 nT and 4 seconds duration that coincides with the channel marker nearby in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-008 is a positive monopolar magnetic anomaly of 10.77 nT and 2 seconds duration that coincides with isolated debris in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-009 (figure 95) is a dipolar magnetic anomaly of 327.68 nT and 14 seconds duration that coincides with isolated hard return debris covering approximately 5 x 15 m on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

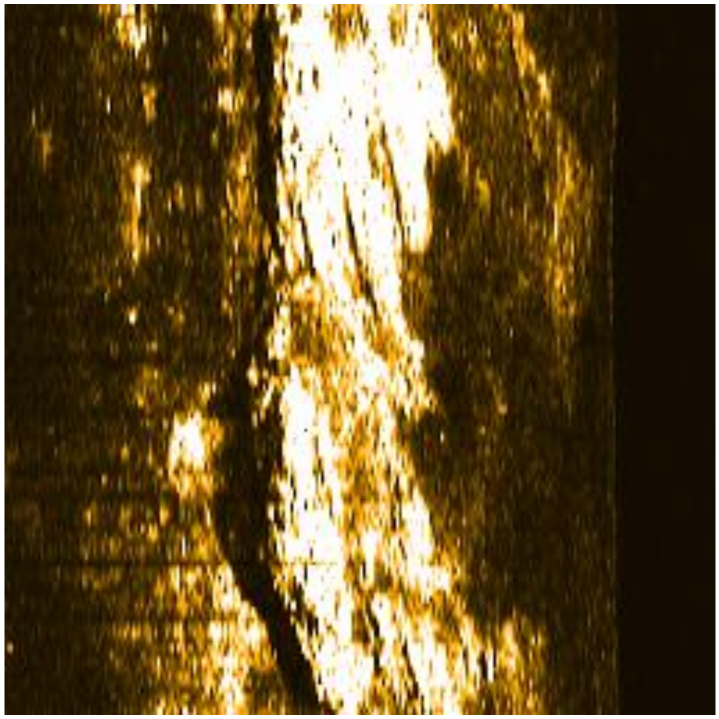
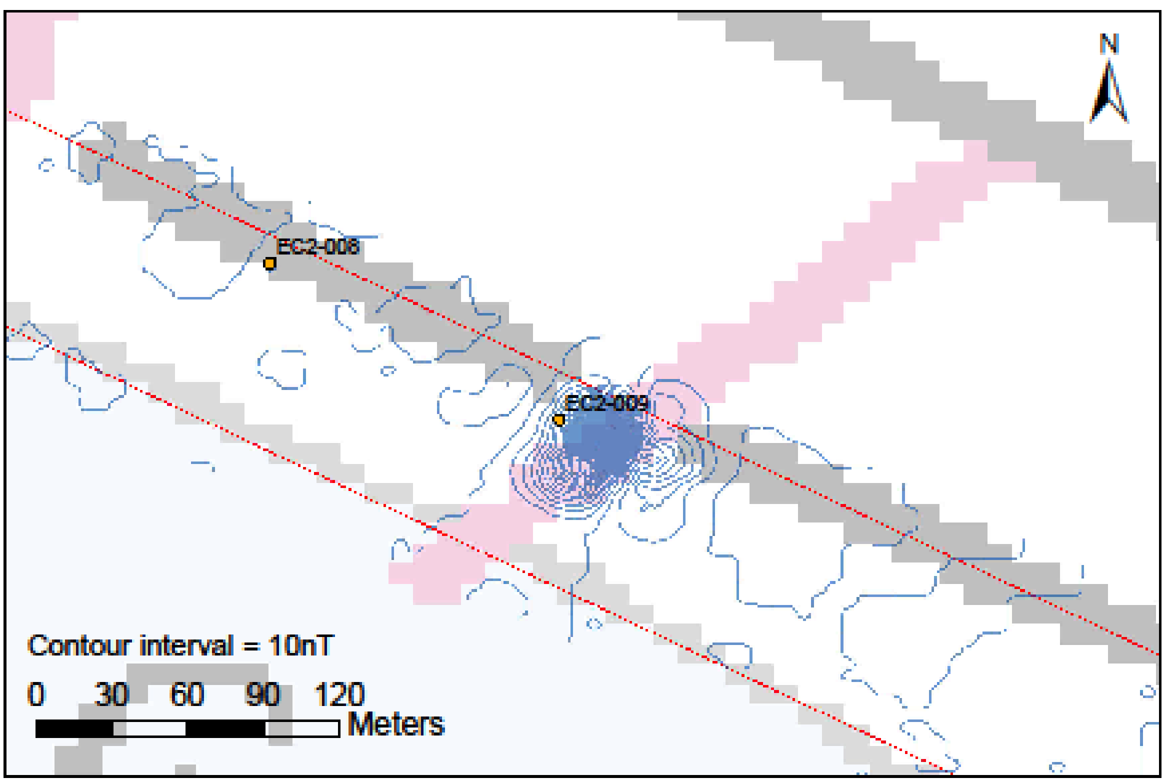


Figure 95. Anomaly EC2-009 sonogram showing large debris (top). Anomaly EC2-009 magnetic contour map (bottom).



EC2-010 is a dipolar magnetic anomaly of 89.15 nT and 6 seconds duration that coincides with an isolated piece of debris approximately 1 m long and 0.2 m above the sea bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-011 is a dipolar magnetic anomaly of 24.18 nT and 4 seconds duration that coincides with a length of pipe or cable 3 m long and 0.1 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

EC2-012 is a positive monopolar magnetic anomaly of 13.29 nT and 3 seconds duration that coincides with a buoy sink in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

Offshore Dredged Material Disposal Site 1 (OD1)

OD1 Remote sensing data was generated from this survey area on 12 and 13 November 2012. A total of 9 individual anomalies were identified for this survey section and each is described below, including recommendations. Table 16 and figure 96 provide specific details of each target.

Table 16. Characteristics of Ocean Dredged Material Disposal Site 1 (OD1) magnetic anomalies.

Anomaly	**Amplitude (nT)**	**x coords**	**y cords**	**Duration**	**Depth (m)**	**Altitude (m)**	**Shape**	**Identification**	**Recommendation**
OD1-001	35.09	2377022.2	291436.1	0:00:03	12.97	8.83	Dipolar	cable	No further work
OD1-002	9.94	2377347.1	290701.4	0:00:01	12.93	8.91	Positive monopolar	pipe	No further work
OD1-003	8.15	2376709.7	290445.7	0:00:01	12.65	8.62	Positive monopolar	none	No further work
OD1-004	18.78	2378971.6	290549.7	0:00:02	12.30	8.32	Dipolar	small object	No further work
OD1-005	11.06	2377269.9	288930.3	0:00:02	14.41	10.39	Negative monopolar	isolated rod-like object	No further work
OD1-006	9.04	2381353.1	288938.6	0:00:01	13.36	9.10	Positive monopolar	none	No further work
OD1-007	70.27	2384729.1	286492.7	0:00:02	16.86	16.16	Positive monopolar	cable	No further work
OD1-008	8.99	2385984.4	285922.1	0:00:02	14.39	10.24	Positive monopolar	isolated metal debris	No further work
OD1-009	45.04	2391026.7	282993.9	0:00:03	15.44	11.46	Positive monopolar	post	No further work

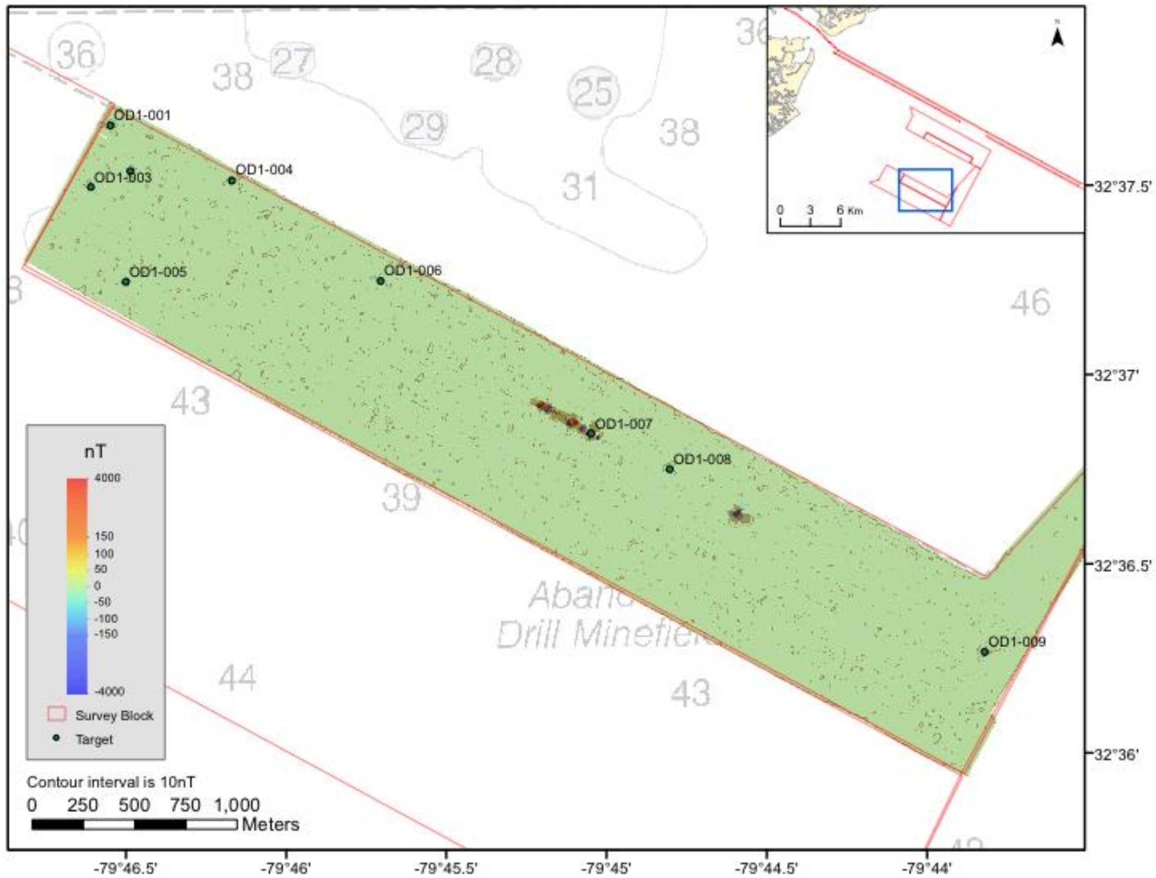


Figure 96. Magnetic anomaly color contour map of OD1.

OD1-001 is a dipolar magnetic anomaly of 35.09 nT and 3 seconds duration that coincides with an isolated piece of cable approximately 2 m long and 0.1 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD1-002 is a positive monopolar magnetic anomaly of 9.94 nT and 1 second duration that coincides with an isolated piece of pipe approximately 1.5 m long and 0.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD1-003 is a positive monopolar magnetic anomaly of 8.15 nT and 1 second duration that coincides with no specific identified feature on the flat sandy sea bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD1-004 is a dipolar magnetic anomaly of 18.78 nT and 2 seconds duration that coincides with a section of rod or narrow diameter pipe approximately 1.6 m long on the was found in the anomaly area.

OD1-005 is a negative monopolar magnetic anomaly of 11.06 nT and 2 seconds duration that coincides with an isolated rod-like object in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD1-006 is a positive monopolar magnetic anomaly of 9.04 nT and 1 second duration that coincides with no specific identified feature as it is an artificial reading of the end of a lane and has no accompanying sonogram records. It is not a viable anomaly.

OD1-007 is a positive monopolar magnetic anomaly of 70.27 nT and 2 seconds duration that coincides with an isolated piece of cable approximately 0.1 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD1-008 is a positive monopolar magnetic anomaly of 8.99 nT and 2 seconds duration that coincides with what appears to be a metal ring, perhaps from a 55-gallon drum, in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD1-009 is a positive monopolar magnetic anomaly of 45.04 nT and 3 seconds duration that coincides with what appears to be an upright post at least 1.2 m tall on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

Offshore Dredged Material Disposal Site 2 (OD2)

OD2 Remote sensing data was generated from this survey area on 11 and 12 November 2012. A total of 31 individual sites were identified for this survey section and each is described below, including recommendations. Table 17 and figures 97-98 provide specific details of each target.

Table 17. Characteristics of Ocean Dredged Material Disposal Site 2 (OD2) magnetic anomalies.

Anomaly	Amplitude (nT)	x coords	y coords	Duration	Depth (m)	Altitude (m)	Shape	Identification	Recommendation
OD2-001	5.28	2384498.9	304515.0	0:00:00	12.09	7.26	Positive monopolar	post	No further work
OD2-002	12.88	2384101.6	304029.9	0:00:02	11.53	7.03	Negative monopolar	post	No further work
OD2-003	17.94	2384128.6	303833.7	0:00:03	11.56	6.89	Positive monopolar	isolated debris	No further work
OD2-004	15.45	2385178.4	304315.8	0:00:02	12.25	7.91	Positive monopolar	isolated debris	No further work
OD2-005	8.42	2386189.1	303960.6	0:00:02	10.96	6.66	Negative monopolar	post	No further work
OD2-006	28.08	2385987.9	303801.7	0:00:03	12.06	7.72	Positive monopolar	post	No further work
OD2-007	18.34	2386063.6	303657.0	0:00:03	12.60	8.10	Negative monopolar	post	No further work
OD2-008	26.60	2386267.9	303808.7	0:00:03	11.25	7.03	Positive monopolar	post	No further work
OD2-009	26.22	2385756.5	303347.7	0:00:03	10.86	6.36	Negative monopolar	crab pot	No further work
OD2-010	10.91	2385674.1	303030.1	0:00:03	13.41	8.52	Positive monopolar	isolated debris	No further work
OD2-011	23.63	2386039.4	303369.3	0:00:03	13.35	8.37	Dipolar	isolated debris	No further work
OD2-012	10.25	2386958.7	303700.7	0:00:02	10.98	6.51	Negative monopolar	crab pot	No further work
OD2-013	15.13	2387525.5	303401.9	0:00:03	11.51	7.17	Positive monopolar	post	No further work

Table 17 continued

OD2-014	59.34	2386726.2	302566.3	0:00:05	13.09	8.43	Negative monopolar	pipe	No further work
OD2-015	20.78	2388169.8	301808.9	0:00:05	13.73	9.11	Negative monopolar	isolated debris	No further work
OD2-016	18.89	2387973.4	301249.8	0:00:04	13.43	9.32	Positive monopolar	post	No further work
OD2-017	70.92	2389086.8	302078.4	0:00:05	14.17	9.83	Negative monopolar	rod or pipe	No further work
OD2-018	13.77	2389069.7	300953.9	0:00:02	13.42	9.80	Negative monopolar	isolated debris	No further work
OD2-019	10.71	2389518.9	300217.2	0:00:02	13.91	9.74	Positive monopolar	isolated debris	No further work
OD2-020	7.93	2390965.8	300955.3	0:00:02	13.92	9.26	Positive monopolar	crab pot	No further work
OD2-021	35.70	2391602.0	300282.8	0:00:03	13.72	9.05	Negative monopolar	isolated debris	No further work
OD2-022	18.16	2393713.0	299086.3	0:00:04	15.15	10.53	Dipolar	cable	No further work
OD2-023	17.19	2394967.4	299211.0	0:00:06	14.64	10.47	Dipolar	pipe	No further work
OD2-024	8.59	2394939.1	299010.5	0:00:01	13.20	8.66	Positive monopolar	dispersed rocks; not ballast	No further work
OD2-025	5.72	2395324.8	298931.6	0:00:01	12.93	8.79	Negative monopolar	pipe	No further work
OD2-026	16.04	2395298.7	298560.2	0:00:02	13.20	8.66	Positive monopolar	post	No further work
OD2-027	30.78	2395100.3	297680.8	0:00:02	14.02	9.00	Negative monopolar	isolated debris	No further work
OD2-028	7.36	2394660.7	297384.3	0:00:01	14.13	10.11	Negative monopolar	isolated debris	No further work

Table 17 continued

OD2-029	9.42	2396855.3	297655.4	0:00:00	14.56	9.62	Positive monopolar	crab pot	No further work
OD2-030	103.05	2396889.8	297848.7	0:00:08	13.81	9.75	Dipolar	cable	No further work
OD2-031	138.94	2396859.9	297779.2	0:00:07	14.46	10.76	Dipolar	a metal frame	No further work

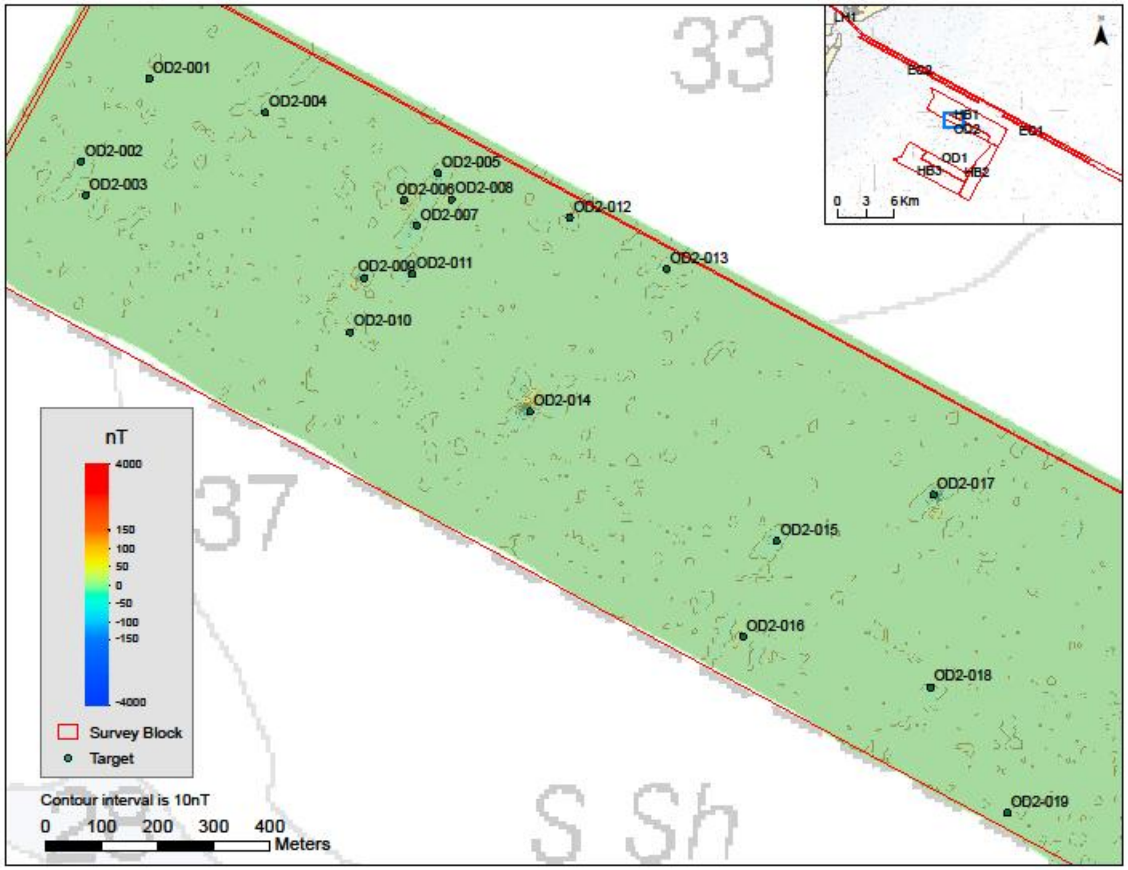


Figure 97. Magnetic anomaly color contour map of OD2.

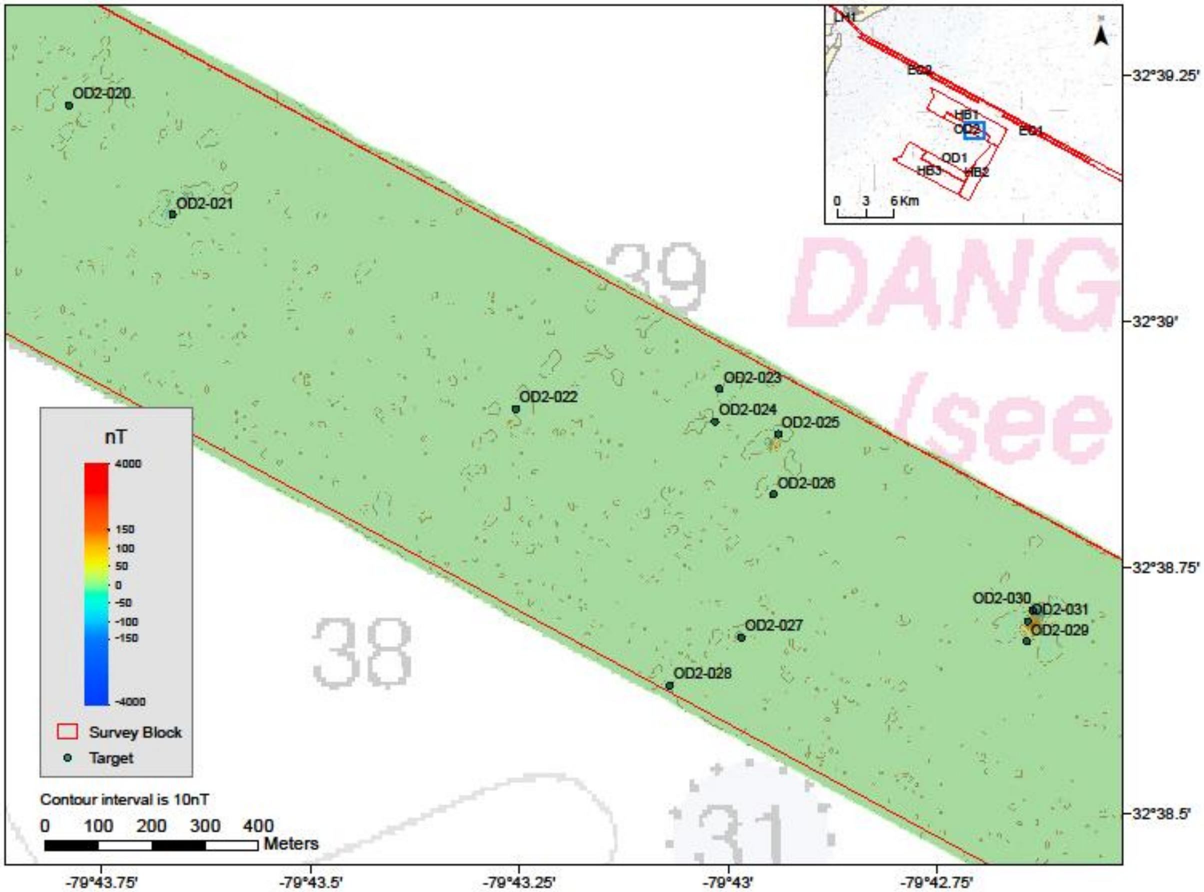


Figure 98. Magnetic anomaly color contour map of OD2 continued.

OD2-001 is a positive monopolar magnetic anomaly of 5.28 nT and 1 second duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-002 is a negative monopolar magnetic anomaly of 12.88 nT and 2 seconds duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-003 is a positive monopolar magnetic anomaly of 17.94 nT and 3 seconds duration that coincides with an isolated piece of debris less than 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-004 is a positive monopolar magnetic anomaly of 15.45 nT and 2 seconds duration that coincides with an isolated piece of debris less than 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-005 is a negative monopolar magnetic anomaly of 8.42 nT and 2 seconds duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-006 is a positive monopolar magnetic anomaly of 28.08 nT and 3 seconds duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-007 is a negative monopolar magnetic anomaly of 18.34 nT and 3 seconds duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-008 is a positive monopolar magnetic anomaly of 26.6 nT and 3 seconds duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-009 is a negative monopolar magnetic anomaly of 26.2 nT and 3 seconds duration that coincides with a crab pot and what appears to be another upright post in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-010 is a positive monopolar magnetic anomaly of 10.91 nT and 3 seconds duration that coincides with an isolated piece of debris less than 1 m long and 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-011 is a dipolar magnetic anomaly of 23.63 nT and 3 seconds duration that coincides with several pieces of hard return debris less than 2 m long and approximately 0.3 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-012 is a negative monopolar magnetic anomaly of 10.25 nT and 2 seconds duration that coincides with a crab pot in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-013 is a positive monopolar magnetic anomaly of 15.13 nT and 3 seconds duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-014 is a negative monopolar magnetic anomaly of 59.34 nT and 5 seconds duration that coincides with an isolated piece of pipe 3 m long and 0.1 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-015 is a positive monopolar magnetic anomaly of 20.78 nT and 5 seconds duration that coincides with several pieces of hard return debris less than 1.3 m long and in cracks between rocks on the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-016 is a positive monopolar magnetic anomaly of 18.89 nT and 4 seconds duration that coincides with an upright post approximately 1.2 m above the sea bottom in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-017 is a negative monopolar magnetic anomaly of 70.92 nT and 5 seconds duration that coincides with a rod or pipe in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-018 is a negative monopolar magnetic anomaly of 13.77 nT and 2 seconds duration that coincides with an isolated rod or narrow-diameter pipe approximately c. 2 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-019 is a positive monopolar magnetic anomaly of 10.71 nT and 2 seconds duration that coincides with an isolated piece of debris 1.8 m long and 0.4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-020 is a positive monopolar magnetic anomaly of 7.93 nT and 2 seconds duration that coincides with an isolated crab pot less than 1 m long and 0.4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-021 is a negative monopolar magnetic anomaly of 35.70 nT and 3 seconds duration that coincides with an isolated piece of debris 2.3 m long and 0.4 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-022 is a dipolar magnetic anomaly of 18.16 nT and 4 seconds duration that coincides with an upright post at least 1.2 m above the harbor bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-023 is a dipolar magnetic anomaly of 17.19 nT and 6 seconds duration that coincides with a rod or narrow diameter pipe less than 2 m long in accompanying sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-024 (figure 99) is a positive monopolar magnetic anomaly of 8.59 nT and 1 second duration that coincides with a scatter of small rocks on the sea bottom in sonogram records. This scatter is inconsistent with ballast material signatures or appearance. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-025 is a negative monopolar magnetic anomaly of 5.72 nT and 1 second duration that coincides with a piece of pipe 5.2 m long and 0.6 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-026 is a positive monopolar magnetic anomaly of 16.04 nT and 2 seconds duration that coincides with what appears to be an upright post at least 1.2 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-027 is a negative monopolar magnetic anomaly of 30.78 nT and 2 seconds duration that coincides with an isolated piece of pipe or a log approximately 4 m long and 0.4 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-028 is a negative monopolar magnetic anomaly of 7.36 nT and 1 second duration that coincides with two pieces of pipe or logs more than 7 m long and 0.6 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-029 is a positive monopolar magnetic anomaly of 9.42 nT and 1 second duration that coincides with a crab pot on the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-030 is a dipolar magnetic anomaly of 103.05 nT and 8 seconds duration that coincides with a piece of wire rope or cable 4 m long and 0.1 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

OD2-031 is a dipolar magnetic anomaly of 138.94 nT and 7 seconds duration that coincides with a piece of metal framework possibly 3 x 3 m on each side and 1 m above the sea bottom in sonogram records. No additional evidence of submerged cultural material was found in the anomaly area.

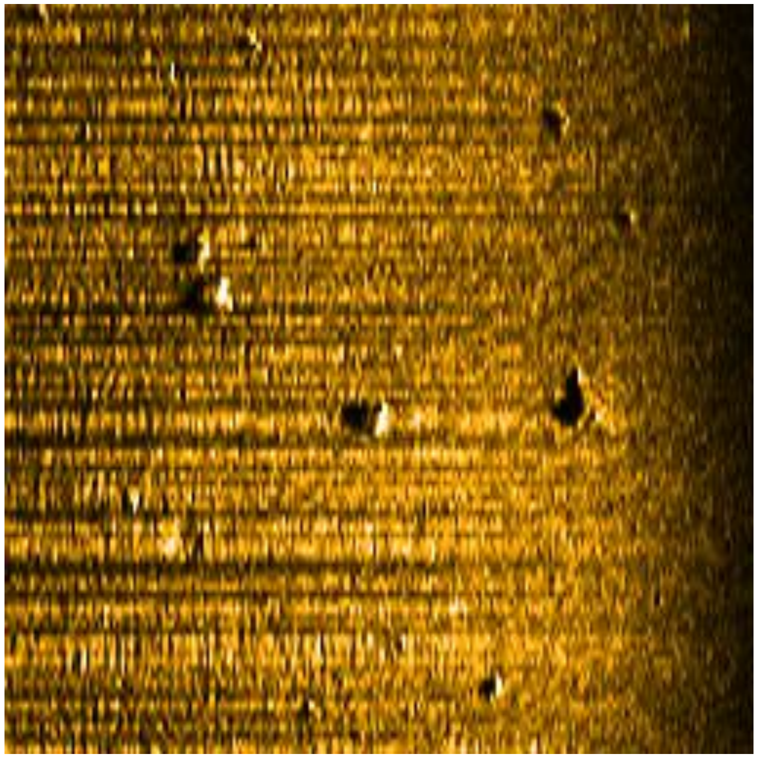
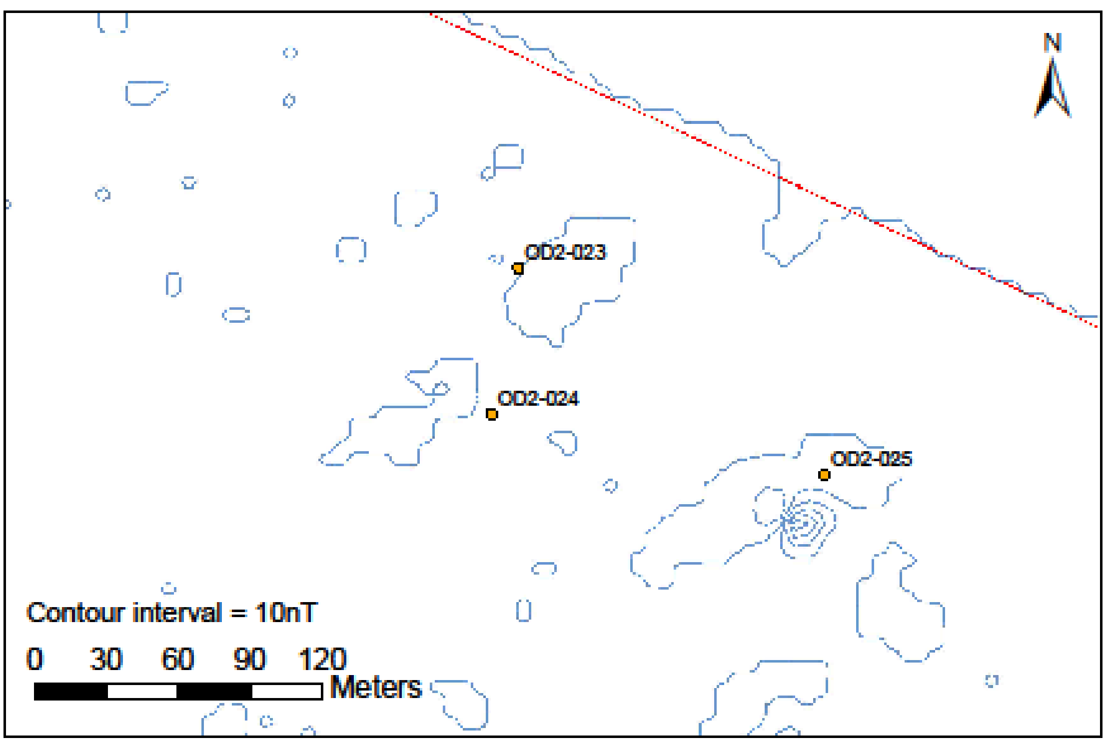


Figure 99. Anomaly OD2-024 sonogram showing dispersed rocks (top). Anomaly OD2-024 magnetic contour map (bottom).



Summary of Underwater Remote Sensing Survey and Recommendations

Investigation of the underwater areas within the APE for deepening the shipping channels in Charleston Harbor and its entrance identified 421 magnetic and acoustic anomalies in 15 survey areas. Three anomalies (LH1-001, LH1-009, and LH5-013) require further inspection by diving archaeologists to determine their nature. At this time, there is insufficient information to determine whether they are culturally or historically significant, but their characteristics are similar to those of previously recorded archaeological sites from similar underwater environments. No prehistoric or historic archaeological sites have been identified to date in the APE.

Most of the anomalies identified in this survey are emblematic of the modern industrial use of Charleston harbor rather than of its historic past. Cables, buried pipelines, crab pots, fragments of building activities and of previous major features such as bridges, tires, and other debris are all represented by the sites identified in this survey. They are included for completeness and were identified through the correlation of magnetometer data with sonograms taken simultaneously.

Throughout the review of all sites, the primary concern was to identify any potentially significant cultural resources for further data collection and examination. As noted by Watts (1995c) in his previous survey work in Charleston Harbor, there are few reasons to expect preservation of cultural materials in this major thoroughfare as regular dredging, removal of obstructions, and harbor deepening have occurred throughout the past 150 years.

To ensure it is possible to define the nature of two of the three anomalies, our recommendation is further inspection through use of multi-beam and video at a 50 x 17 m raised mound of uncertain origin in Lower Harbor 1 (LH1-009) and an area in Lower Harbor 5 west of the Ravenel Bridge on the south side (LH5-013).

Sonogram images of anomaly LH1-009 (figure 40) reveal a 50 x 17 m mound that is about 1 m above the harbor bottom and has a multicomponent, 76.59 nT amplitude associated with it. LH1-009 incorporates a variety of materials, and has trapped modern debris, so it is difficult to determine from remote sensing data alone whether it is culturally significant. It shares basic characteristics with wooden-hulled shipwrecks, and it is highly unusual because of the extent and height of the accumulated sediment. Further inspection by multibeam and video is highly recommended for this location as it occurs within an area of repeated Revolutionary War and Civil War engagements and loss of vessels. It may also be necessary to arrange for diving archaeologists to visit the site and conduct standard investigations including probing the sediment and defining the boundaries of the anomaly.

In a dynamic area like the harbor, several feature types might support the aggregation of sediment over an area of this size. Nets, the remains of wharves, debris deposits from major storm events are some of the possible causes, but shipwrecks also serve the same function. The mound has different types of debris visible on its surface in sonogram images and registered a maximum amplitude of 76.59 nT over 30 seconds, consistent with examples recorded for historic wooden or mixed construction vessels.

LH5-013 (figure 48) is about 7 m long; it is a group of timbers that appear to be fastened together. Located in an area of debris related to bridge construction and dismantling, this anomaly has an amplitude of only 17.31 over 2 seconds, but it is possible that the timbers could represent historic or archaeologically significant materials. Further examination is recommended; it is of moderate priority.

Submerged bridge remains in the region of LH5-013 are readily identifiable in sonograms. The area that is listed as an obstruction on charts, and the sonogram images are suggestive of timbers rather than concrete or metal structures. The amplitude of the site is less than 15 nT, consistent with wood, and it should be inspected visually to assess its characteristics and potential as a culturally significant site. Mooring dolphins, navigational aids, or barriers to traffic may also have similar appearance.

The third anomaly for which further investigation is recommended will require diving archaeologists to determine site composition and boundaries. Anomaly LH1-001 is measurable over a distance of approximately 95 m (312 ft), with a core area of 20 x 30 m (figure 41). On-site activity would be limited to the location and examination of material exposed on the bottom surface and to probe beneath the surface to positively identify material generating the magnetic signature. Although nothing is visible in sonogram images of the harbor bottom acquired in three passes over the anomaly, its amplitude (513.68 nT over 21 seconds) suggests a large disturbance that may be buried cultural resources of potential historic or archaeological significance. For example, in 2000, a bucket dredger raised a Parrott gun, propeller, and iron-sheathed wood from what seems to have been a deeply buried ironclad of the Civil War (Krivor and Tuttle 2000) that was close to the location of a previously recorded magnetic anomaly of similar amplitude that also had no visible acoustic signature (Watts 1986). It is a high priority to locate and identify anomaly LH1-001 before any primary or secondary dredging activities take place in this position.

For sites for which there is no specific identification through the correlation of side scan sonar data with magnetic anomalies, evaluation of sites included an assessment of sea state, continuity of data streams, comparison of survey area with charts that indicate buried cables and pipelines, and the shape and duration of magnetic anomalies. Most of these occur in areas such as the Cooper River where charts indicate significant buried conduits and cables, and recommendations for anomalies in those areas reflect the modern use of the harbor rather than proof of its past activities.

The overarching concern in the identification of each site, and the recommendation for further work, is that any potential cultural material be identified and evaluated for significance. Although only three sites are recommended for further review, the thoroughness of the APE and its extension some 75 m beyond the edges of the current channel offers assurance that any deepening activities are unlikely to result in untimely and unexpected discoveries of cultural material.

It is possible that archaeological remains may be encountered in the project area during primary dredging activities, mooring or disposal of sediments. Crews should be advised to report any discoveries of concentrations of artifacts (such as bottles, ceramics, or projectile points), stones, wood timbers with large metal fasteners or metal sheathing, iron cannon, or brick rubble to the project engineer, who should in turn report the material to the USACE, the State Historic Preservation Office or to Coastal Carolina University (the process of dealing with late discoveries is discussed in 36CFR800.13(b)(3)). No construction should take place in the vicinity of these late discoveries until they have been examined by an archaeologist and, if necessary, have been processed according to 36CFR800.13(b)(3).ii.

Further investigations of anomalies identified during the underwater survey of the APE can contribute to our understanding of maritime activities in the Charleston Harbor area during the historic period. It is recommended that additional investigations should be undertaken prior to the initiation of any activities associated with the proposed harbor deepening in the APE. Additional recommendation concerning the nature of the anomalies, documentation of any confirmed archaeological or historic cultural resources, and evaluation of the NRHP eligibility and management of these resources will be developed based on information recovered during the additional investigations.

ACKNOWLEDGEMENTS

We would like to thank the many agencies and individuals involved with production of this report and accompanying data sets. James D. Spirek of the South Carolina Institute for Archaeology and Anthropology provided valuable insight to the cultural resources investigation. Productive insights came from the November 29, 2012 mid-project meeting at the USACE Charleston District office. Agencies in this meeting included NOAA fisheries, Fish and Wildlife Service, South Carolina Department of Natural Resources, and SCIAA among others. Preliminary data reviews and discussions during this meeting were instrumental in completing groundtruthing efforts and interpretations.

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Table 18. Date, location, and fieldwork completed by CCU for Post 45 study.

Date	Location(s)	Work Conducted	Comments	Personnel
10-3-12	- Wando River - Myers Bend - Lower Harbor	- Magnetic mapping - Side scan sonar mapping	Start of mapping effort	Marshall, Phillips
10-4-12	- Wando River - Myers Bend - Lower Harbor	- Magnetic mapping - Side scan sonar mapping	Large percentages (90+) of some sections, very shallow areas	Marshall, Phillips
10-5-12	- Wando River - Myers Bend - Lower Harbor	- Magnetic mapping - Side scan sonar mapping	Started lower harbor section, expected to complete next week	Marshall, Phillips
10-8-12	- Wando River - Myers Bend - Lower Harbor - Cooper River	- Magnetic mapping - Side scan sonar mapping	Competed various sections on attached maps. Rigging was adjusted to cover a few sections of particularly shallow water.	Johnson, Phillips
10-9-12	- Wando River - Myers Bend - Lower Harbor - Cooper River	- Magnetic mapping - Side scan sonar mapping		Johnson, Phillips
10-10-12	- Wando River - Myers Bend - Lower Harbor - Cooper River	- Magnetic mapping - Side scan sonar mapping		Marshall, Phillips
10-11-12	- Wando River - Myers Bend - Lower Harbor - Cooper River	- Magnetic mapping - Side scan sonar mapping		Marshall, Phillips
10-12-12	- Wando River - Myers Bend - Lower Harbor - Cooper River	- Magnetic mapping - Side scan sonar mapping	Media interviews with Lt. Col. Chamberlayne	Marshall, Phillips, Spirek (SCIAA)
10-15-12	- Entrance Channel areas 1 and 2	- Magnetic mapping - Side scan sonar mapping	Areas inside the jetties	Marshall, Phillips
10-16-12	- Entrance Channel areas 1 and 2	- Magnetic mapping - Side scan sonar mapping	Broke off survey towards mid-day due to sea state	Marshall, Phillips
10-25-12	- Remleys Point	- Magnetometer and side scan sonar demonstration	Media interview	Williams (USACE), Tomsic (reporter), Marshall, Phillips, Viso
11-5-12	- Entrance Channel	- Chirp - Magnetic mapping - Side scan sonar mapping	Ended survey due to sea state and data quality. Side scan failed due to data cable	Marshall, Johnson, Craig
11-6-12	- Port	- none	Survey suspended due to high winds/sea state. Side scan cable fixed in	Marshall, Johnson, Craig

			port.	
11-7-12	- Entrance Channel	- Side scan sonar mapping - Magnetic mapping - Single beam bathymetry	Survey suspended due to high winds/sea state	Marshall, Johnson, Craig
11-8-12	- Entrance Channel - Channel Extension	- Chirp	Rough conditions/ difficult to stay on line.	Marshall, Johnson, Craig
11-9-12	- ODMDS areas 2, 3	- Chirp - Side scan sonar mapping - Magnetic mapping	Hardbottom areas	
11-10-12	- ODMDS 3 - Channel Extension	- Chirp - Side scan sonar mapping - Magnetic mapping	Hardbottom areas completed	Marshall, Johnson, Craig
11-11-12	- Channel Extension - ODMDS	- Side scan sonar mapping - Magnetic mapping - Single beam bathymetry	Some cell link drop outs. DGPS was tide corrected	Marshall, Johnson, Craig
11-12-12	- ODMDS 1	- Side scan sonar mapping - Magnetic mapping - Single beam bathymetry	Sea state building/ conditions degrading	Marshall, Johnson, Craig
11-13-12	- ODMDS 2, 3	- Side scan sonar mapping - Magnetic mapping	Cultural resources areas completed	Marshall, Johnson, Craig
12-19-12	- ODMDS - Channel	- Video tows	Various transects throughout study area	Marshall, Johnson
1-4-13	- ODMDS - Channel	- Video tows - Sediment grabs	Various video transects and sediment grabs throughout study area	Marshall, Johnson
1-6-13	- ODMDS - Channel	- Video tows - Sediment grabs	Various video transects and sediment grabs throughout study area	Marshall, Johnson
1-23-13	- Single beam	- Various in harbor	Finish single beam holidays	Marshall, Johnson

Data processing notes

Time stamps:

Magnetometer data were acquired using the real-time layback selection in the Geometrics MagLog acquisition software on the R/V Privateer and R/V Cape Fear (October/November 2012). Time stamps were recorded using GPS UTC time provided to the acquisition software directly from the GPS data string.

Sidescan sonar data file time stamps collected aboard the R/V Cape Fear (November 2012) were collected using a DGPS receiver that did not provide GPS UTC time to the acquisition software. The navigation time stamps are defaulted to the acquisition computer's clock. The acquisition computer clock was approximately 1 hour 13 minutes and 45 seconds ahead of true GMT as provided by the U.S. Naval Observatory, Time Service Department, Washington, DC, therefore there was a time offset between GPS UTC time and acquisition computer time. As a work around for this problem, the time stamp error for SSS data was corrected using XTFTimeOffset.exe provided by Klein Associates, Inc. Layback correction has also been applied during the time stamp correction, therefore -1hr11min48sec is applied to data between Nov5 and 10, and -1hr12min is applied to data between Nov11 and 13. SS data collected on R/V Privateer from Oct 5 to 15 were reference to UTC time. There is no time offset between magnetometer data and SSS data. So it should be remembered that for only November data, the data timestamps need to be adjusted to be synchronized with UTC time.

The file name of SSS data (.xtf) contains the year, day and time (YYMMDDHHSSSS). These numbers are also taken from the clock on the acquisition computer, therefore the time in XTF file names are 1 hr 13 min 45 sec ahead of the reference time (GPS time).

Benchmark Information

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.00
1        National Geodetic Survey,   Retrieval Date = JANUARY 25, 2013
 DM3305 ***********************************************************************
 DM3305  HT_MOD       -  This is a Height Modernization Survey Station.
 DM3305  DESIGNATION -  REMYLES POINT
 DM3305  PID         -  DM3305
 DM3305  STATE/COUNTY-  SC/CHARLESTON
 DM3305  COUNTRY     -  US
 DM3305  USGS QUAD   -  CHARLESTON (1983)
 DM3305
 DM3305                        *CURRENT SURVEY CONTROL
 DM3305  ______________________________________________________________________
 DM3305* NAD 83(2011) POSITION- 32 48 50.39143(N) 079 54 25.27017(W)   ADJUSTED
 DM3305* NAD 83(2011) ELLIP HT-   -31.521 (meters)        (06/27/12)   ADJUSTED
 DM3305* NAD 83(2011) EPOCH   -  2010.00
 DM3305* NAVD 88 ORTHO HEIGHT -     1.70   (meters)       5.6   (feet) GPS OBS
 DM3305  ______________________________________________________________________
 DM3305  NAVD 88 orthometric height was determined with geoid model     GEOID09
 DM3305  GEOID HEIGHT    -         -33.20  (meters)                     GEOID09
 DM3305  GEOID HEIGHT    -         -33.23  (meters)                     GEOID12A
 DM3305  NAD 83(2011) X  -     940,310.186 (meters)                     COMP
 DM3305  NAD 83(2011) Y  - -5,282,619.758 (meters)                      COMP
 DM3305  NAD 83(2011) Z  -   3,436,623.102 (meters)                     COMP
 DM3305  LAPLACE CORR    -          -3.03  (seconds)                    DEFLEC12A
 DM3305
 DM3305  FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)
 DM3305  Type                                        Horiz  Ellip  Dist(km)
 DM3305  -------------------------------------------------------------------
 DM3305  NETWORK                                      0.59   0.57
 DM3305  -------------------------------------------------------------------
 DM3305  MEDIAN LOCAL ACCURACY AND DIST (003 points)  0.85   0.57      2.57
 DM3305  -------------------------------------------------------------------
 DM3305  NOTE: Click here for information on individual local accuracy
 DM3305  values and other accuracy information.
 DM3305
 DM3305
 DM3305.The horizontal coordinates were established by GPS observations
 DM3305.and adjusted by the National Geodetic Survey in June 2012.
 DM3305
 DM3305.NAD 83(2011) refers to NAD 83 coordinates where the reference
 DM3305.frame has been affixed to the stable North American tectonic plate. See
 DM3305.NA2011 for more information. for more information.
 DM3305
 DM3305.The horizontal coordinates are valid at the epoch date displayed above
 DM3305.which is a decimal equivalence of Year/Month/Day.
 DM3305
 DM3305.The orthometric height was determined by GPS observations and a
 DM3305.high-resolution geoid model using precise GPS observation and
 DM3305.processing techniques.
```

```
DM3305
DM3305.The X, Y, and Z were computed from the position and the ellipsoidal ht.
DM3305
DM3305.The Laplace correction was computed from DEFLEC12A derived deflections.
DM3305
DM3305.The ellipsoidal height was determined by GPS observations
DM3305.and is referenced to NAD 83.
DM3305
DM3305. The following values were computed from the NAD 83(2011) position.
DM3305
DM3305;                   North         East     Units Scale Factor Converg.
DM3305;SPC SC       -   109,298.068   711,944.610   MT  0.99990419   +0 36 21.4
DM3305;SPC SC       -   358,589.46  2,335,776.28   iFT  0.99990419   +0 36 21.4
DM3305;UTM  17      - 3,631,195.910   602,317.963   MT  0.99972909   +0 35 32.5
DM3305
DM3305!             -  Elev Factor  x  Scale Factor =   Combined Factor
DM3305!SPC SC       -   1.00000495  x   0.99990419  =   0.99990914
DM3305!UTM  17      -   1.00000495  x   0.99972909  =   0.99973404
DM3305
DM3305                        SUPERSEDED SURVEY CONTROL
DM3305
DM3305  NAD 83(2007)-  32 48 50.39128(N)    079 54 25.27073(W) AD(2002.00) 1
DM3305  ELLIP H (09/01/10)  -31.495  (m)                        GP(2002.00) 3 1
DM3305
DM3305.Superseded values are not recommended for survey control.
DM3305
DM3305.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
DM3305.See file dsdata.txt to determine how the superseded data were derived.
DM3305
DM3305_U.S. NATIONAL GRID SPATIAL ADDRESS: 17SPS0231731195(NAD 83)
DM3305
DM3305_MARKER: DD = SURVEY DISK
DM3305_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
DM3305_STAMPING: REMYLES POINT 2010
DM3305_MARK LOGO: SCGS
DM3305_PROJECTION: FLUSH
DM3305_MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET
DM3305_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
DM3305+STABILITY: SURFACE MOTION
DM3305_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
DM3305+SATELLITE: SATELLITE OBSERVATIONS - January 27, 2010
DM3305
DM3305  HISTORY     - Date     Condition        Report By
DM3305  HISTORY     - 20100127 MONUMENTED       SCGS
DM3305  HISTORY     - 20121206 GOOD
DM3305
DM3305                        STATION DESCRIPTION
DM3305
DM3305'DESCRIBED BY SOUTH CAROLINA GEODETIC SURVEY 2010 (DDW)
DM3305'STATION IS LOCATED 4.8 MI (7.8 KM) SOUTHEAST OF NORTH CHARLESTON, 3.1
DM3305'MI (4.9 KM) NORTH-NORTHEAST OF CHARLESTON, 2.9 MI (4.7 KM)
DM3305'WEST-NORTHWEST OF MOUNT PLEASANT.  OWNERSHIP--CHARLESTON COUNTY
DM3305'REMLEYS POINT LANDING. TO REACH THE STATION FROM THE JUNCTION OF U.S.
DM3305'HIGHWAYS 17/701 (JOHNNIE DODDS BOULEVARD) AND STATE ROAD 56 (MATHIS
DM3305'FERRY ROAD) IN MOUNT PLEASANT, GO NORTH-NORTHWEST ON ROAD 56 FOR 0.4
DM3305'MI (0.6 KM) TO A PAVED ROAD LEFT AT THE HOLY TRINITY A.M.E. CHURCH,
DM3305'BEAR LEFT ON THE PAVED ROAD FOR 0.05 MI (0.1 KM) TO THE JUNCTION OF
```

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DM3305'STATE ROAD 415 (FIFTH AVENUE), TURN LEFT ON ROAD 415 FOR 0.6 MI (1.0
DM3305'KM) TO A SHARP BEND RIGHT (ALSO THE JUNCTION OF THIRD AVENUE), TURN
DM3305'RIGHT ON THIRD AVENUE FOR 0.3 MI (0.5 KM) TO THE JUNCTION OF SECOND
DM3305'STREET, TURN LEFT ON SECOND STREET FOR 0.3 MI (0.5 KM) TO THE STATION
DM3305'IN AN OPEN GRASSY AREA IN THE NORTHWEST CORNER OF THE REMLEYS POINT
DM3305'LANDING. STATION IS A CONCRETE POST FLUSH WITH THE GROUND AND LEVEL
DM3305'WITH THE PARKING LOT, 10.6 FT (3.2 M) EAST OF THE EAST CORNER OF A
DM3305'NEARBY CONCRETE PAD FOR A SEASIDE BENCH, 25.4 FT (7.7 M) NORTH OF THE
DM3305'WEST END OF A 1.0-FT CONCRETE PIPE CULVERT BENEATH AN ACCESS PATH TO
DM3305'THE GRASSY AREA, 148.0 FT (45.1 M) WEST-NORTHWEST OF SECURITY LIGHT
DM3305'POLE NUMBER 454255, 57.5 FT (17.5 M) NORTHWEST OF A METAL SIGN POST
DM3305'(NO PARKING TOW-AWAY ZONE) AT THE NORTH EDGE OF THE PARKING LOT.
DM3305'DESCRIBED BY T. HALL.
DM3305
DM3305                          STATION RECOVERY (2012)
DM3305
DM3305'RECOVERY NOTE BY   2012 (JAB)
DM3305'RECOVERED AS DESCRIBED

*** retrieval complete.
Elapsed Time = 00:00:03
```